2019-2029
Forest Management Plan

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2019

Weyerhaeuser

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

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Executive Summary

As per subparagraph 10(1) of the FMA agreement, a Forest Management Plan (FMP or Plan) must be submitted to the Minister on or before April 1, 2021. This Plan has been prepared in accordance with paragraph 10 of Forest Management Agreement 6900016 and replaces the 2011 Plan. This plan will be updated every ten years, or sooner if significant developments occur that impact current forest management strategies.

The FMP describes the activities in the Forest Management Area (FMA area) for the designated time-period and provides details regarding the sustainable forest management planning to support the Annual Allowable Cut (AAC) for both coniferous and deciduous species on the FMA area. There are two embedded Deciduous Quota Holders within the Forest Management Area, Norbord Inc. and Tolko Industries Ltd. This FMP was developed in cooperation with the three forest companies as well as the Province of Alberta (GoA or the Province). Integration of the industry representatives and the province is an integral component to the successful management of the forest resource in the FMA area.

Public and Indigenous involvement is a fundamental part of the development of an FMP. The Public Involvement Plan and the First Nations Consultation Plan are included in the appendices of this document. It describes the efforts Weyerhaeuser has taken to inform engaged members of the public, First Nations communities and Metis Settlements and most importantly, how Weyerhaeuser has solicited feedback and how that feedback was then considered in the plan.

The FMP provides direction in the sustainable management of the forest landbase over a 200-year planning horizon. The content and structure of this plan are compatible with the *Alberta Forest Management Planning Standard- version 4.1* (2006).

The FMP includes:

- A detailed description of Forest Management Unit 16 and Forest Management Area 6900016
- A predictive forest growth Timber Supply Analysis (TSA)
- A Preferred Forest Management Scenario (PFMS) that provides future direction for operations on the landbase with consideration to non-timber values
- A Spatial Harvest Sequence (SHS) outlining the spatial polygons associated with the Preferred Forest management Scenario
- An Annual Allowable Cut (AAC) for both coniferous and deciduous tenure holders
- A Reforestation Strategy for the FMA area that will meet the TSA yield projections; and
- A list of VOITs derived from the Alberta Forest Management Planning Standard that provide measurable targets for performance monitoring and reporting

Monitoring and forest stewardship reporting are an important component of this FMP. Monitoring provides the necessary feedback on the management strategies developed. The data collected will subsequently lead to improved forest management strategies through learnings and adaptation.

Glossary of Terms

Access schedule – Group of forest stands classified solely for harvest sequencing in the timber supply modeling process.
Active landbase – The area contained within the boundary of the DFA that is covered by stands that possess forested cover types and have not been assigned a deletion code under the landbase classification process.
Alberta Biodiversity Monitoring Institute (ABMI) – A non-profit organization that measures the state of Alberta's biodiversity though a systematic grid survey.
Alberta Conservation Information Management System (ACIMS) – A data center that provides biodiversity information on Alberta's species, natural ecological communities and sites. Information about the location, condition, status, and trends of selected elements is collected, updated, analyzed, and disseminated (Alberta, 2016a).
Alberta Reforestation Information System (ARIS) – The province-wide tracking system for reforestation activities. Companies must submit their reforestation activities to ARIS by May 15 annually.
Alberta Vegetation Inventory (AVI) – A spatial inventory of a landbase, focusing on attributes of both vegetated and non-vegetated polygons, completed to specific standards as defined by the Alberta government.
Annual Allowable Cut (AAC) – The volume of timber that can be harvested under sustained-yield management in any one year, as stipulated in the pertinent approved forest management plan.
Annual Operating Plan (AOP) – A plan prepared and submitted to the Alberta government by the forest operator each year. An AOP approved by the Alberta government provides the forest operator with authorization to undertake harvesting, reforestation and road construction activities on their operating areas.
Aspect – The direction in which a slope faces that is normally expressed in broad terms using the cardinal directions (north, south, east and west).
Biodiversity (biological diversity) – The variety, distribution and abundance of different plants, animals and microorganisms at the regional or landscape levels of analysis.
Broad Cover Group (BCG) – A classification of forest types based on coniferous and deciduous components of the AVI species composition.
Compartment – A subsection of a DFA for which operational plans are developed. For the 2019 FMP, Weyerhaeuser's compartments are called Cost Zones or Caribou Access Units.
Controlled parentage program (CPP) - A stock production program that includes in its population several selected individuals. Production of deployment stock for the program occurs in a production facility (such as a seed orchard or stool bed) where parents are propagated vegetatively or sexually (Alberta Forest Genetic Resources Council, 2016).
Crown land – Land within the province under the jurisdiction of the Alberta government.
Cull – Trees or logs or portions thereof that meet the minimum utilization standards but are rendered non-merchantable due to the presence of defects.
Deciduous Timber Allocation (DTA) – A volume-based timber allocation granted to a forestry operator for the purposes of harvesting a set volume of deciduous timber within a defined area.

Defined Forest Area (DFA) - A specified area of forest, including land and water (regardless of ownership or tenure), to which the requirements of the CSA Z809-02 standard or Alberta Forest Management Planning Standard apply.
Deletion code – a code that is assigned to stands or portions of stands based on a specific and defined deletion rationale, including riparian buffers, dispositions, subjective deletions (i.e. larch and black spruce).
Forest Management Plan (FMP) - A long-term plan used to outline higher-level management objectives, and sustainability and timber production assumptions for a Forest Management Agreement area. Previously referred to as a Detailed Forest Management Plan or DFMP.
Ecosystem – A dynamic complex of plants, animals, and micro-organisms and their non-living environment, interacting as a functioning unit.
Eligible landbase – The area of the active landbase that is old enough for harvesting, as defined by the Minimum Harvest Age.
Environmental Management System (EMS) – A management system that recognizes and manages primary environmental issues through awareness and assessment of applicable legal requirements, objectives for improvement, assignment of responsibilities, competent personnel, communications, procedures, controls and monitoring, emergency response capability, self-correction and assessment, and internal reviews.
Forest Harvest Plan (FHP) – A compartment-level operational plan requiring the approval of the Alberta government; precedes the AOP and details the laid-out access and harvesting activities for a set period.
Fire Behaviour Potential (FBP) – A rating or classification of a forest stand's likelihood of burning as a reflection of fuel type and topography. FBP is one input into the Alberta government's Fire Behaviour Prediction model.
FireSmart – A Government of Alberta program designed to incorporate management techniques that seek to mitigate large, high intensity, high severity wildfires and incorporate natural disturbance emulation.
Fish Management Zone – A geographical division of Alberta based on unique assemblages of water bodies, game fish species, and management regimes (Alberta, 2009).
Forecasting – the process of determining explicit statements of the expected future condition of the forest and its indicators.
Forest Cover Type – Hierarchical broad cover group classification based on the provincial strata in the yield projections guidelines of the Forest Planning Standard.
Forest Management Agreement (FMA) - A contract between the province of Alberta and the FMA holder whereby the province provides an area-based timber supply from Crown land.
FMA Area – The area covered only by the Forest Management Agreement.
Forest Management Unit (FMU) - An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the Forests Act.
FOREST*CARE* – The Alberta forest industry's stringent code of practice for mill and woodlands operations.
Forested Landbase – The area contained within the boundary of the DFA covered by stands that possess forested cover types. This landbase excludes areas such as shrub cover types, water, roads, etc.
Fur Management Zone (FMZ) – Divisions within Alberta based on common environmental features. The timing and length of the trapping season are established based on these zones,

reflecting differences in furbearer status, trapping pressure, and seasonal pelt quality (Alberta, 2016b).

Genetic Diversity (within species populations) – In a group such as a population or species, the possession of a variety of genetic traits that frequently result in differing expressions in different individuals. The variation of genes within a species, the material upon which the agents of evolution act. Loss of variation may prevent adaptive change in populations of a species and reduce its ecological fitness (Alberta Forest Genetic Resources Council, 2016).

Genetic Integrity (regarding natural tree populations) – the conservation of genetic diversity in a group such as a population or species. Such diversity is the result of long-term evolutionary processes and is key to biological adaptation to regional habitats and to maintenance of future evolutionary potential (Alberta, 2014).

Geographic Information System (GIS) – A collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

Goal – A desired outcome placed on a forecasting model indicator which the model will aim to achieve but which can be deviated from under the goal programming or heuristic modeling approaches.

Green Area – Alberta-government-owned land that is managed primarily for timber production, but on which other uses are permitted.

Gross landbase – The area contained within the boundary of the DFA. In the case of Weyerhaeuser Grande Prairie's 2019-2029FMP, this includes all FMU G16. As well as grazing leases contained within the FMUs. In other words, the active and passive landbase

Growing stock - The sum (by number, basal area or volume) of trees in a forest or a specified section of the forest.

Healthy Pine Forest Strategy – An Alberta government strategy whose goal is to alter the current age class structure of susceptible pine forests to increase their long-term resistance to MPB infestations.

Heritage resource – Sites of historical, architectural, archaeological, paleontological, or scenic significance to the Province.

Hydrologic Feature – A water feature such as a lake, river, stream, or oxbow. Hydrologic features can be natural or man-made, permanent or recurring.

Indicator – A variable that measures or describes the state or condition of a value.

Integrated Land Management (ILM) – A strategic planned approach to managing and reducing the human-caused footprint on public land (Alberta, 2015a).

Intensive forest management – Utilization of a wide variety of silvicultural practices (e.g. planting, thinning, fertilization, release, harvesting, and genetic improvement) on a limited scale, to improve the attributes of the fibre occupying the site, generally volume, piece size or quality.

International Organization for Standardization (ISO) – An international body, represented by various national standards organizations, that develops and publishes industrial and commercial standards.

Invasive exotic species – see noxious weeds

ISO 14001 – A standard that defines the requirements for an environmental management system. ISO 14001 applies to environmental aspects over which the organization has control and can be expected to have an influence.

Key Wildlife and Biodiversity Zone (KWBZ) – Areas established by the province to protect regions of high biodiversity habitat potential and key winter ungulate habitat. Because of the relatively high importance of these areas to biodiversity, and particularly to ungulates, the province developed corresponding industrial-user guidelines, including minimizing activity during winter months and reducing access development (Alberta, 2015b).

Land-Use Framework (LUF) – The GOA's regional integrated land-use planning system. The province is divided into 7 land-use regions, of which plans have been or will be developed. The purpose of the land-use framework is to manage the competing demands on Alberta's land and natural resources for the achievement of long-term economic, environmental, and social goals. The land-use framework regional plans are the highest-level plans in Alberta, under which all other plans must align (e.g. FMPs, recreation plans, energy plans, etc.).

Leave for Natural Regeneration (LFN) – Reforestation of a stand through reliance on natural suckering or seeding, not planting of seedlings.

Long Run Sustained Yield Average (LRSYA) - The hypothetical timber harvest that can be maintained indefinitely from a management area.

Managed Stand - A forest stand that has had any anthropogenic action applied to it (previously harvested, thinned, etc.).

Mean Annual Increment (MAI) – The average annual growth rate of individual trees or stands up to a specified point in time. Expressed as volume/hectares/year.

Minimum Harvest Age (MHA) – The average age at which a stand is operable. This age is a function of the stand's species strata and timber productivity rating or density.

Mountain pine beetle (MPB) - *Dendroctonus ponderosae*, or mountain pine beetle, is one of the most destructive pests affecting mature pine. Adults emerge from host trees and attack green trees in midsummer, inflicting serious damage in the form of blue stain and checking.

Natural subregion – Natural subregions are subdivisions of a natural region, generally characterized by vegetation, climate, elevation, and latitudinal or physiographic differences within a given region (Natural Regions Committee 2006).

Natural stand – A forest stand in which its initiation is a result of natural (non-anthropogenic) disturbance, such as fire, pest or pathogen outbreak, etc.

Not satisfactorily restocked (NSR) – A regeneration classification, based on survey results, that indicates insufficient regeneration, as per provincial or regional/company standards.

Noxious Weed - A plant designated in accordance with the Alberta Weed Control Regulation as a noxious weed and includes the plant's seeds. A person shall control a noxious weed that is on land the person owns or occupies (Alberta, 2011). A **Prohibited Noxious Weed** is a plant designated in accordance with the Alberta Weed Control Regulation as a prohibited noxious weed and includes the plant's seeds. A person shall destroy a noxious weed that is on land the person owns or occupies (Alberta, 2011).

Objective function – One or more objectives incorporated into a mathematical expression that are being maximized or minimized.

Old interior forest – Forest patches greater than 100 ha in the "old" seral stage (120-179 years old) that are located beyond a defined edge-effect buffer zone. The edge-effect buffer zone is applied in two cases: along any stand edge which shares a common boundary with a linear disturbance greater than 8 meters in width; or stand edge along which the seral stage changes.

Opening patch – Area containing either clearing or regeneration seral stages.

Operating Ground Rules (OGR) – Standards for operational planning and field practices that must be measurable and auditable, and which are based on forest management plan objectives. Also known as Timber Harvest Planning and Operating Ground Rules.
Overstory – The tallest layer of multi-storied stands.
Patchworks – A spatially-explicit wood supply modeling tool developed and serviced by Spatial Planning Systems. Designed to provide the user with operation-scale decision-making capacity within a strategic analytical environment. Allows trade-off analyses of alternative operational decisions to be quickly determined and visually displayed.
Performance Standards – criteria used to develop the PFMS, while taking in to account the natural processes which influence the landscape. Performance standards are applicable for plan implementation, monitoring, and reporting, and take the form of VOITs.
Permanent all-weather forestry road – Department Licenses of Occupation (DLOs) within the FMP area.
Permanent Sample Plot (PSP) – A fixed or variable area plot established for (forest) sampling and measurement purposes and designed for re-measurement.
Plan Development Team (PDT) – the team assembled to coordinate and guide the development of Weyerhaeuser's 2019-2029 FMP. The PDT consisted of representation from Alberta Agriculture and Forestry, Weyerhaeuser, Norbord and Tolko as well as technical advisors to the FMP.
Planned block – An area defined for harvest at date following the start date of the forecasting process (May 1, 2017).
Planning horizon - The length of time over which a series of defined management actions occur. For the purposes of modeling for sustainability, the 2019-2029 FMP planning horizon is 200 years.
Planning standard – The Alberta Forest Management Planning Standard (Version 4.1 – April 2006) is the standard guiding the preparation and implementation of forest management plans in Alberta.
Preferred Forest Management Scenario (PFMS) –The result of the forecasting and VOIT development processes, the PFMS is the scenario that forms part of the 2019-2029 FMP that will be submitted to the Alberta government for review and approval.
Provenance - The original geographic source of seed or other propagules. Also, the test population resulting from seed collected from a particular location (Alberta Forest Genetic Resources Council, 2016).
Public Advisory Group (PAG) – A venue for sharing environmental performance information with members of the public and interested stakeholders as well as a forum for discussing issues of concern to the forest sector. Weyerhaeuser's PAG was formed in December 2017 with representation from several public interest groups, including education boards, municipalities and counties, other industries, recreational groups, contractors and the public.
Quadrant Timber Production – the volume of wood harvested within each 5-year period of the FMP.
Reforestation Standard of Alberta (RSA) – The GOA's standard for sustained yield management on crown land. Harvested blocks must meet certain stocking requirements in both the establishment and performance stages for forest operators to successfully meet reforestation obligations (Alberta, 2016e).

Regenerated stand – A forest stand in which its initiation is a result of anthropogenic disturbance such as harvesting.
Regenerated Yield Stratum – A delineation of stands that share the quality of being human-origin.
Regeneration lag - The period between harvest and establishment of the regenerated stand. In timber supply analysis terms, the established stand is defined as age 0 on the regenerated yield curve. Also referred to as regen delay.
Representative residual structure – live, commercially viable trees that are representative of the pre-harvest stand and are retained post-harvest to create old forest characteristics in young and mid-aged regenerating stands.
Riparian Buffer – Vegetated areas around water features left untouched during harvesting to protect riparian ecosystems.
Salvageable – In regard to trees killed by natural causes (ex. fire, insects, disease, blowdown), those that are still commercially viable as merchantable if harvested.
Satisfactorily restocked (SR) – A regeneration classification, based on survey results, that indicates sufficient regeneration, as per provincial or regional/company standards.
Seasonal/temporary forestry road – a forestry road only available for harvesting/hauling use during certain seasons or for a set amount of time.
Seed Zone – A geographic area with relatively uniform ecology and genetic population structure. Limiting the reforestation of cutblocks to seedlings from the corresponding seed zone allows native trees, and by extension native plants of all species, to be moved some distance without risk of maladaptation or erosion of genetic integrity and conserves genetic biodiversity (Alberta, 2014).
Seral stage - A stage in forest succession. A series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age.
Site preparation – Any of several actions taken in conjunction with a reforestation effort (natural or artificial) to create an environment favorable for survival of trees during the first growing season. Actions can include altering the ground cover, soil or microsite conditions; using biological, mechanical or manual clearing; prescribed burns; herbicides or a combination of methods.
Snag – A dead tree that is taller than 2 m.
Spatial Harvest Sequence (SHS) – A mapped harvest sequence showing the inventory cover types scheduled for harvest in the first four 5-year periods (20 years) of the planning horizon.
Special Access Zone – Natural areas within an intensively developed landscape that have been designated by the GOA to received special development considerations, to avoid further fragmenting the landscape and to maintain important contiguous parcels (Alberta, 2013a).
Species strata - A stratification based upon broad cover group and species group composition. Used to classify every forested stand (operable and non-operable) within the FMA area.
Stakeholder - A person, group, agency or other entity that has a share or interest in the DFMP and the activities occurring on the FMP Area.
Stand Susceptibility Index (SSI) - A measure of a stand's capacity to produce beetles (i.e. new populations of MPB in the next year) in the event it is attacked. It is a function of four variables: 1) relative abundance of susceptible pine basal area in the stand; 2) age of dominant and co-dominant live pine; 3) density of the stand; and 4) the climatic suitability of the stand.

Stewardship report – A required report as defined within the Alberta Forest Management Planning Standard and committed to in the FMP. The report summarizes certain activities or performance measures over a five-year period.
Structural retention - Standing live or dead trees left in harvested areas to maintaining biological diversity.
Subjective deletion – A type of landbase deletion applied on an operational basis as opposed to a legislatively or otherwise prescribed basis.
Surge cut – A short-term accelerated harvest over and above the long-term even-flow harvest level that is followed by a harvest dropdown at a future time.
Sustainable forest management (SFM) – A way of using and caring for forests to maintain their environmental, social, and economic values and benefits over time (Natural Resources Canada, 2016).
Sustained Yield Unit (SYU) - The area on which timber supply is calculated. For Weyerhaeuser's 2019-2029 FMP the SYU is the FMA area.
Target - A specific statement describing a desired future state or condition of an indicator. Targets should be clearly defined, time-limited, and quantified, if possible.
Timber Productivity Rating (TPR) – The potential timber productivity of a stand based on height and age of dominant and co-dominant trees of the leading species.
Timber Supply Analysis (TSA) – A process consisting of calculations/computer models with built-in assumptions regarding forest growth patterns that is used to determine the AAC and SHS.
Timber year – The period in which forest management planning and reporting is applicable to. In Alberta, the timber year spans May 1 – April 30. The year assignment is based on the year in which the timber year begins.
Trade-off analysis – A process that involves an iterative assessment of various indicators, for the purpose of selecting an optimally balanced final set of indicator levels.
Uncommon plant community – A distinct collection of similar plant species of similar species composition and structure within an environmental ecosystem.
Understory – The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth (Dunster, 1996).
Utilization Standard – The portion of the stand or individual tree used for manufacture of wood products defined in terms of piece length and diameter at each end. Minimum standards for utilization are defined in the timber disposition.
Values, Objectives, Indicators and Targets (VOITs) – reflect forest management objectives and form the basis for sustainable forest management strategies. Some objectives are defined by the Alberta government, while others have defined through collaboration and consultation with PDT members and other stakeholders. The values and objectives set the strategic direction for the FMP, while the indicators and targets drive the management practices at an operational level necessary to meeting those objectives.
Wetland – An area where water continually or periodically gathers, because inflow equals or exceeds outflow. The wetland area supports hydrophytic vegetation, and, in the boreal region, plant production generally exceeds decomposition, creating peat. A wetland contains soil indicative of high-water tables or poor drainage for extended periods of time.
White Area – Land that is mostly privately-owned, that is managed primarily for residential development and agriculture.

Wildfire Management Area (WMA) – The administrative level accountable for wildfire management in the province (Alberta, 2013b); WMAs divide Alberta's Green Area into zones of responsibility by wildfire base.
Wildlife Management Unit (WMU) – Geographic divisions through which the GOA manages wildlife according to the Wildlife Act.
Yield strata - A stratification based upon species strata, broad cover group, crown closure class and TPR. Does not include non-operable species strata. Yield strata form the basis for the development of yield curves; each yield stratum has one or more associated yield curves.

Acronym Listing

AAC – Annual Allowable Cut
ABMI – Alberta Biodiversity Monitoring Institute
ACIMS – Alberta Conservation Information Management System
AFGO – Alberta Forest Growth Organization
A-I-P – Agreement in Principle
AOP – Annual Operating Plan
ARIS - Alberta Regeneration Information System
ARS – Alternative Regeneration Standards
AVI – Alberta Vegetation Inventory
BAP1 – Biodiversity Assessment Project
BCG – Broad Cover Group
CBFA – Canadian Boreal Forest Agreement
CFS – Canadian Forest Service
CPP – Controlled parentage program
CWD – Coarse woody debris
DFA – Defined Forest Area
DIDs – Digital Integrated Dispositions
DLO – Department License of Occupation
DTA – Deciduous Timber Allocation
ECA – Equivalent Clearcut Area
EMS – Environmental Management System
FBP – Fire Behaviour Potential
FGL – Forest Grazing Lease
FGRMCS – Forest Genetic Resource Management and Conservation Standards
FHP – Forest Harvest Plan
FMA – Forest Management Agreement
FMP –Forest Management Plan (sometimes referred to as DFMP)
FMU – Forest Management Unit
FMZ – Fur Management Zone
FOMP – Forest Operations Monitoring Program
GDP – General Development Plan
GIS – Geographic Information System
GOA – Government of Alberta (or the Province)
GRL – Grazing Lease
GRP – Grazing Permit

GYPSY – Growth and Yield Projection System
HRV – Historic Resource Value
HSM – Habitat Supply Model
HUC – Hydrologic Unit Code
ILM – Integrated Land Management
LAT – Landscape Assessment Tool
LFN – Leave for Natural
LPG – Landscape Projection Group
LRSYA – Long Run Sustained Yield Average
MAI – Mean Annual Increment
MOU – Memorandum of Understanding
MPB – Mountain Pine Beetle
NLB – Net Landbase
NRV – Natural Range of Variation
NSR – Not satisfactorily re-stocked
OGR – Operating Ground Rules
PAAC – Periodic Annual Allowable Cut
PAG – Public Advisory Group
PSP – Permanent Sample Plot
PFMS – Preferred Forest Management Scenario
PGYI – Provincial Growth and Yield Initiative
RFMA – Registered Fur Management Area
RSA – Reforestation Standard of Alberta
RSF – Resource Selection Function
SHS – Spatial Harvest Sequence
SSI – Stand Susceptibility Index
SOP – Standard Operating Procedure
SFM – Sustainable Forest Management
SR – Satisfactorily Restocked
SYU – Sustained Yield Unit
TIA – Tree Improvement Association of Alberta
TMR – Timber Management Regulation
TPR – Timber Productivity Rating
TPRS – Timber Production and Revenue System
TSP – Temporary Sample Plot
TSA – Timber Supply Analysis
VOIT – Value, Objective, Indicator and Target
WMU – Wildlife Management Unit
WTA – Wildfire Threat Assessment
WY – Weyerhaeuser Company Limited
WYGP – Weyerhaeuser, Grande Prairie

Forest Management Plan List of Chapters & Annexes

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CHAPTER 1 BACKGROUND INFORMATION

1.1. Forest Management Agreement

The first Forest Management Agreement (FMA) was signed in 1969 between Alberta and Procter & Gamble. Weyerhaeuser Company Limited continues to hold a Forest Management Agreement with the Province of Alberta which grants Weyerhaeuser the right to establish, grow, harvest and remove coniferous timber within the FMA area. This agreement entitles the company to construct roads, yards, camps and other installations necessary and incidental to operations as well as carry out silviculture and other programs necessary for the long-term health and sustainability of the FMA area.

1.2. Sustainable Forest Initiative

Weyerhaeuser's forestry operations in Canada had been almost exclusively certified to the CSA Z809 standard for sustainable forest management since the late 1990s. Weyerhaeuser forestry operations in the United States are certified to the SFI standard and in May 2009, Weyerhaeuser announced that all of it's more than 40 iLevel mills producing structural framing materials are certified to the SFI, SFI fiber sourcing or PEFC chain-of-custody standards. As of January 2010, all of Weyerhaeuser's Canadian operations were also certified to the SFI standard.

Weyerhaeuser's Sustainable Forest Policy states: "We are committed to independent certification of our forest management and to meeting the principles and objectives of applicable forest certification systems." Weyerhaeuser manages our forests for the sustainable production of wood and wood products that meet our customers' needs. We are committed to independent certification of our forest practices and to meeting the principles and objectives of the Sustainable Forestry Initiative program (2015-2019).

The SFI 2015-2019 program is separated into Forest Management Standard and Fiber Sourcing Standard. The Forest Management standard promotes responsible forestry practices based on requirements that include measures to protect water quality, biodiversity, wildlife habitat, species at risk and forests with exceptional conservation value. The fiber sourcing standard also promotes responsible forestry practices with requirements that include measures to broaden the practice of biodiversity, use of best management practices, and use of the services of forest professionals. Fiber sourcing requires responsible procurement of fiber from non-certified forest lands.

Weyerhaeuser commits to the SFI program as it verifies a history of good performance, builds public trust, and addresses customer concerns about responsible forestry through promotion of the following key principles:

1. Practice sustainable Forestry
2. Forest productivity and Health
3. Protection of water resources
4. Protection of biological diversity
5. Aesthetics and recreation
6. Protection of special sites and species of concern
7. Responsible fiber sourcing practices in North America
8. Avoidance of controversial source including illegal logging in offshore fiber sourcing
9. Legal compliance
10. Research
11. Training and education
12. Public involvement
13. Transparency
14. Continual improvement

1.3. Research and Long-term Monitoring

Weyerhaeuser strongly believes that research, good science and data and the use of long-term monitoring programs should form the foundation of good forestry practices. These elements are the basis for both adaptive forest management, and sustainable forest management activities. In addition to generating information to improve for management activities, Weyerhaeuser is focused on the ongoing development of programs and projects that will help maintain fiber security and enhance fibre supply on the FMA, now and into the future.

The following is a list of research projects, and long-term monitoring programs Weyerhaeuser currently supports on the FMA:

- University of Alberta Ecosystem Based Management IRC – Weyerhaeuser is a collaborator and financial supporter of the recent submission to NRCAN for an Industrial Research Chair (IRC) position at the University of Alberta.
- fRI (Foothills Research Institute) – long time supporter and shareholder of this research organization; https://friresearch.ca/; programs under fRI include a Grizzly Bear program, a Caribou program, Water, Mountain Pine Beetle and a Healthy Landscapes program. All

of which Weyerhaeuser supports with annual financial contributions, in addition to our shareholder support.

- Caribou Research and Monitoring program – Weyerhaeuser was instrumental in initiating this program at fRI and have been a strong supporter since it's inception. We provide funding support on an annual basis to the program for a variety of caribou research projects and a long-term monitoring program. In addition to the fRI caribou program, Weyerhaeuser GP provides financial support for local fecal DNA work, long term GPS monitoring and a variety of other local and regional caribou research projects.
- Canadian Forest Service (CFS) – Weyerhaeuser Grande Prairie (GP) is working with CFS researchers to do vulnerability assessments related to climate change, fire and pest outbreaks for our GP FMA.
- National Council for Air and Stream Improvement (NCASI) - Weyerhaeuser Corporation is a long-time member of NCASI; recent projects include a long-term caribou nutrition project, a forest management species at risk data base and a compendium of best practices for impacts to songbirds.
- Raptor monitoring surveys – Weyerhaeuser has a long-term Raptor monitoring program in place; we revisit and sample a set number of sites that have been distributed across the FMA. Surveys occur every three years. Information is used to inform management plans.
- Songbird monitoring surveys – Weyerhaeuser has a long-term songbird monitoring program in place; we revisit and sample a set number of sites that have been distributed across the FMA. Surveys occur every three years. Information is used to inform management plans.
- fRI Grizzly Bear Program – Weyerhaeuser has been supporting Grizzly Bear research through this program since 1998. Information generated through this program is used to inform management plans and adopt new practices that help support Grizzly Bear populations in our operating areas. Associated projects that Weyerhaeuser supports under this umbrella program include things like 'Linkages between forestry practices, ungulate abundance and the habitat use of Grizzly Bears', and a long-term population monitoring program.
- Traditional Use Studies- Weyerhaeuser GP recently initiated a series of projects with local Indigenous communities to help identify and catalogue Traditional Use and sensitive Sites. This is in addition to a company sponsored project with Aseniwuche Winewak Nation community and elders to collect and integrate traditional knowledge associated with caribou.

<u>FGROW</u>

Weyerhaeuser continues to provide both in-kind and financial support to FGROW with the general objective of building capacity to support the rational implementation of enhanced forest management. The Forest Growth Organization of Western Canada (FGROW) is an amalgamation of the following organizations:

- Western Boreal Growth and Yield Cooperative (WESBOGY)
- Foothills Growth and Yield Association (FGYA)
- Mixedwood Management Association (MWMA)
- Alberta Forest Growth Organization (AFGO)
- Tree Improvement Alberta

HASOC

- Weyerhaeuser is an operating partner in HASOC along with CanFor, West Fraser, Miller Western and ANC Timber. The primary objective of the HASOC programs are to provide high quality material for reforestation, optimize genetic gain, maintain genetic diversity and long-term adaptive capability and to preserve genetic resources.
- Weyerhaeuser Grande Prairie has supported a Tree Improvement Program for over 20 years. This includes several individual projects that are supported under the Tree Improvement umbrella, including things like the Region A Pine Program, an Industrial Research Chair in Tree Improvement at the UofA, and various progeny trial sites for improved stock.

Ducks Unlimited Canada (DUC)

Weyerhaeuser signed a long-term MOU with DUC in 2006 to work on wetland classification, wetland inventories and beneficial management practices in our harvesting operations. Weyerhaeuser and DUC most recently began working together as a part of a multi company forestry initiative called ‘Forest Management Wetland Stewardship Initiative’ (FMWSI).

Sustainable forest management and sustaining wetland habitats are intertwined and achievable. Weyerhaeuser has been working with Ducks Unlimited Canada (DUC) since 2006 to identify opportunities for maintaining or enhancing wetlands and waterfowl in their managed forests. Past joint projects include wetland mapping, waterfowl research including modeling and mapping waterfowl abundance, and the development of best management practices (BMPs) related to wetland road crossing design and construction. In addition, DUC wetland mapping and waterfowl distribution models were used to help develop caribou conservation strategies throughout the GP FMA.

In 2016 Weyerhaeuser began working with DUC and a coalition of forest industry partners on the Forest Management and Wetland Stewardship Initiative (FMWSI). The purpose of the FMWSI is to share knowledge and work on projects that advance wetland, waterfowl, and waterfowl habitat stewardship in the context of forest management. Between 2016 and 2019 the FMWSI completed three project *Forestry and Waterfowl: Assessing and Mitigating Risk (FMWSI 2018a)*; *Guiding Principles for Wetland Stewardship and Forest Management (FMWSI 2018b)*; and *Wetland Best Management Practices for Forest Management Planning and Operations (FMWSI 2019)*.

Weyerhaeuser is committed to continuing to work with DUC on the FMWSI and other projects over the timeframe of this DFMP. In addition to supporting wetland habitat and waterfowl population conservation, this work helps Weyerhaeuser meet their regulatory and social obligations. Things like using wetland maps and inferred products to increase awareness and understanding of wetlands on the Grande Prairie FMA and working with DUC to identify and implement planning and operating BMPs for working in or near wetlands can help Weyerhaeuser address the intent of the Alberta Wetland Policy (Government of Alberta 2013), the SFI 2015 – 2019 Forest Management Standard (SFI 2015), and future SFI Standards.

For more information please refer to *Chapter 1- Appendix 1- Weyerhaeuser Grande Prairie Timberlands DFMP- Ducks Unlimited Input.*

1.4. Land Use Framework

Alberta initiated a Land Use Framework process in 2005 with input from the public, stakeholders and indigenous peoples. The final Land-use Framework guiding document was completed in December of 2008.

> *Alberta's prosperity has created opportunities for our economy and people, but it also has created challenges for Alberta's landscapes. Industrial activity, municipal development, infrastructure, recreation and conservation interests often are competing to use the same piece of land. There are more and more people doing more and more activities on the same piece of land. The competition between user groups creates conflict, and often puts stress on the finite capacity of our land, air, water and habitat. (Land Use Framework (2008))*

There were seven land-use regions defined and Weyerhaeuser's FMA area is solely within the Upper Peace Region. The Upper Peace Region is bordered by the Alberta-British Columbia border to the west, ranges east of Fox Creek to the boundary of the M.D. of Greenview, heads south to the Jasper National Park border and extends to the north boundary of Clear Hills County. The Upper Peace Region is approximately 7,427,032 hectares, making it the sixth largest of the seven regions[1].

The Upper Peace Regional Plan has not yet been started[2].

[1] https://landuse.alberta.ca/regional plans
[2] As of June 13, 2018

Chapter 1-Appendix 1- Weyerhaeuser GP Timberlands DFMP- Ducks Unlimited Input

Introduction

Wetlands, although poorly understood by many sectors of society, are prevalent across the western boreal forest and are important features on Weyerhaeuser Company Limited's (Weyerhaeuser hereafter) Grande Prairie Timberland Forest Management Area (FMA). Wetlands, including shallow open waters, marshes, swamps, fens, and bogs, are an integral component of forest ecosystems and thus play an important role in ecosystem-based management. Wetlands provide numerous ecological, social, and economic benefits that include providing habitat for plants and animals some of which are rare or at-risk species; sequestering and storing of atmospheric carbon, contributing to annual water budgets; and regulating surface and subsurface water supplies and flow.

Research shows that wetlands and forests can be interdependent, and thus healthy wetlands and healthy forests work together to create functioning forest ecosystems (e.g., Devito et al. 2012; Devito et al. 2016; McEachern 2016; Petrone et al. 2016, IUFRO 2018). Sustainable forest management is therefore key to maintaining wetland functions and conversely, functioning wetlands are important to maintaining healthy forests. Wetlands and forest management activities intersect in several ways. These intersections provide both challenges and opportunities. For example, when roads cross wetlands the performance of the road can be compromised due to wet soils and flowing water. This can result in increased construction and maintenance costs and may impact worker and public safety. From a wetland stewardship perspective, forest industry activities have the potential to affect wetland quality, wetland quantity, and wetland/watershed hydrology. Because wetlands are highly connected, these effects can be felt at the local regional, or landscape scale. Forest companies can also enhance wetland stewardship by applying tools and information, such as those described in this DFMP, to direct activities away from wetlands and provide opportunities for wetland conservation. Planning and operational practices such as identifying wetlands so that they can be avoided or accommodated during road construction or using wetlands as anchors for retention patches, can support wetland conservation efforts.

Wetland stewardship is increasingly part of the legal, certification, and social license obligations that forest companies must meet. In Alberta, the provincial Wetland Policy (Government of Alberta 2013) applies to all wetlands and came into effect in the White Area of the province June 1, 2015 and in the Green Area as of July 4, 2016. Under this policy, impacts to wetlands must be avoided where possible. Where avoidance is not possible, impacts must be minimized by demonstrating improved practices to support the intent of the policy. Third party forest certifications are also evolving to include wetlands. In 2015 the Sustainable Forestry Initiative (SFI) revised its forest management standard to include wetlands under Principle 3 (Protection of Water Resources) and Objective 3 (Protection and Maintenance of Water Resources; SFI 2015). To conform to this Standard, forest companies must demonstrate how they are managing wetlands to maintain water reach, flow, and quality during all stages of forest management.

Appendix 1- Ducks Unlimited Input

Sustainable forest management and sustaining wetland habitats are intertwined and achievable. Weyerhaeuser has been working with Ducks Unlimited Canada (DUC) since 2006 to identify opportunities for maintaining or enhancing wetlands and waterfowl in their managed forests. Past joint projects include wetland mapping, waterfowl research including modeling and mapping waterfowl abundance, and the development of best management practices (BMPs) related to wetland road crossing design and construction. In addition, DUC wetland mapping and waterfowl distribution models were used to help develop caribou conservation strategies throughout the GP FMA. In 2016 Weyerhaeuser began working with DUC and a coalition of forest industry partners on the Forest Management and Wetland Stewardship Initiative (FMWSI). The purpose of the FMWSI is to share knowledge and work on projects that advance wetland, waterfowl, and waterfowl habitat stewardship in the context of forest management. Between 2016 and 2019 the FMWSI completed three project *Forestry and Waterfowl: Assessing and Mitigating Risk (FMWSI 2018a)*; *Guiding Principles for Wetland Stewardship and Forest Management (FMWSI 2018b)*; and *Wetland Best Management Practices for Forest Management Planning and Operations (FMWSI 2019)*.

Weyerhaeuser is committed to continuing to work with DUC on the FMWSI and other projects over the timeframe of this DFMP. In addition to supporting wetland habitat and waterfowl population conservation, this work helps Weyerhaeuser meet their regulatory and social obligations. Things like using wetland maps and inferred products to increase awareness and understanding of wetlands on the Grande Prairie FMA and working with DUC to identify and implement planning and operating BMPs for working in or near wetlands can help Weyerhaeuser address the intent of the Alberta Wetland Policy (Government of Alberta 2013), the SFI 2015 – 2019 Forest Management Standard (SFI 2015), and future SFI Standards.

References:

Devito, K, Mendoza, C. and C. Qualizza. 2012. Conceptualizing water movement in the Boreal Plains: Implications for watershed reconstruction. Synthesis report prepared for the Canadian Oil Sands Network for Research and Development, Environmental and Reclamation Research Group. 164 p.

Devito, K.J., Mendoza, C., Petrone, R.M., Kettridge, N., and J.M. Waddington. 2016. Utikuma Region Study Area (URSA) – Part 1: Hydrogeological and ecohydrological studies (HEAD). *The Forestry Chronicle*. 92(1): 57-61.

Forest Management and Wetland Stewardship Initiative (FMWSI). 2018a. Forestry and Waterfowl: Assessing and Mitigating Risk. Ducks Unlimited Canada. Edmonton, Alberta.

Forest Management and Wetland Stewardship Initiative (FMWSI). 2018b. Guiding Principles for Wetland Stewardship and Forest Management. Ducks Unlimited Canada. Edmonton, Alberta.

Forest Management and Wetland Stewardship Initiative (FMWSI). 2019. Wetland Best Management Practices for Forest Management Planning and Operations. Ducks Unlimited Canada. Edmonton, Alberta.

Government of Alberta. 2013. Alberta Wetland Policy. Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. 26pp.

International Union of Forest Research Organizations (IUFRO). I.F. Creed and Meine van Noordwijk (eds.). 2018. Forest and Water on a Changing Planet: Vulnerability, Adaptation and Governance Opportunities. A Global Assessment Report. IUFRO World Series Volume 38. Vienna. 192 p

McEachern, P. 2016. Forest Watershed and Riparian Disturbance Project (FORWARD). *The Forestry Chronicle*. 92(1): 29-31.

Petrone, R., Devito, K.J., and C. Mendoza. 2016. Utikuma Region Study Area (URSA) – Part 2: Aspen harvest and recovery study. *The Forestry Chronicle.* 92(1): 62-65.

Sustainable Forestry Initiative. 2015. SFI 2015 – 2019 Forest Management Standard. Washington, DC. 13pp.

Overview of Wetlands and Waterfowl in the Grande Prairie FMA

Wetlands

Wetlands are an important component of boreal forest ecosystems and provide a variety of ecosystem services with social, ecological, and economic benefits. Understanding where and what kind of wetlands occur on Weyerhaeuser's Grande Prairie FMA, and how these wetlands function, can help Weyerhaeuser staff conserve wetlands, waterfowl, and waterfowl habitat. Wetland conservation is important for conserving the services wetlands provide, meeting legislation and forest certification requirements, and reducing operational costs. For example, knowing where the different types of wetlands are located, in combination with an understanding of typical water flow characteristics for those wetland types, can assist forest planners and operators locate roads to avoid wetlands or implement road construction techniques that mitigate potential impacts on wetlands. These actions can improve road safety, decrease maintenance costs, and improve environmental performance. For more information about wetlands in the boreal forest, including information about the wetland classes described below, refer to Appendix A of this document.

In 2009, DUC completed wetland mapping of the Weyerhaeuser FMAs of northwestern Alberta using the Enhanced Wetland Classification (EWC) inventory (Ducks Unlimited Inc. 2009). The EWC aligns with the Canadian Wetland Classification System (CWCS) at the five major class level and with the AWCS at the class and form levels. The results of the inventory are summarized and reported here using the CWS and the AWCS groupings. According to this inventory, wetlands make up 12.9% (143,901ha) of the Grande Prairie FMA (Table 1 and Appendix B, Figure B1). All five wetland classes are represented; however, most wetlands are swamps, followed by fens. Following the AWCS (Alberta ESRD 2015; see Appendix A for more details) most of the fens and swamps are wooded with conifer trees (Table 2 and Appendix B, Figure B2).

Swamps are a common, diverse group of tree or tall shrub (thicket) dominated wetlands. Because their diversity and tendency to have (relatively) large trees, swamps are often the least understood of boreal wetland types. Sometimes called lowlands, forested wetlands, treed swamp forests, wooded swamps, or shrub swamps they are often transition areas between upland forest and other wetland types or shorelines. Swamp soils are predominantly mineral, although deep wood-rich peat deposits (>40cm) can sometimes occur (e.g., conifer swamps) technically making these wetlands a peatland. Swamps are the most prevalent wetland class on the Grande Prairie FMA and make up 9.6% of the total area (107,155ha). Of the swamp classes, coniferous swamps are the most abundant (over 50% of total swamp area).

Fens are peatlands with deep organic deposits with greater than 40cm of decayed sedges and brown moss. Fens are typically connected to surrounding areas through ground and surface water flow. They receive or provide water and nutrients to other wetlands and uplands depending on conditions such as the amount of precipitation and soil moisture level. Tamarack and stunted black spruce are the tree species found in treed fens. Fens are the second most prevalent wetland class on the Grande Prairie FMA and make up 2.0% of the total area (22,633ha). Of the fen classes, treed fens are the most abundant (over 50% of total fen area).

Appendix 1- Ducks Unlimited Input

Table 1. The area in hectares (ha) of the five major wetland classes according to the CWCS, uplands, and other/unclassified landforms in the Grande Prairie FMA. See Appendix B, Figure B1 for associated map.

Major Wetland Class	Area (ha)	Percent of Total Area
Shallow Open Water	6,849	0.6%
Marsh	2,337	0.2%
Fen	22,633	2.0%
Bog	4,927	0.4%
Swamp	107,155	9.6%
Upland	970,514	86.9%
Other / Unclassified*	2,876	0.3%
Total Wetland	143.901	12.9%
Total Area	1,117,291	100.0%

*Other/Unclassified area includes cutblocks, cloud, cloud shadow, burn, and no data

Table 2. The area in hectares (ha) of the 13 wetland forms according to the AWCS, uplands, and other/ unclassified landforms in the Grande Prairie FMA. See Appendix B, Figure B2 for associated map.

Wetland Form	Area (ha)	Percent of Total Area
Bare Shallow Open Water	6,347	0.6%
Submersed / Floating Aquatic Vegetation	503	0.0%
Graminoid Marsh	2,337	0.2%
Graminoid Fen	586	0.1%
Shrubby Fen	5,828	0.5%
Wooded, Coniferous Fen	16,219	1.5%
Shrubby Bog	430	0.0%
Wooded, Coniferous Bog	4,497	0.4%
Shrubby Swamp	10,975	1.0%
Wooded, Deciduous Swamp	9,400	0.8%
Wooded, Mixedwood Swamp	18,762	1.7%
Wooded, Coniferous Swamp	68,017	6.1%
Upland	970,514	86.9%
Other / Unclassified	2,876	0.3%
Total	1,117,291	100.0%

*Other/Unclassified area includes cutblocks, cloud, cloud shadow, burn, and no data

References:

Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy Division, Edmonton.

Ducks Unlimited, Inc. 2009. "Weyerhaeuser Project Enhanced Wetlands Classification User's Guide." 70 pp. Ducks Unlimited, Inc., Rancho Cordova, California. Prepared for: Ducks Unlimited Canada; Weyerhaeuser; Government of Alberta; The PEW Charitable Trusts; Encana; U.S. Forest Service; U.S. Fish and Wildlife Service (NAWCA); and the Canadian Boreal Initiative.

Wetland Below-Ground Carbon Storage

Carbon sequestration and storage are important ecosystem services provided by wetlands, and boreal peatlands are particularly important. Because of the value of these services, quantifying the extent of carbon sequestration and storage (carbon accounting) on the lands they manage is increasingly important to forest companies. Avoiding or minimizing wetland disturbance can help prevent or reduce greenhouse gas emissions and carbon accounting can help inform these avoidance and minimization decisions. While carbon estimates are often available for managed uplands, carbon estimates for boreal wetlands are lacking or incomplete.

In the boreal forest, wetlands store an order of magnitude more carbon per given area than uplands. Peatlands (bogs and fens) make up over half of Alberta's wetlands (56%) and are particularly important carbon stores because of their deep peat accumulations. A conservative estimate of 11.5-13 billion metric tons of below ground carbon is stored in Alberta's boreal wetlands. However, good quality estimates of subsurface wetland carbon stocks are limited, in part, by availability and access to wetland data (e.g., peat depth, carbon content) needed to improve carbon storage models and calculations. To help address this information gap, DUC has developed a set of wetland soil organic carbon densities for various wetland classes and applied those values spatially to DUC's EWC mapping products. Soil organic depth and soil organic carbon bulk densities were compiled from various sources (e.g., Zoltai et al. 2000, NFI, Suncor) and from internal collection with partners. Because of regional differences of peat depth amongst wetland types throughout the western boreal forest, additional sampling work is recommended to better reflect more local/regional estimates of wetland subsurface carbon storage values.

Based on the preliminary work, The Weyerhaeuser Grande Prairie FMA stores an estimated 85.8 million tonnes of organic carbon in wetland soils (Table 3, Appendix C, Figure C1). This is roughly equivalent to the annual CO_2 emissions of 68.4 million standard vehicles (USEPA, 2018). Forty six percent of all the wetland soil organic carbon is stored in conifer swamps with an additional 11% in treed rich fens, 8% in treed poor fens, and 7% in both shrubby rich fens and treed bogs. These numbers largely reflect the most abundant wetland types (conifer swamps are the dominant wetland class); however, wetland types such as treed bogs and graminoid fens store a significant amount of carbon despite representing a small area of the FMA.

Practices that conserve wetland carbon storage capacity are an important component of wetland stewardship and can help avoid or reduce emissions associated with disturbance, maintain wetland values and functions, and help mitigate climate change.

Table 3. Summary of DUC's EWC system wetland area and soil organic carbon densities for Weyerhaeuser's Grande Prairie FMA.

EWC Minor Wetlands	Area (ha)	Soil Organic Carbon (T/ha)	Soil Organic Carbon (Tonnes)	CO_2 (Tonnes)	Number of cars annual emissions equivalent	% of Total SOC
Open Water	6,347	289	1,834,154	6,724,010	1,461,741	2%
Aquatic Bed	503	289	145,295	532,653	115,794	0%
Emergent Marsh	1,537	289	444,064	1,627,940	353,900	1%
Meadow Marsh	800	289	231,251	847,768	184,297	0%
Graminoid Rich Fen	576	1,242	715,254	2,622,121	570,026	1%
Graminoid Poor Fen	10	1,147	11,560	42,378	9,213	0%
Shrubby Rich Fen	5,123	1,104	5,655,071	20,731,491	4,506,846	7%
Shrubby Poor Fen	706	1,248	880,737	3,228,782	701,909	1%
Treed Rich Fen	9,581	1,001	9,588,907	35,152,935	7,641,942	11%
Treed Poor Fen	6,638	996	6,612,245	24,240,491	5,269,672	8%
Shrubby Bog	430	1,199	516,208	1,892,420	411,396	1%
Treed Bog	4,497	1,367	6,147,054	22,535,101	4,898,935	7%
Shrub Swamp	10,975	429	4,704,731	17,247,543	3,749,466	5%
Hardwood Swamp	9,400	289	2,716,675	9,959,330	2,165,072	3%
Mixedwood Swamp	18,762	289	5,422,283	19,878,091	4,321,324	6%
Tamarack Swamp	1,671	289	482,871	1,770,205	384,827	1%
Conifer Swamp	66,346	599	39,753,245	145,735,395	31,681,608	46%
Total	143,901		85,861,607	314,768,653	68,427,968	100%

*Carbon is converted to CO_2 using a multiplication factor of 3.666 which is further converted to number of cars annual emissions equivalent using a division factor of 4.6. "This assumes the average gasoline vehicle on the road today has a fuel economy of about 22.0 miles per gallon and drives around 11,500 miles per year. Every gallon of gasoline burned creates about 8,887 grams of CO_2" (USEPA, 2018)

References:

United States Environmental Protection Agency (USEPA). 2018. Greenhouse Gas Emissions from a Typical Passenger Vehicle: Questions and Answers. Office of Transportation and Air Quality, United States Environmental Protection Agency. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100U8YT.pdf

Zoltai, S. C., Siltanen, R. M., & Johnson, J. D. (2000). A wetland data base for the western boreal, subarctic, and arctic regions of Canada. Northern Forestry Center Information Report NOR-X-368.

Bridgham, S. D., Megonigal, J. P., Keller, J. K., Bliss, N. B., & Trettin, C. (2006). The carbon balance of North American wetlands. Wetlands, 17(2), 889-916.

Waterfowl

DUC has identified the Western Boreal Forest as a conservation priority because this region contains important nesting, rearing, molting, staging, and migration habitat for waterfowl. Twenty-three species and nearly 30% of breeding season waterfowl counted in North America are found in the WBF (Slattery et al. 2011). For more information on boreal waterfowl refer to Appendix E of this document.

To predict waterfowl abundances across the boreal landscape DUC developed statistical models that are presented as maps (DUC 2014). These models were used to map predicted waterfowl abundance for total waterfowl pairs and for each of three nesting guilds based on nest placement (*i.e.*, ground, overwater and cavity nesting). Nesting guilds were chosen because of expected similarities of responses and sensitivities to localized disturbance compared to other guild level groupings. Information about how the waterfowl models were developed can be found in Appendix E.

These maps represent *predictions* of relative waterfowl densities based on breeding pair surveys and a suite of environmental variables used to characterize the landscape. Thus, these maps are best considered to represent densities over broad areas rather than at fine spatial scales. While some waterfowl species tend to return to the same areas where breeding was successful, inter- and intra-annual variation in abundance of waterfowl at any given wetland does occur.

The predicted total breeding pair abundance for the Grande Prairie FMA is 11,008 (Table 4 and Appendix E, Figure E1). Of the total predicted breeding pairs on the FMA, 62% are ground nesters, 28% cavity nesters, and 10% overwater nesters (Table 4; Appendix E, Figure E2).

Table 4. Predicted pair abundance numbers and percent (of all guild) for the three nesting guilds and all guilds combined on the Weyerhaeuser Grande Prairie FMA.

Ground Nesters	Ground Nester%	Overwater Nesters	Overwater Nester%	Cavity Nesters	Cavity Nester%	All Guilds
6,835	62%	1,120	10%	3,053	28%	11,008

The majority of the Grande Prairie FMA (95%) is predicted to have very low or low pair densities. These areas represent 61% of the total number of breeding pairs predicted on the FMA. Three percent of the area is predicted to have medium waterfowl densities, representing 19% of the breeding ducks. The remaining area (1%) is predicted to have high pair densities, representing 13% of the total breeding ducks. (Appendix E, Figure E1 and Table E1). Patterns for the three nesting guilds are like those seen for total waterfowl (with most of the area low or very low density and small areas of high density). Information about cut-offs for density classes can be found in Appendix E.

Waterfowl distribution maps have many potential applications to guide conservation planning efforts that seek to conserve areas important for waterbirds and aquatic biodiversity. For example, Weyerhaeuser, DUC and other forest sector partners completed a project *Forestry and Waterfowl: Assessing and Mitigating Risk* that incorporated these maps into a decision-making approach to assess the risk of incidental take as part of the FMWSI. An ongoing FMWSI project is focused on translating this decision-making approach into a spatial tool that uses these maps (described under future work).

Waterfowl density distribution maps can also be used to identify areas that are the most likely to support large numbers of breeding waterfowl and can assist with both strategic and operational planning efforts designed to minimize risk of impact to waterfowl and potentially other wetland associated birds (Paszkowski and Tonn 2006).

References:

Ducks Unlimited Canada. 2014. Distribution and abundance of waterfowl in the western boreal forest. Ducks Unlimited Canada, Edmonton, Alberta.

Paszkowski, C.A., and M.T. Tonn. 2006. Foraging guilds of aquatic birds on preductive boreal lakes: environmental relations and concordance patterns. *Hydrobiologia* 567: 19-30.

Wetland Biodiversity Values

Boreal wetlands developed under unique ecological conditions and have resulted in diverse plant and animal communities. A 2016 DUC report vertebrate biodiversity in boreal wetlands documented that as high as 188 bird, 46 mammal, five amphibian and one reptile species in Alberta are associated with wetland ecosystems during all or part of their lifecycle (DUC 2016). Wetlands can provide important wildlife habitat for species at risk, uncommon species, wetland endemic species, and economic or culturally important species. Examples include the rusty blackbird, yellow rail, woodland caribou, moose, waterfowl and various furbearing species. Although some boreal wetlands may contain lower biodiversity values than other areas (e.g., bogs tend to have lower biodiversity values), low biodiversity does not necessarily reflect the overall importance of an area. In some instances, areas of low biodiversity may contain habitat of high importance to unique or rare species such as caribou, and therefore can have a high conservation value.

Maintaining healthy wetlands across the Grande Prairie FMA is an important contribution to biodiversity conservation. Maintaining healthy wetlands helps maintain species richness and supports the protection of keystone species, threatened species, and other species of significance.

Caribou Planning Support

In 2018, DUC worked with Weyerhaeuser to assess and rank waterfowl and wetland values to help develop caribou conservation strategies throughout the GP FMA. More specifically, DUC provided an analysis of wetland and waterfowl values by the geographic structure that Weyerhaeuser provided (i.e. Zone and Compartments) throughout the respective FMA. Values included in the analysis included: estimated pairs of waterfowl by nesting guilds (i.e. ground, cavity, and overwater); total wetland area by major wetland class (i.e. open water, marsh, swamp, fen, bog); and primary waterfowl habitat.

Waterfowl Habitat

Wetland Habitat - Ranked the total wetland area per compartment and assigned to a value of 1 (low) to 4 (high) based on the area found within the respective geographic compartment. Assignment of rank was based on the total area in the compartment compared to the total area in all compartments considered. The compartments were assigned a rank based on quartiles (25%, 50%, etc.) of the total value.

Primary Waterfowl Habitat - Ranked the total primary habitat area per compartment and assigned to a value of 1 (low) to 4 (high) based on the area found within the compartment. Assignment of rank was based on the total area in the compartment compared to the total area in all compartments considered. The compartments were assigned a rank based on quartiles (25%, 50%, etc.) of the total value.

Final Habitat – From the 2 above featured variables, created a final habitat ranking, assigning the highest rank as the final rank for that compartment for habitat (1-4)

Final Waterfowl - Ranked the individual nesting guilds per compartment and assigned a value of 1 (low) to 4 (high) based on the number of estimated pairs found within the compartment. Assignment of rank was based on the total estimated pairs in the compartment compared to the total estimated pairs in all compartments being considered. The compartments were assigned a rank based on quartiles (25%, 50%, etc.) of the total value. A final waterfowl ranking was created that assigned the highest rank over the three guilds to the compartment (values of 1-4). Added together the *Final Habitat* ranking and the *Final Waterfowl* ranking for a ranked score between 1-8 with 8 being of the highest value and assigned rankings spatially to each individual compartment (Appendix D, Figure D2).

References: Ducks Unlimited Canada. 2016. Ranking Vertebrate Biodiversity in Boreal Wetland Habitats of Alberta using Enhanced Wetland Classification System – Version 2.1. Ducks Unlimited Canada. Edmonton, Alberta, Canada.

Future Work with DUC

Forest Management and Wetland Stewardship Initiative (FMWSI)

The FMWSI is a three-year collaboration between DUC and a coalition of forest industry partners, including Weyerhaeuser and the Forest Products Association of Canada. The FMWSI was initiated in 2016 and the first term ran from 2016 to 2019. Weyerhaeuser and other FMWSI members have committed to renewing this initiative for another three-year term. In the first three years, FMWSI partners completed three projects that helped establish wetland stewardship guiding principles and develop wetland and waterfowl BMPs. Each project was developed and launched with direct engagement with forest industry partners to ensure that the deliverables are practical and achievable. FMWSI was formed to provide information that will be integrated into on-going sustainable forest management planning and operations, and that will support forest certification programs and efforts to meet the intent of the Alberta Wetland Policy.

Completed FMWSI projects include:

1. *Forestry and Waterfowl: Assessing and Mitigating Risk*

This project resulted in a practitioner guide and technical report (completed October 2018) that describe a decision-making approach to assessing the risk of incidental take of waterfowl in Canada's boreal guidance and provide guidance on how to reduce that risk. The project specifically targets boreal forest waterfowl with the forest industry as the intended user. The technical report and practitioner guide promote the proper management, conservation, and protection of migratory birds nesting in the boreal forest to assist industry in meeting their regulatory (e.g., Migratory Bird Convention Act) and voluntary (e.g., forest certification) requirements. This project is intended to be used in conjunction with other incidental take guidance that focuses on songbirds. The FMWSI is currently working on expanding these deliverables into a spatial tool.

2. *Guiding Principles for Wetland Stewardship and Forest Management*

This project resulted in a practitioner guide and technical report (completed December 2018) that present a range of strategic planning considerations for working in and around wetland environments and includes wetland stewardship principles, objectives and considerations to accommodate wetland conservation actions. The technical report is intended to be a reference document and describes in detail the interactions between boreal wetlands and forests and how forest managers can use this information to help avoid or minimize adverse effects to wetlands. The report presents guiding principles for wetland stewardship and wetland avoidance and minimization planning considerations. The practitioner guide is a user-friendly overview of the contents of the technical report. The deliverables from this project provide the framework for wetland stewardship in the context of forest management and are an important foundation for future FMWSI projects.

3. *Wetland Best Management Practices for Forest Management Planning and Operations*

This project resulted in a practitioner guide (completed June 2019) that describes planning and operations practices for activities ranging from access, to timber harvest, to forest renewal and training. This plain language, field-oriented handbook is geared towards forest practitioners with the goal of raising awareness and understanding of practices that be applied to avoid and minimize adverse effects to boreal wetlands and promote wetland stewardship. This field guide links back to the "Guiding Principles" document and provides descriptions regarding implementation of recommended practices.

Weyerhaeuser is committed to continuing their involvement in the FMWSI, including developing new projects and working with DUC to determine how the results of the first three projects can be integrated into Weyerhaeuser's forest management planning and operations. FMWSI 2.0 projects are expected to start in late 2019/ early 2020.

Operating Ground Rules (OGRs) and Standard Operating Procedures (SOPs)

Following the approval of the DFMP, Weyerhaeuser will engage DUC to assist in reviewing and, where possible, strengthening the existing OGRs related to wetland and waterfowl conservation. Reviewing the Alberta OGRs is a proposed FMWSI 2.0 project. If this project goes ahead, then the initial review and strengthening will be completed as part of a collaborative project with all FMWSI partners. DUC will work with Weyerhaeuser to fill any gaps relevant to strengthening OGRs for the Grande Prairie FMA. If the FMWSI 2.0 OGR review project doesn't go ahead, DUC will work individually with Weyerhaeuser to review and, where possible, strengthen the existing OGRs for the Grande Prairie FMA. Based on the outcomes of the OGR review, DUC will also work with Weyerhaeuser to review and strengthen their SOPs in relation to wetland and waterfowl stewardship.

Further, as information and practices that inform and support boreal wetland stewardship become available, Weyerhaeuser will continue to work with DUC to develop and adapt relevant BMPs to enhance wetland conservation on Weyerhaeuser's Grande Prairie FMA. This could include practices that assist in avoiding or minimizing impacts to wetlands, including wetland soils and water. These practices can be used to strengthen Weyerhaeuser's environmental performance and to assist Weyerhaeuser in meeting the intent of the Alberta Wetland Policy and forest certification requirements.

Wetlands Training

Fundamental to wetland stewardship is to ensure that all planning and operations staff have a comprehensive understanding of boreal wetland types, values, and functions. Wetlands training is an important tool for developing this capacity. Training is also an important complement to DUC's wetland mapping products such as the EWC and hydrologic risk mapping (discussed in the following section). Training helps to ensure that awareness and understanding of boreal wetlands, including wetland classification, is disseminated across strategic planning, operational planning, and operations. Collectively, a wetland inventory and a complementary training program will contribute to a wetland stewardship program, help meet components of SFI forest certification requirements, and help address the intent of the Alberta Wetland Policy.

Wetlands Training is a proposed FMWSI 2.0 project. If this project goes ahead, it will likely meet some of Weyerhaeuser's wetlands training needs. Weyerhaeuser will work with DUC to develop a wetland training program that complements work done through the FMWSI and fills any gaps to meet Weyerhaeuser's specific training needs.

Hydrologic Risk Mapping

Wetland mapping completed for the Grande Prairie FMA utilizes DUC's ecologically based EWC. The EWC can be used to create inferred products such as maps of flow characteristics and maps of hydrologic risk (Appendix F, Figure F1 and F2). These sorts of products can provide additional information that can be used when making decisions about activities in and around wetlands, particularly access activities (i.e. wetland road crossings) that have the potential to disrupt natural flow patterns.

To develop a relative hydrologic risk map for non-frozen conditions, wetlands were first grouped based on flow characteristics taken from a generalized understanding of how boreal wetlands move water (Appendix F, Table F1). The groupings account for the direction of water movement (vertical vs. lateral) and amount of water movement (stagnant vs. dynamic flow) under typical climatic conditions. These flow characteristics were then linked to relative risks of hydrologic impairment. It is important to recognize that relative risk will differ depending on the time of year and climatic conditions. While bogs are generally characterized as having little water movement, they can move considerable amounts of water under certain conditions (i.e. are a water source during dry periods). While flow characteristics and relative hydrologic risk can be useful for planning, it is important to recognize other variables may also influence boreal wetland hydrology. For a more detailed description of DUC's hydrologic risk mapping work see Appendix F.

Hydrologic risk mapping, inferred from an understanding of wetland flow characteristics, can be helpful when planning road networks and associated wetland road crossing construction techniques (refer to Appendix F Figures F1 and F2).

Weyerhaeuser will work with DUC to determine how flow characteristics and hydrologic risk mapping products can be used as part of access planning to design, construct, and adapt wetland crossings to accommodate wetland flows.

Below-Ground Wetland Carbon Store Estimates

Carbon accounting is becoming important to the forest industry and companies are increasingly interested in understanding how much carbon is stored in the areas they manage. While estimates are often available for managed uplands, carbon estimates for boreal wetlands are lacking or incomplete. Good quality estimates of subsurface wetland carbon stocks are limited, in part, by availability and access to spatially referenced data associated to various wetlands types (e.g., peat depth, carbon content) that is required to improve carbon storage models and calculations.

To help address this information gap, DUC developed a draft first generation set compilation of wetland soil organic carbon densities for various wetland classes and applied those values spatially to DUC's EWC mapping products across western Canada where the EWC has been completed to date. Soil organic depth and soil organic carbon bulk densities were compiled from various sources (e.g., Zoltai et al. 2000, NFI, Suncor) and from internal collection with partners.

Further scoping additional spatially referenced peat core depth information associated with wetlands, compiling an accompanying report and reporting values to the respective FMWSI partners where EWC coverage exists over their respective FMA's is a proposed FMWSI 2.0 project. If this project goes ahead, the initial scoping of available field data and further calibration of peat values by wetland type will be strengthened where wetland subsurface carbon storage values can be summarized with all FMWSI partners.

Because of regional differences of peat depth amongst wetland types throughout the western boreal forest, Weyerhaeuser and DUC may also want to fill any gaps relevant to strengthening wetland carbon storage values for the Grande Prairie FMA, and potentially other FMA holdings throughout Alberta and Saskatchewan to account for any potential regional variation of carbon values. Weyerhaeuser will work with DUC to determine how soil organic carbon mapping can be used to assist as part of Weyerhaeuser's carbon accounting.

Special Management

Approximately 33% of the Grande Prairie FMA is wetland, with the majority being wooded fens and conifer swamps. Bogs, shallow open water, and marshes are relatively rare on the landscape representing approximately 2% of the wetlands on the FMA. Given these wetland types are relatively rare, special management considerations may be required and Weyerhaeuser will work with DUC to jointly develop conservation strategies and practices to help maintain their integrity.

Wetland Biodiversity Tool

DUC developed a Biodiversity Tool that can be used to improve understanding of vertebrate biodiversity in Alberta's boreal wetlands, including wetlands within the Grande Prairie FMA. The tool links vertebrate species to boreal wetland classes based on an extensive literature review of species habitat use, and produces a habitat ranking score by wetland class for biodiversity based on Species Richness, Species Overlap, and Rare Species Potential. The relative habitat ranking scores (high to low) are combined with DUC's EWC system to produce a visualization of boreal wetland biodiversity values. The tool was designed to identify wetlands with relatively higher and lower vertebrate biodiversity for all species on the Alberta boreal species list but also for seven Key Categories (rare species, hunted and trapped species, key waterfowl and waterbirds, species of high importance to First Nations in the Fort Mackay Region, ecological indicator species, migratory bird species, and wetland indicator species).

Information about wetland biodiversity can help support special management considerations that can be aligned with various government-led policy and planning initiatives. For example, this information could fit into the Regional Land Use Planning process, including the regional biodiversity management framework that is part of the regional land use planning process. In addition, biodiversity information can support Weyerhaeuser's planning and certification needs by providing information about wetlands with high biodiversity values. This information can then be used to identify management strategies to maintain these ecosystems for a variety of species of interest (e.g., rare species, species of concern, songbirds affiliated to different wetland types, etc.). For example, Appendix D, Figure D2 shows biodiversity values for wetlands within the Grande Prairie FMA for Rare Species (including provincially and federally listed species). Many of the wetlands within the Grande Prairie FMA appear to be in the Medium-High biodiversity range (orange), but areas of high (red) and low (blue) are also present. Wetlands ranked as high (red) for rare species may be areas to target for avoidance where feasible or for on-the-ground surveys if harvest or access activities are planned in or near these areas.

Weyerhaeuser will work with DUC to assess how the tool can be used to improve understanding of wetland biodiversity on the Grande Prairie FMA and to determine how this biodiversity information can inform forestry practices to conserve these values.

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Wetland Stewardship Plan

Wetland stewardship, within the context of this DFMP, is a demonstrated commitment by Weyerhaeuser to implement responsible planning and management of the FMA through the appropriate implementation of sustainable land use practices that work to help conserve wetlands and waterfowl habitat. As the role of boreal wetlands become increasingly recognized, in combination with the implementation of the Alberta Wetland Policy and various land-use planning processes, establishing a commitment to wetland stewardship demonstrates a recognition by Weyerhaeuser of the importance of wetlands as being integral to ecosystem-based forest management.

The work undertaken between DUC and Weyerhaeuser since 2006 speaks volumes to the joint interest
and commitment to enhanced wetland stewardship and waterfowl conservation on the land base that
Weyerhaeuser has management responsibilities. Further, this body of work provides the opportunity to
pull this material together in a single document that summarizes how this work will be used by Weyerhaeuser to integrate wetland and waterfowl conservation into their ongoing forest management
activities on the lands under their tenure. The preparation of Wetland Stewardship Plan will in turn support future Forest Management and Operational Plans, one-the ground activities and contribute to support SFI certification requirements relative to the conservation of wetlands and biodiversity.

Over the next several months Weyerhaeuser will work with DUC to develop a Wetland Stewardship Plan. Details of this plan will need to be developed and could include the drafting of wetland and waterfowl objectives, the incorporation of DUC conservation tools such as the DUC wetland inventory and waterfowl distribution maps into Weyerhaeuser planning, wetlands training for planners and operators, and implementation of best management practices as described above.

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Appendix A – General Wetland Information

Wetland Benefits

At the local and regional scales, wetlands influence rainfall and temperature patterns. At the global scale, Canada's wetlands, especially peatlands, play a key role in the regulating greenhouse gases such as methane and carbon dioxide and buffering the impacts of climate change (Gingras *et al.* 2016). Wetlands store water and slowly release it when conditions warrant. Wetlands therefore help maintain water flow through droughts and floods, can regulate flow during storm-water peaks and thereby reduce the risk of erosion. Because wetlands can slow water movement, they can filter suspended sediments that settle to the wetland floor. Excess nutrients and/or pollutants are often either buried within these sediments or are absorbed by plant roots and microorganisms (Gingras *et al.* 2016).

Wetlands also provide fresh surface water and replenish ground water supplies for industrial (e.g. petroleum extraction) use and to a lesser extent for domestic and agricultural use (Gingras et al. 2016). In addition, some wetland plants and animals offer provisioning benefits such as food (e.g., fish, wild rice, waterfowl, berries, fiddlehead ferns, moose, woodland caribou, and mushrooms) and/ or are sources for timber, fuel, and fur for domestic and commercial use. Wetlands also provide opportunities for recreational activities including canoeing, hunting, hiking, fishing, trapping, and bird watching (Gingras *et al.* 2016).

Wetlands are rich in biodiversity and provide important habitat for hundreds of species of plants and animals, some of which are of conservation concern in Alberta (e.g., woodland caribou). For example, an estimated ~26 million waterfowl representing 35 species and ~7 million shorebirds representing 19 species use Canadian boreal forest wetlands as migratory stop over or breeding habitat (Blancher and Wells 2005).

Recent studies indicate that wetlands influence forest productivity and resiliency. Johnston *et al.* (2010) report that the thick wet soils of peatlands are more resilient to spatial or temporal changes in climate than other forest habitat types. Waddington *et al.* (2015) suggest that there are feedback mechanisms inherent to wetlands that promote water retention and stability. These wetlands can act as stable water sources to adjacent forest. For example, through a combination of field studies and modelling, Devito *et al.* (2012), found that boreal plain uplands and wetlands are hydrologically connected, and that water is redistributed through ground water, surface runoff, and root processes. Petrone *et al.* (2016) indicate that following forest harvest in the boreal plains, measures of soil hydraulic lift show that regenerating aspen may use adjacent wetlands as water sources. In addition, Petrone *et al.* (2016) observed "root pipelines", that is, suckering from aspen forest through riparian zones to wetlands.

Wetlands also influence fire patterns and recovery and could buffer the impact of climate change on boreal plan forest lands. Johnston *et al.* (2010) and Schiks *et al. (*2016) indicate that in many undisturbed peatlands, thick wet soils and moss limit wildfire frequency and inhibit deep burning under most fire-weather conditions. Following a fire, regenerating aspen may use adjacent wetlands as water sources. Schneider *et al.* (2016) suggest that if precipitation is maintained as expected in the boreal plains, most peatlands should be very resilient to climate change. They indicate that “because peatlands retain large amounts of water on the landscape and because they are resistant to change, peatlands may play an important role in slowing the rate of forest loss”.

Wetland Types

Wetlands are defined in Alberta as “land that is saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to wet environments” (Alberta Environment and Sustainable Resource Development, AESRD 2015). Under this definition, wetlands can have areas of open water or be temporarily dry, they can vary in size and can be treed, shrubby, or open with mosses, sedges or grasses.

Both the Canadian Wetland Classification System (CWSC, National Wetlands Working Group 1997) and the Alberta Wetland Classification System (AWCS, AERSD 2015) note that wetlands can be organic (bogs and fens) or mineral (marshes, shallow open waters, and swamps) based.

Organic wetlands - have a surface layer of living roots and plants and a deep layer of decomposing organic deposits (>40cm) that are slowly accumulating over time due to cool and wet conditions. Organic wetlands are also referred to as peatlands, are commonly called muskeg and are the most prevalent wetlands in Canada’s temperate and boreal forests. Bogs and fens are the two types of organic wetlands found in the boreal.

Bogs - are peatlands with a deep layer of peat made up primarily of decomposed Sphagnum mosses. They are raised or level with the surrounding land and are generally isolated from groundwater and runoff thus, they receive water and most nutrients from precipitation (most bogs are nutrient poor) and considered stagnant systems. There is no open water at the surface of the bog, but the peat below is saturated with water. Bogs, particularly during dry periods, may be important sources of water for adjacent forests. Bogs can be treed (e.g., lowland/stunted black spruce), can have low-lying shrubs, (e.g., Labrador tea) or can be open areas dominated by *Sphagnum* moss.

Fens - are peatlands with deep organic deposits of decayed sedges and brown moss. Unlike bogs, fens are highly connected to surrounding areas through ground and surface water flow making them more nutrient rich than bogs generally making them more productive and biologically diverse than bogs. They receive or provide water and nutrients to other wetlands and uplands depending on conditions such as the amount of precipitation and soil moisture level. Thus, the water table in fens may fluctuate but is generally within a few centimeters above or below the surface of the fen. Fens can be treed with tamarack with a component of lowland/stunted black spruce can have shrubs, (e.g., bog birch or willow) or can be open areas dominated by narrow leaved sedges, buckbean, grasses, and moss

Mineral wetlands – have shallow organic deposits (<40cm) and are characterized by nutrient-rich soils and water. The presence of shallow organic deposits is a result of periodic drying of the wetland allowing for decomposition of the organic layer. They are a diverse group of wetlands with dynamic water regimes. Swamps, marshes, and shallow open water are the three types of mineral wetlands found in Alberta.

Swamps - are a common, diverse group of tree or tall shrub (thicket) dominated wetlands occurring in a variety of landscapes and often the least understood wetlands in forested environments. Sometimes called lowlands, forested wetlands, treed swamp forests, wooded swamps, or shrub swamps are often transition areas between upland forest and other wetland types or shoreline areas. They typically have hummocky ground that may contain pools of water. Swamp soils are predominantly mineral based, although deep wood-rich peat deposits (>40cm) can occur in some settings (e.g., conifer swamps) technically making these wetlands a peatland. They have fluctuating water tables; some of the year the water table can be well below the surface creating an aeration zone in the soil that promotes tree and shrub root development. Swamps support a diversity of trees (typically > than 10 meter in height), shrubs (typically >2 meter in height), and other vegetation.

Marshes – sometimes called reed swamps or sedge meadows, often exist as the transition between open water and upland shorelines. Marshes are highly productive due to a dynamic water regime resulting in periodic drawdown periods that expose the soil resulting significant aeration, the subsequent release of nutrients and the re-establishment of emergent vegetation. Aquatic non-woody emergent vegetation dominates and includes sedges, rushes, reeds, grasses, and cattails. Floating (e.g. pond lily) and submerged (e.g. pondweed) aquatic vegetation is also present where open water exists. Marshes are the least common wetland in forested regions.

Shallow Open Water – have standing water that is generally <2m deep. These wetlands often called, ponds, pools, oxbows, deep marshes, or sloughs are usually flooded but may experience water table fluctuations dependent on yearly and seasonal climatic conditions. Vegetation, if present, is dominated by floating or submerged aquatic plants.

These five major types of wetlands can be further classified in various ways. For example, DUC has developed an ecologically - based enhanced wetland classification (EWC) system for the Boreal plains ecozone further categorizing the 5 major classes of wetlands into 19 minor classes. The AWCS breaks the five major classes into 13 forms (see Table A1).

Table A1. Classification of wetlands according to the CWCS, AWCS and the EWC.

CWCS/AWCS/ESC Major Class [1, 2, 3]	AWCS Form [2]	EWC Minor Class [3]
National (n = 5)	**Provincial (n = 13)**	**Ecozone (n = 19)**
Shallow Open Water	Submersed and/or Floating Aquatic Vegetation	Aquatic Bed
	Bare Shallow Open Water	Open Water
		Mudflats
Marsh	Graminoid Marsh	Emergent Marsh
		Meadow Marsh
Swamp	Coniferous Wooded Swamp	Tamarack Swamp
		Conifer Swamp
	Wooded, Deciduous Swamp	Hardwood Swamp
	Wooded, Mixedwood Swamp	Mixedwood Swamp
	Shrubby Swamp	Shrub Swamp
Fen	Wooded, Coniferous Fen	Treed Rich Fen
		Treed Poor Fen
	Shrubby Fen	Shrubby Rich Fen
		Shrubby Poor Fen
	Graminoid Fen	Graminoid Rich Fen
		Graminoid Poor Fen
Bog	Wooded, Coniferous Bog	Treed Bog
	Shrubby Bog	Shrubby Bog
	Graminoid Bog	Open Bog

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2. Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy Division, Edmonton.

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Appendix B – Wetlands on Weyerhaeuser's Grande Prairie FMA

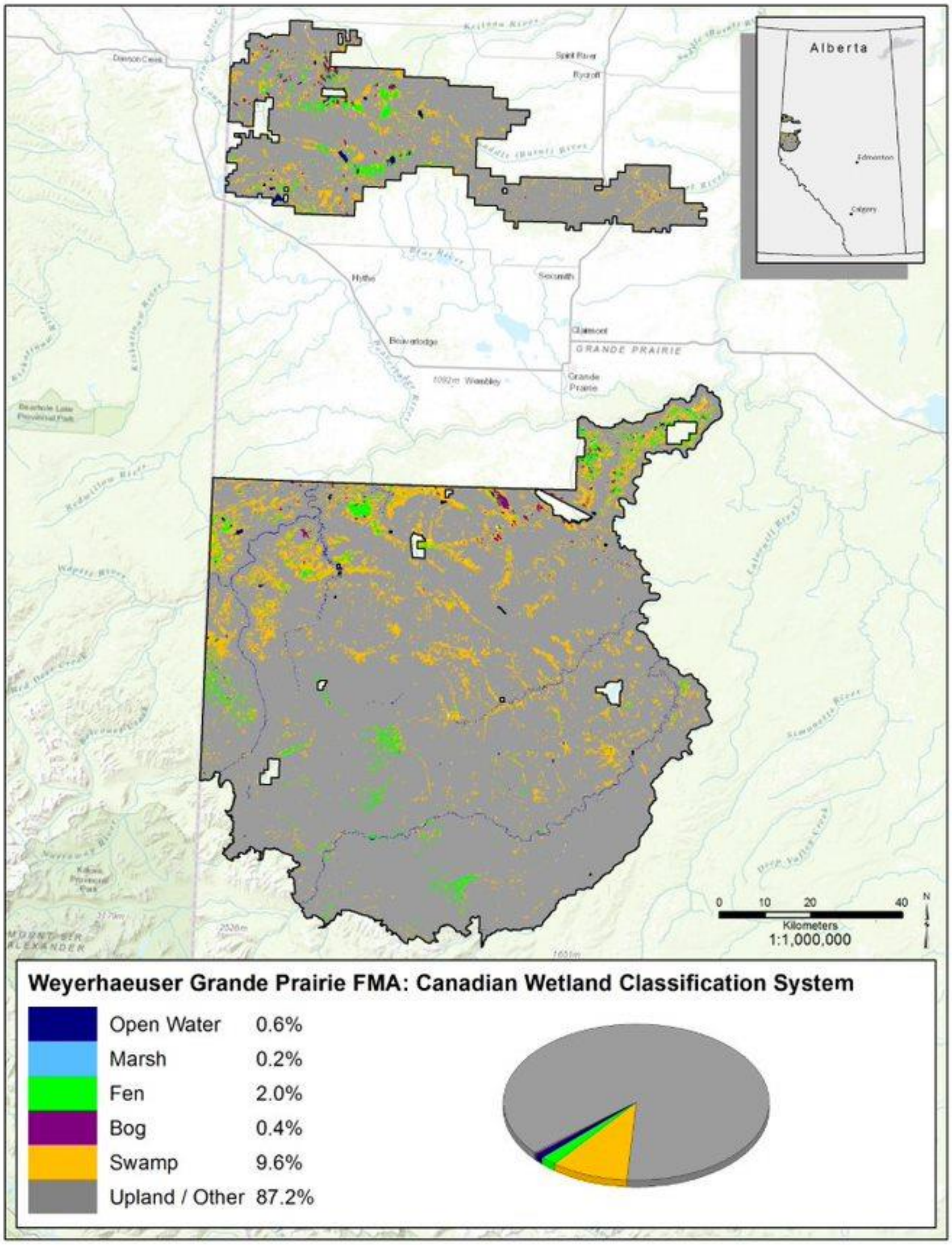

Figure B1. Distribution of the five major CWCS wetland classes on the Weyerhaeuser Grande Prairie FMA using DUC's EWC inventory data.

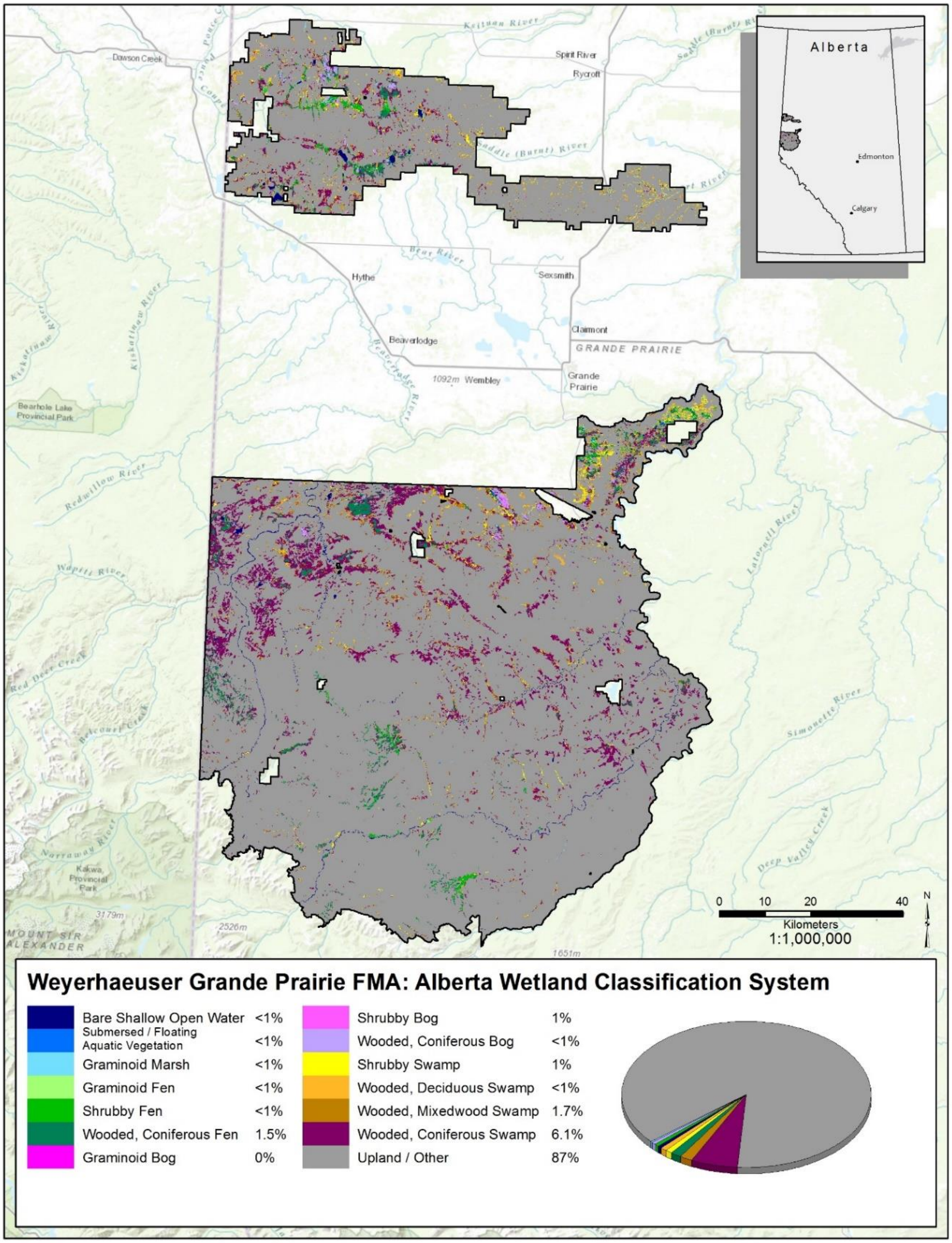

Figure B2. Distribution of the 13 minor AWCS wetland Forms on the Weyerhaeuser Grande Prairie FMA based on DUC's EWC inventory data.

Appendix C – Wetland Below-Ground Carbon Storage

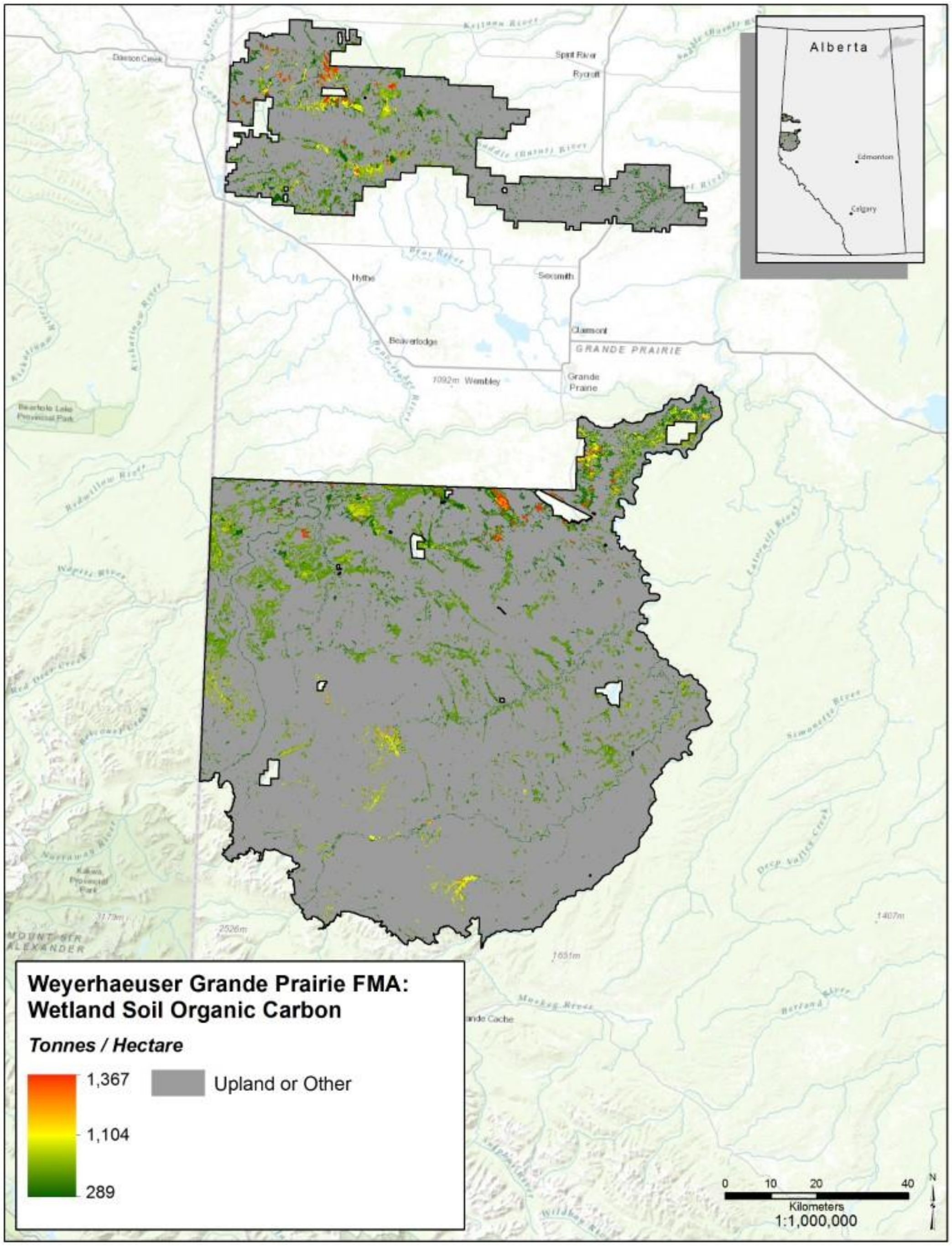

Figure C1. Estimated wetland soil organic carbon density (T/ha) on the Weyerhaeuser Grande Prairie FMA. Red represent areas of higher estimated soil organic carbon (1,367 T/ha) and green represents areas of lower estimated soil organic carbon (289 T/ha).

Appendix D - Wetland Biodiversity

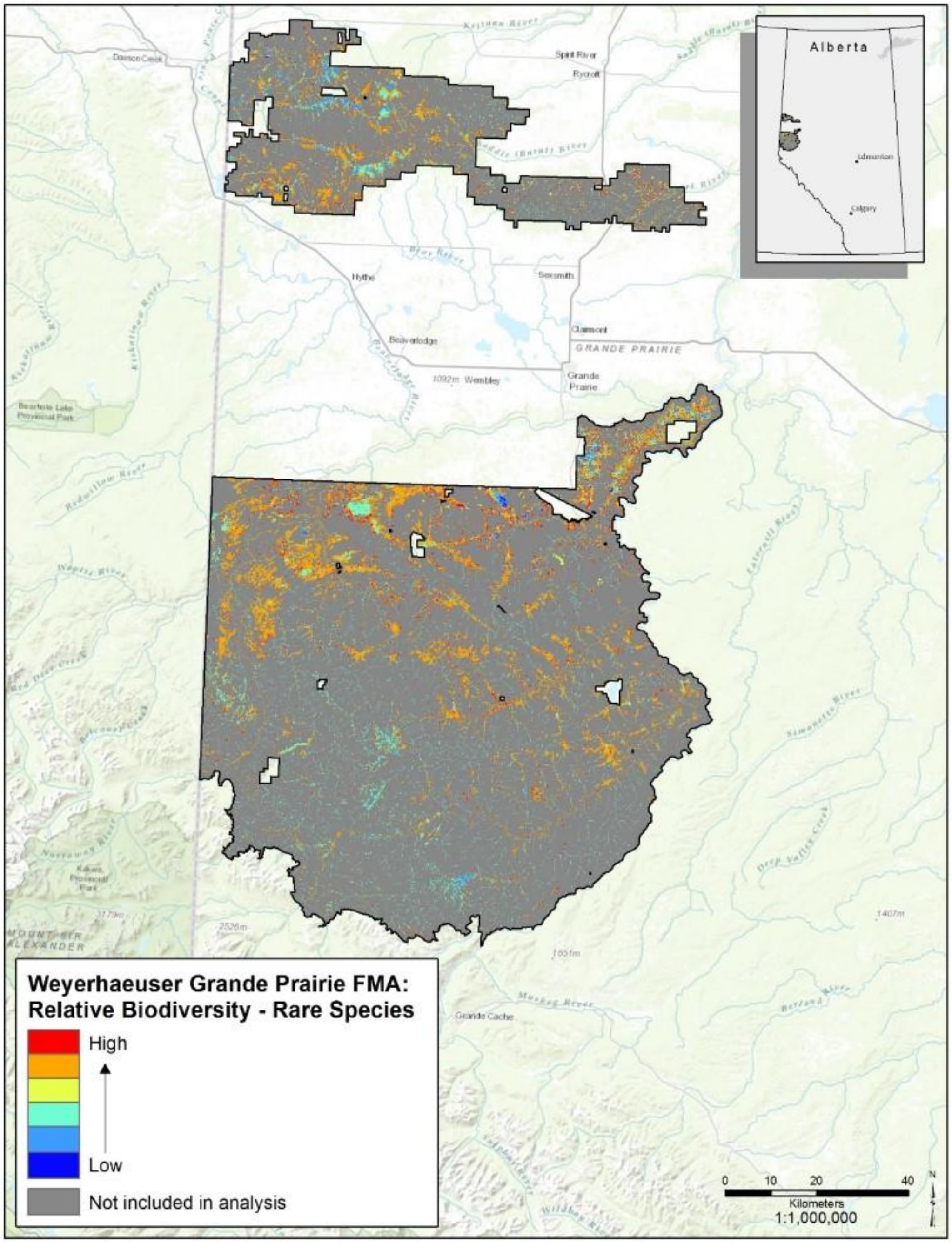

Figure D1: Example of the Wetland Biodiversity Tool for the Rare Species key group on the Weyerhaeuser Grande Prairie FMA. Colours show high (red) to low (blue) relative biodiversity values for Wetlands mapped using the DUC EWC inventory.

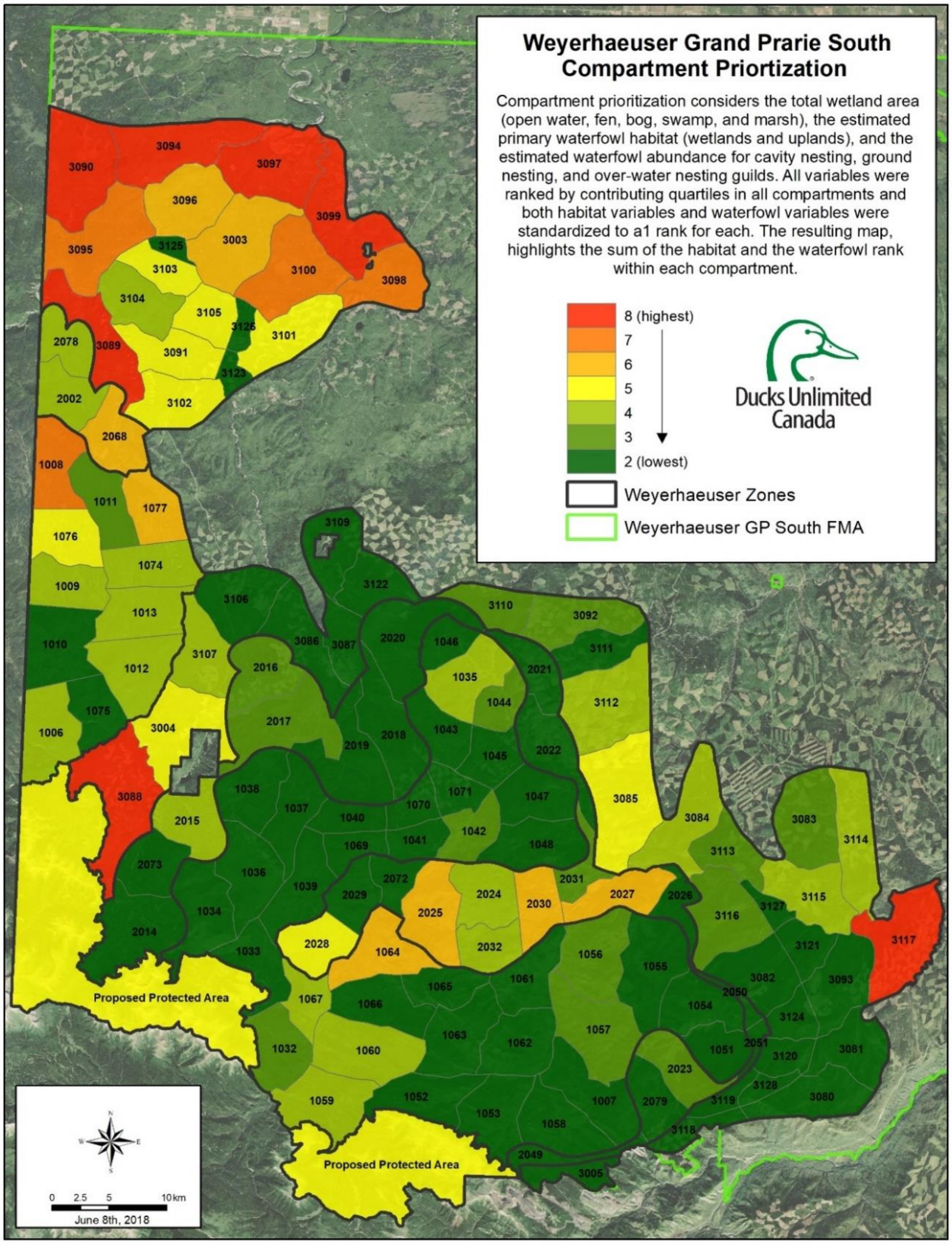

Figure D2: Weyerhaeuser Grand Prairie South wetland/waterfowl compartment prioritization.

Appendix E – Waterfowl on Weyerhaeuser's Grande Prairie FMA

Waterfowl of the Boreal

DUC has identified the Western Boreal Forest (WBF) as a conservation priority because this region contains important nesting, rearing, molting, staging, and migration habitat for waterfowl. Twenty-three species and nearly 30% of breeding season waterfowl counted in North America are found in the WBF (Slattery et al. 2011). A large percentage of the continent's waterfowl use this region during molting and migration periods, including between 25% and 40% of the world's Tundra and Trumpeter Swans (Ducks Unlimited Canada 2006). While many species of waterfowl in the WBF are considered to have stable or increasing populations, the boreal forest contains the primary breeding grounds for some species whose continental populations are well below population goals including Scaup *spp.*, Scoter *spp.*, American Wigeon, Northern Pintail, Mallard, and Blue-winged Teal (Ducks Unlimited Canada 2006; Fast et al. 2011; Slattery et al. 2011). Currently no western boreal duck is federally listed, however, at the provincial level the white-winged Scoter is listed as a species of special concern in Alberta (Alberta Environment and Sustainable Resource Development 2014). The suitability of the boreal for waterfowl is due, at least in part, to an abundance of wetlands and stable water levels through time (*i.e.,* high proportion of permanent wetlands) relative to other North American regions, such as the prairies and parklands (Slattery et al. 2011).

Waterfowl are considered obligate aquatic species. In other words, all waterfowl breed and feed in and near water and depend on a range of open water areas as essential components of their lifecycle. Water bodies and open water wetlands can provide food sources, refuge from terrestrial predators, molting and staging habitat, and nest sites for some species. Thus, any waterbody or wetland that contains an adequate food supply and areas nearby for nesting is potential waterfowl habitat. In addition, areas containing high wetland density or wetland complexes – areas of connected wetland systems – are generally considered to be of the highest importance to waterfowl.

However, waterfowl also rely on a broad range of vegetation communities such as riparian areas (zones of transition between wetland and upland areas), vegetated wetlands including treed and shrubby wetlands, and upland forests for nesting and security - often located a considerable distance from open water (Slattery et al. 2010). For example, nests for cavity nesting ducks are commonly found up to 500 m away from a water body; and geese spend considerable amounts of time in terrestrial habitats where they graze on grass (Batt et al. 1989). In addition, because wetland ecosystems are embedded within watersheds, changes to upland vegetation, such as through forest fire or harvest, may affect the volume and timing of water flow and potentially nutrient loading into aquatic areas (Steedman et al. 2001; Devito et al. 2005). Boreal forest systems are very dynamic in space and time and waterfowl numbers may increase or decrease in number depending on the nature of these changes.

Waterfowl Modelling Methods and Interpretation

To predict waterfowl abundances across the boreal landscape DUC (2014) developed statistical models (referred to as NFWF models) that are presented as maps. These models are mathematical relationships between the number of waterfowl counted during annual surveys and a suite of environmental variables thought to play a role in determining habitat quality. Waterfowl count data were obtained from surveys conducted over nine years (2001-2009) in seven study sites across the Boreal Plains Ecozone, using helicopters and standardized collection protocols. DUC's final maps display interpolated results of statistical models for particular project areas, such as Weyerhaeuser's Grande Prairie project area and FMA.

The NFWF models were used to map predicted waterfowl abundance for total waterfowl and for each of three nesting guilds based on nest placement (*i.e.*, ground, overwater and cavity nesting). Nesting guilds were chosen because of expected similarities of responses and sensitivities to localized disturbance compared to other guild level groupings.

Table E1. Density classes by nesting guild (# of indicated breeding pairs (IBP) per 2.5km x 2.5km survey grid cell)

	Very Low	Low	Medium	High
Ground	<10	10 - 21.9	22 - 46.9	> 47
Overwater	<2	2 - 3.9	4 - 7.9	> 8
Cavity	<4	4 - 7.9	8 - 15.9	> 16

For each nesting guild, density classes were established based on 25%, 50%, and 75% of total breeding pairs counted across all western boreal project areas. Also, for each guild, survey grid cells (2.5km x 2.5km) with the highest predicted abundances of waterfowl were labelled 'high density' until 25% of the predicted pairs were accounted for, the same was repeated for 'medium' (50%), 'low' (75%), and 'very low' (100%) until all predicted pairs were accounted for. These classes were used to develop density distribution maps for each nesting guild. To represent the distribution of total ducks on the landscape, a map was created by combining density distributions for all three guilds, plus a fifth density class, 'high density all guilds' to identify areas predicted to have high densities for all three nesting guilds combined. Thus, for the total waterfowl map there are two types of high-density areas; those where any one of the three guilds were predicted to occur in high densities and those where all guilds at once were predicted to occur in high densities.

These maps represent *predictions* of waterfowl relative densities based on breeding pair surveys, and a suite of environmental variables used to characterize the landscape. Thus, maps are best considered over broad areas rather than at fine spatial scales. While some waterfowl species tend to return to the same areas if they bred successfully, inter-and intra-annual variation in abundance of waterfowl at any given wetland can be substantial.

Waterfowl Distribution on Weyerhaeuser's Grande Prairie FMA

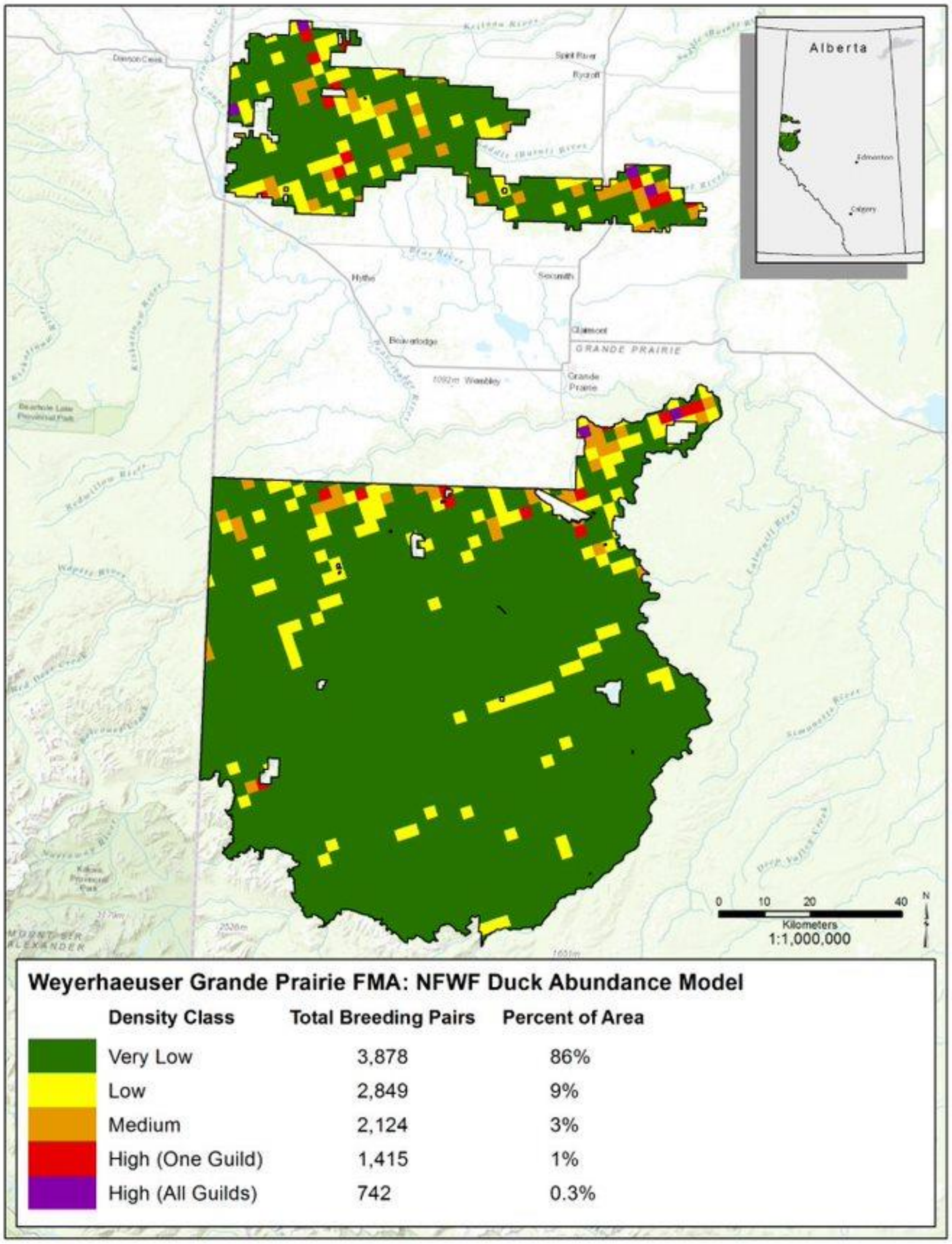

Figure E1. Predicted total waterfowl abundances on the Weyerhaeuser Grande Prairie FMA for all guides. Red represents areas where any one guild is expected to be found in relatively high abundance and purple represents areas where all three guilds are predicted to be found in relatively high abundance.

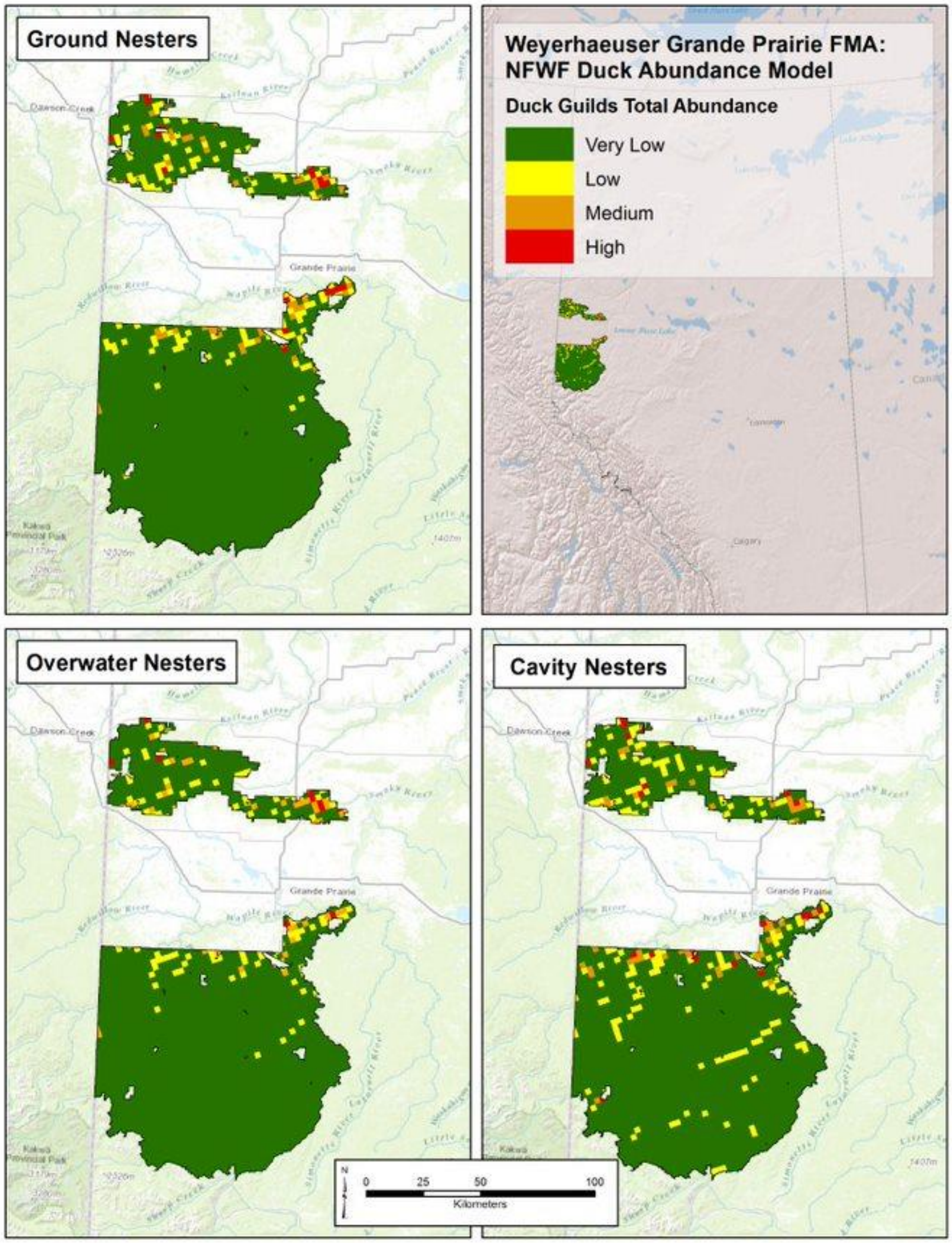

Figure E2. Predicted waterfowl abundances by nesting guild on the Weyerhaeuser Grande Prairie FMA. Red represents areas of relative high abundance and green areas of relative low abundance.

Table E2. Predicted breeding pairs (number and percent) and percent area of density classes for all waterfowl, ground nesters, overwater nesters, and cavity nesters in the Weyerhaeuser Grande Prairie FMA, and the Weyerhaeuser Grande Prairie overall project area and FMA. Total project area is 11,173km^2.

	Weyerhaeuser Grande Prairie FMA			
	Predicted Pairs	**% Predicted Pairs**	**Area (Hectares)**	**% Area**
All Ducks				
High (all guilds)	742	7%	3,702	0.3%
High (one guild)	1,415	13%	13,038	1%
Medium	2,124	19%	36,891	3%
Low	2,849	26%	100,837	9%
Very Low	3,878	35%	962,823	86%
Total	**11,008**	**100%**	**1,117,291**	**100%**
Ground Nesters				
High	1,218	18%	11,642	1%
Medium	1,278	19%	27,331	2%
Low	1,575	23%	69,118	6%
Very Low	2,765	40%	1,009,199	90%
Total	**6,835**	**100%**	**1,117,291**	**100%**
Overwater Nesters				
High	115	10%	5,828	1%
Medium	185	17%	21,423	2%
Low	226	20%	52,963	5%
Very Low	593	53%	1,037,076	93%
Total	**1,120**	**100%**	**1,117,291**	**100%**
Cavity Nesters				
High	389	13%	12,025	1%
Medium	489	16%	28,823	3%
Low	902	30%	99,854	9%
Very Low	1,274	42%	976,588	87%
Total	**3,053**	**100%**	**1,117,291**	**100%**

Appendix F: Wetland Flow Characteristics and Hydrologic Risk

The DUC EWC is an ecologically based wetland classification system based on the CWCS. Boreal wetlands are often interconnected and may be permanently or seasonally waterlogged. Water tables typically rise and fall seasonally or after precipitation and often flow laterally across the landscape between wetlands above, at, or below the surface. In very wet years or during the snowmelt, wetlands can move large amounts of water even if there is no evidence of surface or flowing water during dry periods (e.g., conifer swamps). Several wet years or several dry years also affect amount and movement of water.

It is recognized that wetland water flow can be impaired by poorly constructed resource road crossings. Not taking wetland hydrology into account when planning for and building wetland crossings can result in construction and maintenance challenges. To help predict wetland water flow, wetlands were grouped into four main flow categories according to flow characteristics and their respective relative risk to road construction (Table F1 & Figure F1). Figure F2 outlines both the flow characteristics and translation to a road construction risk assessment map for the Grande Prairie FMA, developed using the EWC functional groupings information listed in Table E1. It is important to note that there are other variables influencing boreal hydrology (e.g. surficial geology, evaluation), and that those variables are not reflected into the wetland flow characteristic / risk mapping tools that is described in this section.

These tools provide some insight on boreal hydrology and can be used as a decision-support tool which can provide clues into the permanency, amount and type of water flow into, through and from a wetland or a wetland complex. Thus, when making decisions about wetland crossing location, design, and construction, it is helpful to use maps that provide the wetland type and distribution to identify potential risks and establish crossing strategies. Identifying the type of wetland flow (e.g., stagnant, slow lateral flow, seasonally fluctuating, or inundated/flooded) can help provide an initial risk assessment in terms of potential impacts on flow and associated consequences on wetland function. All wetlands have the potential to move water and wetland classes characterized as stagnant under average conditions may act as water sources under wet conditions, transmitting water to adjacent wetlands and uplands. Thus, while stagnant wetlands are often considered lower risk for impeding natural water movement, they are not without risk.

Understanding the type of flow can help guide where to locate road networks. In addition, incorporating this type of information within the road planning and construction process can reduce potential negative impacts on wetlands such as: impediment of surface and/or subsurface water movement from soil compaction, or ponding of water due to inadequate water flow through the road. Further this can be used to inform road construction techniques that can reduce such impacts as well as reduce ongoing maintenance costs.

Table F1: Cross walk between wetland flow characteristic classes with the relative risk to road construction and the associated wetland types according to the EWC.

Flow Characteristics Class	Relative Risk of Hydrologic Impairment	Enhanced Wetland Classification System Classes
Flooded/Inundated	High	Open Water, Aquatic Bed, Mudflats, Emergent Marsh, Meadow Marsh
Slow Lateral Flow	Medium	Graminoid Rich Fen, Graminoid Poor Fen, Shrubby Rich Fen, Shrubby Poor Fen, Treed Rich Fen
Seasonally Fluctuating	Medium	Shrub Swamp*, Hardwood Swamp*, Mixedwood Swamp*, Tamarack Swamp
Stagnant	Low	Treed Poor Fen, Open Bog, Shrubby Bog, Treed Bog, Conifer Swamp*

*Often associated with flowing water systems, in which case increased water movement and water level fluctuations are expected.

Flooded/ Inundated: Open water wetlands systems are less than 2m in depth and are seasonally or permanently inundated. Water levels in many of these wetlands can fluctuate widely and it is possible for these wetlands to periodically dry out. Marshes often form the transition with open water and shorelines. Water sources come from precipitation, runoff, ground water and stream inflow.

Slow Lateral Flow: Slow lateral flows at and below the surface, including continuous seepage at depths greater than 30 cm. These wetlands are typically connected to other wetlands that are sometimes great distances apart. At times these systems e can be single continuous wetland. Because of this connectivity the entire system can be considered sensitive with respect to potential disruption to flows.

Seasonally Fluctuating: Water levels will fluctuate seasonally or during runoff events, and may fluctuate widely flooding above the root mat, particularly when these wetlands are associated with flowing water systems. Generally slow lateral water movement at and below the surface from adjacent areas occurs. Often sites will have hummocky terrain with pools or evidence of past pools of water will be present. The water table is typically maintained below the surface except during runoff events when above surface flow can occur.

Stagnant: Water source typically from rain or snow fall and ground water resulting in minor fluctuations seasonally. In many cases these wetlands are isolated from other wetland systems. Water is often present at or below the surface and a defined stream channel is unlikely. Conifer Swamps are the wettest in this group but are typically not flooded for long periods of time. Often sites will have hummocky terrain and pools of water may be present during periods of high water.

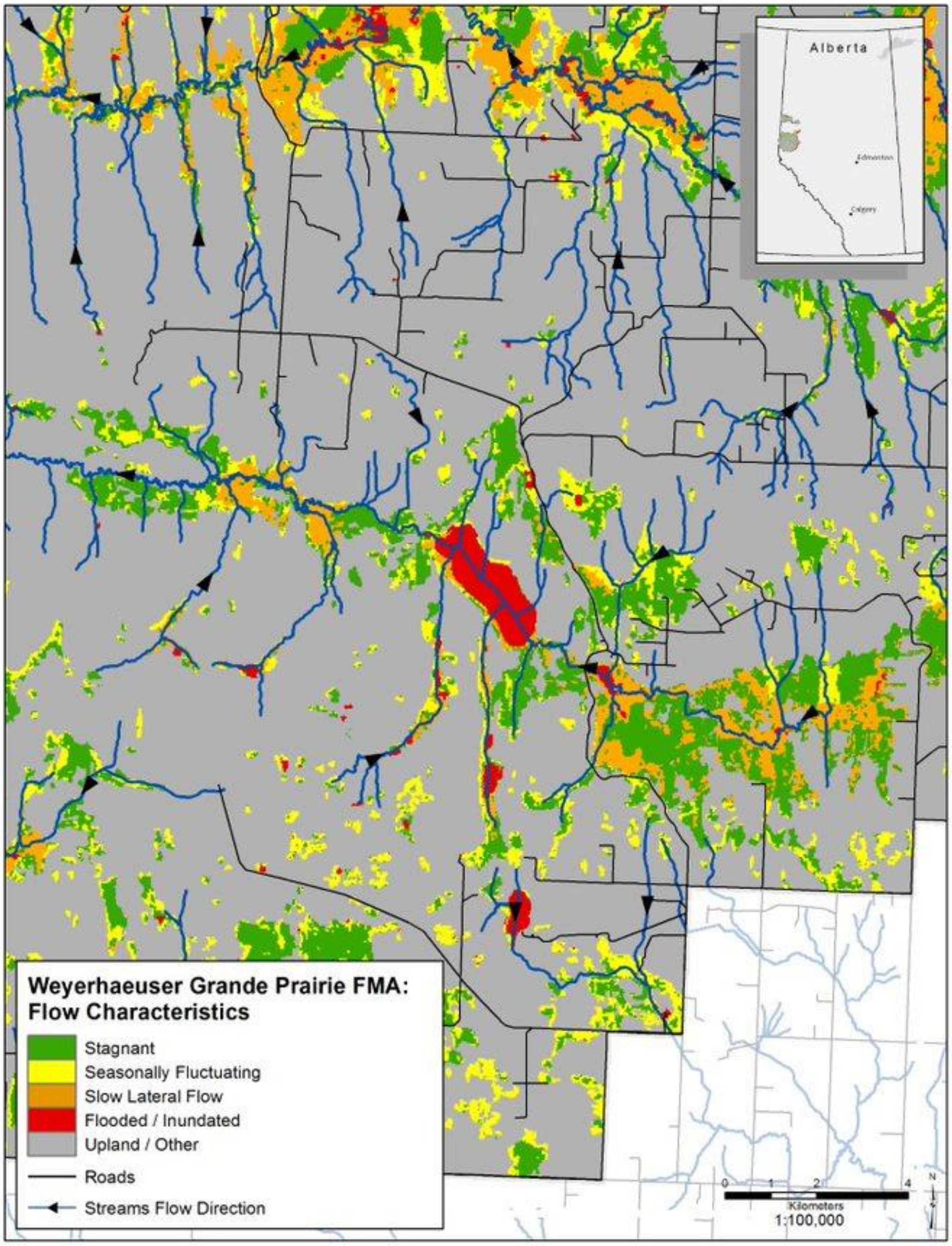

Figure F1. Example of the predicted flow characteristics for a section of Weyerhaeuser's Grande Prairie FMA using DUC's EWC inventory and inferred wetland flow characteristic. Flow characteristics may vary based on the time of year and climatic conditions. For example, some wetland types classified as 'stagnant' have the potential to move significant amounts of water under the right conditions.

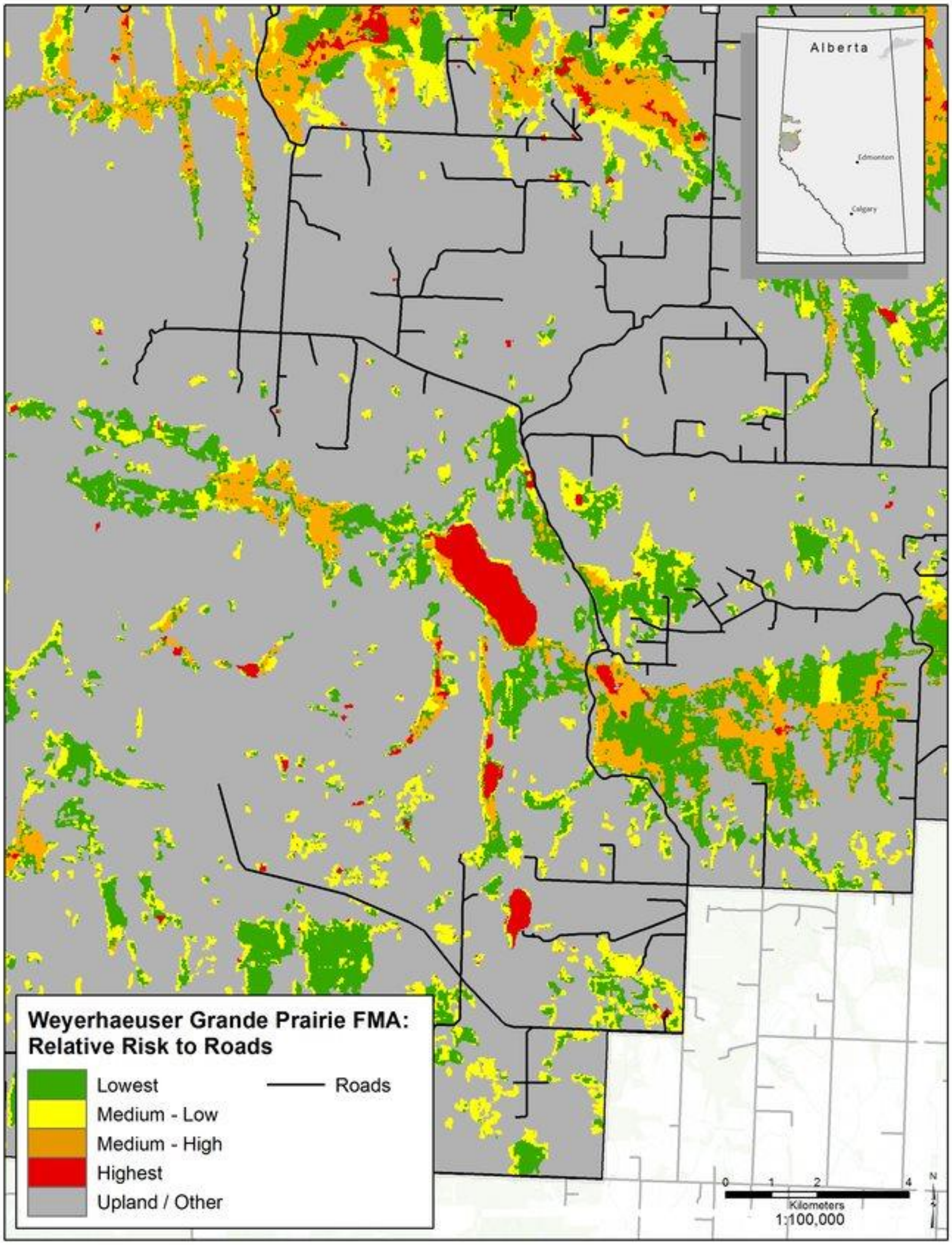

Figure F2. Example of the how wetland flow characteristics can be translated into a relative hydrologic risk ranking based on DUC's EWC inventory for a section of Weyerhaeuser's Grande Prairie FMA. Colours in this map correspond to the flow characteristic groupings in Figure F1.

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CHAPTER 2 THE FOREST MANAGEMENT PLANNING PROCESS

2.1. Alberta Forest Management Planning Standard

The structure and content of Weyerhaeuser's Forest Management Plan is aligned with the requirements of the Alberta Forest Management Planning Standard (AFMPS) version 4.1- April 2006.

2.2. Plan Development Team

The objective of the Plan Development Team (PDT) was established in the spring of 2016 to produce a consensus-based Forest Management Plan. The core members of the PDT included representation from Weyerhaeuser, Alberta Agriculture and Forestry Area Forester and Forest Management Planning Branch representatives[3] as well as deciduous quota holders Norbord Inc and Tolko Industries Ltd.

The PDT solicitated the support of technical advisors to provide specialized technical or analytical information throughout the planning process to ensure forest management strategies reflect sustainable ecological forest management.

Technical advisors were used to develop the following areas of the Plan:

- Alberta Vegetation Inventory (AVI)
- Contributing Landbase
- Growth & Yield
- Forest Health
- Watershed
- Fisheries and Wildlife
- Forest Genetics
- Wildfire
- Values, Objectives, Indicators & Targets
- Landbase, Tenure, Allocations

2.3. Quota Holder Involvement

Norbord Inc. and Tolko Industries Ltd. have played, and will continue to play, an integral part in the development of the FMP by providing editorial and technical input regarding strategic and operational plans, resource and timber supply analysis, growth and yield projections and harvest sequencing.

Both quota holders had representatives on the Plan Development Team, and both were invited to all open house events.

[3] In the Terms of Reference Gareth Davies is listed as the lead planner from the Forest Management Branch. However, Liana Luard replaced him early in the process and represented the Forest Management Branch as the lead planner for this FMP.

2.4. Forest Management Issues

The Forest Management Planning process can generate issues that have the potential to impede progress without clear direction. Knowing this, the Plan Development Team generated a list at the beginning of the planning process (April 2017) of important issues that might derail the timely submission and approval of this plan.

This list of issues was reviewed at each PDT meeting and a strategy identified with input from all members prior to development of the Preferred Forest Management Strategy.

Defined Forest Area

Single or Divided Landbase

Deciduous Volume Reduction

Operational SHS

Healthy Pine Strategy

Superior Gains

Mixedwood Management

Structure Retention

Conifer AAC Fall down

Allocations

Harvest & AAC from the Caribou Ranges

Non-Timber Value Assessments

DC to CD Transition

2.5. Public Involvement

Weyerhaeuser's Public Involvement Program[4] (PIP) outlines how Weyerhaeuser will provide opportunities to inform the public and solicit input regarding Forest Management within the Defined Forest Area. The program provides information regarding the process for internal and external communication as well as a mechanism to understand how concerns will be addressed. The approved PIP is included in *Annex 6 Public Involvement Program*.

2.5.1. Public Advisory Group

Prior to 2016, Weyerhaeuser participated in a joint Environmental Advisory Committee with the cellulose fibre business. That committee went with the sale of that business to International Paper.

On December 1, 2017 Weyerhaeuser solicitated membership for a Public Advisory Committee with the intent that it would be focused on forest management. In February of 2018 the PAG was formed with representation from industry, transportation, provincial government, municipal government, recreation and commercial stakeholders such as grazing leaseholders and trappers. Invitations mailed to 36 stakeholders. Organizations that regularly attend and/ or receive copies of notes & presentations are listed in Table 2-1.

Table 2-1. Public Advisory Group Membership

Alberta Agriculture and Forestry	Peace Country Flyfishers Association
Alberta Trappers Association Grande Prairie Local 1070	Peace Wapiti Public School Division
City of Grande Prairie	Saddle Hills County
County of Grande Prairie	Spring Lake Recreation Area
Grande Prairie Catholic School District	Stewards of Webster
Grande Prairie Public School District	Swan City Rotary Club
Grande Prairie Regional College	Swan City Snowmobile Club
International Paper	Town of Beaverlodge
MD of Greenview	Town of Grande Cache/ MD of Greenview (2019)
Mighty Peace Watershed Alliance	Weyerhaeuser Sawmill

Weyerhaeuser held bi-monthly meetings in Grande Prairie beginning in February of 2018. Meeting format was a combination of presentations, working input sessions and discussion. When requested, Weyerhaeuser presented to individual stakeholder groups to discuss forest management strategies that had the potential to impact their specific area of concern.

[4] Agreed to in Principle by GoA Area Forester September 22, 2017

Table 2-2. PAG Meeting Schedule & Curriculum

February 6, 2018	Welcome to Weyerhaeuser Forest Management in Alberta
April 3, 2018	Values, Objectives, Indicators, Targets Silviculture Strategies
June 5, 2018	Species of Special Management (Guest- Wendy Crosina, WY Biologist) Classified Landbase Growth & Yield
September 4, 2018	Operational Planning (Guest- Carleen Masik, WY Operational Planner) Wildfire Values (Guest- Tyler Pinnock, AAF Wildfire Technologist) Fish & Watersheds (Guest- Adrien Meinke, AAF Fisheries Biologist)
November 6, 2018	Roads & Road Maintenance (Don Petteplace, WY Roads) Harvest & Haul (Tony Dozorec, WY Operations) Silviculture (Dale Dunand, WY Operations) Herbicide (Andrew Shandro, AAF Silviculture)
January 8, 2019	Forest Health Flights Viewshed Analysis Process Structure Retention Adequacy
February 5, 2019	Values, Objectives, Indicators, Targets Open Houses Spatial Harvest Sequence Viewshed Assessments
March 5, 2019	Summary of Public Open House Events & discussions Summary of Indigenous Consultation & discussions VOIT Table including proposed targets Non-Timber Value Model Results (to date) Caribou Range Plan progress

At this point the PAG determined that Weyerhaeuser had met the obligations as set out in the Public Involvement Plan. No further meetings were required before the final Public Open House.

Post Approval	As agreed with the members of the PAG, a meeting will be scheduled to discuss approval conditions, monitoring commitments and the most recent stewardship report.

Table 2-3. Other Activities

March 26, 2018	Herbicide Public Open House- invitations emailed to PAG members	Public open house detailing forestry herbicide operations for the upcoming year in the GP area
April 19, 2018	Presentation to the Mighty Peace Watershed Zone Alliance Board of Directors	Forest Planning and Operations around Watercourses
October 19, 2018	AOP Public Open House- invitations emailed to PAG members	Public Open House detailing forestry operations for the next 1-3 years; partnership with all operators in the GP area
March 18, 2019	Herbicide Public Open House- invitations emailed to PAG members	Public open house detailing forestry herbicide operations for the upcoming year in the GP area
April 5, 2019	Info share regarding AFPA project “Public Education and Awareness Campaign: Our Forest Resource”	Shared the results from the first focus group
June 13, 2019	Info share of Ducks Unlimited new guide: Wetland Best Management Practices for Forest Management Planning and Operations	Shared the link to the new guide as well as a small update of FMP activities and progress

2.6. Public Open Houses

Open Houses are opportunities for stakeholders, Indigenous community members, Timber Quota Holders and the General Public (any member of the public not involved in previously mentioned groups) who may be directly or indirectly impacted by the Plan to view information and ask questions pertaining to overall forest management or a specific area of interest. Open House logistics are advertised through community websites, social media advertising such as Twitter and Facebook as well as mailed invitation to specific stakeholder groups (trappers, grazing leaseholders).

A series of public open houses were held in Grande Prairie, Grovedale, Beaverlodge, Saddle Hills County and Grande Cache in February 2019 in addition to the annual Open AOP open houses held every October in Grande Prairie. This was done so that interested members of the public had several options to choose from to attend an open house event. The February 2019 open house events focused on providing information about the Forest Management Area, the FMP development process, the draft spatial harvest sequence, the role of non-timber values in forest management and VOITs.

Advertising to the public about the opportunity to consult on the Forest Management Plan began on January 24, 2019 through various community social media sites such as Twitter, Facebook and official community websites and notice boards. This included the MD of Greenview’s large digital sign in Grovedale.

On January 25, 2019 invitations showing the dates of all the open house events were emailed to general stakeholders using the contact list generated during previous years of consultation activities. This included the local forestry community, the entire Weyerhaeuser employee list, the members of the PAG and all registered Guiders & Outfitters.

On January 28, 2019, Invitations showing the dates of all the open house events were mailed to registered trappers and grazing leaseholders within FMU G16.

From February 6, 2019 through February 21, 2019, advertising for the 5 local open houses was done through everythingGP.com. This is the main collective online advertising and news site for the Grande Prairie area. Advertisements included an online banner that will link to the invitation that showcases all 5 open houses. Everything GP is the Peace Country's leading News Team with 2.8 million views.

From February 6, 2019 through February 21, 2019, recorded voice radio advertising for the 5 local open houses was done through the main stations in Grande Prairie. This included a description of the events as well as what information was provided, why the public would want to attend and that Weyerhaeuser's objective for the events was to "seek input from the public regarding forest management strategies". Big Country XX FM and Q99 radio station are part of the Jim Pattison Broadcasting Group coverage area physically reaches over 280,000 listeners from north to Peace River and south past Grande Cache. Both stations have livestream listening options as well with documented testimonies of listeners from all over Canada.[5]

Open House Pictures clockwise from top right: Grande Prairie Eastlink Center; Beaverlodge Farmers Market; Saddle Hills County Office; Grande Prairie Eastlink Center

[5] Statistics taken from their websites 2019/01/28: https://www.bigcountryxx.com/advertising/ and https://www.q99live.com/advertising-2 (Barb Shannon, CRM, Assistant Sales Manager, Jim Pattison Broadcasting Group- February 1, 2019)

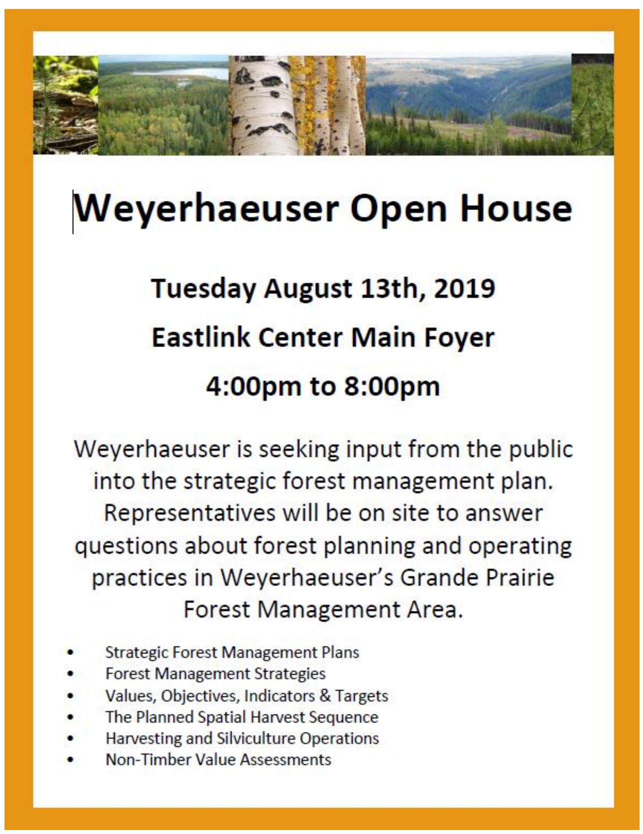
The final open house was held in Grande Prairie on August 13, 2019. On July 9th, 2019 invitations were mailed to general stakeholders including the members of the Plan Development Team, local forest community leaders, the members of the PAG, all registered trappers, grazing leaseholders within FMU G16 as well as local Indigenous communities. Invitations were emailed to the entire Weyerhaeuser employee list, the entire International Paper employee list as well as all registered Guiders & Outfitters.

Online advertising began July 8th, 2019 through various local community social media sites (Facebook and Twitter) including the sites for Weyerhaeuser Roads, Saddle Hills County, Birch Hills County, County of Grande Prairie No. 1, Webster Community Hall, Grande Cache, Village of Hythe, Town of Beaverlodge and the Town of Sexsmith.

From August 1 through August 13, the event was advertised online through everythinggp.com. From August 7 through August 13 recorded voice radio ads ran 3x per day on both the Big Country and the Q99 radio stations.

This event was also advertised through Windspeaker Radio, an Aboriginal Radio Network that reaches over 85 Alberta communities and surrounding areas. Their online network, www.windspeaker.com, averages 100,000 views monthly.

Figure 2-1. Advertisement-Final Open House



At each of the Open House events the following information was available for review.

- Forest Management Plan Renewal Timeline of Activities
- 20-year Spatial Harvest Sequence map
- Values, Objectives, Indicators & Targets (VOITS)
- Viewshed Assessments
- Description of Retention Strategy and past results
- Species at Risk information
- Herbicide Use in Forestry
- 2009-2014 Stewardship Report
- 2014-2019 Stewardship Report
- Operational Ground Rules
- Copies of Public advisory group meeting presentations

Table 2-4. Summary of Public Open House Interest

Date	Location	Attendees	Interest
February 11, 2019 4pm-7:30pm	Eastlink Center, Grande Prairie, Alberta	28	Local AAF and ACO; trappers, grazing lease holders, educators, hunters and general public.
February 13, 2019 10:30am-2pm	Farmers Market, Beaverlodge, AB	14	Local AAF; silviculture contractors, hunters, ATV enthusiasts, local newspaper and general public
February 14, 2019 10:30am-2pm	Saddle Hills County Municipal Office	9	Local AAF, trappers, Saddle Hills County employees and general public
February 20, 2019 5pm-8pm	Nitehawk Recreation Park, Grovedale, AB	13	Nose Creek Settlement; County of GP council member; GP Teachers; Archeological survey contractor and general public
February 21, 2019 11pm-2pm	Eagles Nest Community Hall, Grande Cache, AB	15	Grande Cache community members; trappers; AWN community members; Alexander FN community members; West Yellowhead constituency and general public
August 13, 2019 4pm-8pm	Eastlink Center, Grande Prairie, Alberta	23	Local city government, trappers, chamber members, industry representatives and general public
	Total	**102**	

Table 2-5. Public Consultation Input, Outcomes and Commitments

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-001	1-Dec-17	Invitation to join Public Advisory Group	track RSVPs and attendance	FMP submission
PIP-002	6-Feb-18	PAG#1 WELCOME TO WEYERHAEUSER		
PIP-002a	7-Feb-18	Send terms of reference out to the group to review.	With minutes	7-Feb-18
PIP-002b	7-Feb-18	Provide group with a list of disposition acronyms.	with minutes	7-Feb-18
PIP-002c	7-Feb-18	Interest from group on a presentation from Wendy on species of special concern on the FMA and other non-timber values.	PAG 3	7-Feb-18
PIP-002d	7-Feb-18	Provide Spring Lake Recreation Area with Norbord direct contact to discuss concerns in the Spring Lake area.	with minutes	7-Feb-18
PIP-002e	7-Feb-18	Interest from group regarding stream crossing program and stream protection. Add to discussion on Hydrology.	PAG 4	7-Feb-18
PIP-002f	7-Feb-18	Interest from group in a discussion with Silviculture Forester regarding silviculture practices (herbicide).	PAG 5	7-Feb-18
PIP-002g	7-Feb-18	Provide Grande Cache member with contact name for Forest Tenures in Alberta	with minutes	7-Feb-18
PIP-002h	7-Feb-18	Provide group with future meeting dates as per presented timeline (some adjustments)	with minutes	7-Feb-18
PIP-002i	8-Feb-18	suggested to change wording from meeting minutes to meeting notes	completed	8-Feb-18

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-002j	13-Feb-18	request for more info regarding Grizzly Bear Zones	sent follow up information/ clarification to meeting notes to group	13-Feb-18
PIP-002k	13-Feb-18	Clarification on Trumpeter Swan status and management strategies	sent follow up information/ clarification to meeting notes to group	13-Feb-18
PIP-002l	13-Feb-18	clarification on Energy sector reclamation responsibilities	sent follow up information/ clarification to meeting notes to group	13-Feb-18
PIP-002m	13-Feb-18	more information regarding Aspen Dieback and climate change	sent follow up information/ clarification to meeting notes to group	13-Feb-18
PIP-003	5-Mar-18	Provided invitation to Herbicide Open House to group	None	n/a
PIP-004	5-Mar-18	provided information regarding Caribou Information session to group	None	n/a
PIP-005	20-Mar-18	resent PAG committee invitation to all "nonresponses" with an "unsubscribe" option	accept, decline, delete as RSVP'd	20-Mar-18
PIP-006	3-Apr-18	PAG#2 VOITS & SILVICULTURE STRATEGIES		
PIP-006a	3-Apr-18	suggestion to add fly fishing association/ group	emailed fly-fishing group the invitation	9-Apr-18
PIP-006b	3-Apr-18	suggestion to add wapiti shooters club	emailed the invitation	5-Jun-19
PIP-006c	3-Apr-18	question regarding which recreation groups were invited	sent list of groups invited in April 3 minutes	4-Apr-18
PIP-006d	3-Apr-18	send current OGRs (based on interest during meetings)	emailed	4-Apr-18
PIP-006e	3-Apr-18	Ask Wendy about a study regarding GB in National parks having poorer health that the ones not in a national park	covered at PAG3	5-Jun-18

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-006f	3-Apr-18	Ask Wendy about what happens to the protection strategies when a species starts to recover. I.e. Grizzly Bear	covered at PAG3	5-Jun-18
PIP-006g	4-Apr-18	email notes, attendance and presentation to entire PAG group + substitutes	emailed 04/04/2018	4-Apr-18
PIP-007	10-Apr-18	request from Adam Norris (MPWA) for a presentation to their board of directors on April 17	Vashti presented to group- good turnout and questions	19-Apr-18
PIP-008	25-May-18	request from Christine for more information on snowmobile trails and how they are protected	brought maps and examples to PAG3	5-Jun-18
PIP-009	5-Jun-18	PAG#3 CLASSIFIED LANDBASE; GROWTH & YIELD; SPECIES AT RISK		
PIP-009a	5-Jun-18	group interested in more information on Spruce Beetle	included info sheet from GoA website in minutes	7-Jun-18
PIP-009b	5-Jun-18	County of GP member interested in socio-economic reach of WY	included assumptions on employment, taxes, real estate… in minutes	7-Jun-18
PIP-010	4-Sep-18	PAG #4 WATERSHEDS, WILDFIRE, OPERATIONAL PLANNING		
PIP-010a	4-Sep-18	Members interested in more information regarding herbicide use	Andy Shandro presents at PAG5	13-Sep-18
PIP-010b	4-Sep-18	Members interested in more information on access control on roads (gates)	shared documents/ revisited at PAG Nov 6, 2018	6-Nov-18
PIP-011	6-Nov-18	PAG#5 OPERATIONS (HARVEST, ROADS, SILVICULTURE)		
PIP-011a	6-Nov-18	follow up on process in place to clean mud from Hwy 40 where log trucks enter the hwy	discussion with contractor, process in place, shared with DD	8-Nov-18
PIP-011b	6-Nov-18	follow up on potential impacts of aspen leaching from stored decks/ crossings	shared information from WY and GoA with AN	8-Nov-18

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-012	8-Jan-19	PAG #6 FOREST HEALTH; VIEWSHEDS; RETENTION; TIMELINE		
PIP-012a	8-Jan-19	check to see if Duane Didow (Grande Cache) is still going to participate.	DD has requested to remain on committee with new structure. Replaces current non-active MD member for MD of Greenview.	9-Jan-19
PIP-012b	8-Jan-19	WY to add to list of sensitive areas for viewshed assessment: Sherman meadows, Torrens Falls and Lick creek	done	9-Jan-19
PIP-012c	8-Jan-19	WY to bring completed assessments back to PAG to share	done	5-Feb-19
PIP-012d	8-Jan-19	WY to include completed assessments as part of open house documents	done	Feb 11 starts
PIP-012e	8-Jan-19	Share discussion about wind direction with operations group to include in retention training	included in work instruction documents	9-Jan-19
PIP-012f	8-Jan-19	WY to add GPS's trails in dead horse meadows to geodatabase	PAG 7 discussion- trails are outside FMU G16	5-Feb-19
PIP-013	15-Jan-19	Question regarding the First Nations Consultation process. Does Weyerhaeuser do the application in house?If it is done in house what training does Weyerhaeuser utilize?	Replied to member with a description of Weyerhaeuser Indigenous Consultation practices including relationship building activities and support. Directed to the Alberta Aboriginal Consultation Office for actual guidelines and policies.	15-Jan-19
PIP-014	Feb 4	PAG #7 VOITS, VIEWSHEDS, SPATIAL HARVEST SEQUENCE		
PIP-014a	13-Feb-19	no specific follow up noted	n/a	n/a

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-015	11-Feb-19	OPEN HOUSE; EASTLINK CENTER; 4PM-730PM		
PIP-015a	11-Feb-19	Several deciduous blocks were scheduled in an area where he grazes his cattle. Concerned about the impacts harvesting in this lease on his ability to graze his animals and to the water availability.	Removed sequence from this grazing lease for P1&2.	12-Feb-19
PIP-015b	11-Feb-19	Provided a map of all the trails in his trapline to be GPS'd and included on our operational maps.	Included in spatial trail layer.	12-Feb-19
PIP-015c	11-Feb-19	Junior trapper with his father. Looking for information on how Weyerhaeuser communicates and what reasonable requests from them to us would be.	Discussed annual consultation, map reviews and the annual open house. Encouraged him to use us as the main point of contact over trying to talk with the logging contractors.	12-Feb-19
PIP-016	13-Feb-19	OPEN HOUSE; BEAVERLODGE FARMERS MARKET; 11AM-2PM		
PIP-016a	13-Feb-19	no specific follow up noted	n/a	n/a
PIP-017	14-Feb-19	OPEN HOUSE; SADDLE HILLS COUNTY OFFCE; 11AM-2PM		
PIP-017a	14-Feb-19	Operational concern: commitments made to trappers not flowing through from planning to operations to silviculture	shared this concern with Timberlands lead team to address through operations best practices and awareness	15-Feb-19
PIP-017b	14-Feb-19	provided County of Saddle Hills member (at his request) with a large overview map showing roads and dispositions.	n/a	15-Feb-19
PIP-018	20-Feb-19	OPEN HOUSE; GROVEDALE (NITEHAWK); 5-8pm		
PIP-018a	20-Feb-19	concerns with planned sequence in his trapline	sent trapper a map to identify sensitive areas within his trapline to be protected. Will be addressed as part of the CMZ sequence	22-Feb-19

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-019	21-Feb-19	OPEN HOUSE; GRANDE CACHE; 11am-2pm		
PIP-019a	21-Feb-19	concerned with long term affects harvesting would have to the value of his trapline	sent trapper a map of his trapping showing that there is no area planned for harvest within his trapline in the next 20 years.	22-Feb-19
PIP-019b	21-Feb-19	looking for more information on species at risk; invasive plants and employment as a traditional knowledge keeper	confirmed with AWN that person is not a community member first- then email response to person (cc to AWN) asking for more information on what type of species at risk and invasive plants he was wanting info on; directed him to work with AWN on employment enquiries	22-Feb-19
PIP-020	5-Mar-19	PAG #8 CONSULTATION OUTCOMES, VOITS, CARIBOU		
PIP-020a	5-Mar-19	PAG agreed that they have information they need. Next sharing opportunity will be final public open house	n/a	n/a
PIP-021	9-Jul-19	FINAL OPEN HOUSE Invitations sent		
PIP-021a	10-Jul-19	Public member/ recreationalist looking for information on past and pending harvest footprint in the Pinto/ Pinto West operating area	Provided a map showing recent and short term planned harvest; showed the 20-year planned SHS; requested he check back in a year or 2 from now for updated short term plans.	10-Jul-19
PIP-021b	26-Jul-19	Sturgeon Lake Cree Nation member requesting shape files of the planned harvest sequence.	WY declined to send shape files (as per GoA-SLCN was not part of the PCA). Provided a PDF map of the SHS, sent a poster sized hard copy in the mail, encouraged concerned community members to attend the open house.	06-Aug-19

Tracking Number	Date	Issue/ Discussion	Response/ Action Item	Completion Date
PIP-021c	13-Aug-19	Trappers who hold traplines within the CMZ concerned with aggregated harvest sequence and proximity to their traplines	Weyerhaeuser to hold a stakeholder meeting with these trappers to understand their concerns. Sept 2019 update: Decision made to hold 1:1 meetings with potentially affected trappers prior to planning activities within their trapline to better understand and address individual concerns. October 29, 2019- WY held a follow up meeting with the trappers that communicated concerns at the open house. Discussions around SHS in CMZ, caribou populations and the planning process.	Ongoing
PIP-021d	13-Aug-19	Swan City snowmobile club interested in harvest levels and impacts to the 2 lakes road maintenance in proximity to their snowmobile camp area.	Weyerhaeuser is committed to ongoing and timely communication with swan city club regarding road maintenance activities in the two lakes area. Formal response sent to SCSC October 21, 2019.	14-Aug-19
PIP-021e	13-Aug-19	Public member/ residential stakeholder interested in harvest plans near his property.	Weyerhaeuser to send a map focused on sequence near his property.	14-Aug 19
PIP-021f	13-Aug-19	Public member concerned with proposed gun range in the saddle hills/ Webster area.	Weyerhaeuser explained the disposition process and how Weyerhaeuser is and isn't involved when area is removed from the FMA.	13-Aug-19
PIP-021g	15-Aug-19	Chamber of Commerce CEO interested in organizing a field tour for the board.	Weyerhaeuser committed to working with the CoC to deliver a field tour that meets their needs and interest levels.	planning

2.7. Indigenous Consultation

Indigenous peoples are an integral part of the communities in which Weyerhaeuser operates. In addition, they form a distinct constituency that helps create and improve public perception of forest management performance. The long-term, secure supply of good quality, competitively priced raw material, logs, and fibre is fundamental to Weyerhaeuser's operations. The needs and perspectives of Indigenous communities are relevant to many of our decisions, including the use of public land and resources. Weyerhaeuser is committed to building mutually beneficial relationships with Aboriginal peoples in the company's areas of operation.[6]

The provincial Aboriginal Consultation Office (ACO) provided a pre-consultation assessment on June 26, 2017 for the renewal of the Forest Management Plan. This assessed the project as requiring Level 3, extensive consultation and identified the following five groups to consult with:

1) Aseniwuche Winewak Nation
2) Horse Lake First Nation
3) Duncan's First Nation
4) Sucker Creek First Nation
5) East Prairie Métis Settlement

As required for Level 3, extensive consultation, Weyerhaeuser completed a First Nations Involvement Process which was agreed to in principle by the ACO on November 15, 2017.

Weyerhaeuser has used the Government of Alberta's Indigenous Relations Record of Consultation (ROC) Log to track consultations with each of the five Indigenous groups identified in the Pre-Consultation Assessment. Parallel to the Record of Consultation (ROC) Log, Weyerhaeuser has maintained a Concerns and Response Table for each group that records each concern brought forward by the Indigenous group, Weyerhaeuser's measures to accommodate the concern and any Indigenous Community response to the proposed measures.

Record of Communication Logs and the Concerns and Response Tables were sent to the Indigenous groups and to the Grande Prairie Forest Area Manager bi-monthly beginning in November 2017 and continued until September 6, 2019 when the Forest Management Plan was submitted to the Province.

The following milestones at which consultation would occur were identified in the First Nations Consultation Plan.

Initial Notification

The five Indigenous groups were sent an information package notifying them of this project on December 1, 2017. Weyerhaeuser answered questions from several of the communities regarding the difference between this project and the annual consultation activities and what their responsibilities going forward would be. There was no follow up or concerns identified at this point.

[6] Weyerhaeuser's Policy and Framework for Building Relationships with Canada's Aboriginal Peoples.

Values, Objectives, Indicators and Targets (VOITS)

The VOIT table is a detailed technical document describing the overall values for each objective of the Forest Management Plan as well as the indicators to illustrate Weyerhaeuser's progress towards meeting those objectives. Due to the level of detail included in this table, an invitation to review it in person was extended to the five indigenous groups. Weyerhaeuser sent the VOIT table to each of the groups for review on December 6, 2018.

Face to Face meetings were held with Sucker Creek First Nation (Dec 11, 2018), East Prairie Metis Settlement (Dec 11, 2018) and Aseniwuche Winewak Nation (Jan 23, 2019) to discuss the VOIT tables.

Spatial Harvest Sequence

The Spatial Harvest Sequence is a map product that shows where operations are planned over the next 4 periods (20 years). The intent of sharing this product with Indigenous groups is to gain valuable information regarding the potential adverse impacts to First Nation Treaty rights and traditional uses and Métis Settlements members' harvesting or traditional use activities. Weyerhaeuser shared the Spatial Harvest Sequence with each of the groups on February 13, 2019 via registered mail. A letter explaining the 20-year timeline as well as three maps were included in the information package.

- The first map showed the entire 20-year sequence in two, 10-year groupings
- The second map showed only the first decade (May 1, 2017 to April 30, 2027)
- The third map showed only the second decade (May 1, 2027 to April 30, 2037)

On July 9th, 2019, the final version of the Preferred Forest Management Scenario Spatial Harvest Sequence was sent to the Indigenous communities with an explanation of the changes.

- Email notification sent
- Shapefiles sent
- Letter with 36"x48" map sent via registered mail

Indigenous Community Open Houses

The Aseniwuche Winewak Nation consultation staff assisted in the planning and implementation of the open house event on February 21, 2019 in Grande Cache, AB. Community members and Elders were specifically invited to this event and Weyerhaeuser arranged for a Cree translator from the community to be onsite to translate for elders.

As per the advice of the Horse Lake First Nations consultation staff, Weyerhaeuser held a public event in Beaverlodge, AB. Community members and Elders of Horse Lake First Nation were specifically invited to the event on February 13, 2019 in Beaverlodge, AB.

The Duncan's First Nation consultation staff assisted in the planning and implementation of the open house event held on February 26, 2019 at the DFN Band Office. Community members and Elders were specifically invited to this event where Weyerhaeuser hosted a supper, provided information about Weyerhaeuser and the forest management planning process as well as answered questions from the community members in attendance.

A summary of Forest Management Plan related concerns captured during Indigenous consultation as well as Weyerhaeuser's measure to accommodate the concern is described in Table 2-6. In order to respect the confidentiality of the consultation process, specific details identifying the Indigenous community, or the community member has not been included.

Final Submission

Reviewing the Forest Management Plan document including supporting appendices is the final opportunity for Indigenous groups to have input into the Forest Management Plan. Included with this final review is a summary of previous comments and/ or concerns and how they have been addressed and/ or incorporated into the plan.

The Forest Management Plan, as intended to be submitted to the Province, was provided to each of the groups during the week of August 26, 2019 for final consultation. It is important to note that consultation with Indigenous communities on the Forest Management Plan will continue after submission in order to give the communities adequate time to review the document.

Adequacy

Completed Record of Consultation Logs and Concerns and Responses tables will be sent to the Province and the Indigenous communities September 20, 2019. Weyerhaeuser expects to request adequacy on October 4, 2019 [7].

[7] Section 3.6 The Government of Alberta's Proponent Guide to First Nations and Metis Settlements Consultation Procedures (June 6th, 2016) indicates a 10-working day review period.

Table 2-6. Indigenous Consultation Comments, Outcomes and Commitments

The following table captures all expressed concerns within the scope of the Forest Management Plan Submission as well as Weyerhaeuser's measures to accommodate the concern.

Proponent's capture of the Expressed Concern	Proponent's measures to accommodate the Concern
Concern with planned blocks close to an existing community, as well as along the access road.	The planned harvest sequence was adjusted, and these planned blocks removed from the sequence.
Culturally valued and sensitive sites were identified in the Porcupine cost zone.	The planned harvest sequence was adjusted so as not to overlap with these sites.
Culturally valued and sensitive sites were identified in the southernmost part of the FMA.	The planned harvest sequence was adjusted so as not to overlap with these sites.
Concern that current creek buffers are not adequate to protect the culturally valuable plants that most often grow next to water.	Weyerhaeuser's buffers on watercourses along with measures taken to protect water quality and prevent soil erosion are compliant with provincial guidelines and are detailed in our approved operating ground rules. Weyerhaeuser will consider site specific requests to increase buffer widths because of an identified value. Weyerhaeuser provided a field tour to a group of elders that focused on the ground harvest and reclamation practices on the FMA. This included a visual assessment of creek buffers and reclaimed watercourse crossings.
Concerns about the effects of harvesting on moose populations.	Weyerhaeuser is committed to supporting current research on the effects of harvesting on moose populations and has shared a NCASI research paper on harvesting and moose populations. Weyerhaeuser shared information from Alberta Environment and Parks that showed moose populations as either stable or recovering in WY's FMA6900016 based on long-term population studies. Weyerhaeuser provided a field tour to a group of elders that focused on the ground harvest and reclamation practices on the FMA. This included a visual assessment of post harvest browse species.

Proponent's capture of the Expressed Concern	Proponent's measures to accommodate the Concern
Concerns about the effect of harvesting on all wildlife populations.	Weyerhaeuser has several operational controls in place that consider wildlife habitat including timing of operations, buffers, retention and cumulative effect which are described in the current approved Operating Ground Rules. Weyerhaeuser also shared the Non-Timber Value Assessments of the quantity and quality of wildlife habitat, over time, in response to our activities. These assessments are included in the FMP.
Questions regarding the reforestation treatments for and performance of replanted blocks.	Weyerhaeuser ensures that every hectare harvested is reforested and growing again within 2 years of harvest. The overall health and productivity of the planted hectares is monitored at establishment and at 8 years and at 14 years. These results are reported to the government. Regeneration Standards of Alberta dictates that FMA holders must put back the species of trees it removed, using seed suited to that area, in the same ratio that it was removed. Weyerhaeuser provided a field tour to a group of elders that focused on the ground harvest and reclamation practices on the FMA. This included a visual assessment of plantations at different periods of growth.
Comments regarding the number of existing roads and questions around reclamation.	Explained that Weyerhaeuser's activities are a small percentage of the use of the FMA. Oil & Gas and other industrial activity accounts for most of the permanent footprint (roads, pipelines, leases, etc.) Weyerhaeuser reclaims all temporary harvest access within 3 years and plant or aerial seed every reclaimed road. Weyerhaeuser has no plans to add permanent roads to the access plan. Weyerhaeuser provided a field tour to a group of elders that focused on the ground harvest and reclamation practices on the FMA. This included a visual assessment of reclaimed roads and reclaimed watercourse crossings.

Proponent's capture of the Expressed Concern	Proponent's measures to accommodate the Concern
General concerns about herbicides and the application of herbicides in the forest.	Weyerhaeuser uses Glyphosate, which is a Health Canada approved herbicide. Weyerhaeuser applies this herbicide in amounts and methods as approved by the Province for forestry applications. Weyerhaeuser supports and keeps current with all research regarding the effects of herbicides in forest applications. Weyerhaeuser will consider site specific concerns related to herbicide use because of an identified value. Weyerhaeuser provided a field tour to a group of elders that focused on the ground harvest and reclamation practices on the FMA. This included a visual assessment of a post herbicide cutblock and blueberry patch.
Concerned with cumulative effects of industry use; the loss vs return appears to be unbalanced.	Weyerhaeuser acknowledges that the effects of long-term forest removal due to industrial activity is concerning, however, forest management does not convert forested land to unforested land. All harvest blocks and reclaimed temporary roads are reforested. The Alberta Planning Standard for Forest Management Planning commits Weyerhaeuser to considering timber and non timber values of a forest and maintaining a cut level that can be sustained over 200 years and is even flowed. As in, no very highs and very lows. This prevents forest companies from taking all the timber out in a short time and walking away.
Diamond Willow is identified as a culturally valued plant that should be protected.	Weyerhaeuser added a commitment to protect diamond willow where identified in the Retention Strategy as well as in the VOIT table under "uncommon plant communities/ unique areas".

Proponent's capture of the Expressed Concern	Proponent's measures to accommodate the Concern
Continuous patches of undisturbed forest are used for ceremonies and forests with these values are disappearing.	Weyerhaeuser commits to maintaining interior old forest on the landscape. The definition of old interior forest is forest that is > 120 years old and > 100 hectares in size located more than 60m from forest that is <40 yrs old and is not split by a linear feature > 8m wide. There are also forested stands in the FMA that are not included in the contributing landbase and will not be sequenced for harvest. Weyerhaeuser will consider site specific concerns related to ceremonial use.
Concerns with Aspen dieback.	Weyerhaeuser acknowledges that there is aspen dieback occurring on the FMA. The planned harvest sequence focuses deciduous harvest in the oldest stands which is helping to address the areas most heavily hit by aspen dieback.
Part on annual consultation- community requested that Weyerhaeuser explore the feasibility of alternate vegetation control methods such as livestock (sheep) browsing.	The silviculture matrix was adjusted to allow for alternate methods of vegetation control. Benchmarking field trips were done with the community and livestock browsing is being considered for the 2019/20 silviculture season.
Desire to see VOITS that commit the company to create opportunities for community members.	VOIT 6.1.1.3 sets the following targets for all indigenous communities that may be impacted by this plan: A. Increase company leadership awareness of Indigenous people within the communities in which we operate B. Increase the pool of indigenous candidates that meet the present & future workforce needs C. Support contract opportunities that are mutually beneficial D. Support Indigenous community initiatives and events
Concerned that First Nations Science is not captured as being a consideration along with western science in the VOIT table and reports.	Weyerhaeuser updated the VOITs to include Indigenous Traditional Knowledge everywhere that we indicate that we use sound science or ecological considerations as the means to identify the target. This is also described in Weyerhaeuser's approach to Forest Management in the FMP.

2.8. Timeline

The following describes the milestone activities achieved during the planning process.

Table 2-7. Planning process timeline of events

2012-2016	• Alberta Vegetation Inventory Project ○ AVI 2.1.1 standards ○ Colour IR photos collected for the FMA area ○ Leaf off photography ○ Understory enhancement & MPB mortality assessment ○ December 13, 2016 approval
October - December 2016	• Letter of Intent to Renew FMP sent to GoA (Sept 2016) and Acknowledged (Dec 2016) • Weyerhaeuser initiates a Caribou Range Planning working group with representation from WY, GoA, CPAWS, AWN and FLMS
January – March 2017	• Work begins towards establishing the Contributing Landbase
April- June 2017	• First PDT meeting is held • Pre-consultation Assessment is requested (May 2017) and received (June 2017) • Work begins on enhanced regeneration gains • Second PDT meeting is held
July-September 2017	• Pine and Phase 1 Spruce height gains approved (July 21, 2017) • Terms of Reference is approved (Aug 1, 2017) • Managed and Natural Yield Curve Development process approved (Aug 1, 2017) • Public Involvement Process is approved (Sept 22, 2017) • Third PDT meeting is held • Initiate discussions on single versus divided landbase
October-December 2017	• Incorporating Genetic Gains into Yield Curves approved (Nov 6, 2017) • First Nations Consultation Process is approved (Nov 15, 2017) • Work begins on ARIS reconciliation • Fourth PDT meeting is held • Project Notification packages sent to First Nations and Metis groups (Dec 1, 2017) • Public Advisory Group invitations go out (Dec 1, 2017)

January-March 2018	• Fifth PDT meeting is held • Weyerhaeuser requests 1-year extension for the 148,000m^3 deciduous allocation • MPB Strategy agreed to in principle by the PDT (Feb 1, 2018) • Retention Strategy agreed to in principle (Feb 1, 2018) • Continue discussions regarding AAC fall down, facility needs and landbase designation • Initial Public Advisory Group Meeting (Feb 6, 2018) • Phase 2 Spruce Enhanced regeneration gains approved (March 2, 2018) • ARIS Reconciliation complete • Work begins on Silviculture Strategy Table • Work begins on VOIT Table
April- June 2018	• Sixth PDT meeting is held • Second PAG meeting held • Third PAG meeting is held
July-September 2018	• Fourth PAG meeting is held • Caribou Range Plan Scenario 8000 is submitted • Aug 13, 2018- commitment from the province to work with WYGP to develop solutions to meet the minimum volume requirement for the sawmill.
October 2018	• Landbase Assignment Document is submitted • Growth & Yield Curve Report is submitted
November 2018	• Fifth PAG Meeting is held • Seventh PDT Meeting is held • Initial Non-Timber Value model resultants is reviewed with local AEP biologists
December 2018	• Verbal AIP is given for Growth & Yield Curves • Classified Landbase is returned • Eighth PDT meeting is held
January 2019	• Sixth PAG Meeting is held • Classified Landbase is resubmitted • CLB is submitted to Wildfire for Annex 3 Assessment • Mixedwood Management Strategy is developed with input from Deciduous Quota holders and Province
February 2019	• Public & Indigenous Community Open Houses are held in Grande Prairie, Saddle Hills County, Beaverlodge, Grande Cache, Grovedale and Duncan's First Nation • Seventh PAG is held • Mixedwood • Non-Timber Value meeting#2 is held with local AEP Biologists

March 2019	• Tenure/ Allocation issues are addressed with provincial Tenure Branch • Eighth PAG is held • Ninth PDT is held • The Larch strategy is agreed to • March 12, 2019- commitment from the province to source a set annual volume from the Caribou Range for 10 years
April 2019	• AIP for the G&Y Curves is received • AIP for the Classified Landbase is received • Permission granted to explore the DC to CD strategy providing rationale is included in the FMP • VOITs are finalized • Received direction from the province regarding caribou plan integration into FMP • Finalized VOIT table sent to 5 identified Indigenous communities • Formal request to FMB for AFMPS deviation regarding 2-year window from effective date of the landbase to submission (April 23, 2019) • Annex 3 is provided to WY by the Wildfire Branch (April 24, 2019)
May 2019	• 2014-2019 Stewardship Report is Completed-WY
June 2019	• Block tagging process is initiated • PFMS is aligned to between operators
July 2019	• PFMS 20-year SHS is provided to operators for review • PFMS 20-year SHS is provided to Indigenous communities for review • PFMS sequence is tagged with primary and secondary operators (20 years) • NTV outputs are provided to GoA biologists for review (baseline and PFMS)
August 2019	• Final Public Open House is held in Grande Prairie. Indigenous communities are invited. • Meet with GoA biologists to discuss their input into mitigation strategies for NTVs • Final Indigenous consultation milestone is achieved- draft FMP that WY intends to be submitted is shared. • Draft FMP is shared with Quota Holders and local AAF area foresters
September 2019	• Weyerhaeuser submits 2019 Forest Management Plan to GoA for approval • Weyerhaeuser submits the final ROC log for Indigenous Consultation to the Province and requests adequacy.
January 2020	• September to January: Technical Reviews (GoA) and edits (WY) • Resubmission of FMP

2.9. Ongoing Communication with the Public, Stakeholders and Indigenous Groups

Forest operators will continue to engage members of the public, stakeholders and Indigenous Groups and solicit feedback regarding our operations through annual consultation events. This includes Annual Operating Plan consultation with Indigenous groups and stakeholders as well as the Annual Open House held each year in Grande Prairie in October.

A documented **record of public and indigenous consultation**, including mitigative strategies implemented are shared with the Province.

The Province of Alberta maintains an inclusive webpage regarding the **Alberta forest industry** at *www.alberta.ca/forestry*. Members of the public, industrial operators and stakeholders can access information about the status of the industry, programs, research and operational tools here.

All **Forest Management Agreements** within the province of Alberta are listed on the Government of Alberta (www.alberta.ca/forest-management-agreements).

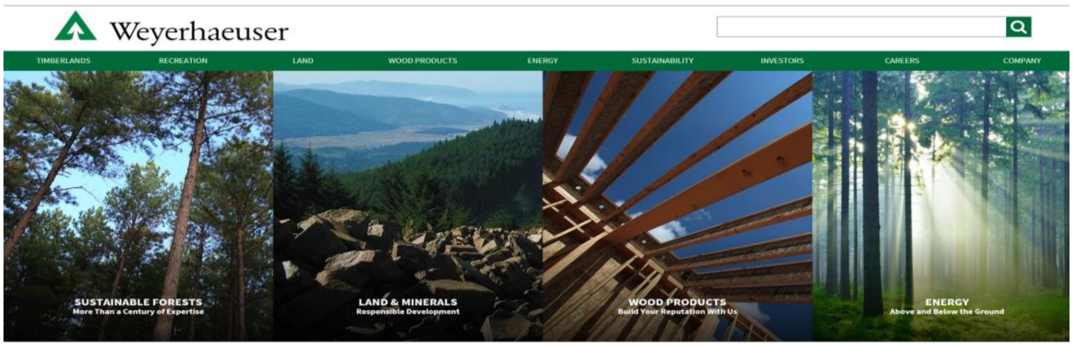
The current approved **Forest Management Plan** is posted on the Government of Alberta website (www.alberta.ca/forest-management-plans-overview).

The **Operating Ground Rules** for FMA6900016 is posted on the Government of Alberta website at www.alberta.ca/forest-management-manuals-and-guidelines.

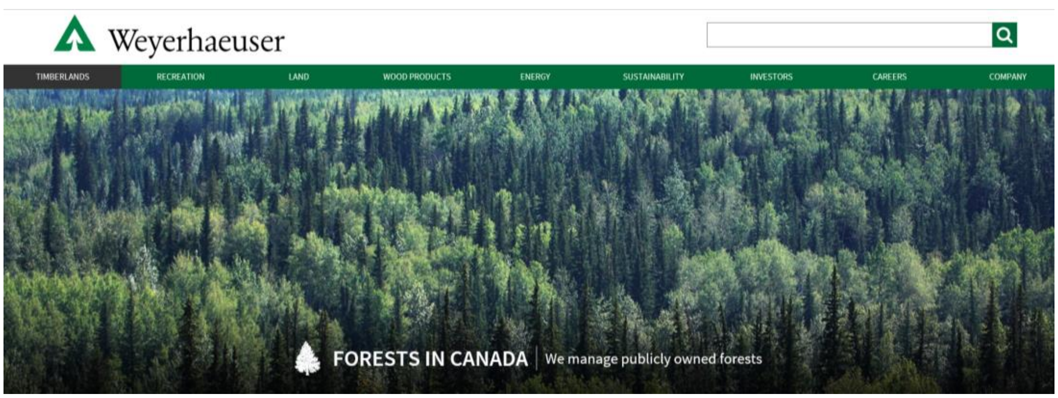
To meet the legislative requirements in the Forests Act and the Public Lands Act, the Province publishes all **contraventions assessed** in the last five years. This information can be found at www.alberta.ca/forest-management-compliance-and-enforcement.

Weyerhaeuser has a significant online presence where members of the public can find information regarding the **Weyerhaeuser Corporation** including our operations, locations and people; Wood Products; Alternative Energy; Sustainability; Financial reports and the Weyerhaeuser people.

The **corporate website** is www.weyerhaeuser.com.



Information about **Canadian Forests** is found within this site under the tab timberlands/ forestry/ Canada. This is where people can read about Forest Management in Canada, Environmental Stewardship, Research and Partnerships.



Weyerhaeuser openly shares our **Sustainable Forestry Initiative** certificates for our forests and manufacturing facilities on our website under the tab sustainability/ environment/ certification.

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CHAPTER 3 TIMBER INDUSTRY OVERVIEW

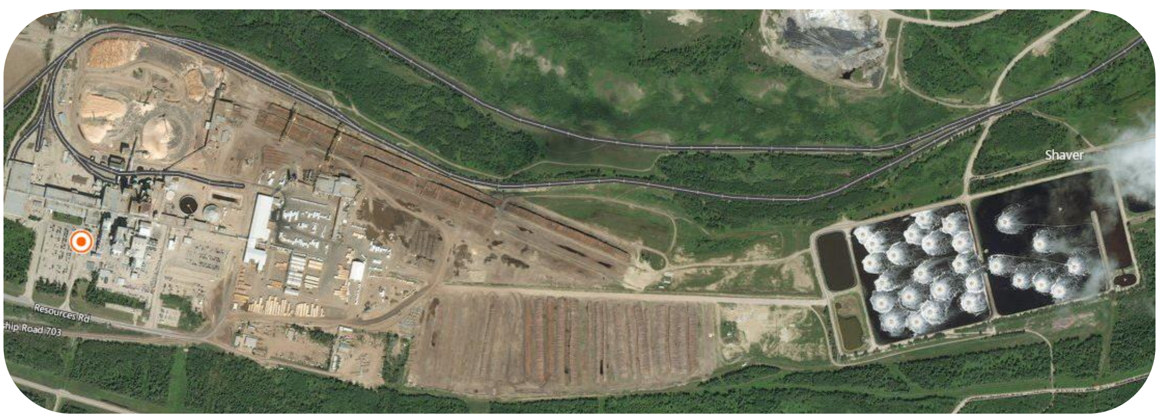
3.1. Forest Management Area Timber & Facilities

3.1.1. Weyerhaeuser Company Limited

Procter & Gamble built the Pulp Mill 1972 and harvesting of roundwood pulp began in 1973. In 1980 construction of the lumber mill was completed and harvesting of sawlog timber began, initially as a cost-effective way of supplying the pulp mill with a source of chips. In 1992 Weyerhaeuser purchased the Pulp Mill, Lumber Mill and Forestlands operations from Procter & Gamble.

In 2002, Weyerhaeuser grew its operations to include a cogeneration plant which captures waste steam from the on-site facilities to produce electricity for the site and sells renewable electricity to the Alberta grid. To illustrate the impact, this plant can produce enough electricity to power 1/3 of the homes in Grande Prairie.

In December 2016, Weyerhaeuser sold the pulp mill, the co-generation facility and a representative portion of the site to International Paper.



Weyerhaeuser and International Paper facilities in Grande Prairie, Alberta

In 2018, Weyerhaeuser Company Limited approved a multi-million-dollar capital project to upgrade the lumber facility which began in the fall of 2018. The objective of this project is to upgrade sawmill equipment and technology to better utilize small diameter sawlog, improve cost efficiency and safety and to optimize volume output of high value dimensional lumber.

The FMA area is the sole source of coniferous timber for the Grande Prairie Sawmill. This facility utilizes Lodgepole Pine, White Spruce, Black Spruce and Balsam Fir.

3.1.2. International Paper

International Paper (IP) does not hold an allocation on the FMA area; however, Weyerhaeuser holds a long-term contractual obligation to provide this facility with roundwood fibre. The FMA area is the main source of roundwood fibre into this facility and approximately 35% of their total consumption, through pulpwood and residual chips. Of the coniferous timber that comes into the site in Grande Prairie that is home to the IP and the Weyerhaeuser facilities, approximately 73% is used to produce dimension lumber; 13% is used to produce pulp; 13% becomes hog fuel and is burned to produce green energy. The remaining 1% is used for other products (shavings etc.) or is sent to the landfill. Approximately 65% of the chips utilized by IP is sourced through the purchase of chips or roundwood pulp from sawmills other than Weyerhaeuser. International Paper utilizes Lodgepole Pine, White Spruce, Black Spruce, Balsam Fir and Tamarack.

3.1.3. Norbord Inc.

Norbord Inc operates an Oriented Strand Board facility in the MD of Greenview just south of Grande Prairie and holds a Deciduous Timber Allocation (DTA) that authorizes harvest of deciduous timber from FMU G16 for its facility in Grande Prairie, Alberta. The volume associated with this DTA is variable.

Norbord Facility south of Grande Prairie, Alberta

3.1.4. Tolko Industries Ltd.

Tolko OSB Plant, High Prairie, AB

Tolko operates an Oriented Strand Board facility in High Prairie, Alberta and holds a Deciduous Timber Allocation (DTA) that authorizes harvest of deciduous timber from FMU G16 (VSA 2 - Saddle Hills) for its facility in High Prairie, Alberta.

The volume associated with this DTA is fixed.

3.1.5. Local or Community Use

The Province reserves the right to issue timber dispositions for local use to a maximum allocation as per paragraph 8(2)(a) in the Forest Management Agreement. In the current agreement, this includes 8,634m^3 of coniferous timber and 10,000m^3 of secondary deciduous timber. Several Local Timber Permits (LTPs) are issued each year within FMA6900016 and currently, there are three local sawmillers producing dimensional lumber with fibre sourced from within Weyerhaeuser's FMA.

3.1.6. Unallocated

Up to 51,000m^3 of deciduous volume remains unallocated in VSA2 (Saddle Hills) and is held by the Province of Alberta for potential future allocation.

3.1.7. Salvage Wood


Pipeline construction in Saddle Hills, Alberta

Salvage timber is timber that is harvested when land is cleared for other industrial uses. The land is removed from the FMA and is held by the industrial company under a disposition. Weyerhaeuser has rights to the coniferous timber when the disposition is on FMA 6900016. The salvage pulpwood is sold to International Paper. Weyerhaeuser's objective is to utilize as much merchantable salvage timber from the FMA as possible. On average, Weyerhaeuser purchases 2.5% of its AAC volume through timber salvage. Deciduous salvage wood is sold to either Norbord or Tolko.

3.1.8. Purchase Wood

Timber supply deficits can be addressed through log purchases, however in the Grande Prairie area this is complicated because nearly all crown timber is allocated to existing tenure holders and there are low volumes of mature coniferous timber available on private land in this region.

Purchases of timber from private landowners by Weyerhaeuser are rare. Deciduous quota holders source a portion of the fibre for their facilities from private land or from grazing leases.

3.2. Utilization Standards

Utilization standard is the merchantable standard used in the calculation of the annual allowable cut.


Photo cred: HTC Scaling 100 course

The coniferous utilization standard used is 15/10 where a merchantable tree has a minimum diameter of 15cm (outside bark) at a stump height of 15cm and a merchantable length of 3.66 m to a 10cm top diameter (inside bark).

The deciduous utilization standard used is 15/10 where a merchantable tree has a minimum diameter of 15cm (outside bark) at a stump height of 15cm and a merchantable length of 3.66m to a 10cm top diameter (inside bark).

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CHAPTER 4 LANDSCAPE ASSESSMENT

This Landscape Assessment provides a detailed description of the Defined Forest Area (DFA) current to May 1, 2017. This assessment describes the uses, values, communities and forest conditions within the DFA that are used to develop the preferred forest management strategies (FMS) as well as to validate existing forest management goals within the Forest Management Plan. This assessment has been prepared based on the outline provided in Appendix A of the *Alberta Forest Management Planning Standard (Alberta 2006).*

For this document, unless otherwise indicated, all summaries, graphs and tables are for the Defined Forest Area or FMU G16 and current as of May 1, 2017, the effective date of the Classified Land Base.

4.1. Administrative Boundaries

4.1.1. The Defined Forest Area

The Defined Forest Area (DFA) for this Forest Management Plan (FMP) is Forest Management Unit (FMU) G16 which is located between the 54th and 56th parallels in west central Alberta[8] and covers 1,178,018 hectares.

4.1.2. The Forest Management Area

Within the DFA, the Forest Management Agreement Area (FMA Area) forms the outer extent of the area for which Weyerhaeuser has harvesting rights to and covers 1,117,309 hectares. The FMA area is divided into two disjointed spatial locations, the smaller "Saddle Hills" area to the north of the city of Grande Prairie and the larger main block to the south of the city.

Deciduous operators have specified rights to deciduous volume within FMA6900016 as well as within several grazing leases which are found within the DFA but outside the FMA and cover 11,347 hectares.

4.1.3. Municipal Districts, Counties and Communities

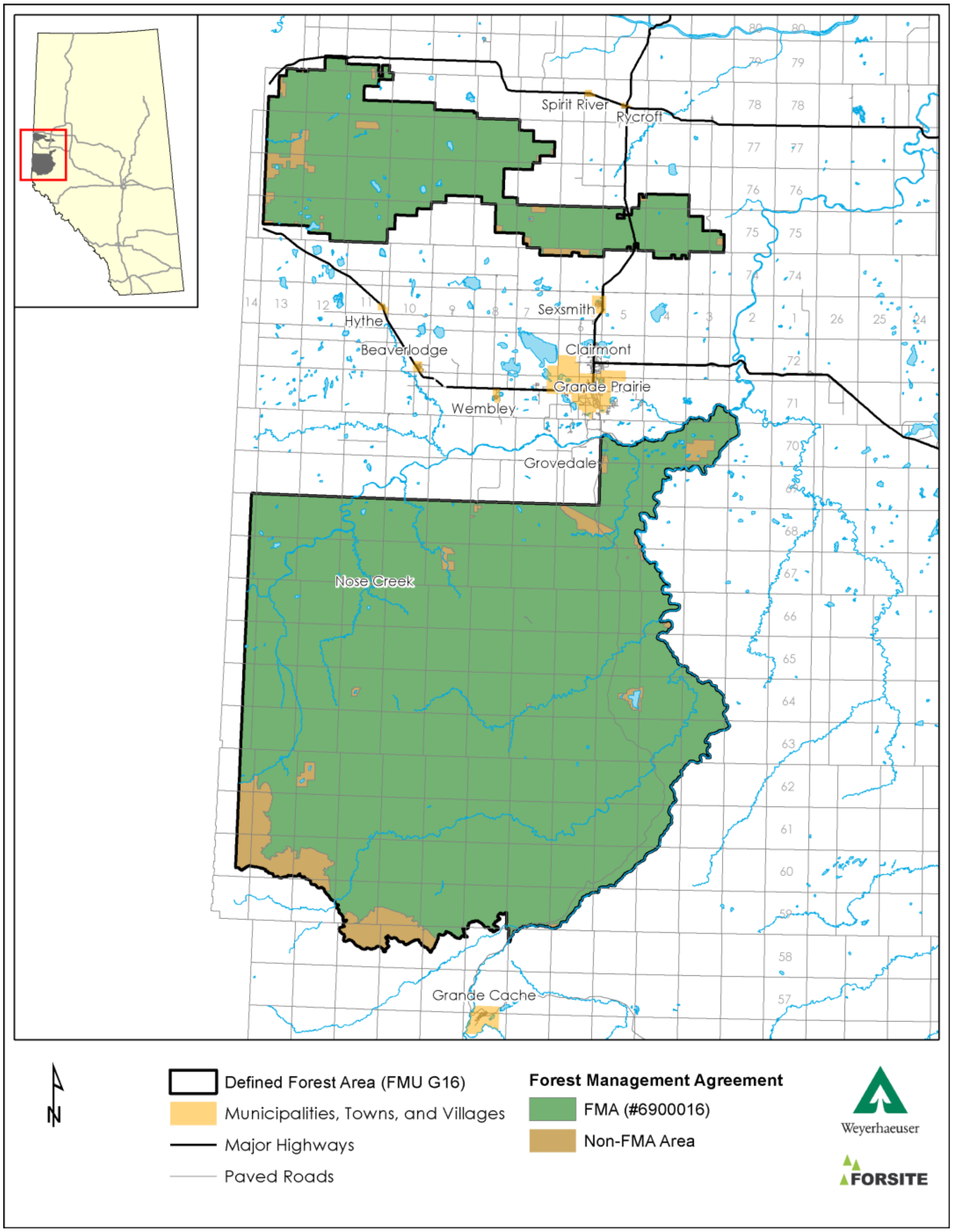
Most of the southern block of the DFA is within MD of Greenview No16. The northern block, known as Saddle Hills, overlaps mostly with Saddle Hills County. There are also small areas that overlap with the County of Grande Prairie No.1 and Birch Hills County.

Grande Prairie is the largest community and it is situated between the southern main block and the northern Saddle Hills area. Rural communities supported by the amenities of Grande Prairie include Grovedale, Beaverlodge, Hythe, Spirit River, Sexsmith and Clairmont. There are also several small farming hamlets near each of these. The town of Grande Cache sits just south of the DFA. Grande Prairie is connected to these communities by Highway 40 to the south, Highway 2 to the north and Highway 43 which runs east-west.

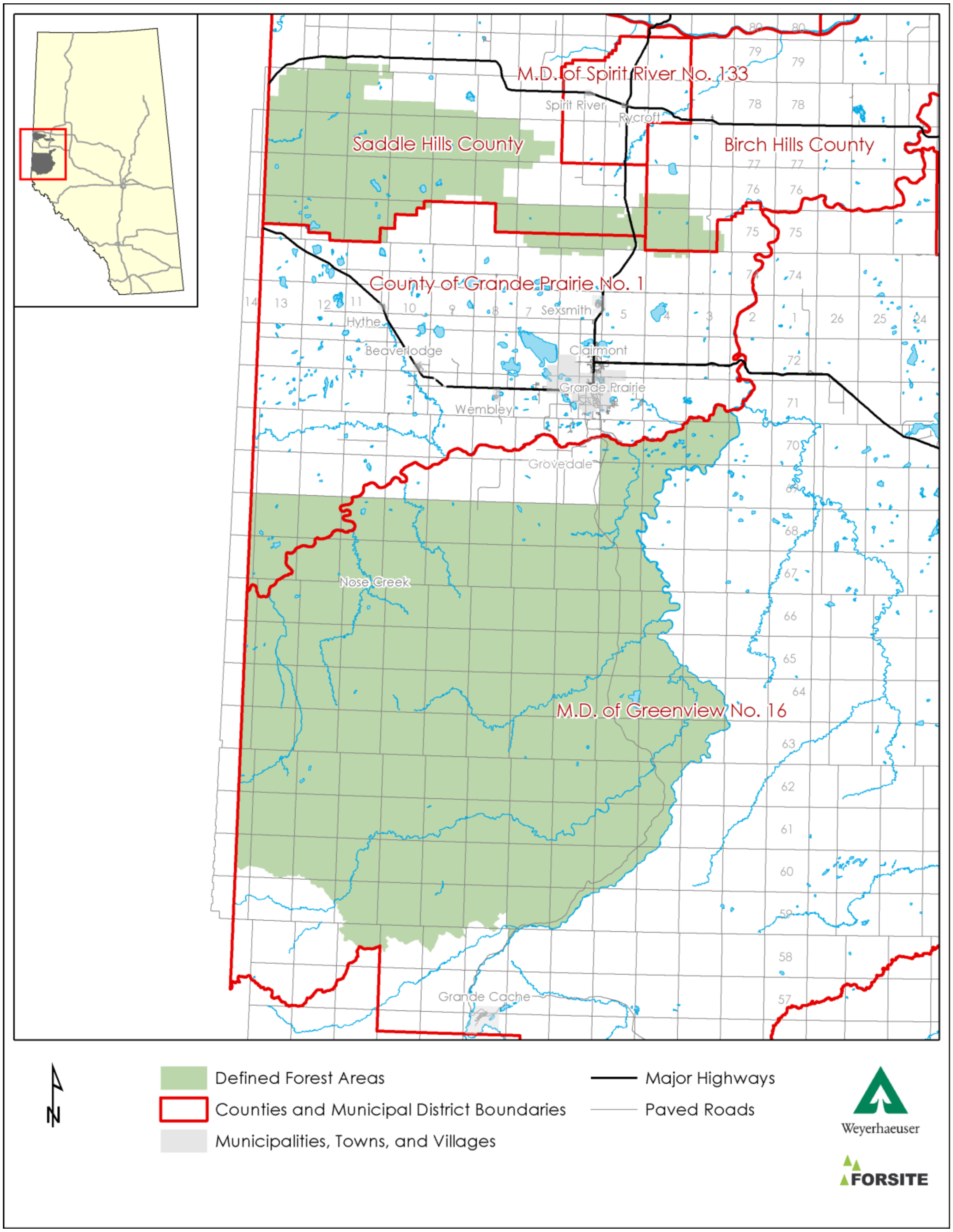
[8] Issue Document LB-0004 resolved June 27, 2017, PDT

Nose Creek is a community on the FMA and is supported by the MD of Greenview. The community consists of several private properties, outbuildings and community shared green spaces. The community has been removed from the FMA.

Map 4-1. The Defined Forest Area and Forest Management Area



Map 4-2. Municipal Districts, Counties and Communities



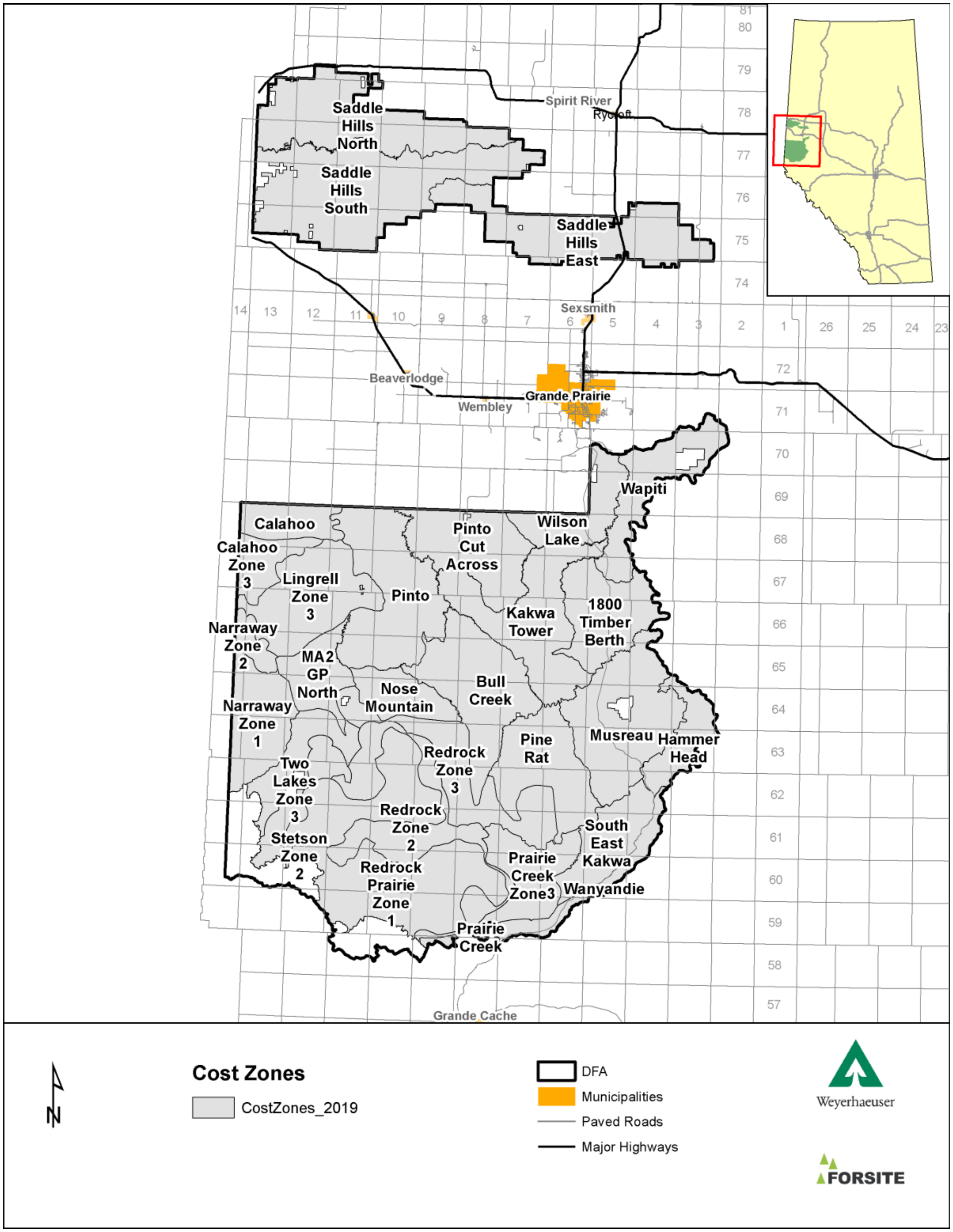
4.1.4. Forest Compartments

The FMA area is managed to a single sustained yield unit. For planning purposes, the FMA is divided into compartments (cost zones) using natural features and road systems as drivers for delineation. For the 2019 FMP submission, cost zone boundaries were adjusted to align with the Caribou Ranges and management zones as outlined in the FMP. This adjustment ensures that all harvest areas in a Forest Harvest Plan have the same management strategy applied. Efforts have been made to keep the average size of each cost zone the same as in previous plans.

Table 4-1. Cost Zones

Cost Zone	Cost Zone (ha)
1800 Timber Berth	38,133
Bull Creek	54,839
Calahoo	17,466
Calahoo Zone 3	15,144
Hammer Head	19,311
Kakwa Tower	57,258
Lingrell Zone 3	47,687
MA2 GP North	21,358
Musreau	61,884
Narraway Zone 1	33,599
Narraway Zone 2	7,482
Nose Mountain	19,639
Pinto	62,412
Pinto Cut Across	42,751
Prairie Creek	483
Prairie Creek Zone3	31,597
Redrock Prairie Zone 1	107,169
Redrock Zone 2	47,582
Redrock Zone 3	42,077
Saddle Hills East	59,955
Saddle Hills North	62,111
Saddle Hills South	95,602
South East Kakwa	27,401
Stetson Zone 2	17,990
Two Lakes Zone 3	21,900
Wanyandie	15,966
Wapiti	33,890
Wilson Lake	24,396
TOTAL	**1,129,330**

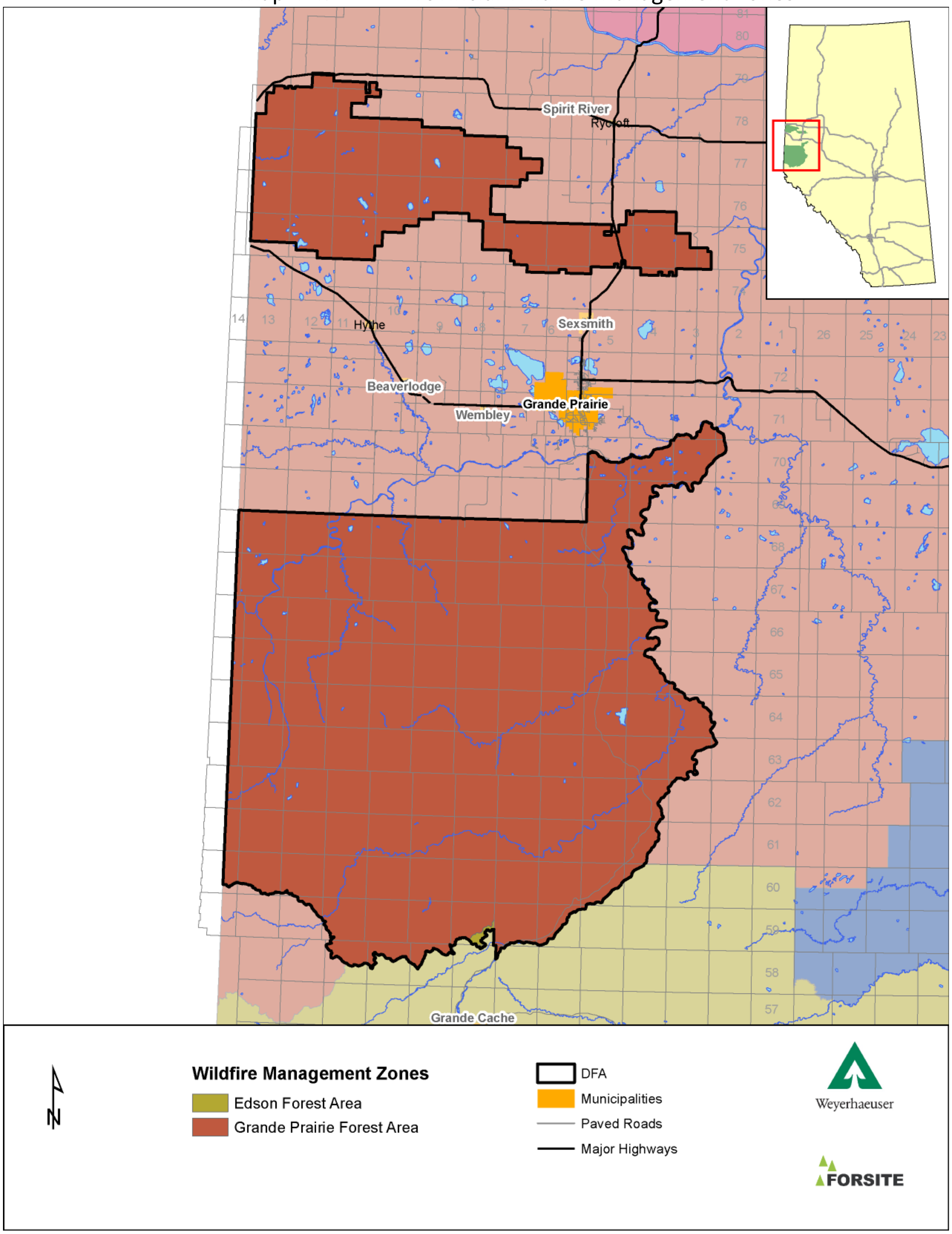
Map 4-3. Forest Management Area Cost Zones



4.1.5. Wildfire Management Areas

The Defined Forest Area is entirely within the Grande Prairie Forest Area Wildfire Management Zone.

Map 4-4. Provincial Wildfire Management Zones



4.2. Areas of Special Value

4.2.1. Federal Government Lands

There are no Federal Government Lands inside or bordering the DFA. The provincial boundary between Alberta and British Columbia runs along the western border of the DFA and FMA 6900016.

4.2.2. Protected Areas & Parks

<u>Provincial Protected Areas</u>

In 1975 the provincial government removed approximately 63, 000 hectares from the original FMU and FMA area to create the Wild Kakwa Wilderness Recreation Area. Today it is known as the Kakwa Wildland Provincial Park and is measured as 65,686 hectares.

During the development of the 1989 FMP, a total of 37,236 hectares was withdrawn from the G3 and G6 Management Units between the Kakwa Wildland Provincial Park and the FMA area. This area is within the DFA, but outside of the FMA area and remains in the Green Zone. This area offers significant recreation opportunities including equestrian trails and camping, fishing, hunting, off-roading, mountain biking and hiking. Kakwa Falls and Horn Ridge are both well-known landmarks within this protected area.

Kakwa Falls; Kakwa River Provincial Rec Area
Photo Source: albertaparks.ca

The following Protected Areas have been removed from the FMA area but are within the DFA and are accessed through the FMA area.

Two Lakes Provincial Park
Photo Credit: Traci Carter

Table 4-2. Provincial Protected Areas

Protected Area	Area (ha)
Big Mountain Creek	13
Shuttler Flats Provincial	14
Musreau Lake Provincial	1,801
Kakwa River Provincial	727
Two Lakes Provincial Park	1,567
Southview Provincial	5
Sheep Creek Natural Area-Recreation	11

Musreau Lake Provincial Park

Big Mountain Creek Provincial Rec Area

Shuttler Flats Provincial Rec Area

Sheep Creek Provincial Rec Area

Photo Credit: Alberta parks

4.2.3. Unique Areas (VOIT 1.1.1.4)

Unique areas are identified as such based on the uncommon plant communities, the surrounding landforms, the uncommon use by wildlife, the historical use (oral history) and/ or significant wildfire use. Several unique areas have been identified through consultation with recreational users, members of the public or Indigenous traditional users or through a review of historical documents. Identification and protection of these unique areas are carried forward from previous plans.

Sherman Meadows Airstrip

Lick Creek and Sherman Meadows are historical sites. Indigenous people had cabins here and the area was well used for hunting and trapping. Sherman meadows has been used as an industrial airstrip. Today these areas are used mostly as a staging area for Guides and Outfitters, equestrian camps, off -road vehicles, snowmobiles and hunters.

Torrens Hiking Trail 145km south of Grande Prairie off the Two Lakes Road. The trail is 3km long and leads into Torrens Falls, a small waterfall and pool.

Sheep Meadows is a naturally non-forested grassy meadow on a bench above a tributary to Narraway River. This area is known habitat for Bighorn Sheep.

The **Kakwa Cabins** are a culturally significant site along the Kakwa River with historical use by local indigenous people. Remnants of old cabins is visible from the riverbanks.

Kakwa River

Porcupine Flats is a historical recreational area used heavily for canoeing, kayaking, hunting, fishing and camping. It is a wide flat spot on the Kakwa River and one of the only river access points.

The **Redrock Outcrops** is a unique rocky outcrop area along Redrock Creek.

Lingrell Lake is a walk-in lake with no developed access or amenities known for its fishing opportunities. Lingrell Creek is a tributary to the Smoky River and is also known for good fishing spots. Lingrell Creek also has an area of benches to the northeast of Lingrell Lake creating small waterfalls.

Long Lake, Spring Lake and Hilltop Lake are identified as areas of high recreation use. The area around Spring Lake is host to an independently run campground, a ski hill and an equestrian area. Hilltop Lake Recreation area is run by the County of Saddle Hills as a campsite and day use area. Long Lake recreation area is used by the public as a day use area.

Spring Lake Boat launch and Spring Lake Ski Chalet

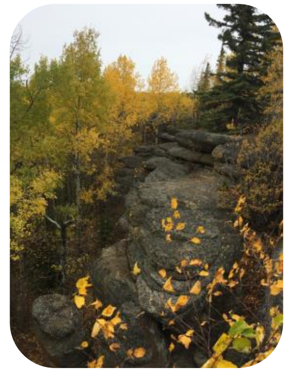
Nose Creek Settlement is a small group of cabins just south of the Nose Creek Community, a subdivision in the MD of Greenview. The elders that reside here are affiliated with the Aseniwuche Winewak Nation.

The Calliope Hummingbird is the smallest breeding bird in Canada and has a limited distribution in Alberta. During the planning process a member of the public identified two areas as known **Calliope Hummingbird territory**.

Calliope Hummingbird
Photo Source: Wikipedia

The Saddle Hills area of the northern boreal forest offers an abundance of wildlife and diverse landforms.

The **Saddle Hills Rimrocks** and the **Saddle Hills Cave** are known recreation sites however they are not formally recognized. There are no amenities, signage does not exist, and access is challenging. However, they provide a unique recreational opportunity for those that know about them.



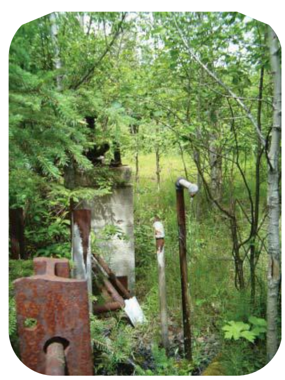
Saddle Hills Rimrock

The **Pouce Coupe Wetlands** is an area that provides an excellent viewing area for birders.

During the second world war, the Government of Canada built a **Prisoner of War Camp** near Musreau Lake. The following is from the South Peace Regional Archives Society "Telling our Stories" Volume 2, Issue 4, September 1, 2011.

"To make use of the prisoners, they were engaged in various activities in the camps. Certain non-violent prisoners, usually navy or air, could be let out to private companies operating in remote areas at - I believe - $5 per day. The companies were either in road construction or lumbering and the prisoners were sequestered within the camps and worked as groups under strict supervision." Dr. David Leonard

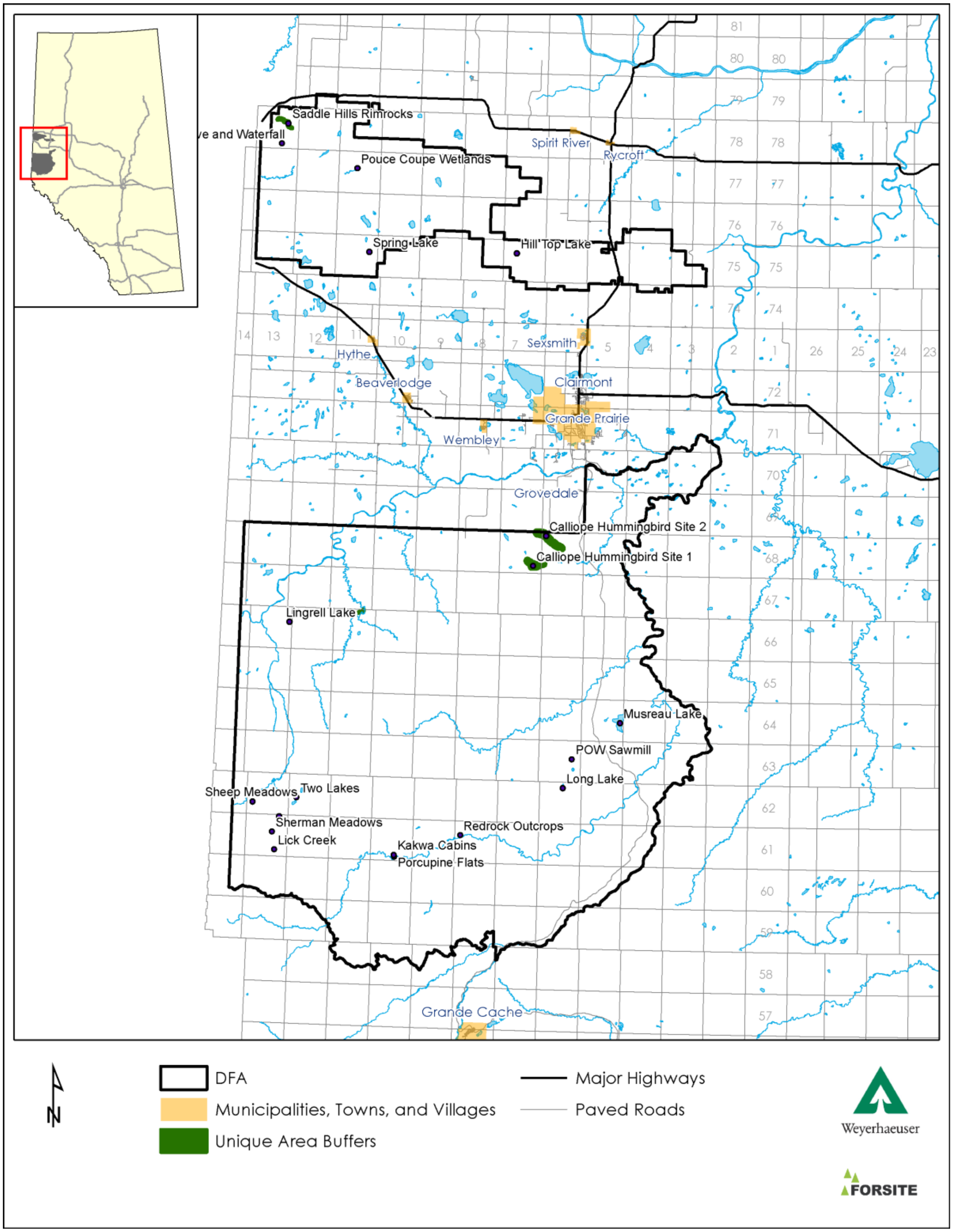
This area has seen significant oil & gas development as well as MPB attack and in 2014 the timber surrounding the sawmill site was harvested, with retention, to reduce the risk of fire as well as improve line of sight for the road.



A pipe which brought water from a spring up the hill into the camp

VOIT 1.1.1.4 commits forest operators to maintain 100% of identified uncommon plant communities and unique areas.

Map 4-5. Unique Areas



4.2.4. Natural Disturbances (VOIT 1.1.1.5 (a)(b)

Natural disturbances are agents that cause most of the trees in a selected area to die. Examples of natural disturbances include fire, wind (blowdown), floods, insects, disease, etc. Areas of natural disturbance create unique habitat for wildlife and add to the diversity of the area. However, in the event of a large natural disturbance area, a salvage plan may be considered providing most of the trees are still commercially viable if harvested.

Wildfires can create large burned over areas with unburned trees existing in green islands, single perch trees and single or clusters of snags. These burned areas become lush again as new growth takes over, often with vegetation that is different from the surrounding areas. Large mammals and ungulates will favor these sites to graze and browse on the new vegetation because they are easy to maneuver through.

Red Deer Creek Fire
(Daily Herald Tribune)

Fire prevention and suppression activities have been very successful in the past ten years. There have been 3 wildfires in the DFA that burned patches over 50 hectares in size.
See *Chapter 4; Section 4.11.2: Wildfire History*.

Blowdown events create clusters of coarse woody debris and horizontal stands. Unlike wildfires, which destroy much of the vegetation, and harvested openings, which removed most of the large woody debris, blowdown stands leave affected vegetation intact on the forest floor with a significant amount of cover from the downed trees. These sites provide a unique habitat for small mammals such as voles and mice but are unfavorable for larger mammals and ungulates.

Blowdown along the edge of a harvest

In the past 10 years there has been one blowdown event in the DFA over 50 hectares in size. This event occurred in 2017/18 in the Wanyandie cost zone south of the Southview lookout on Highway 40 and has been mapped at approximately 82 hectares[9].
This pocket of downed trees is susceptible to spruce beetle infestation and will be salvaged as part of the period one harvest sequence.

[9] 2018 Forest health Aerial Survey, AAF

4.3. Physical Conditions

4.3.1. Topography

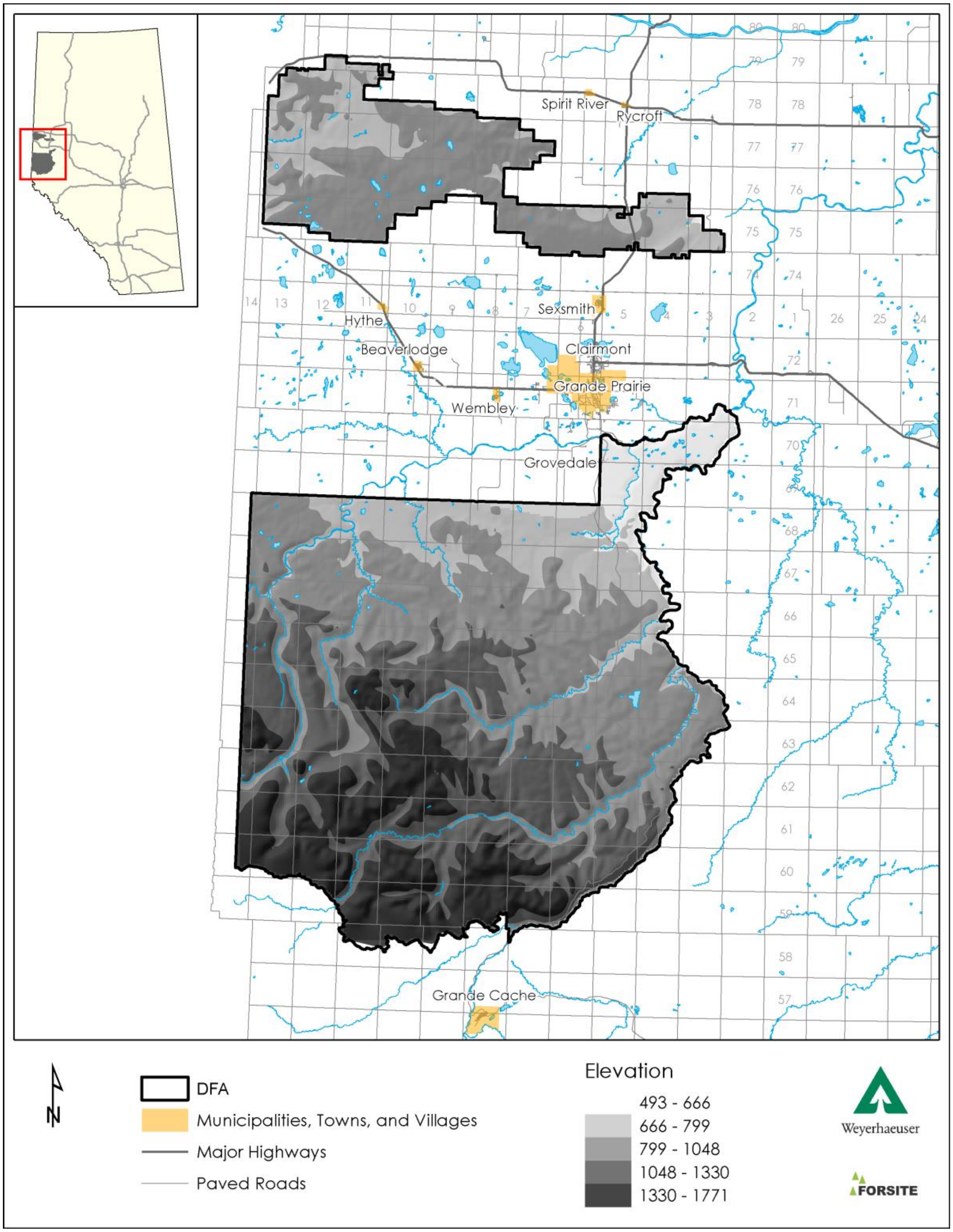
Topography varies throughout the DFA from flat to gentle rolling in the Saddle Hills and Northern Main Block, to steep and rugged in the southernmost area of the DFA where it borders the Rocky Mountains. Steep ravines and rock outcrops can also be found in many of the main riverbanks. Elevations range from 750m to 1,000m in the northern part which is known as the Saddle Hills. In the southern main block of the DFA the lowest elevations (500-750m) are found in the northeast corner in the Wapiti Cost Zone. This area is adjacent to the Wapiti and Smoky Rivers and is the closest area to Grande Prairie. As you move southwest elevations climb from 500m to 1,750m at the edge of the DFA. The Kakwa Wildland Park sits at the very southwest corner and most of this park sits above the treeline at elevations greater than 1,750m.

4.3.2. Soils and Landforms

Major geologic formations found within the DFA include the Wapiti (lower), predominately in the Saddle Hills area, the Wapiti (upper), Scollard, Brazeau, Alberta and Paskapoo formations in the southern area. These formations date back to the Late Cretaceous and Early Tertiary periods.

Gray luvisolic soils dominate, particularly in the lower and upper foothills regions of the DFA. The entire Saddle hills area is predominately Gray luvisolic. At higher elevations on the southern most regions Brunisolic (Brunisolic gray luvisolic, Dystic brunisolic and Eutric brunisolic) subgroups are found.

Map 4-6. Elevation Ranges



4.3.3. Natural Regions and Sub regions

Natural regions and sub regions are ecological units characterized by vegetation, climate, elevation and latitudinal or physiographic differences. The DFA contains seven sub regions with two (lower and upper foothills) making up 70% of the area.

Table 4-3. Natural Sub-regions

Natural Region	Natural Sub region	Percent (%) Representation
Foothills	Lower Foothills	48%
	Upper Foothills	22%
Boreal Forest	Central Mixed wood	12%
	Dry Mixed wood	4%
Rocky Mountain	Subalpine	13%
	Montane	<1%
	Alpine	<1%

Note: the NSR proportions are similar between the non-contributing and contributing forest.

Lower Foothills

Lower Foothills sub region makes up 48% of the DFA and is the predominant sub region in the Saddle Hills area. It is characterised by rolling till covered plateaus that are forested by mesic, closed canopy mixed stands of aspen, lodgepole pine, white spruce and balsam poplar. The lower foothills have the most diverse forests in Alberta in terms of forest types and tree species.

Upper Foothills

Upper Foothills sub region comprises around 22%. It is characterised by closed canopy conifer stands of lodgepole pine, black spruce and white spruce on rolling to steeply sloping terrain. Even-aged fire origin lodgepole pine stands, often with a black spruce understory, are typical of this sub region.

Subalpine

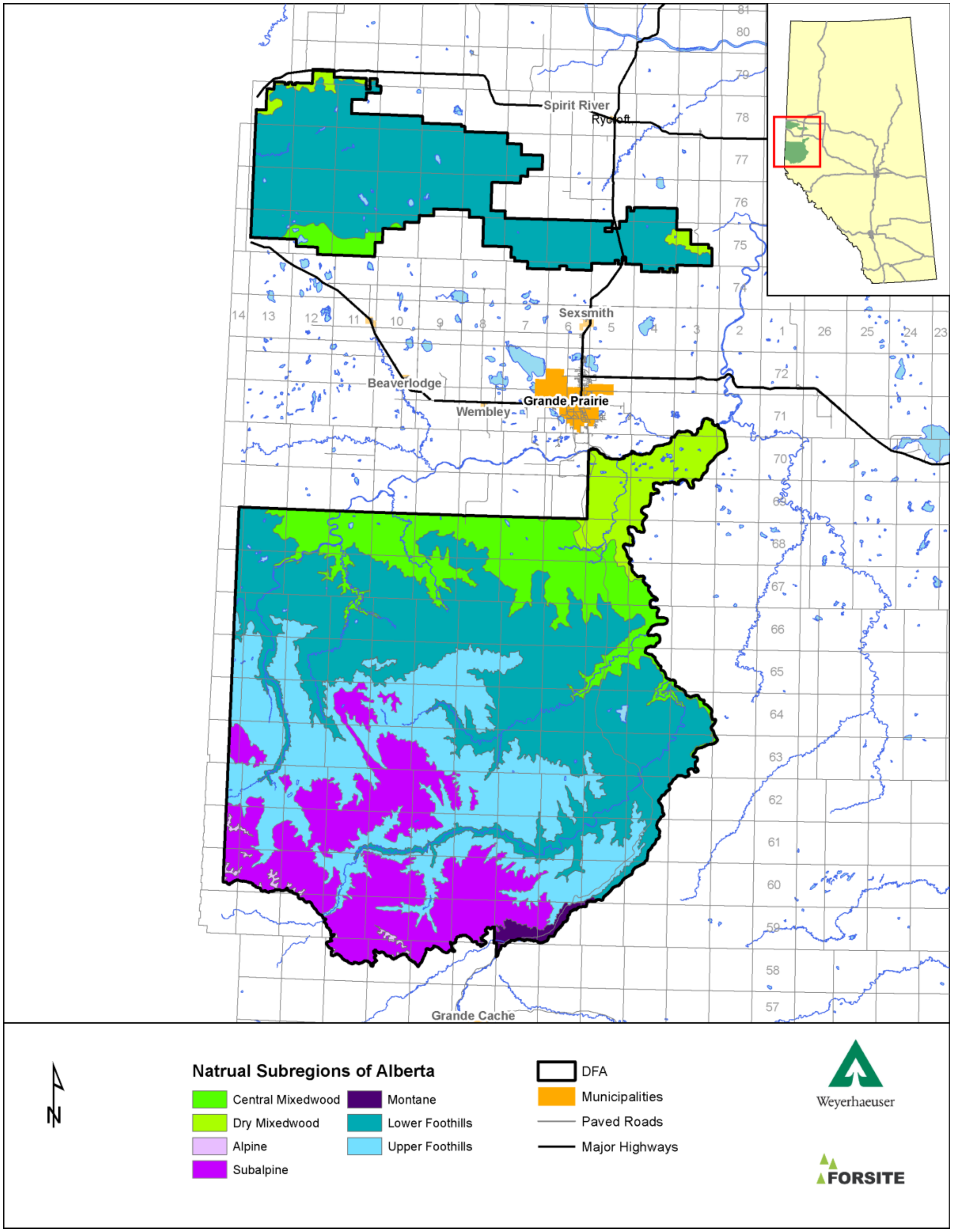
Subalpine sub region comprises about 13% and occurs at higher elevations. Subalpine regions are characterized by short cool summers and high winter snowfalls. In the lower parts of this region you will find closed fire origin lodgepole pine forests with Engelmann spruce and subalpine fir.

Central Mixed wood

12% of the DFA falls within this sub region. It is characterised by vast expanses of upland forests and wetlands on level to gently undulating plains with short, warm summers and long, cold winters. It is the largest natural sub region in Alberta and Aspen dominated deciduous stands, aspen\white spruce forests, white spruce and jack pine stands are typical of upland areas in this sub region.

The remaining 6% is made up of Dry Mixed wood, Alpine and Montane natural subregions.

Map 4-7. Natural Sub Regions



4.3.4. Hydrology and Watersheds

Hydrological processes in the boreal forest are dependent on the interactions between climate, vegetation and soil components of the ecosystem. These interactions influence streamflow, water body composition and the surrounding aquatic habitat. Levels of disturbance in a single watershed heavily influence this process. Forest canopy influences water storage and energy exchange between the surface and the atmosphere. Ground compaction influences surface runoff levels and can alter the pathway or direction.

Using the Forestry Watershed layer provided by the Province, 184 unique watersheds have been identified within the DFA.

The DFA is located within the Peace River Drainage Basin of Alberta. The Saddle Hills area is drained by the Saddle River which flows eastward to the Smoky River, and the Pouce Coupe River flowing to the west.

The main block is drained by the Wapiti River, the Cutbank River and the Kakwa River which are all tributaries of the Smoky River. The Smoky River forms the eastern boundary of the larger southern block of the DFA.

In the boreal forest, precipitation levels are typically the highest in the spring and fall with significant rainfall events, and in the winter months through heavy snow fall. Water discharge/ streamflow levels are at the highest in the spring and early summer when the snowpack begins to recede before the ground has fully thawed, and before vegetation emerges from dormancy.

Water Gauging Station
Photo Credit: Darcy Talma, AEP)

Alberta Environment and Parks (AEP) monitors the rivers and river basins in the province through continuous feed data collected by hydrological stations throughout the province.
This data provides information about Alberta's rivers, including water and flow levels[10].

[10] https://rivers.alberta.ca

Map 4-8. Forestry Watersheds

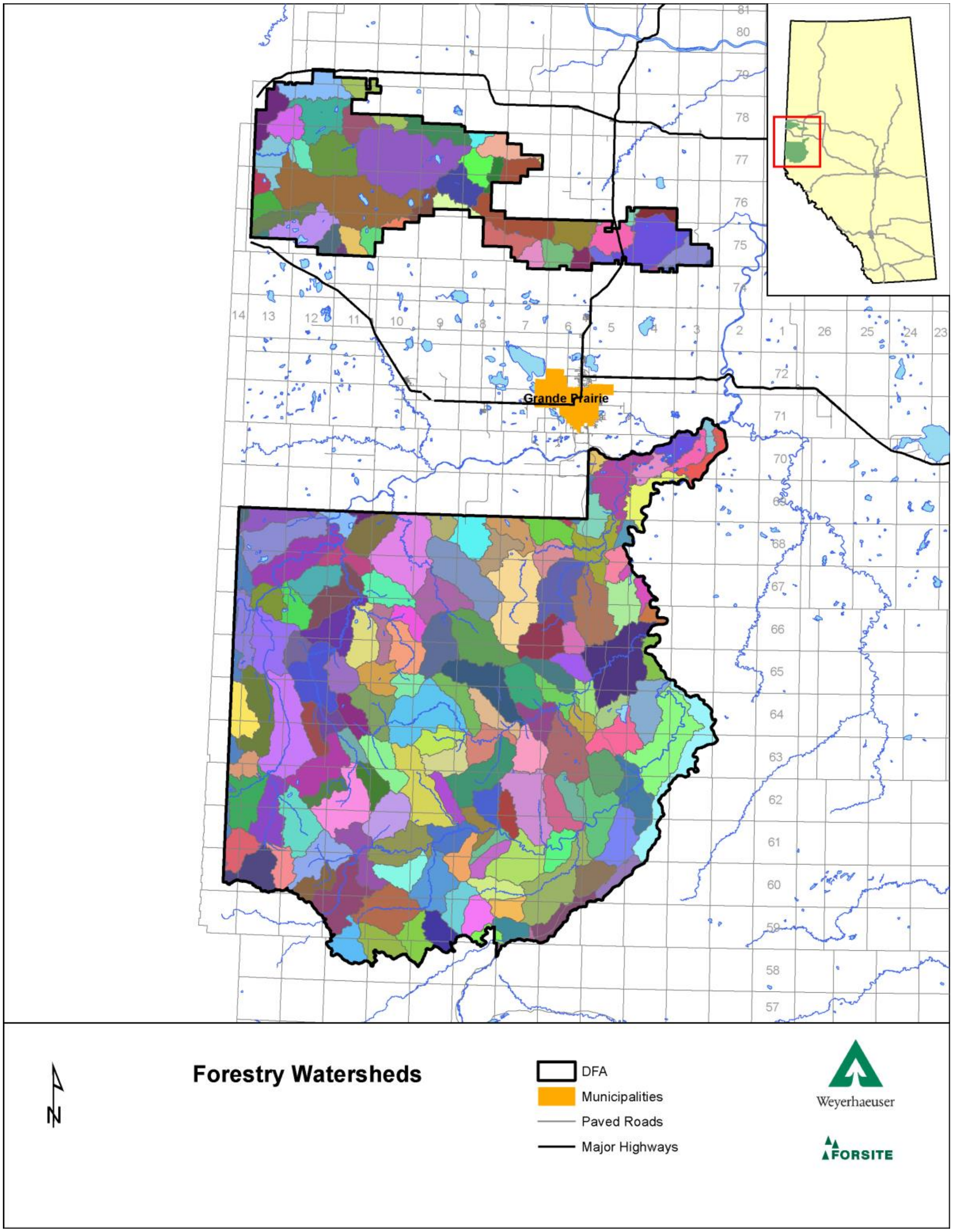


Table 4-4. Hydrological Stations on DFA Main Drainages

River/ Drainage	Station Number	Geographical Area
Saddle River (Woking)	07FD006	North of Woking, Alberta (non FMA)
Wapiti River	07GE001	Grovedale, Alberta (non FMA)
Cutbank River	07GB001	Pine Rat (FMA)
Kakwa River	07GB003	SE Kakwa (FMA)

Figures 1 through 8 depict mean monthly water discharge rates (m^3/s) and peak annual water discharge rates (m^3/s) for the past 10 years (2008-2018) for the main drainages on FMU G16.

Data was only used from April to October as in the winter months data is either not collected or unreliable due to ice buildup on the river. The rating curve for each water course is developed by collecting water level and discharge rates during open water season. Ice build up alters that relationship, so the rating curve does not apply in the winter months.[11]

Figure 4-1. Saddle River Mean Monthly Water Discharge (m^3/s)

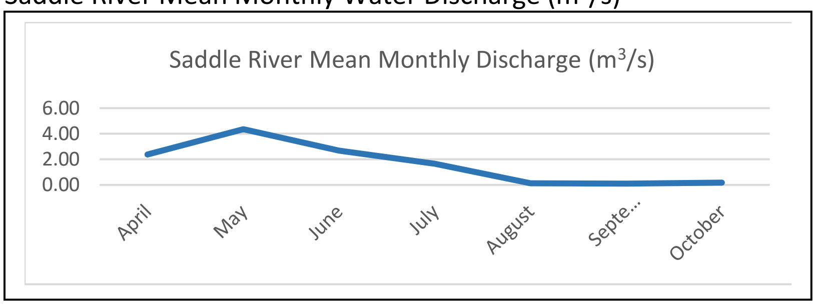
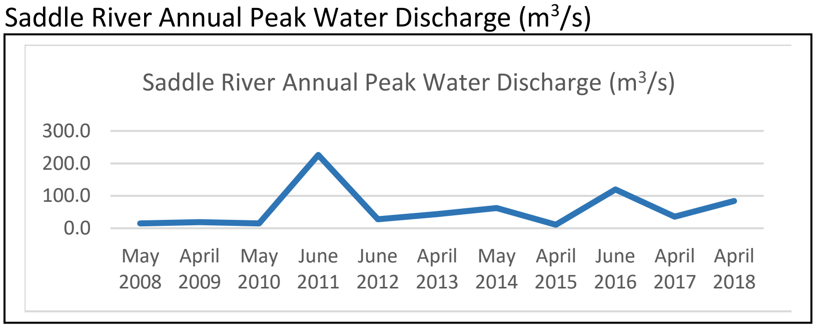


Figure 4-2. Saddle River Annual Peak Water Discharge (m^3/s)



[11] Alberta Environment and Parks Data Management Specialist (Water Supply)-August 8, 2018

Figure 4-3. Wapiti River Mean Monthly Water Discharge (m^3/s)

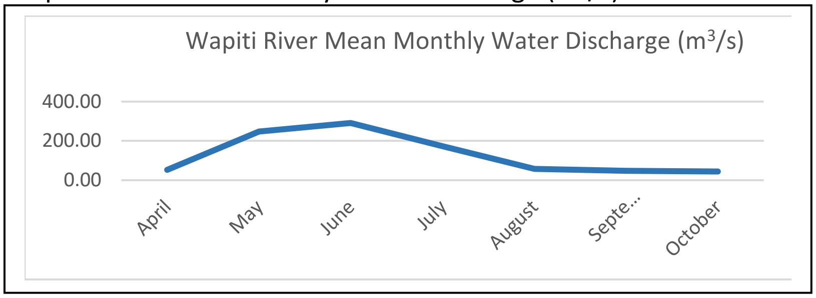


Figure 4-4. Wapiti River Annual Peak Water Discharge (m^3/s)

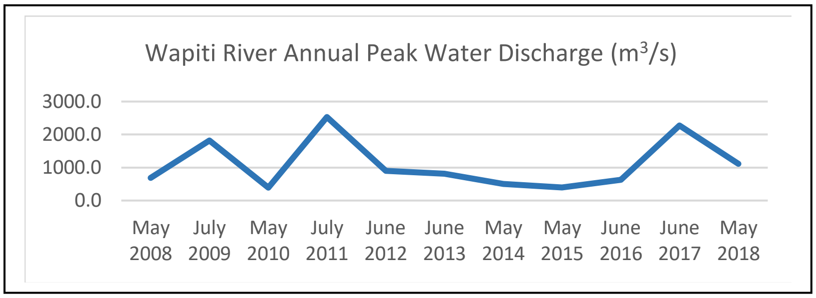


Figure 4-5. Cutbank River Mean Monthly Water Discharge (m^3/s)

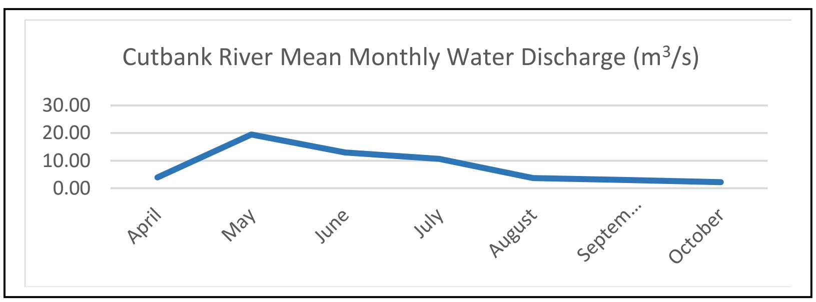


Figure 4-6. Cutbank River Annual Peak Water Discharge (m^3/s)

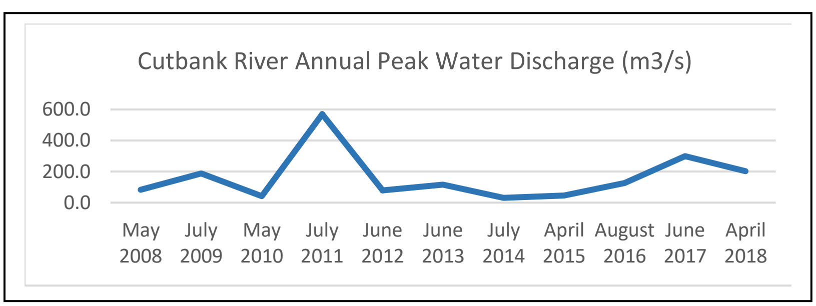


Figure 4-7. Kakwa River Mean Monthly Water Discharge (m^3/s)

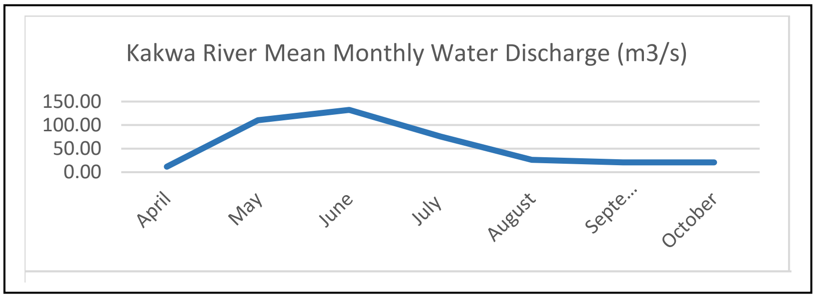
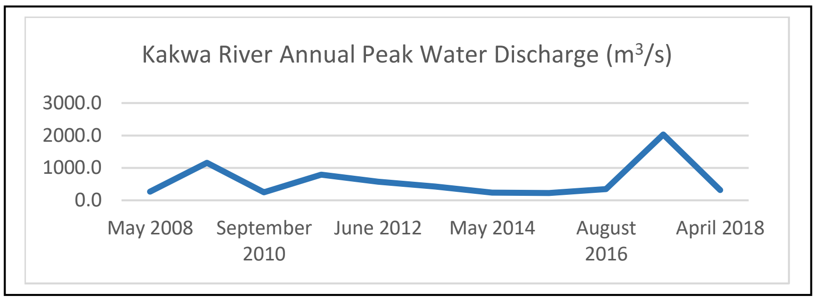


Figure 4-8. Kakwa River Annual Peak Water Discharge (m^3/s)



4.4. Climate

Three major climatic regimes occur within Alberta; Grassland, Boreal and Cordilleran ecoclimatic provinces.[12] The DFA occurs almost entirely within the Boreal regime with the southwestern corner being within the Cordilleran regime. The differences between the two regimes are mostly attributed to the higher elevation of the Cordilleran producing cooler weather, more moisture and a slightly shorter growing season.

The prevailing temperatures in the Boreal regime can be characterized as cold winters and short warm summers with a four to five month growing season (May through September). [13]During the growing season the average temperature is 13° Celsius and the average precipitation is 56mm of rain/ month (89% of the year total). There are very few days where Grande Prairie does not register wind, with the average speed ranging from 9-14km/ hour. Relative humidity in the Grande Prairie region tends to display higher morning humidity and lower afternoon humidity, especially during the growing season. The sun shines often around Grande Prairie, even on some of the coldest days. This region sees over 2,200 hours of bright sunshine in a year and at least 21 days per month with measurable bright sunshine.

Photo Credit- William Vavrek Photography, Grande Prairie, Alberta
Clockwise from top left: Musreau Lake (June 2017); Red Willow River (Sept 2018);
County of GP (Dec 2015); North of Grande Prairie (August 2016)

[12] Natural Regions Committee 2006. Natural Regions and Sub regions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

[13] The weather statistics displayed here represent the value of each meteorological parameter for each month of the year. The sampling period for this data covers 30 years. Record maximums and minimums are updated annually. The Weather Network; Grande Prairie, AB, Weather Station

4.5. Forest Landscape Pattern and Structure

The structure and pattern of the forest landscape is influenced by many interacting factors such as climate, elevation, slope, aspect, soil properties and physical disturbances, both natural and anthropogenic. This section provides a current snapshot of the forest landscape in terms of species composition, forest cover types, age class distribution, seral classes and forest patches.

As part of the FMP development the DFA area was subject to a classified land base determination process to categorize the area into non-forested and productive and non-productive, such as riparian buffers, protected areas and dispositions, forested areas.


Forested landscape (Redrock Cost Zone)

The following provides a summary of the classified land base determination. Further information on the net down process is available in *Annex 4: Classified Landbase.*

Table 4-5. Classified Landbase Summary

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
Gross Classified Landbase	**1,178,018**	**49,362**	**11,347**	**1,117,309**
Less Non-Forested	94,424	4,746	2,050	87,628
= Net Forested Land base	**1,083,594**	**44,616**	**9,297**	**1,029,681**
Less Administrative Removals	48,269	43,113	18	5,137
= Net Classified Forested Land base	**1,135,325**	**1,503**	**9,278**	**1,024,544**
Less Riparian Buffers	80,518	180	600	79,738
Less Non-Merchantable	104,261	170	1,054	103,037
Less Subjective	16,502	6	213	16,284
less Productive Area within Seismic Lines	8,024	22	138	7,866
= Contributing Net Classified Landbase	**826,020**	**1,126**	**7,273**	**817,764**
less aspatial removals	**33,041**	**45**	**291**	**32,711**
= Effective Contributing Net Classified Landbase	**792,979**	**1,081**	**6,983**	**785,503**

Table 4-6. Contributing Land base by Broad Cover Group

Contributing Landbase by Broad Cover Group	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
1. Pure Conifer (CX)	432,330	100	651	431,479
2. Conifer Leading (CD)	61,787	35	287	61,465
3. Deciduous Leading (DC)	52,385	104	302	51,979
4. Pure Deciduous (DX)	236,275	705	6,033	229,538
5. 'Switch' Stands (D_US)	43,385	182	0	43,203
= Contributing Net Classified Landbase	**826,163**	**1,126**	**7,273**	**817,764**
In-Block Retention (4%)	33,047	45	291	32,711
= Effective Contributing Net Classified Landbase	**793,117**	**1,081**	**6,983**	**785,053**

Table 4-7. Classified Land base Net down Table

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
Gross Classified Landbase	**1,178,018**	**49,362**	**11,347**	**1,117,309**
Less Non-Forested				
1. Anthropogenic Non-Vegetated	17,651	501	180	16,969
2. Naturally Non-Vegetated	14,167	787	59	13,321
3. Anthropogenic Vegetated	22,851	2,182	924	19,745
4. Non-Forest Vegetated	20,630	557	805	19,268
5. Non-Forested Dispositions	15,602	716	82	14,804
6. Non-Forested Burn	3,523	3	0	3,521
= Net Forested Land base	**1,083,594**	**44,616**	**9,297**	**1,029,681**
Less Administrative Removals				
1. Non-Contributing Dispositions	39,930	35,867	13	4,051
2. Private	2,109	1,842	0	267
3. Provincial Parks	1,563	1,563	0	0
4. Provincial Recreation Areas	1,179	1,169	0	9
5. Historic Resource Values	91	0	0	91
6. MPB Rehab	696	0	0	696
7. Unreconciled ARIS	22	0	0	22
8. No AVI	309	302	6	1
9. Dunes	2,370	2,370	0	0
= Net Classified Forested Land base	**1,035,326**	**1,503**	**9,278**	**1,024,544**

Table 4.7 cont..

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
= Net Classified Forested Land base	**1,035,324**	**1,503**	**9,278**	**1,024,544**
Less Riparian Buffers				
1. Large Lake	5,695	10	30	5,655
2. Small Lake	180	0	1	180
3. River	16,724	131	218	16,375
4. Stream	55,385	37	346	55,002
5. Trumpeter Swan Buffers	2,533	2	5	2,526
Less Non-Merchantable				
1. Larch	27,836	32	491	27,313
2. Black Spruce	10,346	52	174	10,120
3. A-Density DX Stands	15,979	84	288	15,607
4. Low Density	4,915	3	78	4,834
5. Subhydric Poor/Very Poor	19,093	0	0	19,093
6. Stands Heavily Impacted by MPB	1,121	0	12	1,109
7. Low Productivity (TPR = U)	14,854	0	10	14,844
8. Low Productivity Within Caribou Range	9,334	0	0	9,334
9. Not Sufficiently Restocked (NSR)	642	0	0	642
Less Subjective				
1. Steep Slopes	10,334	0	2	10,332
2. Archaeology	22	0	0	22
3. Trapper Cabin	394	0	0	394
4. Mineral Lick	224	0	0	224
5. Spring	73	0	0	73
6. Prime Protection (ESLUZ1)	661	0	0	661
7. Unique Areas	884	2	176	706
8. Isolated	3,908	4	34	3,870
less Productive Area within Seismic Lines				
1. Seismic	8,026	22	138	7,866
= Contributing Net Classified Landbase	**826,163**	**1,126**	**7,273**	**817,764**
less aspatial removals				
In-Block Retention (4%)	33,047	45	291	32,711
= Effective Contributing Net Classified Landbase	**793,117**	**1,081**	**6,983**	**785,053**

4.5.1. Forest Species

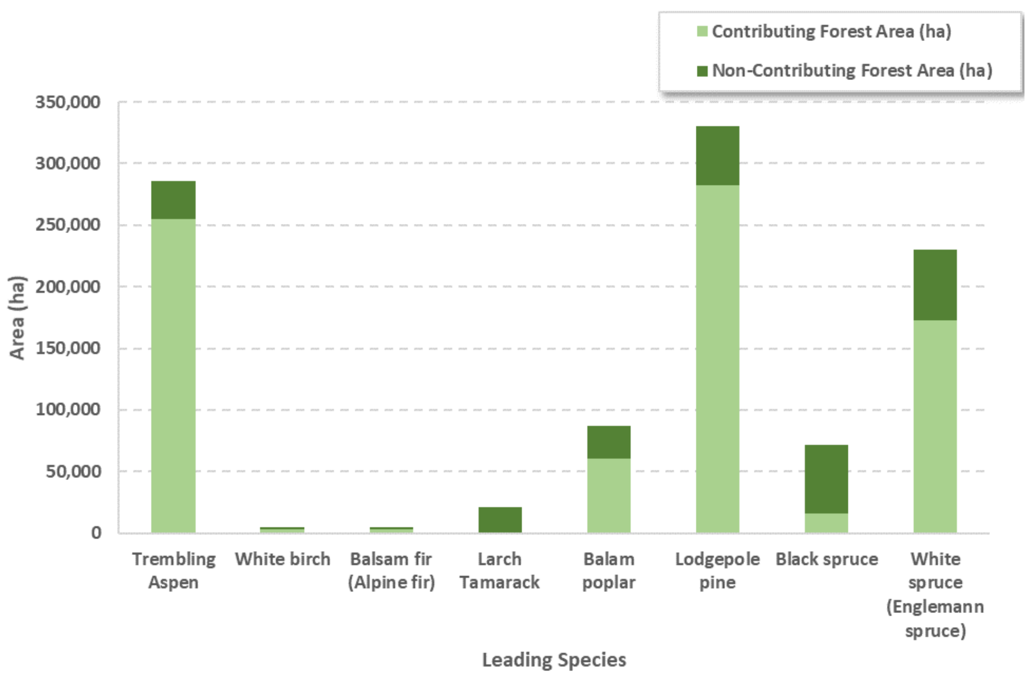
Based on Alberta Vegetation Inventory (AVI), in the forested area, trembling aspen (Aw) and white spruce (Sw) are the dominant species found in the northern portion of the DFA (Saddle Hills) while coniferous species, particularly lodgepole pine (Pl) and white spruce are predominant in the southern portion. Other species found in lesser quantities include the coniferous species black spruce (Sb), Engelmann spruce (Se), tamarack larch (Lt), balsam fir (Fb), alpine fir (Fa) and deciduous species black poplar (Pb) and white birch (Bw).

Table 4-8. Forested Area (Ha) by Leading Species

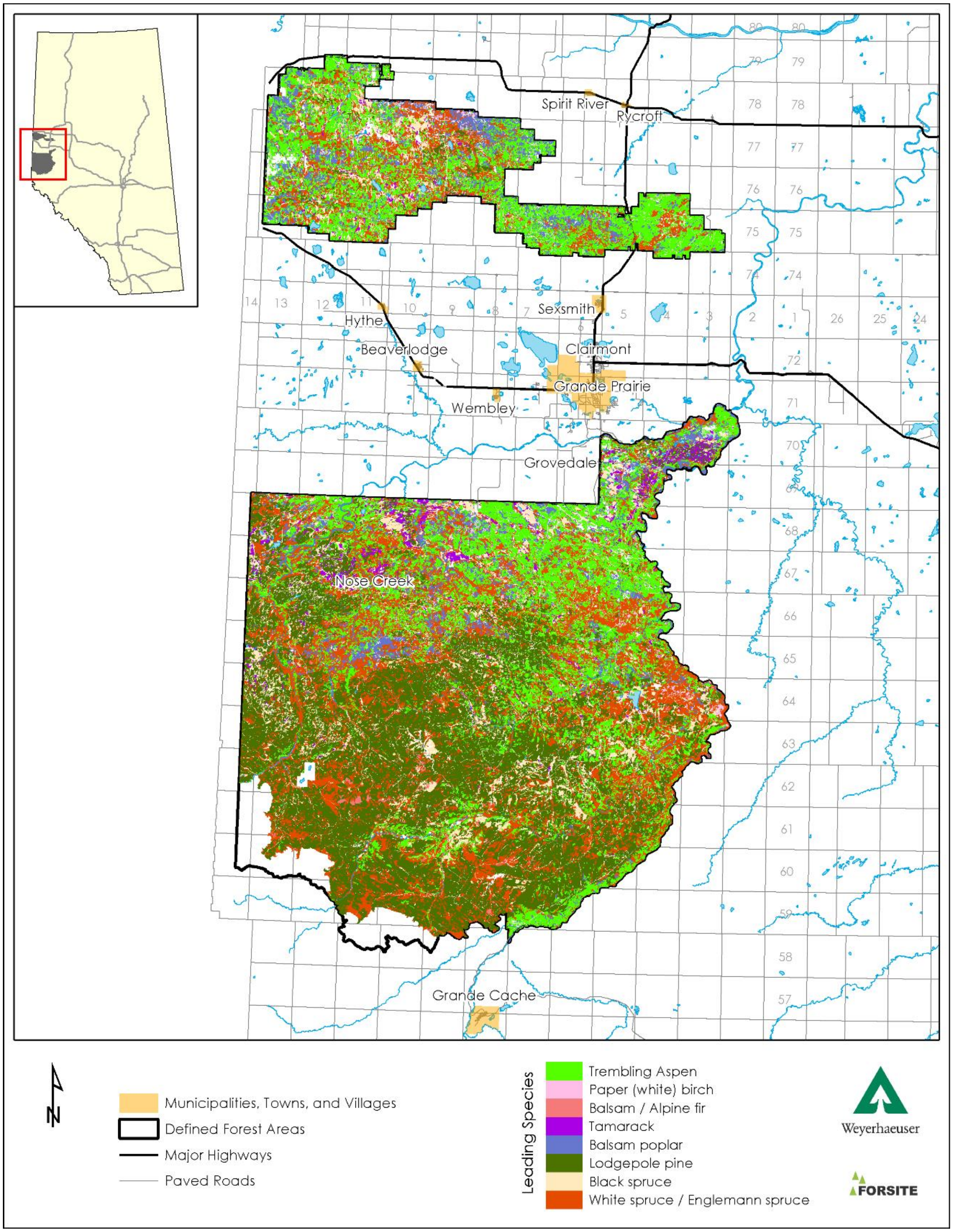
Leading Species of the Overstory -	Contributing Forest Area (ha)	Non-Contributing Forest Area (ha)	Total Forested Area (ha)	Proportion of Forested Total (%)
Trembling Aspen	255,008	30,600	285,608	27.6%
White birch	3,529	1,139	4,668	0.5%
Balsam fir (Alpine fir)	3,145	1,500	4,645	0.4%
Larch Tamarack	164	21,213	21,377	2.1%
Balsam poplar	60,399	26,491	86,889	8.4%
Lodgepole pine	282,203	48,321	330,524	31.9%
Black spruce	15,939	55,599	71,538	6.9%
White spruce (Engelmann spruce)	172,592	57,316	229,908	22.2%
Total	**792,979**	**242,178**	**1,035,157**	**100.0%**

*species in brackets are a minor component

Figure 4-9. Forested Area by Leading Species



Map 4-9. Forested Area by Leading Species



4.5.2. Forest Cover Types

Forest stands are classified into cover types or broad cover groups (BCG) based on the predominant specie(s) in the stand. The four main broad cover groups are CX (pure coniferous), CD (conifer leading mixed wood), DC (deciduous leading mixed wood) and DX (pure deciduous).

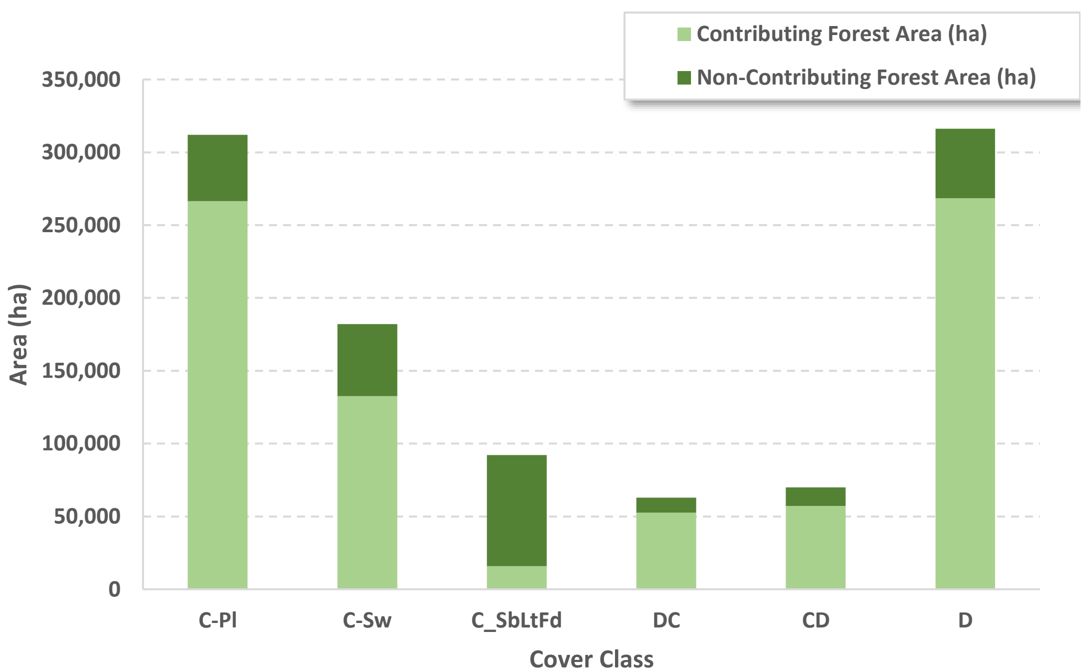
Pure coniferous (Cx) groups have been further separated by leading species- Pine, White spruce and Other (Black spruce, Larch and Fir).

The process for determining the stand BCG is explained in *Section 3.2.1 of Annex 4: Classified Landbase.*

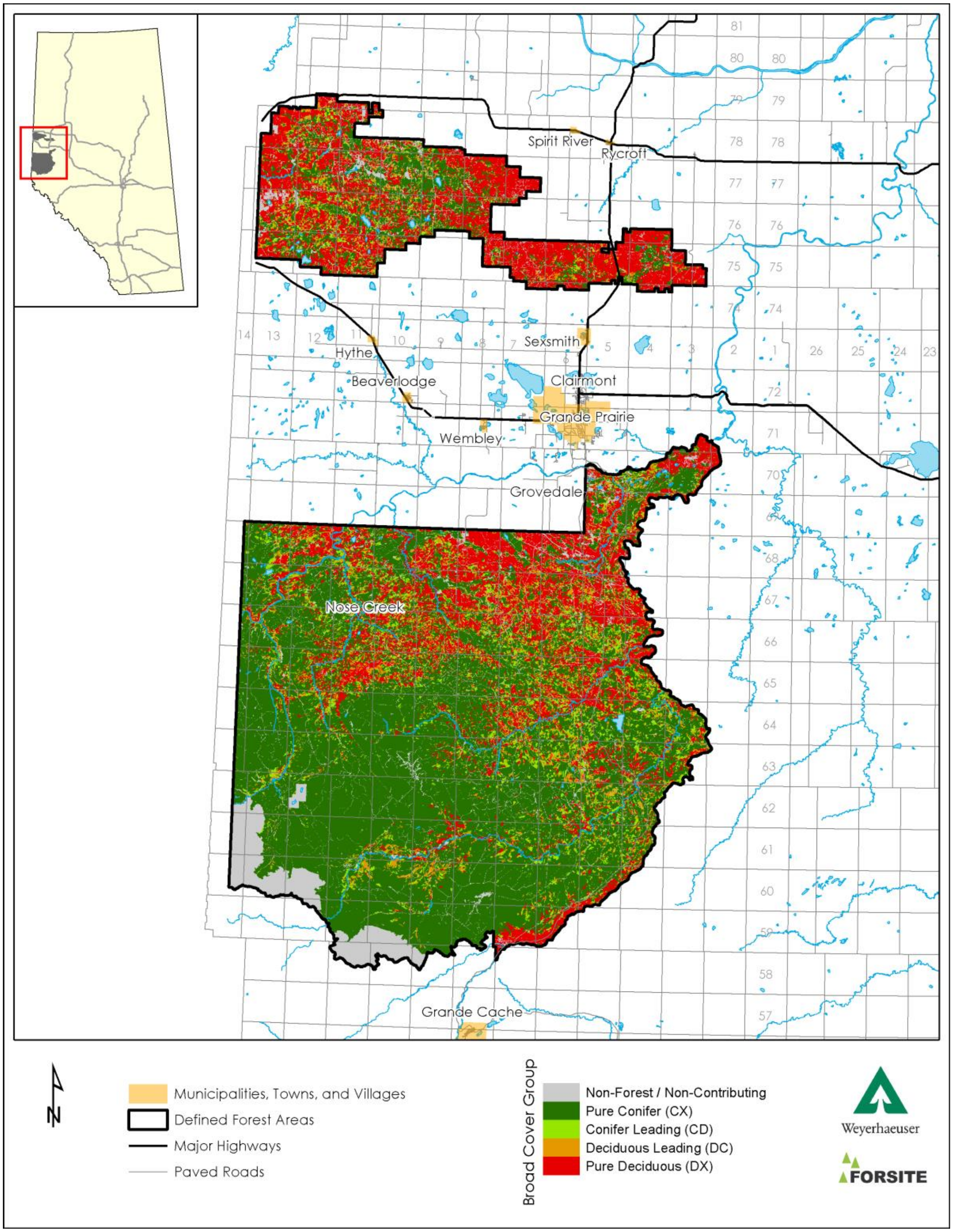
Table 4-9. Forested Area by Broad Cover Group

Broad Cover Group	Contributing Forest Area (ha)	Non-Contributing Forest Area (ha)
Cx-Pl	266,416	45,672
Cx-Sw	132,648	49,309
Cx-other (SbLtFd)	15,853	76,236
DC	52,491	10,432
CD	57,110	12,905
DX	268,460	47,624
TOTAL	**792,979**	**242,178**

Figure 4-10. Forested Area by Broad Cover Group



Map 4-10. Forested Area by Broad Cover Group



4.5.3. Forested Area by Age Class/ Seral Stage

Seral stages refer to stages in forest succession that align with the ecological succession that typically occurs after a major disturbance, such as fire. A good understanding of stand age is important to forest management and planning as it is critical to modelling future wood supply.

Table 4-10. Forested Area by Seral Stage

Seral Stage	Non-Contributing Forest Area		Contributing Forest Area		Total Forested Area
	Ha	%	Ha	%	Ha
Young (0-19yrs)	2,376	1.0%	133,809	17%	136,185
Immature (20-79 yrs.)	48,471	20.0%	243,488	31%	291,959
Mature (80-119 yrs.)	103,300	42.7%	263,053	33%	366,353
Old (120-179 yrs.)	84,088	34.7%	148,744	19%	232,831
Very Old (>180yrs)	3,943	1.6%	3,884	0%	7,828
TOTAL	**242,178**		**792,979**		**1,035,157**

Table 4-11. Forested Area by Age Class (decade)

Age Class	Contributing Forest Area (ha)	Non-Contributing Forest Area (ha)	Total Forested Area (ha)	Proportion of Total (%)
0	76,316	1,030	77,346	7%
10	63,948	1,608	65,556	6%
20	39,329	1,891	41,220	4%
30	32,259	2,223	34,482	3%
40	17,569	2,767	20,335	2%
50	13,778	3,986	17,763	2%
60	33,444	7,455	40,900	4%
70	100,700	29,941	130,641	13%
80	29,098	8,840	37,939	4%
90	85,403	23,920	109,323	11%
100	56,928	20,915	77,843	8%
110	91,611	49,571	141,182	14%
120	68,367	36,650	105,018	10%
130	46,513	22,987	69,499	7%
140	13,953	12,087	26,041	3%
150	12,742	7,171	19,913	2%

Table 4-11 cont.

Age Class	Contributing Forest Area (ha)	Non-Contributing Forest Area (ha)	Total Forested Area (ha)	Proportion of Total (%)
160	3,550	2,812	6,362	1%
170	3,587	2,385	5,972	1%
180	1,056	887	1,944	0%
190	1,884	1,830	3,714	0%
200+	944	1,220	2,164	0%
Total	**792,979**	**242,178**	**1,035,157**	**100%**

Figure 4-11. Forested Area by Seral Stage

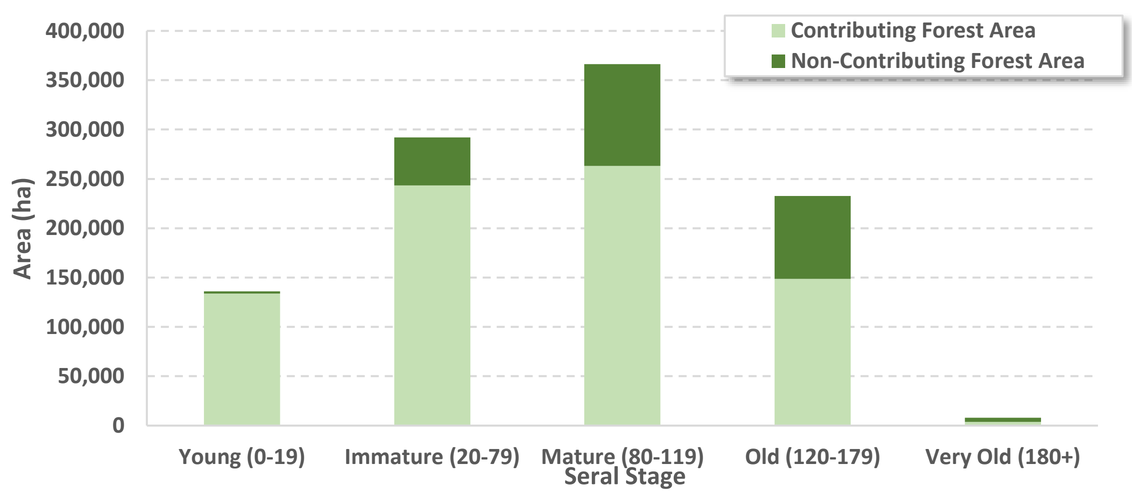
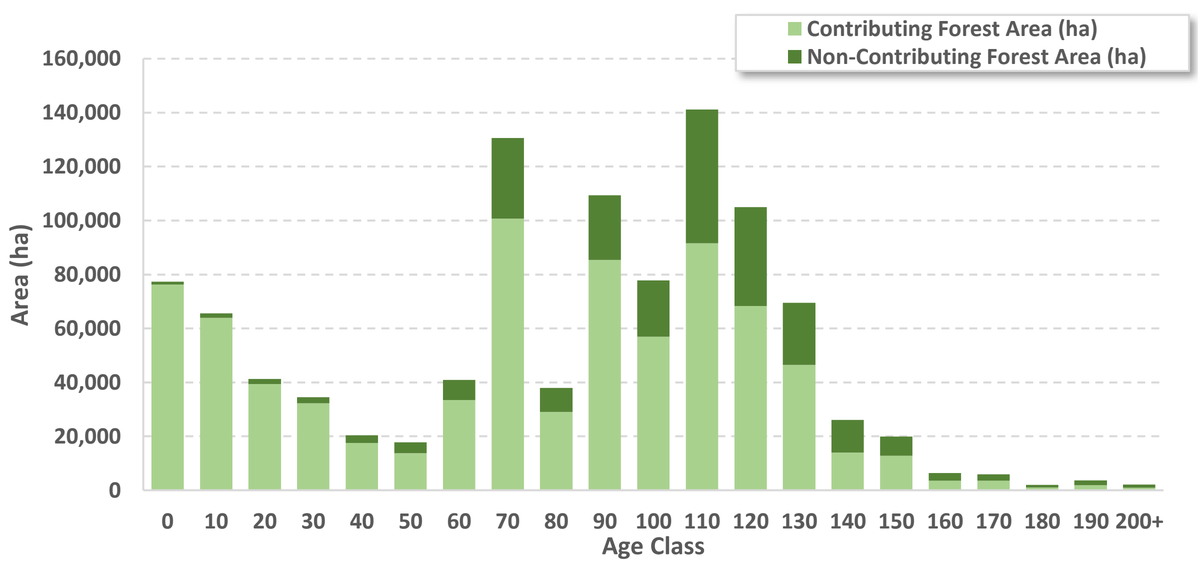
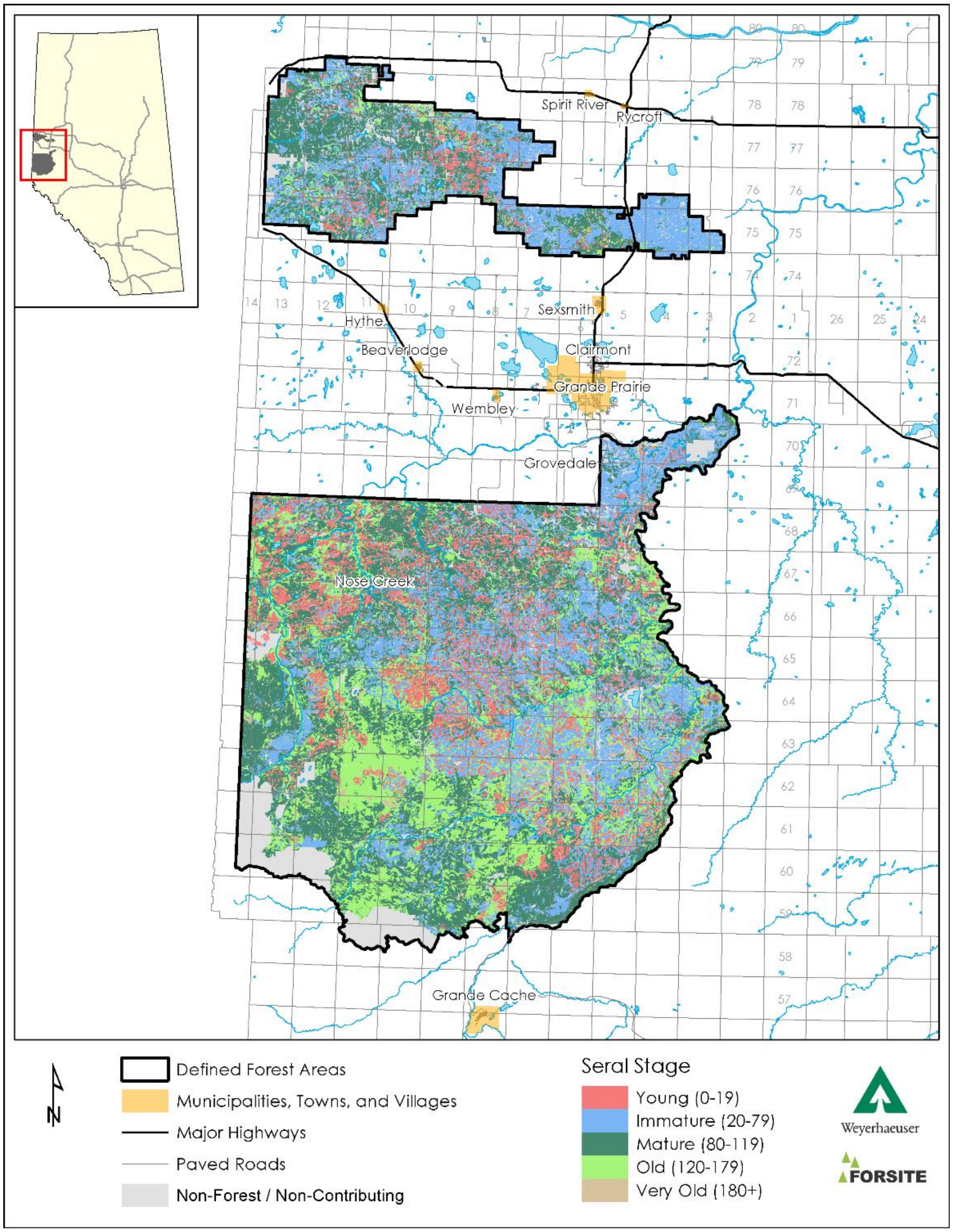


Figure 4-12. Forested Area by Age Class (decade)



Map 4-11. Forested Area Seral Stage



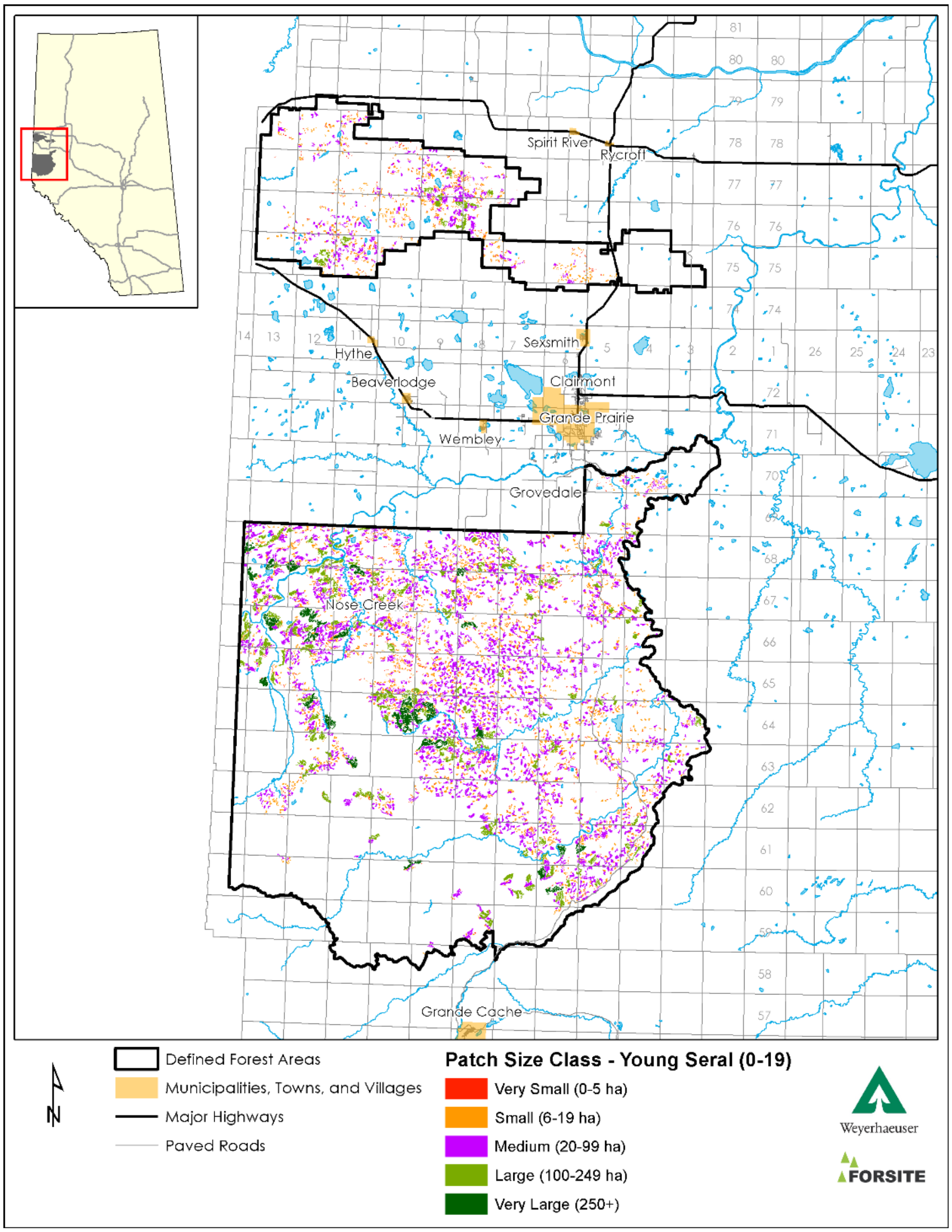
4.5.4. Forest Patches

A forest patch is defined as a stand of forest in the same seral stage which is not split by a linear feature greater than 8m wide. Linear features in this definition include roads, pipelines, power lines, and rivers; seismic lines were excluded. Young seral stands within the DFA have an abundance of medium and large patches (68%) with very small patches only being represented by less than 5% of the forest area.

Table 4-12. Patch Size Proportion of Young Seral Stands

Patch Sizes	Young Seral Stands (0-19 yrs)
0-5 ha	2.8%
6-19 ha	17.7%
20-99 ha	47.9%
100-250 ha	20.4%
>250 ha	11.1%

Map 4-12. Patch Size Distribution of Young Seral Stands



4.6. Forest Landscape Disturbance and Succession

Disturbance is part of the natural life cycle of the forest and are particularly important to the cycle of regeneration and regrowth. Fires, as well as insect and disease outbreaks, have occurred on a large scale in Alberta's boreal forests for thousands of years.

4.6.1. Inherent Disturbance Regime

Historically, fire has been the primary cause of natural disturbance in the region. In 1930's, 1940's and the 1960's large fires occurred adjacent to and within the DFA. The last major fire was the Red Deer Creek Fire in 2014 which crossed over from BC and burned approximately 4,000 hectares within the DFA. For more information refer to *Chapter 4; Section 4.3.4 Natural Disturbances*.

4.6.2. Forest Succession Trajectories

Forest Succession describes the pattern of change over time from disturbance through to when a new environment is formed. How a forest grows and the order in which the vegetation is established depends on competition, the needs of the plant communities and the effects of the nonliving environment on vegetation and wildlife.

Primary succession occurs when disturbances are so extreme, they remove the soil and organisms from a site, leaving only rock. The rock and incoming pioneer plants must break down and decay to form soil before vegetation can establish itself. Examples of primary succession experienced in Alberta are glacial advances and retreats, landslides, scouring floods and very intense fires.

Secondary succession starts when a disturbance removes most of the surface vegetation but leaves the soil, seeds and roots intact. Examples of this are windstorms, insect outbreaks, harvesting or industrial development and fire.

In an unmanaged state, fire is a frequent and important component of boreal forest succession. Fire designs the forest by restarting succession and creating diversity in age, cover type, patch size and pattern. Moist sites with rich soils create lush cover and can lead to intense competition which makes it difficult for forest cover to regenerate.

In a managed forest, the natural succession process is interrupted and manipulated. Industrial clearings will stay in the early successional stage (grass/herb/shrub) to protect the infrastructure (powerlines, road ROWs, pipelines etc.). Harvested areas are replaced by similar stand types using the approved silviculture strategy that meets the provincial reforestation policy and land base balancing guidelines. To successfully regenerate these stands within the provincial timelines, the competing vegetation may be treated using various site preparation methods.

This plan does not apply successional yield curves, however the FMA is stratified into yield groups. The natural projection of these yield groups includes stand breakup and senescence and is viewed as successional.

4.6.3. Forest Health

Many factors can have negative effects on the health of a forest. Some are biotic, or living, while others are abiotic or non-living.

Biotic Factors	Abiotic Factors
• Disease-causing organisms	• Changing climatic conditions
• Insects	• Drought
• Parasitic plants	• Severe weather events (hail, ice storms)
• Mammal browse/ trample	

Native insects and diseases play an essential ecological role in Alberta's forests. They help to renew forests by removing old trees, recycling nutrients and providing new habitat and food for wildlife. Forest insects and micro-organisms contribute to healthy change and regeneration in forest ecosystems. However, when severe infestations destroy or damage large areas of valuable forest, or infest forest products bound for export, then insects and diseases become pests.

An insect or a disease becomes a forest pest when it occurs in unsustainable numbers, placing a constraint on management or utilization of a forest stand. Forest pests threaten the health and vigour of a forest, biodiversity, and the many social, cultural and economic values of a forest.

Photo Credit- AAF; Forest Health & Adaptation
Top row: Lodgepole Terminal Weevil, Spruce Beetle, Armillaria
Bottom row: Western Gall Rust, Forest Tent Caterpillar, Mountain Pine Beetle,

The following forest pests and damaging agents are potentially significant on the DFA.

Table 4-13. Common Forest Pests and Damage Agents of the Boreal Forest

		Potential Impact on Forest Values[14]	Presence on DFA[15]
Coniferous Insects			
Eastern spruce budworm	*Choristoneura fumiferana*	High	Low
Spruce beetles	*Dendroctonus rufipennis*	Moderate	Low
Yellow headed spruce sawfly	*Pikonema alaskensis*	Low	Low
Western spruce budworm	*Choristoneura occidentalis*	Low	Low-Nil
Weevils • Lodgepole terminal • Warren root collar • White pine	*Pissodes terminalis* *Hylobis warreni* *Pissodes strobe*	Low-moderate	Low
Mountain Pine Beetle	*Dendroctonus ponderosae Hopkins*	High	Declining
Coniferous Diseases			
Armillaria root disease	*Armillaria ostoyae*	Moderate	Moderate.
Western gall rust	*Endochronartium harknessii*	Moderate	High
Lodgepole Pine Dwarf mistletoe	*Arceuthobium americanum Nutt*	Moderate	Low
Pine needle cast Spruce needle cast	*Lophodermella concolor*	Low	Moderate (varies with year)
Deciduous Insects			
Defoliators • Bruce spanworm • Forest tent caterpillar • Large aspen tortrix • Linden looper	*Operophtera bruceata* *Malacosoma disstria* *Choristoneura conflictana* *Erranis tilaria*	Moderate-High Moderate-High Moderate-High Low	Low to Moderate- potential to be high in isolated areas of the DFA
Deciduous Diseases			
Hypoxylon Canker	*Hypoxylon mammatum*	Moderate-High	Moderate
Abiotic Damage Agents			

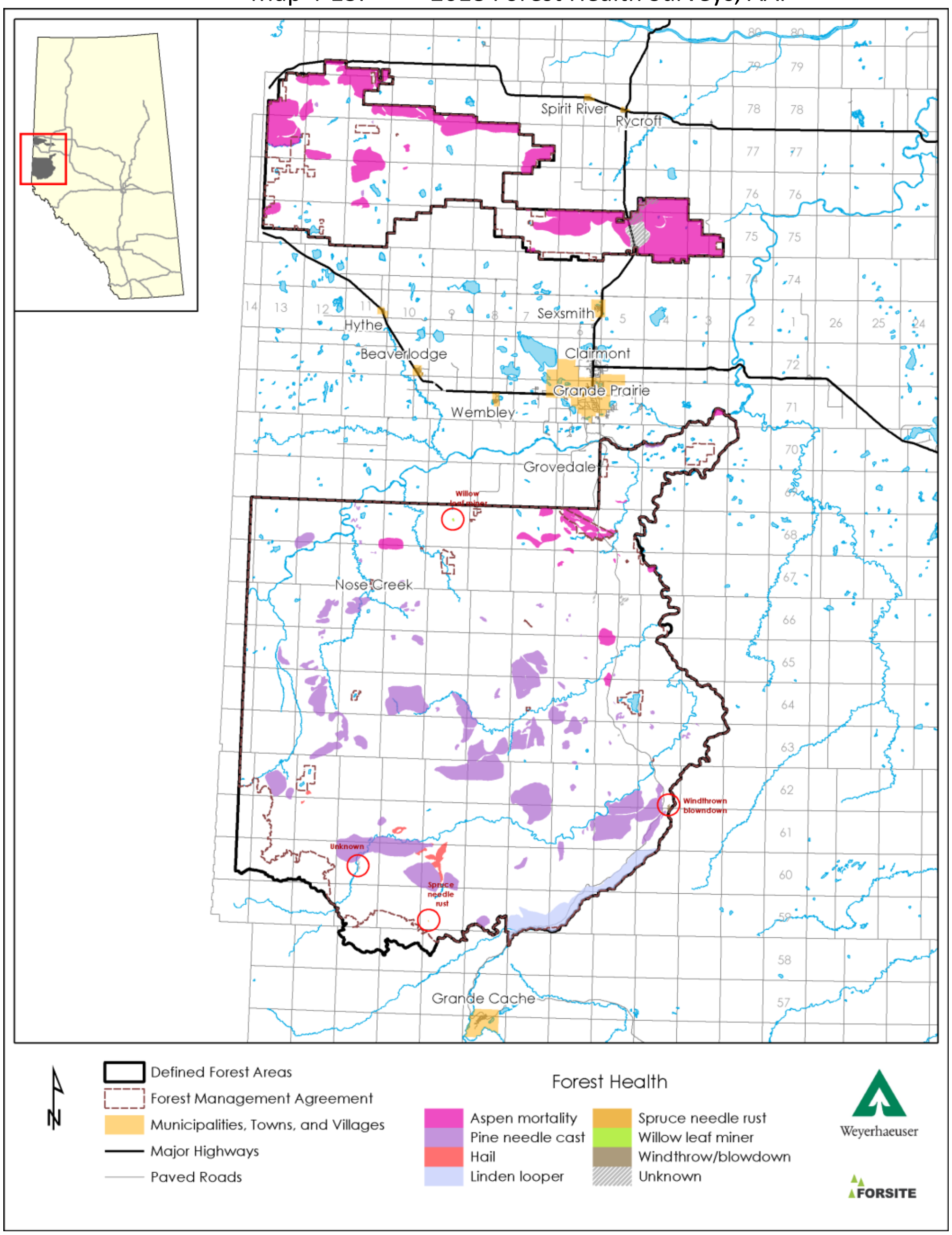
Hail	Damage includes broken branches, shredded foliage, open stem wounds. Significant or repeated damage increases tress & creates vulnerability to insect/ disease infestation
Wind	Damage includes broken branches, broken tops and toppled trees. Damage is primarily found in the forest edge, buffer patches and stems/ patches left as retention.
Drought	Drought stressed trees are vulnerable to insects as well increased risk of wildfire
Excess precipitation	Longer, wetter spring and summer conditions put stress on seedlings and immature stands.

[14] Brandt 1995; Brandt and Amirault 1994; Hall & Moody 1994; Cerezke & Volney 1995; Moody & Amirault 1992; Cerezke et al. 2011
[15] Observations and experience; Devin Letourneau, Forest Health Officer, Alberta Agriculture & Forestry, Grande Prairie

It is important to note that the frequency and intensity of these types of weather events have been steadily increasing over the years.
The Alberta government conducts aerial surveys every year to monitor insect and disease levels as well as investigate any significant patches of abiotic damage.

VOIT 1.1.1.5b refers to areas of significant blowdown (>100ha). None of the blowdown events mapped below are > 100ha.

Map 4-13. 2018 Forest Health Surveys, AAF



4.6.3.1. Aspen Defoliators

The most common aspen defoliator pests in Alberta are the forest tent caterpillar, the large aspen tortrix and the bruce spanworm. Historically, these three species of defoliators have had extensive outbreaks that defoliated many millions of hectares of aspen stands across the province. During aspen defoliator outbreaks in the past, typically forest tent caterpillar is the primary damaging agent with other defoliators acting as the secondary agent(s). Defoliator infestations are usually naturally controlled within one or two years through late spring frosts which kill buds leading to early, mass larval starvation. Later, larvae die of starvation when they run out of food under extreme population levels.

4.6.3.2. Aspen Mortality

The 2018 Forest Health aerial surveys conducted by the province noted the northern and eastern area of Saddle Hills has been the heavily impacted by aspen mortality. Mortality in these stands range from low to severe and is due to a combination of repeated infestation of defoliating insects and multiple years of drought. Approximately 71,000 hectares have been assessed with varying degrees of aspen mortality in the stands (*see Map 4-13*).

4.6.3.3. Pine Needle Cast

The 2018 Forest Health aerial surveys conducted by the province noted a significant amount of pine needle cast in the main block of the DFA. Over 77,000 hectares has been affected. Needle cast is a broad group of fungal diseases that cause needles to fade to light green with yellow spots, which eventually turn red or brown. Control is unnecessary in most situations. (*see Map 4-13*).

4.6.3.4. Other Abiotic Damage

During 2016-2018, an area covering approximately 3,000 hectares in the Copton Creek/ Sheep Creek area of the south FMA consisting of both mature and regenerating forest suffered hail damage (*see Map 4-13*).

4.6.3.5. Spruce Beetle

A spruce beetle outbreak was first detected in the Omineca region of British Columbia in 2013 and has since spread rapidly, growing to 45 times pre-outbreak levels (2017[16]). BC forests have been weakened by drought, milder winters and MPB attack and this puts them at higher risk for localized outbreaks to become bigger. Spruce beetles occur in endemic populations in white spruce stands throughout Alberta. Outbreaks of the spruce beetle often originate from areas with blowdown, logging slash, or damaged standing timber. Spruce beetles breed in these areas and may attack and kill healthy trees. GoA Health and Adaptation is monitoring threat levels closely presented by the outbreak in British Columbia and although outbreaks have been noted in central Alberta, Spruce beetle infestation

[16] BC Ministry of Forests

was not detected on the DFA during the 2018 Forest Health flights conducted by the province.

4.6.3.6. Mountain Pine Beetle

Mountain pine beetle (MPB) has posed the biggest threat to the coniferous forest inventory in Alberta since the first in-flights from British Columbia occurred in 2006. In 2007, the Province of Alberta developed a pine strategy that directed FMA holders to amend their management plans to reduce the amount of susceptible pine on their operating landbase by 75% over the next 20 years. By the end of our current FMP, we will have achieved the provincial target.

FMA 6900016 was hit by mountain pine beetle inflight from BC in 2006 and again in 2009. The 2011 FMP assessed MPB susceptibility and applied a 10-year accelerated pine focused harvest of the hardest hit areas of the FMA.

At present, much of the pine dominated stands in lower elevation areas has been harvested. There is some remaining MPB in higher elevation areas, but rate of spread is relatively low and is in caribou range.

The photos below show stands in various stages of MPB infestation and mortality from recently hit (trees are orange to red) to 5 years post infestation (trees are grey).

Photo Credit: Lyle Dechief

4.6.3.7. Invasive Exotic Species

Section 31 (b) of the Weed Control Act requires owners and occupants of land to control as often as necessary all noxious weeds located on the land to prevent the spread, growth, ripening or scattering of the noxious weeds (invasive exotic species).
Forest disposition holders are expected to assist in managing weeds on their respective dispositions. Invasive plants are classified as either restricted, noxious or nuisance weeds. Noxious weeds are a priority to control as they are mainly non-native plants and may out-compete and occupy sites that were previously occupied by naturally occurring native species and may alter the natural vegetation cover.

The Municipal District (MD) of Greenview regulates the status of noxious weeds present and determines the extent of control for specific weeds of concern. The MD and Counties serve weed control notices for sites they identify that require control efforts within portions of the DFA.

Table 4-14. Commonly identified invasive plants

Common Name	Latin Name	Provincial Designation
Canada Thistle	*Cirsium arvense*	Noxious
Perennial Sow-thistle	*Sonchus arvensis*	Noxious
Common Tansy	*Tanacetum vulgare*	Noxious
Scentless Chamomile	*Tripleurospermum perforatum*	Noxious
Tall Buttercup	*Ranunculus acris*	Noxious
Oxeye Daisy	*Chrysanthemum leucanthemum*	Noxious
Meadow Hawkweed	*Hieracium caespitosum*	Prohibited Noxious
Orange Hawkweed	*Hieracium aurantiacum*	Prohibited Noxious
Tansy Ragwort	*Jacobaea vulgaris*	Prohibited Noxious

If invasive plant populations were to warrant further management, forest operators would participate in a province led co-operative weed management strategy which would be implemented through the company's Annual Operating Plans.

Oxeye Daisy

Scentless Chamomile

Canada Thistle

Photo Source: Alberta Agriculture and Forestry Website

4.6.3.8. Timber Harvesting

The Forest Management Area has been a working forest since 1974. Since this time 239, 606 hectares have been harvested from the FMA area. Since 1973 there have been a series of additions and removals to the FMA area as well as deciduous quota changes.

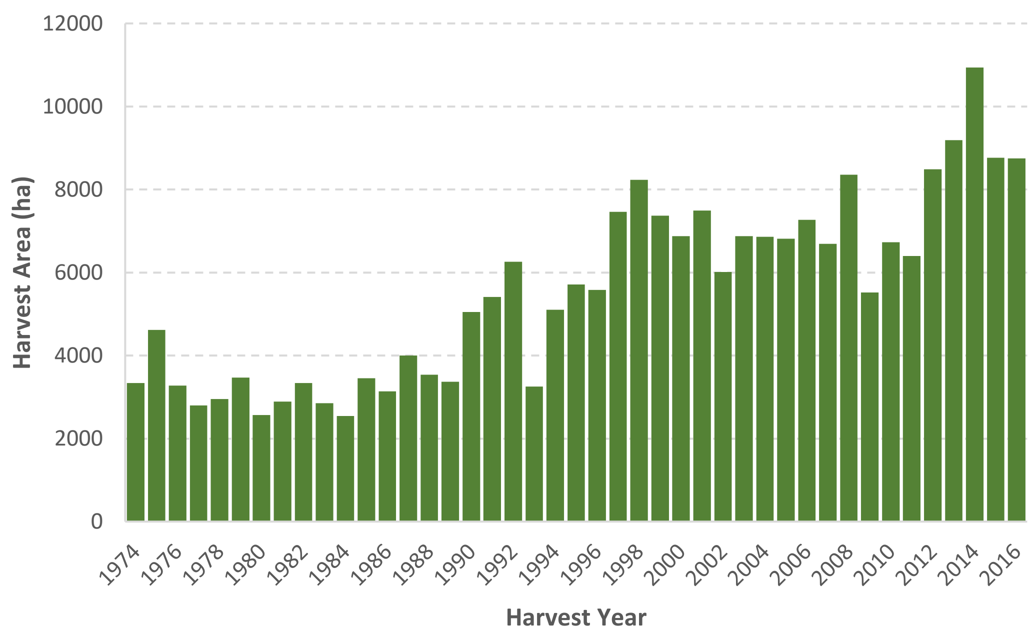
A timber year runs from May 1 to April 30.

Table 4-15. Forest Management Area Harvest History

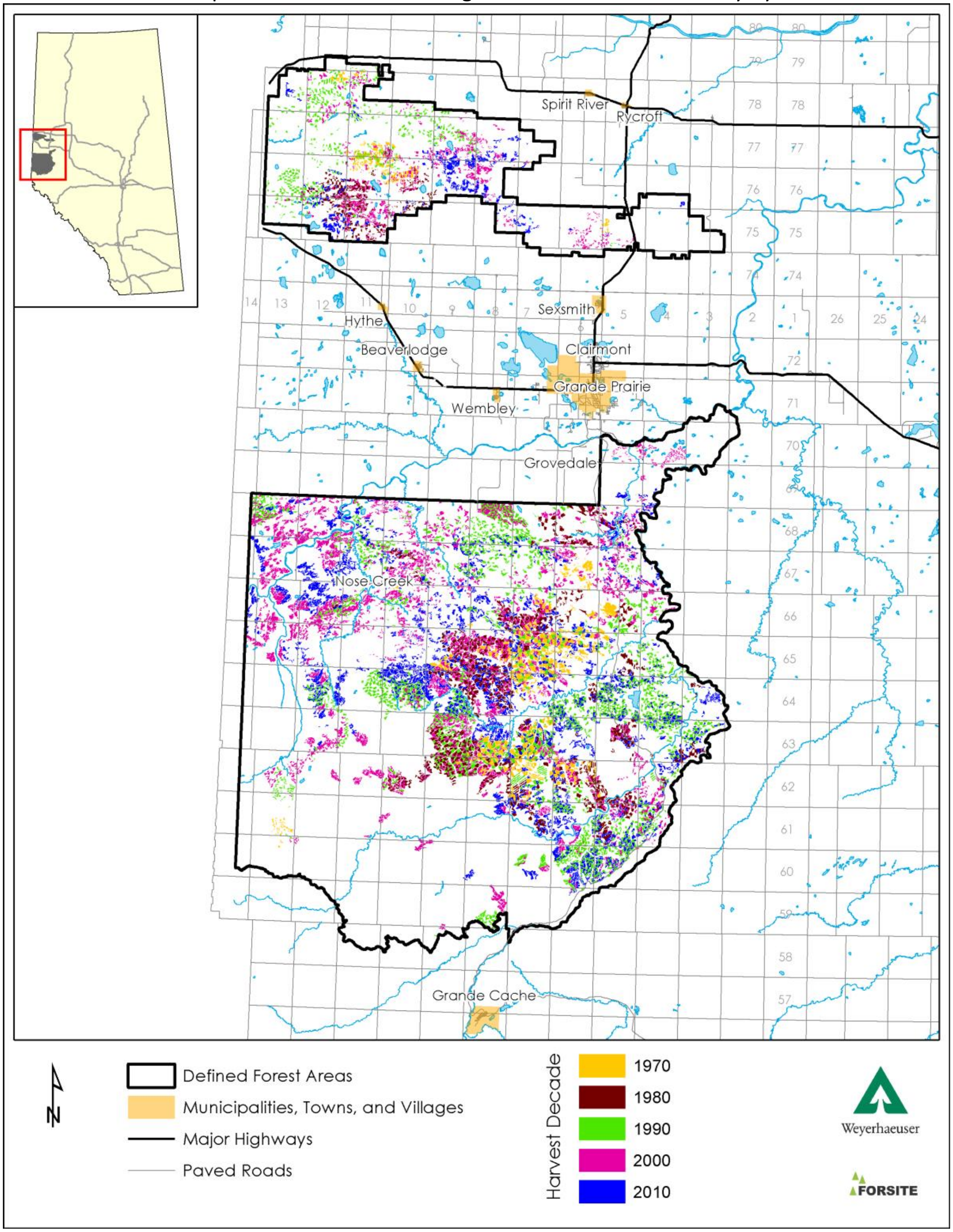
Decade	Area Harvested (ha)
1970	20,451
1980	31,699
1990	59,435
2000	68,765
2010	59,256
TOTAL	**239,606**

***includes hectares harvested under the FMA license, active DTLs and CTPs*

Figure 4-13. Forest Management Area Harvest History



Map 4-14. Forest Management Area Harvest History by Decade



4.7. Industrial Development

The Grande Prairie region has a robust energy sector and the DFA is subject to significant oil and gas exploration activities. While the development activities are rather cyclical and tend to be proprietary in nature, they leave a lasting impact on the entire land base. Alberta's Digital Integrated Disposition (DIDs) from AltaLIS was used to identify industrial footprint in the DFA. A DIDs Application shapefile was used to summarize the various natural resource-based industry requirements for land use.

4.8. Forest Industry Access

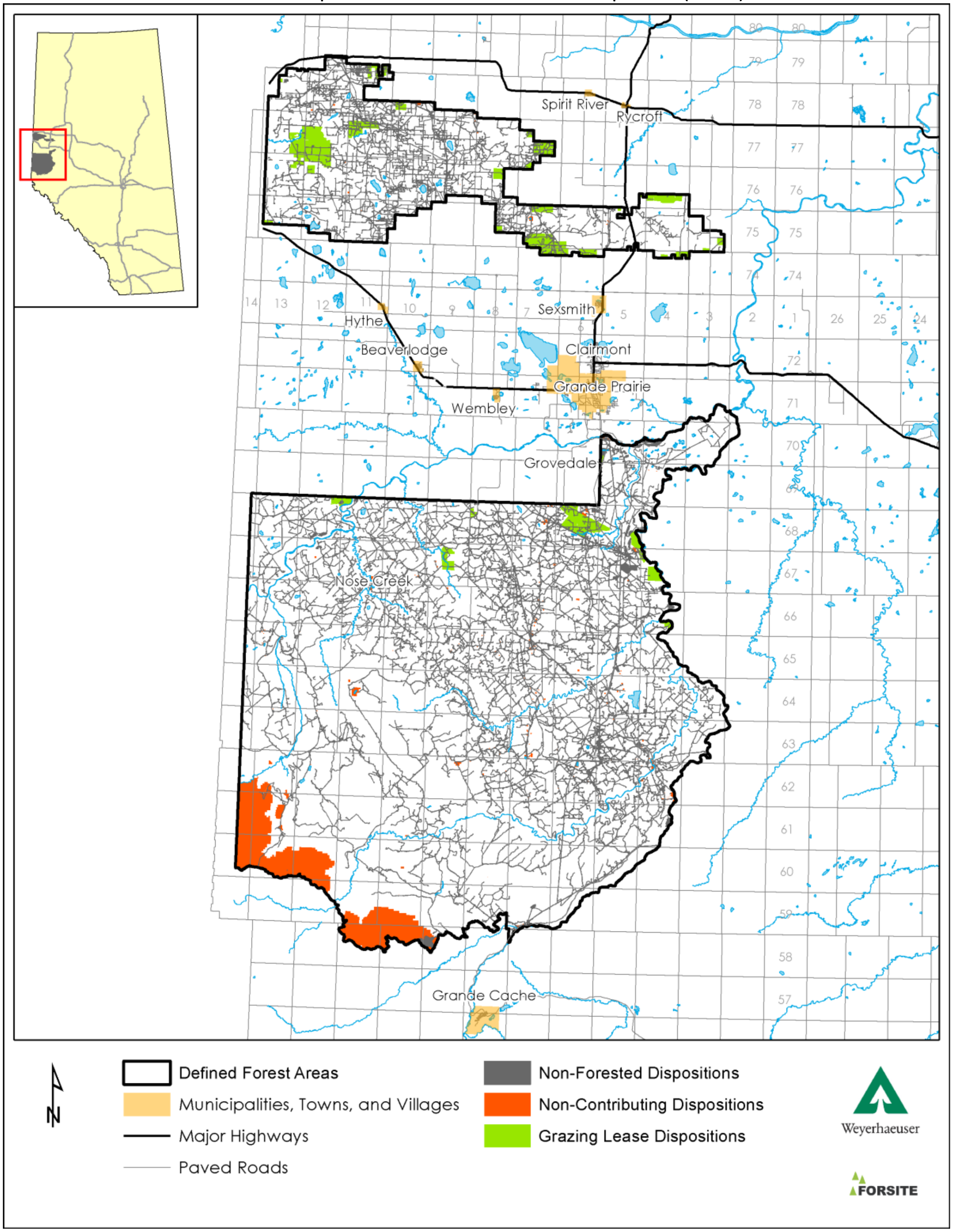
The road network in Forest Management Area 6900016 is both well established and is comprised of both company roads and external stakeholder infrastructure such as primary and secondary highways and energy sector roads. In the last decade, the energy sector has contributed significantly to the maintenance of existing access as well as new development. In support of minimizing the industrial footprint on the landscape, there has been increased coordination between industrial users to reach agreements concerning common access on FMA6900016.


Weyerhaeuser Main Road

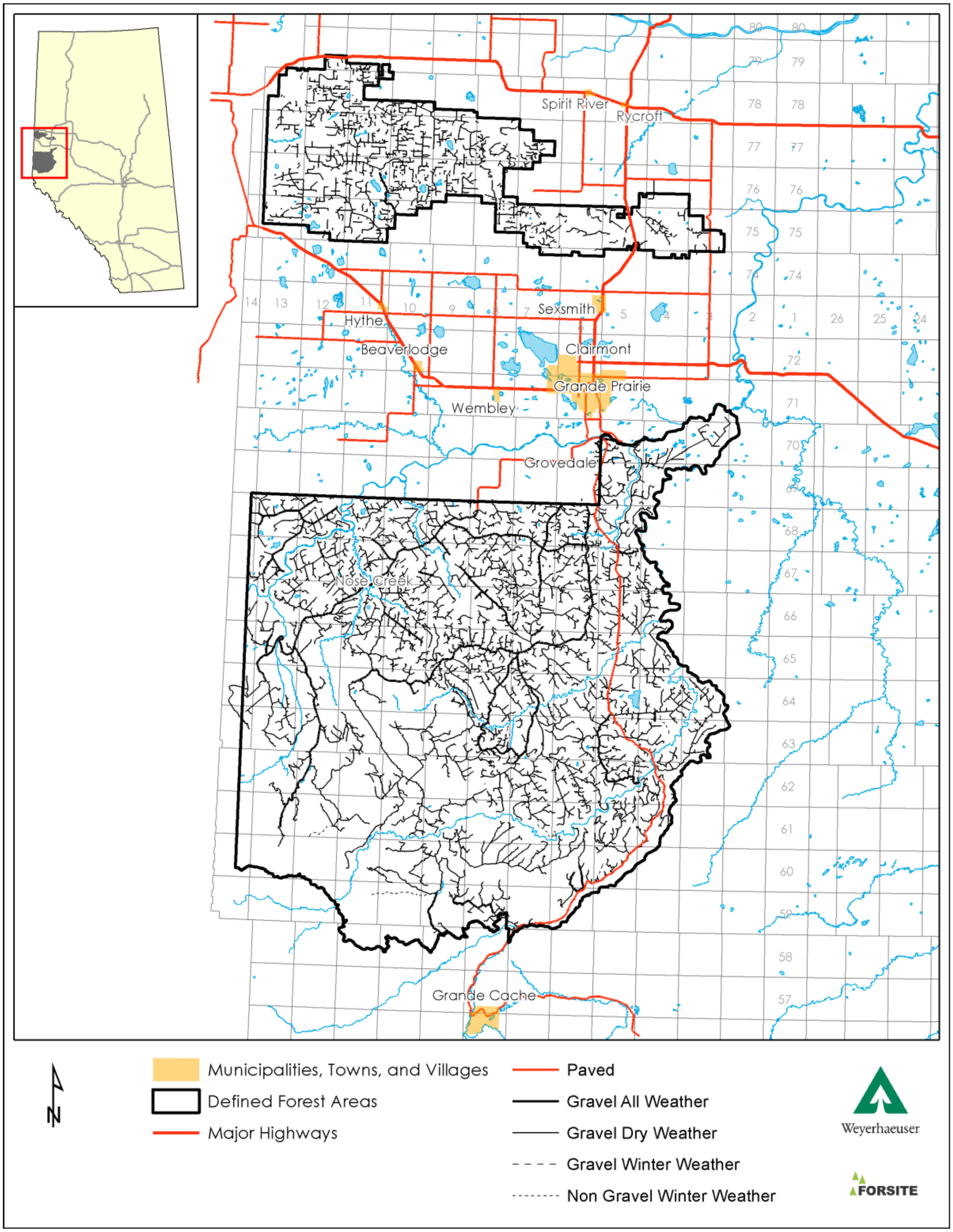
The main access routes for the Saddle Hills area are Highway 43 to the west / northwest and Highway 2 to the north. The main access routes for the southern main block are Highway 40, the Two Lakes Road and Weyerhaeuser's Main Haul Road. The main road systems in these areas are Paul's Cut Across, Nose Mountain Road, Wolf Creek Road and Prairie Creek Road.

VOIT 1.1.1.3 sets a target of 0.6km/km^2 for permanent all-weather road disturbance. Currently, the DFA has 0.5km/km^2 of permanent all-weather road disturbance

Map 4-15. Industrial Development (2017)



Map 4-16. Permanent Roads (DLO and LOC) (2017)



4.9. Monitoring Sites

Sample Plots

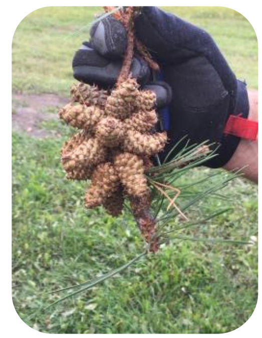
A series of both natural and managed Permanent Sample Plots (Industrial Sample Plots/ ISPs) have been identified and are maintained within FMA6900016 and surrounding areas. This program was started in 1975 to monitor stand growth and yield on natural and regenerated stands. The program consists of 949 natural stand plots and 273 regenerated stand plots established on a fixed grid of 12 plots per township.

Research Installations

There are 3 active research sites on the FMA area.

Western Boreal Growth and Yield Association Aspen/ Spruce Stand Development

These ISP installations were established in 1991 to monitor regenerated stand development of different mixtures of Aspen and White Spruce. There are three installations of 12 subplots each (36 total) with one on a high productivity site and two on medium productivity sites. Plots are on a 5-year remeasurement cycle. In 2016, one of the medium productivity sites burned in a wildfire and will no longer be measured.



Pine Cone Cluster (Hasoc)

Foothills Growth & Yield Association Regenerated Lodgepole Pine Study

These ISP installations were established in 2001 to monitor regenerated Lodgepole pine stand development with varying densities. There are three installations of 21 subplots and plots are on a two-year remeasurement cycle.

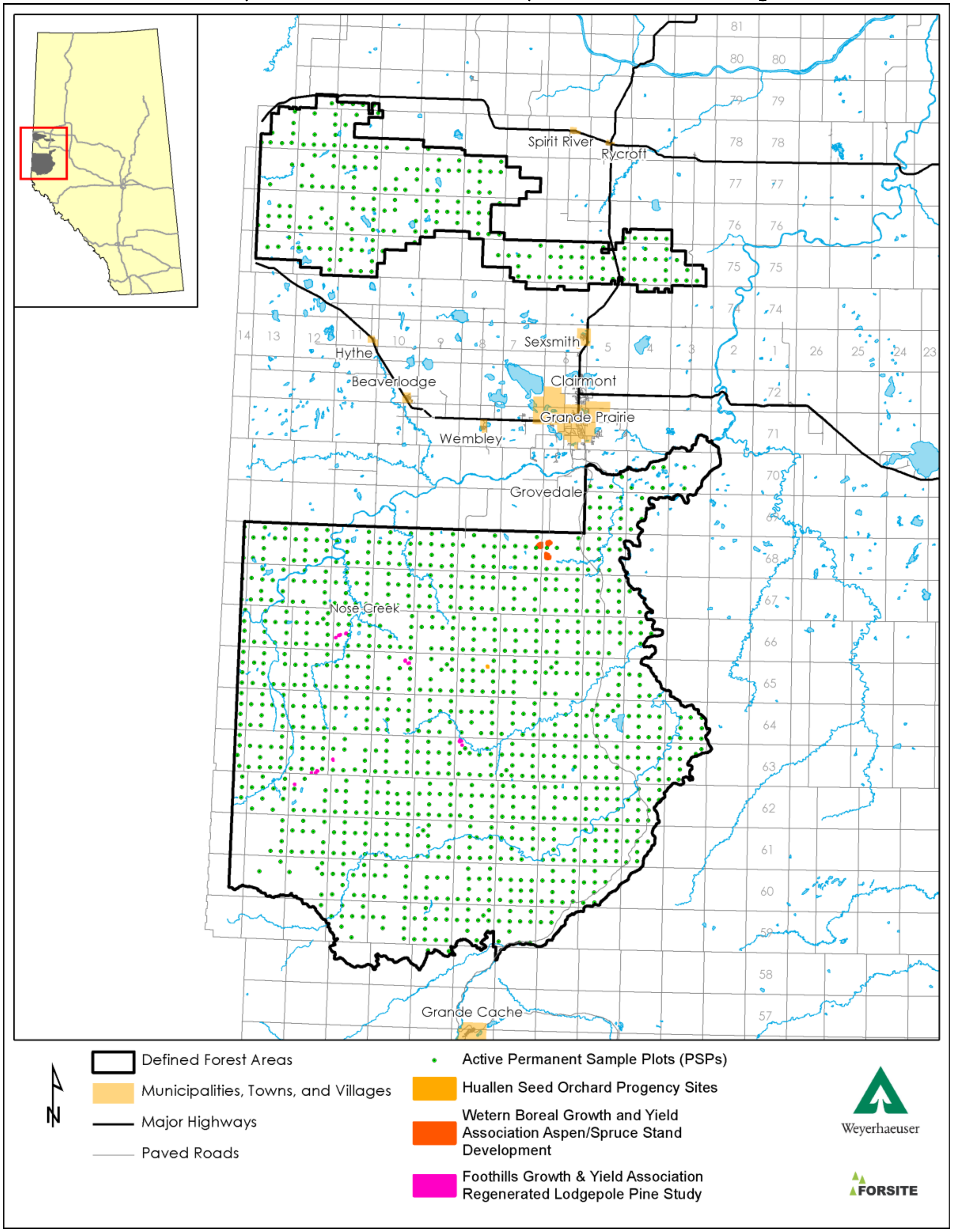
White Spruce female flower (Hasoc)

Huallen Seed Orchard Company (Hasoc) Progeny sites

These 11 plots were established in breeding regions B1-Lodgepole pine, B2-Lodgepole pine and G1-white spruce to assist with the selection of breeding stock for our tree improvement program. Periodic assessments are completed for selections and when required, the calculation of genetic gains.

Huallen Seed Orchard Company, Huallen, Alberta

Map 4-17. Permanent Sample Plots and Monitoring Sites



4.10. Wildfire Threat Assessment

Annex 3 provides a detailed summary of the threat of wildfire for the DFA. This assessment was provided to Weyerhaeuser by the Province (April 24, 2019).

4.10.1. Fire Behavior Potential

The spring season is a concern due to the ready availability dry grasses and fine fuels (slash) at this time of year. Warmer, dry winds, an abundance of fuel and human activity as a potential ignition source make the spring a very risky time of year in most of the DFA for fire starts and fast spreading fires.

In the summer season the overall fire potential reduces slightly in the mixedwoods due to the fine fuels in this regime being less receptive to ignition and less of a risk of fire spread. In the mid and southern areas of the DFA where conifer and conifer dominated mixedwoods are more prevalent, the risk of fire spread is higher in the summer as these stands are quite receptive to burning when fuel moisture content is low. In areas where there are a higher percentage of regenerating cutblocks, the potential fire intensity should decrease but not rate of spread, meaning fires will be not be as hot but fire size should be close to the same. This is a complicated relationship as many factors will influence fire behaviour such as the amount of slash, the precipitation frequency/ drought, temperatures and winds. Cutblocks and slash levels can be a help or a hindrance to a wildfire depending on the year,

Fall fire potential depends almost entirely on the weather experienced during the spring and summer months. The conifer or conifer dominated mixedwood stands continue to maintain their very high or extreme fire behaviour potential throughout the FMA. An early spring, and dry hot summer cause the fire behaviour potential to increase quickly and stay longer into the fall. The fire hazard substantially lowers when precipitation or snow arrives to the area and remains and shorter daylight hours lower fire behaviour.

4.10.2. Fire Occurrence Risk and Burn Probability

The DFA is dominated by the Foothills Natural Region (68%) where there is a risk of both human and lightening caused fires. Overall, the fire regime in this sub region frequently sees medium sized fires (Tymstra et al. 2005).

The Boreal Forest comprises 17% of the DFA and the wildfire regime in this NSR is frequent small human caused fires. Large fires are infrequent in this NSR due to prompt detection and suppression (Tymstra et al. 2005).

The Rocky Mountain region occupies approximately 14% of the DFA and consists of infrequent small fires and very infrequent large wildfires (Tymstra et al. 2005) due to higher elevations found in this region.

4.10.3. Values at Risk

As per Schedule 1 of the Fire Control Agreement, the company will provide information about company owned liabilities on the Forest Management Area. During fire season, forest operators continually provides the province with an up-to-date list of the locations of people, structures, equipment, wood inventory and research trial sites.

4.10.4. Suppression Capability

Forest Protection is primarily the responsibility of the Province as per *Forest Management Agreement Section 26 (1)* "The Minister agrees to provide and maintain an organization of people and equipment necessary for the protection of the forest from and suppression of forest fires on the forest management area…" As per *Section 17 of the Wildfire Control Agreement*, there is a reasonable expectation on the part of the Minister that the company will assist the Province in wildfire suppression.

4.11. Wildfire History & Wildfire Management

Forest operators each hold a Fire Control Agreement with the Province of Alberta which is renewed every five years. As per *Section 2 of the Fire Control Agreement*, each operator will submit a Fire Control Plan prior to March 1st each year. *Annex 3* provides a more detailed summary of wildfire history for the DFA. This assessment was provided to Weyerhaeuser by the Province (April 24, 2019).

4.11.1. Fire Season

Alberta's fire season is between March 1st and October 31st.

4.11.2. Fire History (VOIT 1.1.1.5a)

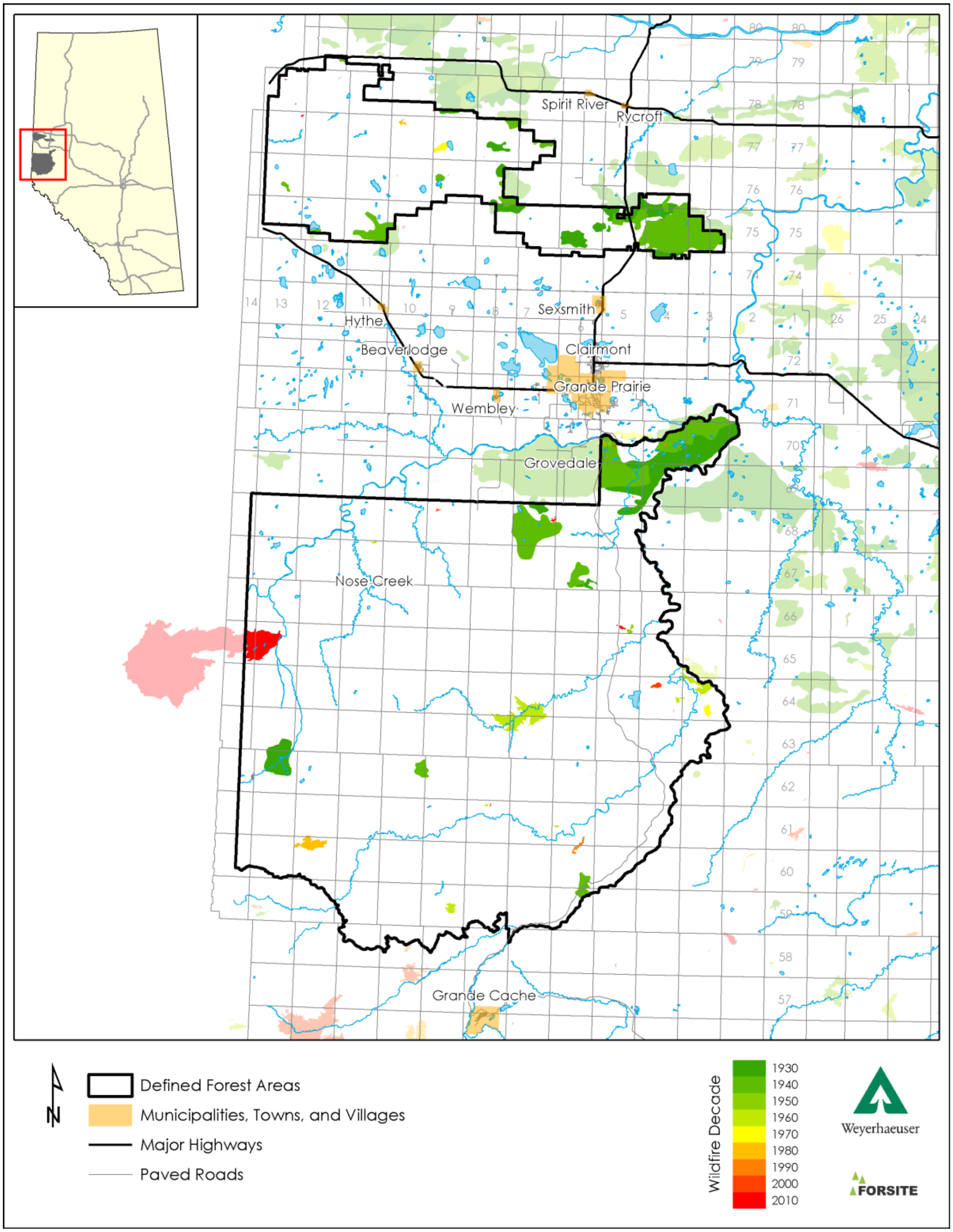
Prior to industrialized harvest, wildfire was the most common type of stand renewal disturbance on the DFA. Forest operators may attempt to salvage log and or reforest burned areas wherever economically feasible. Burned areas that are not salvaged and/ or not reforested are removed from the contributing landbase.

Over the last ten years there have only been 3 wildfires in the DFA that were considered significant (>50ha). In 2014 the Red Deer Creek fire burned 4, 173 hectares in the Narraway Cost Zone adjacent to the BC border. In 2015 100ha burned near Musreau Lake along Highway 40. In 2016, 99 hectares burned southwest of Wilson Lake including part of a measurement trial.

Table 4-16. Wildfire History by Decade

Decade	Hectares Burned	Decade	Hectares Burned
1930	44,338	1980	1,360
1940	47,698	1990	280
1950	650	2000	297
1960	5,771	2010	4,447
1970	749	**Total**	**105,590**

Map 4-18. Wildfire History



4.12. Land Uses

4.12.1. Timber

Weyerhaeuser Company Limited has the right to the coniferous timber within the FMA area. Weyerhaeuser operates a lumber mill 10km south of Grande Prairie, Alberta

International Paper does not hold an allocation on the FMA area; however, Weyerhaeuser holds a long-term contractual obligation to provide this facility with roundwood pulp. International Paper operates a cellulose fibre mill and co-generation facility 10km south of Grande Prairie, Alberta and shares a site with Weyerhaeuser.

Norbord Inc. has been allocated deciduous timber within the DFA area. Norbord has an Oriented Strand Board facility 10km south of Grande Prairie, Alberta.

Tolko Industries Lt. has been allocated deciduous timber within the Saddle Hills area of the DFA. Tolko has an Oriented Strand Board facility in High Prairie, Alberta.

The Province reserves the right to issue coniferous and deciduous Commercial Timber Permits to a maximum allocation as per paragraph 8(2)(a) in the Forest Management Agreement. Commercial Timber Permits are issued to small local use sawmill operators. The Province holds a deciduous allocation in Saddle Hills that is currently[17] unallocated.

Photo Credit: First Pass Oilfield Contracting Inc.

4.12.2. Visual Resources

The 2007 and the 2011 Forest Management Plans focused on the implementation of an effective Mountain Pine Beetle Strategy and a visual quality assessment was not conducted. Constraints were also relaxed around green-up and adjacency in order to meet the Provincial Healthy Pine Strategy.

Forest operators consult annually with Indigenous groups, stakeholders and members of the public. Areas of high visual importance not addressed during the development of this plan but identified during those discussions are taken into consideration during the development of Forest Harvest Plans. A Viewshed Assessment was completed on areas within the FMA that have been previously identified a having high visual importance. The outputs of these viewshed assessments are included in *Annex 9: Non-Timber Value Assessments*. Options for mitigation strategies are described in *Chapter 6 Forest Management Strategies*.

[17] Unallocated as of the date of submission of this FMP

4.12.3. Cultural and Historic Resources

Archaeology is the study of human history through the examination and interpretation of the physical evidence left behind by people in the past. Evidence exists that tells us people have resided in the Province (and in the Grande Prairie area) for at least 10,000 years. This evidence ranges from remnants of structures, gathering sites and artifacts; and all are legally protected in the province by the Alberta Historical Resources Act.

In Alberta, all public and private landowners and developers are responsible for the preservation of historical resources. Forest Management Area 6900016 is crown land, and forest operators hold the responsibility to follow the guidelines specified within the Historical Resources Act. This includes maintaining a process that ensures resource identification, protection and preservation and where possible, facilitates research programs to enhance the knowledge of archaeology.

Conifer and Deciduous operators submit an Annual Operating Plan (AOP) each year so that proposed areas of operation can be screened to determine the annual in-field heritage assessments. The pre-impact fieldwork is conducted during non-frozen conditions and focuses mainly on areas where subsurface (below ground level or dirt work) impacts will be high. Areas identified and having high potential for being archeologically sensitive would undergo further evaluation and potentially a field survey. Mitigation efforts include implementing harvest practices that will minimize ground impacts or, in the case of a significant site, avoidance.

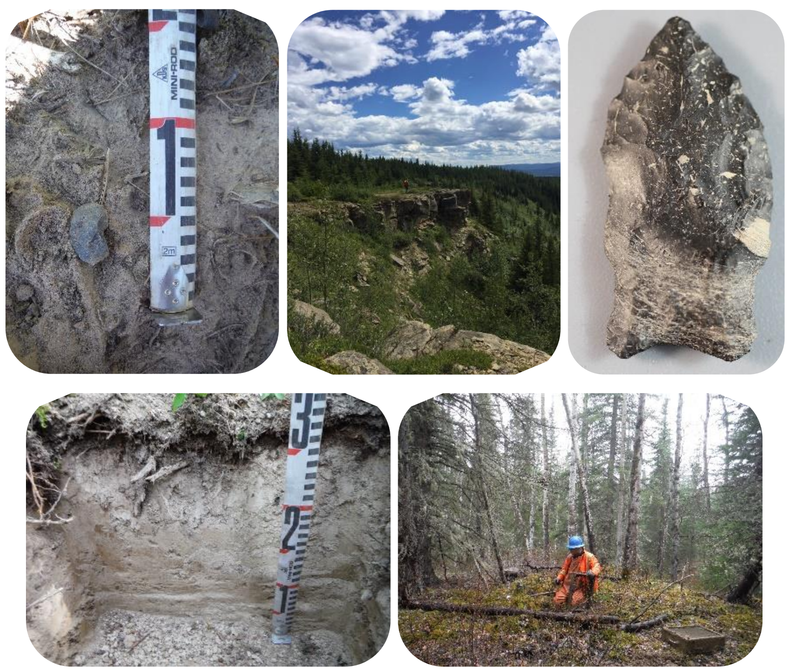


Photo Credit- Grzegorz Kwiecien; Taiga Heritage Consulting Ltd.
Historic Resource field activities- FMA#6900016

4.12.4. Indigenous Communities

There are no reservations or Métis settlements within Forest Management Unit G16.

First Nation Treaty rights and traditional uses and Métis Settlements members' harvesting or traditional use activities which must be protected, covers a wide variety of uses, which include some of the following:

- Use of historic trails, travel or access routes
- Development of campsites for a variety of purposes, such as hunting, fishing, trapping, ceremonies, cultural events, gathering, etc.
- Hunting and fishing for subsistence and cultural or ceremonial events
- Ceremonial, cultural or subsistence access to gathering sites in the forest for berries, plants (trees and shrubs), animal or animal parts, etc.
- Visitation to grave sites or sites of historical, cultural or ceremonial significance

Photo Credit: Sarah Martin, Traci Carter

Clockwise from left: gathering medicinal plants; temporary field shelter; marking carved into tree; tanning camp; drummers with teepees in the background

Aseniwuche Winewak Nation of Canada was formalized in September 1994 by joining the six Indigenous communities surrounding the town of Grande Cache. The members of AWN are non-status Indians and the land-holding agreements that form these communities are unique in Alberta, and possibly in Canada. When the Treaties were being developed, the AWN people were not included and were essentially forgotten until the town of Grande Cache was built.

Duncan's First Nation is a Cree First Nation community that was added to the list of communities to consult with in 2017 due to traditional use area boundary changes. Duncan's First Nation has 2 main reserves; #151A is located 4km south of the hamlet of Brownvale, Alberta and #151K, known as the William McKenzie reserve, is located approximately 40km southeast of Peace River. The main administrative office is in Brownvale, Alberta.

Horse Lake First Nation is party to Treaty 8 and a member of Western Cree Tribal Council. HLFN has two reserves, Horse Lake No. 152B is located 60 km northwest of Grande Prairie near the Village of Hythe and Clear Hills No. 152C is located 56 km northwest of Fairview.

Sucker Creek First Nation is a Cree First Nation community that was added to the list of communities to consult with in 2014 due to traditional use area boundary changes. The Sucker Creek First Nation is located east of High Prairie along Lesser Slave Lake in the hamlet of Enilda, Alberta.

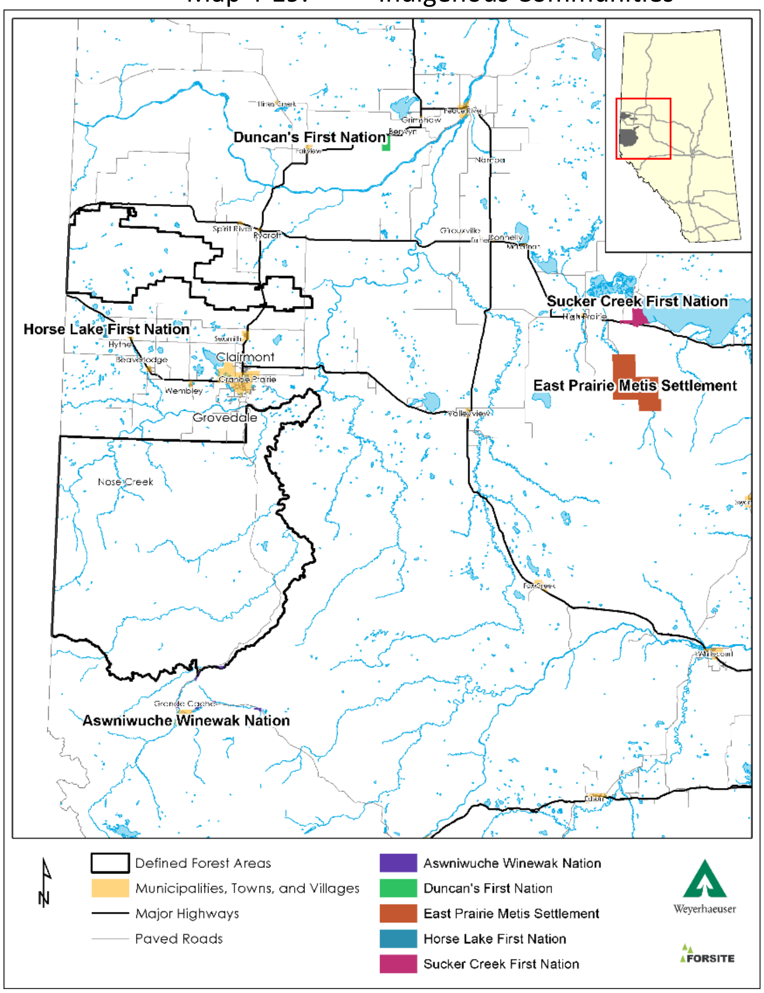
Alberta's Métis Settlements consultation policy, *The Government of Alberta's Policy on Consultation with Métis Settlements on Land and Natural Resource Management, 2016* was developed in consultation with the Métis Settlements General Council and a working group of Settlement leaders to ensure their interests and issues were well understood. Industry also played a key role in the development of the Policy. It is modeled closely after the current First Nations consultation policy, and establishes a formal consultation process between Alberta, project proponents and the Métis Settlements[18]

[18] http://indigenous.alberta.ca/policy-guidelines.cfm

East Prairie Métis Settlement was added to the list of communities to consult with in 2016. East Prairie Métis Settlement has a land area of approximately 33,400 hectares located near High Prairie, Alberta and was founded in 1939. There are approximately 366 people that live in 135 total dwellings on the settlement[19] but the number of persons registered with this settlement are 906[20].

Although operators are not required to consult with the Métis Local 1990 in Grande Prairie, we enjoy a long-standing relationship with these community members and support various youth and elder initiatives such as the Spirit Seekers career fair, the Friendship Center and the Elders Caring Shelter. 3,740 people identify as being Métis in the city and County of Grande Prairie, Alberta[21].

Map 4-19. Indigenous Communities

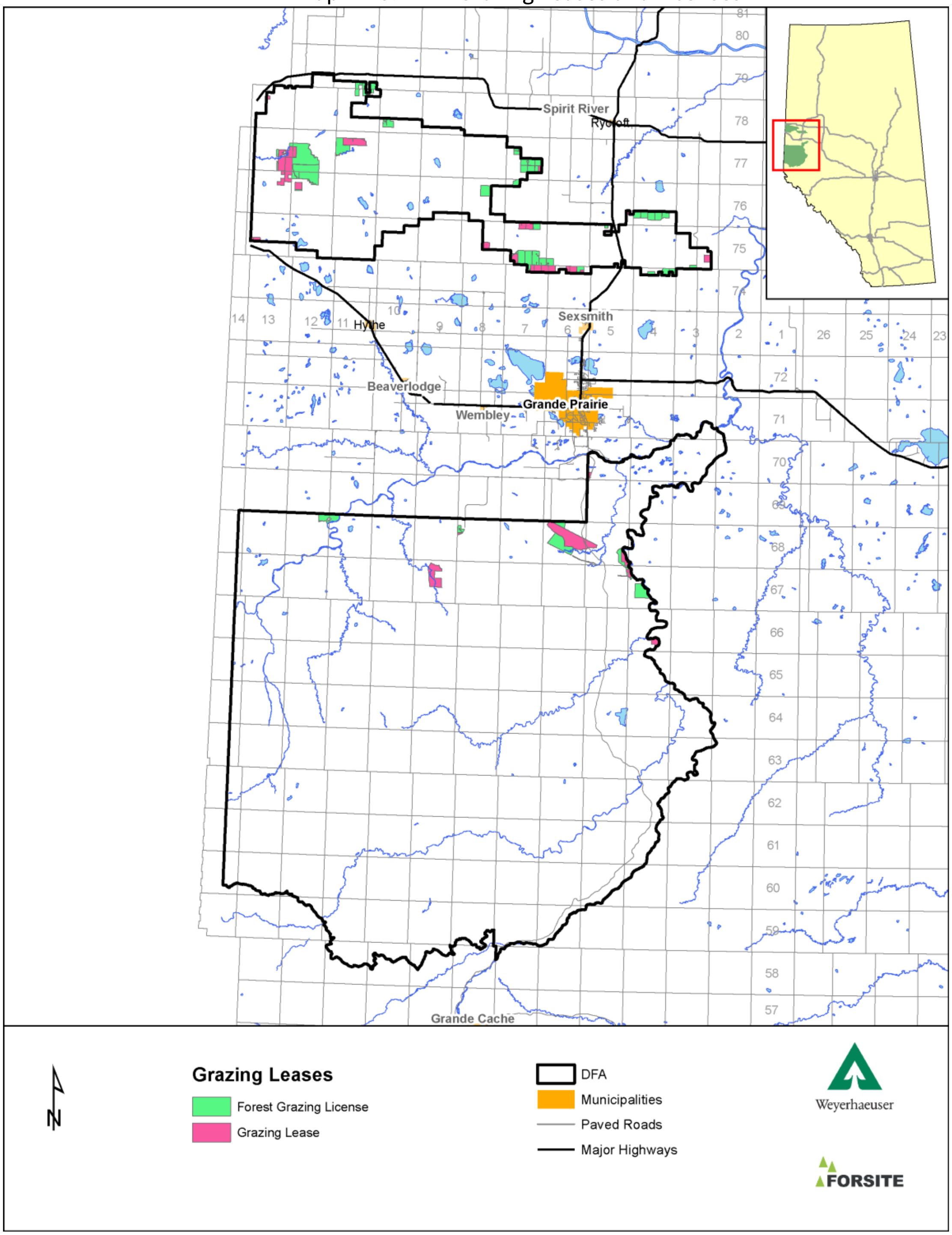


19 2011 Canadian Census; Statistics Canada
20 2009 Municipal Census
21 2011 Canadian Census; NHS Aboriginal Population Profile

4.12.5. Grazing

Grazing licenses, leases and permits and reserves are managed by the Province of Alberta.

Map 4-20. Grazing Leases and Licenses



4.12.6. Recreation & Tourism

The DFA is well used by members of the public for a variety of recreation activities such as hunting, fishing, camping, off-roading, snowmobiling, mountain biking, snowshoeing, birding, photography and berry or mushroom picking.

There are several recreation areas that are currently protected with existing dispositions, protective notations or disposition reservations within the DFA.

Spring Lake Recreation Area

Spring Lake Recreation Area consists of a privately-run campsite, a ski hill that is managed through an association and an equestrian staging area that is used by many local equestrian groups.

Hill Top Lake Recreation Area is managed by Saddle Hills County and offers camping and non-motorized boating.

Long Lake is a recreational camping and day use area. There are no amenities.

Torrens Falls and Hiking Trail is a rugged hiking trail leading to a small pool and waterfall area. There are ample opportunities for hiking, mountain biking, wildlife viewing and fishing.

Sherman Meadows is a well-known area used for ATV, snowmobile and equestrian staging as well as camping. It is an open field that was once used as an airstrip for bush planes.

Swan City Snowmobile Club
Photo credit: D. Weaver

There are also many well-known and well used informal recreational use areas, not associated with a disposition, where the public recreates such as established ATV and Snowmobile trails, hunting camps and random camping areas.

Photo credit: Big CountryXX FM

Alberta has the richest source of dinosaur fossils in the world. The Grande Prairie region is on the northern end of the Fossil Trail and home to the Philip J. Currie Dinosaur Museum. The Pipestone Creek bonebeds and the Wapiti Riverbanks are host each summer to many paleontologists from around the world.

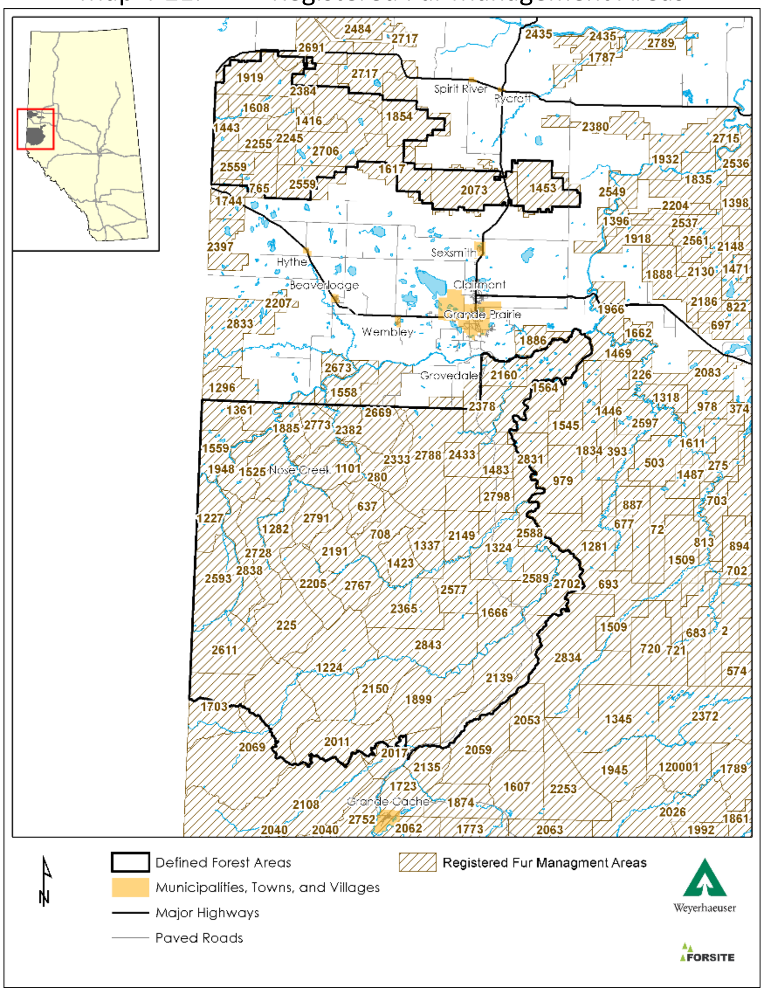
4.13. Fish and Wildlife Resources

The DFA is home to a wide variety of wildlife that are managed by the province of Alberta through the Wildlife Act, a provincial legislation that deals with wildlife. Protecting and maintaining suitable habitat is critical in maintaining long-term wildlife health and viability.

4.13.1. Trapping

Trapping is managed by the Province of Alberta using registered Fur Management Areas.

Map 4-21. Registered Fur Management Areas



4.13.2. Hunting, Guiding and Outfitting

Activities such as hunting and wildlife watching contribute significantly to the provincial economy. Guiding and Outfitting allocations, permits and designations are managed by the Province of Alberta through the Alberta Professional Outfitters Society. There are 7 Wildlife Management Units (WMU) that overlap with the DFA. Hunting tags and draws are allocated as per the WMUs and there are currently (2017) 30 registered outfitters operating in these WMU's.

CHAPTER 5 SUMMARY OF PREVIOUS FMP AND MANAGEMENT OUTCOMES

5.1. Description of the 2011 Forest Management Plan and Area

Classified Landbase

The 2011 Forest Management Plan was developed for the Weyerhaeuser Grande Prairie Forest Management Agreement #6900016. The management area covered under the plan included the FMA area as well as some imbedded grazing leases and dispositions, however the entire Forest Management Unit G16 was not included.

This FMP utilized an AVI that was initiated in 1997, completed in 2004 and updated in 2005.

Forest Management Strategies

The management strategies for the 2011 FMP built on the ones implemented in the 2007 MPB Addendum, which was added to the existing 1999 FMP in order to allow Weyerhaeuser to react to the Mountain Pine Beetle infestation.

The 2011 FMP considered imbedded deciduous quota holders including Norbord Inc, Tolko Industries Ltd as well as the Province of Alberta.

The two most prevalent management strategies for the 2011 FMP were centered around reducing the amount of at-risk pine stands while also significantly restricting the amount of harvest in the Caribou Ranges. This paved the way for a conifer surge cut of existing pine stands outside of the Caribou Range and led to an imbalance in the stand structure and seral stages over the entire FMA. The third most impactful strategy was a deciduous surge cut to address the overabundance of old to very old deciduous on the landscape.

Annual Allowable Cuts

The previous coniferous annual allowable cut (AAC) planned for an accelerated harvest to address the severe Mountain Pine Beetle infestation levels since the in-flights from British Columbia in 2006 and 2009. The AAC was accelerated to 2,278,112m^3 for the first 10 years of the plan, dropping down to 1,313,949m^3 in 2019.

The previous deciduous Annual Allowable Cut (AAC) planned for an accelerated harvest of 1,478,041m^3 for the first 20 years of the plan to address an abundance of overaged deciduous stands on the FMA area.

Table 5-1: Previous Annual Allowable Cut and Allocations (cubic meters (m^3))

	2009-2018		2019-2028	
Operator	**Deciduous**	**Coniferous**	**Deciduous**	**Coniferous**
Weyerhaeuser	148,000[1 2 3 4]	2,269,478 [5]	148,000	1,305,315
Norbord	1,199,041 [6 7]		1,217,625	
Tolko	80,000 [8 9]		80,000	
Local Use		8,634		8,634
Unallocated	51,000		51,000	
TOTAL	**1,478,041**	**2,278,112**	**1,496,625**	**1,313,949**

Notes:

1- Weyerhaeuser's deciduous allocation of 148,000m^3 is included in *section 7 (1) Rights Over the Land* in the current Forest Management Agreement whereas a portion of which may be pure deciduous stands sourced from Volume Supply Area 1.

2- For the 2011 FMP, the portion of pure deciduous volume was allocated at 33,000m^3.

3- For the 2011 FMP, if there is a Local Use interest, up to 10,000m^3 of deciduous volume for local use would come from this allocation.

4- Weyerhaeuser's VSA1 is in the northeast corner of the main block of the FMA and is not the same VSA1 referenced in Norbord's deciduous quota.

5- Weyerhaeuser's conifer allocation is based on a surged cut in periods 1 and 2 to address the threat to the fibre supply from a Mountain Pine Beetle infestation.

6- Norbord's allocation is modelled. Their allocation is established after other allocations have been met.

7- Norbord's allocation is based on a surged cut in periods 1 through 4 to address an abundance of overaged deciduous on the FMA.

8- Tolko's Quota Certificate indicates they must take incidental as identified by operator and zone prior to cutting pure deciduous stands.

9- Tolko's carryover volume has been added to Period 1.

5.2. FMP Approval Conditions

The 2011 Forest Management Plan was approved by the Province on March 28, 2012 with 15 approval conditions to be completed by Weyerhaeuser. Table 5-2 summarizes efforts to date to these conditions.

Table 5-2: Approval Conditions (2011 FMP)

Approval Condition	Section	Requirement	Comments (2019)
6.1 (i)	Public Consultation	written documentation of all issues and comments raised by the public as well as the company's responses and actions	ongoing • Public consultation activities are documented including event details, who attended and noted concerns. • Weyerhaeuser has a documented process for addressing Public Concerns.
6.2 (i) (ii) (iii)	First Nations Consultation	continue to consult with AWN and HLFN; adhere to Alberta's First Nations Consultation Guidelines on Land Management and Resource Development for plan development and approvals; document consultation efforts and activities	ongoing • Indigenous consultation is conducted and documented as per the ACO Proponent Guide.
7.1 (i)	Mountain Pine Beetle	work with Smokey Area to coordinate efforts on MPB control, timber salvage and forest renewal activities	ongoing • Weyerhaeuser has worked with local Forest Health officers to coordinate level 1, 2 & 3 MPB Mitigation work.

Approval Condition	Section	Requirement	Comments (2019)
9.1 (i)	Spatial Harvest Sequence	follow the mapped 20 yr harvest sequence as presented in the FMP	ongoing
9.1 (ii)	Spatial Harvest Sequence	authorized to modify the SHS by deleting/ replacing from the net land base no more than 20% of the total sequenced area in each compartment per decade, while harvesting no more than 100% of the total; area within the SHS by compartment, by decade. preference will be given to stands from (1) period 2 of the SHS (2) other approved high-risk Pine stands.	• Weyerhaeuser operates from the approved SHS unless deviations from the approved plan are required for FireSmart Activities; to meet MPB control PFMS or where designed wood did not meet merchantability targets.
9.1 (iii)	Spatial Harvest Sequence	if the variance exceeds 20%, this may require a Compartment Assessment and may lead to AAC adjustment	
9.1 (iv)	Spatial Harvest Sequence	Variance from the SHS must be reported annually. The 5 yr Stewardship Report will analyze the cumulative variance from the SHS and will describe the potential impacts of the actual variance on the forecasts in the FMP	• Deviations from the approved sequence > 20% are discussed with local AAF Area foresters and are well documented through the SHS variance tracking process.
9.1 (v)	Spatial Harvest Sequence	SRD will not request a modification of the approved harvest sequence for the 1st 15 years of the planning period unless there is a change in legislation or policy	
11.1 (i)	Stand Level Structure Retention	structure retention contributing to meeting the target (coniferous 2.5% and deciduous 3%) will be merchantable, and reflect the species composition and timber profile of the original stand	ongoing • Structure retention targets have been met and operational practices have improved through awareness.

Approval Condition	Section	Requirement	Comments (2019)
12.1 (i, ii, iii)	Grazing Timber Agreement	in advance of operations, develop Grazing Timber Agreements with potentially affected disposition holders. GTA's will include a reviewed AOP. Non-harvested areas within Forest Grazing Licenses will be monitored and reported as variance from the SHS.	Ongoing • Planned blocks within FGL will have a Grazing Timber Agreement in place. • Non-harvested areas within FGL's are tracked as variance (deferred or unplanned). • This condition will be addressed through the renewal of the 2019 FMP.
12.1 (iv)	Grazing Timber Agreement	The net land base and TSA prepared for the next DFMP will address grazing issues	
13.1 (i)(a)	Silviculture Strategies	Amend with a recalculation of each of the seed supplies per tree species per deployment zone to be reforested using the appropriate unit amounts per kg as directed by ATISC	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
13.1 (i)(b)	Silviculture Strategies	amend with an adjustment to the amount of seed required to be collected to meet planting requirements of the 10-year SHS. Include specific details for each timber year where seed collection is planned, including links to planned harvesting in specific compartments	completed • Delivered through the AOP. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
13.1 (ii)	Silviculture Strategies	reconcile the number of regenerated yield curves proposed in the TSA with the regenerated yield trajectories listed within the Silviculture Matrix. Clarify how the distinct yield curves (84) align with the regenerated yield trajectories (6). Requires a formal agreement to the reconciliation with each of the operators.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.

Approval Condition	Section	Requirement	Comments (2019)
14.1 (ii)	Regenerating Land base-ARIS Records Validation	Inconsistent ARIS records and regenerating land base data will be resolved, and ARIS updated. Adhere to procedures outlined in "Regenerating Land base-ARIS records validation procedures"	Unresolved • This condition will remain unresolved and will be addressed through the renewal of the 2019 FMP (as per a letter from the Province on February 22, 2017.
15.1 (i)	Enhanced Silviculture	genetic gain other than approved in this FMP requires a full review and approval of controlled parentage program plans.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
16.1 (i)	Primary and Secondary Volume Tracking	develop and implement a method to monitor and report primary and secondary harvested volumes	Completed. • The Province released Weyerhaeuser from this condition in a letter dated July 12, 2012.
17.1 (i, ii)	Industrial Timber Salvage	all timber depleted by non-forest activities will be reported and accounted for. Exception- low impact seismic. Volumes used will be those published in the TDA tables or otherwise agreed to	ongoing • Volumes were reported as per the TDA tables until 2016 when the process changed to report using the weigh scale method.
18.1 (i)	Delivered Timber Volume Monitoring Program	develop a program that will compare actual delivered timber volumes to volumes anticipated by yield projections from harvested areas.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated July 12, 2012.
19.1 (i)	Growth and Yield Plan	provide a revised G&Y plan that includes sufficient data and analysis to validate natural and regenerated stand yields.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated February 2, 2016.

Approval Condition	Section	Requirement	Comments (2019)
20.1 (i)	Performance Monitoring	submit annual and stewardship reports that document the operational performance of each company's activities implementing the DFMP. Where variances exist, an analysis will provide reasoning and a corrective action plan	ongoing • Annual reporting is accomplished through the Annual Operating Plan, the General Development Plan, ARIS reporting and operational block monitoring reports.
20.1 (ii)	Performance Monitoring	Submit a Stewardship Report current to May 1, 2015	completed • The Stewardship report was submitted December 1, 2016.
21.1 (i)	Future Forest Management Plans	Complete a DFMP that meets forest management planning standards by April 30, 2021	• Completed prior to the targeted date.

5.3. Significant Events

A significant event is where the cumulative impacts from any source(s) reaches 2.5% of the contributing landbase. This would potentially lead to a recalculation of the Annual Allowable Cut (AAC). Examples of potentially devastating natural events would be major forest fires, ice storms, landslides, floods or windthrow.

There have been no natural significant events on the Defined Forest Area (DFA) since the 2011 FMP was approved outside of the MPB infestation, which was addressed in the management strategies of the plan. Smaller natural events, including fires, windthrow and forest pests have occurred on the DFA and these have been described in *Chapter 4, Landscape Assessment*.

There are several non-natural events that would have the potential to significantly affect the FMA and the available AACs.

The one that has been the most prevalent on Weyerhaeuser's FMA is the continued erosion of the contributing landbase for timber production. The Oil and Gas industry continues to produce a heavy footprint on the DFA with the withdrawals of land for the building of well pads, pipelines, roads and powerlines.

The second potentially significant non-natural event on the Defined Forest Area would be the permanent closure of a facility. Although the pulp mill changed ownership, the fibre needs for the facility from the FMA has not changed.

5.4. Timber Production Standing Report

<u>Weyerhaeuser's Allocations</u>

The two quadrants covered in the 2011 FMP were Quadrant 5 (May 1, 2008 – April 30, 2013) and Quadrant 6 (May 1, 2013-April 30, 2018).

In Quadrant 5, 82.36% of the primary conifer was produced and 0% of the secondary conifer for a total of 81.02% of the total conifer authorized to cut being produced. 110.79% of the primary deciduous was produced and 0% of the secondary deciduous for a total of 92.64% of the total deciduous authorized to cut being produced.[22]

Quadrant 6 started May 1, 2013 and runs through April 30, 2018. To date[23] we have received audited Timber Production Summaries to the end of Quadrant 6. 72.99% of the primary conifer was produced and 33.25% of the secondary conifer for a total of 71.51% of the total conifer authorized to cut being produced. 104.95% of the primary deciduous was produced and 146.98% of the secondary deciduous for a total of 87.38% of the total deciduous authorized to cut being produced.

[22] April 11, 2014; Production Standing Report for WY- Grande Prairie-May 1, 2012-April 30, 2013
[23] May 1, 2019; Production Standing Report for WY- Grande Prairie-May 1, 2017-April 30, 2018

There were several issues in the with the way fibre was allocated in Tables 1 through 8 in the 2011 FMP Approval Condition letter and the associated Periodic Allowable Cut (PAC) letter. As a result, the way the tables were interpreted and tracked in the Timber Production Reports varied from year to year in each quadrant. Because of this, although it shows an over cutting of the primary and secondary deciduous cuts- this is not an accurate reflection. The process to be used in the 2019 FMP has been clearly identified in *Chapter 8- Performance Monitoring and Reporting.*

5.5. Preferred Forest Management Strategy

There were five Forest Management Strategies identified in the 2011 FMP which impacted the way Weyerhaeuser guided the forest planning model.

5.5.1. Woodland Caribou Management Strategy

The caribou management strategy in the 1999 Forest Management Plan included a focus on maintaining large contiguous patches of habitat for caribou and retaining a larger amount of older forest than would be normally left (late rotation).

Weyerhaeuser's 2007 FMP included a spatial harvest sequence (SHS) that was scheduled to last until 2019 and indicated minimal harvest activity within areas designated as "High" caribou habitat (defined by Fish & Wildlife biologists in 2006 and shown in maps in the 2007 MPB plan).

The 2011 FMP included a recommendation by the caribou sub-committee to change Caribou Range boundaries based on available GPS data from collared animals.

The 2011 FMP Caribou Management Strategy limited early seral stage (30 years and younger) in each range to 20% of or less of the productive area (the 20/30 rule). The forecasted result of this would be an average of 0.67% of the land base in caribou range being available for harvest each year (150-year rotation). The exception to this was the Lingrell Zone which saw an increased level of harvesting in the first ten years of the plan to address the risk of MPB infestation. This increased the amount of early seral stage forest greater than 20% in the first ten years of the plan and then limited re-entry until the amount of early seral stage forest in the Lingrell is below 20%.

One of the objectives for the 2011 SHS was to carry over the unharvested CMZ blocks from the 2007 SHS and then implement the 20/30 rule. However, the unharvest blocks from the 2006 SHS were not carried into the 2011 SHS and rather these blocks were inadvertently dropped, and the general 20/30 constraint was applied. There were also some math/ transcribing errors that occurred during the handpicking exercise. These errors resulted in almost 6,000 ha in period 3&4 being dropped from the 2011 CMZ SHS which produced a much lower volume being sourced from the CMZ than should have been.

Table 5-3 Current status of the 20/30 rule (May 1, 2017)

CMZ	Productive ha	Ha > 30 yrs old	Ha < 30 yrs old	% area < 30 yrs old
Lingrell	40,706	24,780	15,925	39%
25,277	27,739	25,277	2,462	9%
Redrock-Prairie Creek	195,085	169,841	25,245	13%
All Ranges	**263,530**	**219,898**	**43,632**	**16%**

5.5.2. Enhanced Silviculture Regeneration

For planning activities in the 2011 plan, Weyerhaeuser Grande Prairie was involved in the Huallen Seed Orchard Co-op (HASOC) and had a small inventory of B1/ B2 lodgepole pine, and a large inventory G1 white spruce material. Due to the focus on pine harvest because of the threat of MPB, deployment of improved lodgepole pine was constrained by seed orchard production, however, Weyerhaeuser intended to continue to deploy as much available improved pine seed within the approved seed zones, as the seed became available.

Weyerhaeuser's enhanced silviculture regeneration strategy included the following:

1. Enhanced stands only established outside CMZs for TSA modeling.
2. Enhanced stands must remain as enhanced stands across the planning horizon; and
3. No stands that have been managed under an enhanced silviculture option may break-up naturally during the planning horizon; they will be harvested.

Treatment area targets and actuals achieved were as follows:

Period 1 targets:	<= 3,000 hectares for pine, and <= 7,262 hectares for spruce
Period 1 achieved:	6,147 hectares of pine, and 5,198 hectares of spruce
Period 2 targets:	<= 5,000 hectares for pine, and <= 14,881 hectares for spruce
Period 2 achieved	7,240 hectares of pine, and 5,788 hectares of spruce *(to 2018)*

It is important to note that although the hectares planted with pine overachieved the target, the strategy included planting as much pine as was possible, as the seed became available.

5.5.3. Transitioning a DC Stand to a CD Stand

This strategy to transition DC stands to CD stands was first approved in the 1989 plan to meet the reforestation stocking standards that were in place at that time. To meet 80% conifer stocking level, the most reliable way to accomplish this was to create CDs out of DCs. The conifer cut level was then set with this in mind; and has been part of the silviculture strategy for the FMA area ever since.

A roll-up of performance of this strategy is difficult to track and describe as historically, entire blocks of DC stratum are rarely sequenced. Typically, an opening is sequenced, and DC stratum are some of what makes up the opening. Weyerhaeuser cutblocks receive a year four (non-legislated) stocking survey and blocks with low stocking or un-stocked patches are fill planted. This is followed with an establishment survey by year 8. Establishment surveys completed for all Weyerhaeuser blocks in the last 5 years show very encouraging results, with less than 2% of the total blocks surveyed as NSR. The survey results are not separated by each individual pre harvest stratum. Surveys are completed on the entire opening, which is declared post harvest to a single stratum. Survey results are not tracked by pre-harvest stratum.

A summary of areas in the net harvestable landbase by post-1991 MGD strata is presented below in Table 5-4, an excerpt from the Growth & Yield Report (2018-10-04). This table shows that 2,285 managed hectares are on a DC trajectory.

Table 5-4: Area summary by yield group in the post-1991 existing managed stands.

Yield Group	Description	Net Area (ha)	Net Area (%)
D_CD	ARIS D declared blocks	41,393	24.4
Hw	Pure deciduous in RSA SUs	86	0.1
HwPl	ARIS DC declared - HwPl block or HwPl RSA SU	719	0.4
HwSx	ARIS DC declared - HwSx block or HwSx RSA SU	1,566	0.9
Pl	ARIS C declared - Pl block or Pl RSA SU	73,864	43.5
PlHw	ARIS CD declared - PlHw block or PlHw RSA SU	5,974	3.5
Sb	Sb in RSA SUs	24	0.0
C_SB	ARIS C declared - Sb block	972	0.6
Sw	ARIS C declared - Sw block or Sw RSA SU	18,715	11.0
SwHw	ARIS CD declared - SwHw block or SwHw RSA SU	4,565	2.7
PL_G147p1	ARIS C declared - Pl block or Pl RSA SU identified as genetic	17,398	10.3
SW_G351p1	ARIS C declared - Sw block or Sw RSA SU identified as genetic	4,402	2.6
Total		**169,678**	**100.0**

Table 5-5 below shows the DC based on how the strata was determined and indicates that most of the DC strata was declared based on photo interpretation either from RSA or AVI. It should be noted that photo interpretation may not be fully accounting for conifer stocking underneath the regenerating deciduous canopy. While photo quality and sharpness has improved dramatically in recent years, it is difficult to see all the smaller conifer stems.

Table 5-5: Strata Source Information

Row Labels	Sum of Shape_Are
ARIS	247.1
AVI	892.7
RSAN	157.6
RSAP	1,160.6
Grand Total	**2,458.0**

- AVI- blocks harvested between 1991-1995 were declared based on AVI cover type
- RSAN- these blocks were RSA surveyed (non-photo)
- RSAP- these blocks were RSA surveyed (photo)
- ARIS- the Strata was based on the ARIS declaration

Table 5-6 shows that most of the DC polygons (2,014.2 ha or 82%) are showing up in openings that have been declared to C-2000 or CD 2000.

Table 5-6: Strata Declaration

Row Labels	HwPl	HwSx	Grand Total
C-2000	**532.2**	**580.2**	**1,112.4**
AVI	251.2	332.3	583.5
RSAN		83.1	83.1
RSAP	281.1	164.7	445.8
CD-2000	**196.6**	**705.2**	**901.8**
ARIS	7.3		7.3
AVI	28.0	133.3	161.3
RSAN		18.3	18.3
RSAP	161.3	553.6	714.8
CONF		**1.7**	**1.7**
AVI		1.7	1.7
DC-2000		**295.9**	**295.9**
ARIS		239.8	239.8
RSAN		56.1	56.1
(blank)	**79.6**	**66.6**	**146.2**
AVI	79.6	66.6	146.2
Grand Total	**808.4**	**1,649.6**	**2,458.0**

Table 5-7 shows the 295.9 ha that have been declared to DC-2000 by operator.

The Norbord openings in this table are from 2005 or earlier. The Weyerhaeuser openings are from 2001 or earlier. Openings that are declared to DC are part of a historical issue and it is important to note that since Weyerhaeuser and Norbord started doing joint landbase balancing in 2006, no new openings have been declared to DC.

Table 5-7: Operators for openings declared to DC-2000

Row Labels	NORB	WEYR	(blank)	Grand Total
DC-2000	**231.7**	**56.1**	**8.1**	**295.9**
6050663379	56.2			56.2
6050671946	49.7			49.7
6050672036	44.5			44.5
6070641583		26.0		26.0
6070642158		8.8		8.8
6070672278	38.9			38.9
6080681329		20.2		20.2
6100671583	20.8			20.8
6110662571	13.7			13.7
6110752795	1.2			1.2
6110752796	6.7			6.7
6130683638		1.1		1.1
(blank)			8.1	8.1
Grand Total	**231.7**	**56.1**	**8.1**	**295.9**

Based on the performance data from the previous two periods we anticipate transition performance to be approximately 98.5% successful. DC stands (HwPl & HwSx) that continue to exist in the managed landbase are assigned to an RSA based DC yield curve using the actual data used to assign that label.

5.5.4. Switch Stands

FMA6900016 currently operates as a divided landbase where Weyerhaeuser operates in stands identified as Pure Conifer (CX); Conifer Leading Mixedwoods (CD); and Deciduous Leading Mixedwoods (DC). The deciduous quota holders operate in Pure Deciduous (Dx) stands.

The exception to this was in Pure Deciduous (Dx) stands where there is enough conifer understorey to identify the stand as a Switch Stand (Du). In a Switch Stand, management decisions are based on the understorey age, but the reporting is completed on the age of the overstorey. When creating the Du yield curves, the overstorey age is used to drive the projections. Although the definition of a Switch Stand has evolved from plan to plan, Switch Stand Management strategies have been part of the strategic planning process since the 1989 Forest Management Plan.

For the 2011 FMP, a switch stand was one where there are at least 250 conifer stems per hectare. These stands were managed as part of the conifer landbase with no deciduous overstory removal prior to final harvest. This strategy impacted both timber supply and the harvest sequence. Volume from these stands was available as part of future fibre supply and these stands were not sequenced until the conifer understory was merchantable. Because the photography used for the AVI in the 2011 FMP was taken leaf on, there were some stands that were part of the Dx landbase that had a considerable amount of conifer understory. These stands were harvested by the deciduous operators with a conifer understory avoidance/ protection plan wherever possible.

5.5.5. Mountain Pine Beetle

Weyerhaeuser's FMA 6900016 was hit by mountain pine beetle (MPB) inflight from BC in 2006 and again in 2009. The MPB strategy for the 2011 plan focused on a forest management approach that resulted in long term healthy forests both from regeneration and a wildlife habitat perspective. Harvest strategies for period 1 were focused in the Saddle Hills first and then moving to the northernmost part of the main block of the FMA. By the end of the second period, the plan focused harvest on the mid to southern portions of the FMA where the risk of infestation, although less than in the north, was still present.

Although the assumptions that determined when a stand would be "killed" and removed from the landbase changed slightly depending on which MPB "zone" a stand fell in, the spatial harvest sequence generally followed the same rule for stand susceptibility which included stands with > 60% pine, an SSI CF > 31 and > 60yrs of age. Although stand susceptibility to MPB was a consideration in the hand selection of stands for harvest, maintaining caribou habitat within the Caribou Ranges was the main priority when sequencing stands.

In period 1, operational planners noted several issues with the spatial harvest sequence.

1. The thresholds for minimum height and volume per hectare were lower than what would be considered merchantable.
2. The minimum patch size was lowered which resulted in slivers and retention patches being sequenced.
3. Constraints for low site index or low productivity were not considered.
4. A constraint was included to artificially "kill" stands if they weren't harvested by the end of period 1. This resulted in stands being removed from the sequence while they were still salvageable.
5. Because pine was "killed" and removed from the sequence, a high amount of spruce was included in the 20-year SHS, which should not have been a priority for harvest.
6. There were also issues created due to stand mistyping from the old AVI.

Final Harvest Plans showed high levels of variance as operational planners bypassed sequenced spruce and non-merchantable stands in order to salvage truly at-risk pine stands that were not originally sequenced. The Province was aligned with this strategy and approved the variance as described in the rationale in the Final Harvest Plans.

Using the MPB strategies in the 2011 plan, 66,845 hectares of pine leading stands were sequenced for harvest in period 1 and 2. By the end of the 2018 harvest year- 21,996 hectares were deferred or deleted because of landbase removals, mistyping or slivers and 33,395 hectares were harvested. This leaves 11,453 hectares of pine leading stands from the 2011 SHS to be sequenced in the 2019 FMP, with consideration to constraints from the new Preferred Forest Management Strategy.

In 2007, the Province of Alberta developed a pine strategy that directed FMA holders to amend their management plans to reduce the amount of susceptible pine on their operating landbase by 75% over the next 20 years. By the end of the 2018 harvest season, Weyerhaeuser has accounted for 83% of the at-risk pine stands identified in the 2011 FMP.

At present, Weyerhaeuser has harvested much of the pine dominated stands in lower elevation areas. Using the 2016 AVI and the stand susceptibility rules described above, the susceptible hectares that remain outside the CMZ occurs mainly in buffers and in retention patches. There is some remaining MPB in higher elevation areas, but rate of spread is relatively low, and this area is largely in caribou range. Although Weyerhaeuser is monitoring the risk of MPB in the CMZ, an accelerated conifer cut is not being proposed as a strategy in the 2019 FMP to address Mountain Pine Beetle infestation.

5.6. Accelerated Harvest

The final strategy that influenced the model and impacted the Annual Allowable Cut was to implement an accelerated harvest for both the conifer and the deciduous volumes.

5.6.1. Conifer Surge Cut

In the 2011 plan the primary conifer harvest was accelerated to approximately 2.2 million m^3/yr for the first decade which was almost 40% over the current LRSY. This strategy was necessary to capture the volume from infested pine stands that, unless harvested within 10 years, would be killed off by the mountain pine beetle and require removal from the active land base.

During the 2011 plan, Weyerhaeuser was focused on harvesting the pine stands identified in the sequence as being at highest risk for Mountain Pine Beetle. Due to several factors beyond our control, Weyerhaeuser underutilized this accelerated cut level by approximately 18% each year, averaging between 1.6-1.8 million m^3/ year. The main factors included inclement weather (warmer winters/ wetter summers) and lower than anticipated contractor capacity. These upset conditions impacted our ability to harvest and haul at full productivity rates at several periods during the last decade.

5.6.2. Deciduous Surge Cut

In the 2011 plan the primary deciduous harvest was modelled at approximately 31% above the long term AAC for periods 1-4 to address the abundance of over-mature deciduous stands.

Deciduous quota holders have consistently under utilized the deciduous annual allowable cut (32% from 2013 to 2018; Quadrant 6) and the deciduous SHS has not been fully implemented.

This has resulted in a continued overabundance of decadent deciduous stands as well as a reduction in deciduous volume as unharvested stands start to fall over. Operationally, this resulted in sterilized deciduous volume in conifer blocks as well as a deferral of some mixedwood stands that were sequenced. There are very few reasonable alternative markets for deciduous volume in the Grande Prairie region. This increased Weyerhaeuser's harvesting and reforestation costs and resulted in some areas with lower volume infested MPB pine stands to be bypassed. These were all considerations included in this FMP.

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CHAPTER 6 FOREST MANAGEMENT STRATEGIES

Weyerhaeuser's forest management strategies support the overall objective to sustainably utilize and develop the productive forest land base while maintaining biodiversity and ecological integrity. Weyerhaeuser strives to continuously improve the overall health and productivity of the forest through research and consultation as well as collaborative work with other organizations, such as the Forest Resource Institute, drawing upon their expertise to adjust resource management strategies and practices.

6.1. Sustainable Forest Management

The foundation of Weyerhaeuser's forest management approach lies within sustainable forest management practices as demonstrated through the company's commitment to certification with Sustainable Forest Initiative (SFI-00001). The SFI program is based on the following principles[24]:

1. **Sustainable Forestry**—Weyerhaeuser is committed to meeting the current needs of its facility without compromising the ability of to meet future needs. Weyerhaeuser accomplishes this through the protection of soil and water, diversity, wildlife and aquatic habitat as well as areas of cultural and recreational significance.

2. **Forest Productivity and Health**—Weyerhaeuser maintains the productive capacity of the forest land base through soil protection and post-harvest regeneration. Weyerhaeuser supports forest health monitoring and research initiatives.

3. **Protection of Water Resources**—Weyerhaeuser's best management practices are committed to maintaining water quality through the protection of watersheds, water bodies and riparian zones.

4. **Protection of Biological Diversity**— Weyerhaeuser's best management practices are committed to the protection and promotion of biological diversity, including animal and plant species, wildlife habitats, and ecological or natural community types.

5. **Aesthetics and Recreation**— Weyerhaeuser's best management practices are committed to managing the visual impacts of forest operations, and to not creating barriers to recreational opportunities for the public.

6. **Protection of Special Sites**— Weyerhaeuser's best management practices are committed to protecting the unique qualities and integrity of lands of ecological, geological or cultural significance.

[24] http://SFI.org/standards and principles

7. **Responsible Fiber Sourcing Practices in North America**—Weyerhaeuser sources all its fibre from Alberta, Canada. The vast majority is from government owned lands that are subject to strict laws and regulations.

8. **Legal Compliance**—Weyerhaeuser complies with all applicable federal, provincial, and local forestry and related environmental laws, statutes, and regulations.

9. **Research**—Weyerhaeuser has always, and will continue to, take a leadership role in the research and development of forest management practices through its participation in industry, professional and educational research associations. Weyerhaeuser remains committed to staying current with the most up-to-date technology and incorporating scientifically validated ideas into its forest management plans.

10. **Training and Education**—Weyerhaeuser is committed to providing training and education programs to its employees and contractors that are timely, thorough and relevant to sustainable forestry practices.

11. **Community Involvement and Social Responsibility**—It is essential that Forest Management Plans reflect societal values and Weyerhaeuser ensures this through regular and meaningful consultation with members of the public, stakeholders and indigenous peoples.

12. **Transparency**—Weyerhaeuser has built solid relationships with stakeholders, indigenous communities and the communities surrounding the forest management area. It will continue to openly and honestly share information and respond to public inquiries.

13. **Continual Improvement**—Weyerhaeuser is committed to monitoring, measuring and reporting performance toward the values and objectives of a sustainable forest management plan.

14. **Avoidance of Controversial Sources**, including Illegal Logging, in Offshore Fibre Sourcing– Weyerhaeuser does not engage in off-shore fibre sourcing.

This approach follows the Values, Objectives, Indicators and Targets framework as described in the Alberta Forest management Planning Standard (2006).

6.2. Natural Range of Variation

The concept of a Natural Range of Variation (NRV) is to mimic the range of ecosystem structures and processes that were present on the landscape prior to being influenced by industrial operations. NRV is based on historical fire and disturbance patterns, knowledge from aboriginal elders, historical databases, and archives. Targets are set for the landscape to move the forest to a state that more closely fits its natural range of variation.

Weyerhaeuser partnered with Canadian Forest Products Ltd (Canfor) on a Forest Resource Improvement Association of Alberta (FRIAA) project titled *Historical Landscape Condition Benchmarks for Northwestern Alberta* (Crosina, 2014). Dr. David Andison (Bandaloop Landscape Ecosystem Services) is a national expert who specializes in the study of NRV, historical disturbances and disturbance patterns, and has developed a simulation model called LANDMINE to complete an NRV spatial analysis specific to the FMA area. The objective of the project is to "…create stand-alone, scientifically defendable output in the form of historic landscape conditions for an area that includes both the Weyerhaeuser Grande Prairie FMA and the Canfor Grande Prairie FMA" (Crosina, 2014).

Weyerhaeuser believes that developing forest management plans with consideration to the historical or natural range of variation of ecosystem patterns and processes results in significantly lower risk of loss of biological function, productivity, and individual ecological elements.

6.3. Ecologically Based Forest Management

Ecologically based forest management requires forest management objectives that result in the preservation of natural ecological processes for the long term through recognition of the complex set of relationships that drive the abundance and distribution of plant and animal communities. Forest management plans must endeavor to maintain landscape diversity and stand structure within the range of natural variability while at the same time consider economic and social expectations of the forest.

6.3.1. Course Filter Approach

Natural stand removal type disturbances such as extreme wind or ice events and even the most intense fires, create irregular shaped openings of various size and shape and leave behind most of the vegetation structure. Depending on the event, this would include standing dead and live trees scattered individually, in clumps or in patches as well as horizontal large woody debris. Over the landscape, this variable pattern of dense to sparse vegetation of varying seral stages with kilometers of forest edge provides habitat opportunities to a range of mammal and bird species depending on site-specific conditions left behind.

Harvest plans attempt to emulate this type of stand replacing disturbance. However, unlike a natural disturbance event, these plans must also take into consideration safety and operational constraints, silvicultural considerations, and the protection of non-timber values such as watersheds and known wildlife range. Harvest openings follow stand type boundaries which are delineated using species, height and age indicators. Live trees are retained as individual stems, clumps and patches and will eventually contribute to future snag abundance and coarse down woody material. The retention of trees in large clumps or patches within openings maintains connectivity between habitat patches so that wildlife can move sheltered through the forest. The intent of retention patches is that they include a variety of habitat structure such as riparian habitats, springs and mineral licks, inoperable sites, as well as merchantable trees, and can contribute to the older age class distributions.

6.3.2. Fine Filter Approach

When the ecological approach to forest management is not enough to address habitat requirements of a species that is either rare, endangered or threatened, or are of special societal value; forest management plans may be required to specifically address the habitat requirements of that species. This plan has identified provincially and nationally rare, endangered and threatened plants and wildlife species that are thought to occur on the DFA. The habitat requirements of selected species have been inventoried and integrated into timber harvest planning.

6.3.3. Adaptive Management

Sustainable forest management is a key driver for this plan however it is heavily dependent on the ability to predict, to some degree, the future forest conditions resulting from the plans and practices of the industry. Adaptive management is supported through monitoring. The monitoring required for Weyerhaeuser's Sustainable Forest Initiative (SFI) and the province's Stewardship reporting provides the necessary feedback on those predictions.

Adaptive management is defined as the process of planning activities, implementing activities, monitoring results and comparing against planned results, and taking corrective action where unplanned results occur[25].

An adaptive management style requires regular monitoring and analysis to incorporate learnings from previous actions into the decision-making processes and these learnings are used to update current plans and strategies.

Adaptive management is also required to revise forest management strategies in response to a natural calamity such as wildfire or insect infestation. When these conditions occur on the FMA area and affects the net productive forest land base by more than 2.5%, the forest management plan will need to be revised to account for a change in the forest condition[26].

[25] Alberta Forest Management Planning Standard (2006)
[26] Alberta Forest Management Planning Standard (2006)

6.4. Incorporation of Indigenous Traditional Knowledge

Indigenous knowledge is used by Indigenous people who have a long-standing and complex relationship with a local area. Like western science, traditional knowledge is a systematic approach to acquiring, storing and transferring information of their traditional lands.

Forest management planning provides Weyerhaeuser with the opportunity to incorporate Indigenous traditional knowledge, where applicable, when considering broad landscapes with long term forecasts of natural and anthropogenic development.

Weyerhaeuser recognizes that the key to ensuring an effective transfer of knowledge between Weyerhaeuser and the Indigenous communities we consult with is to maintain effective and mutually beneficial relationships built on consistency and trust.

Specific projects where we have worked with Indigenous peoples to incorporate their traditional knowledge include:

- Development of Weyerhaeuser's Indigenous Awareness training program
- Annual participation at Traditional land use camps
- Participation in ceremonial round dance celebrations
- Annual and strategic planning consultation
- Caribou Range Plan Development
- Traditional Use Inventory Management Studies

Photo credit: Aseniwuche Winewak Nation

6.5. Climate Change

Forest ecosystems are highly dependent upon climate for distribution of tree species, their growth, productivity and health, and are predicted to respond in a variety of ways to a changing climate.
Climatic variables such as mean annual temperature, mean annual precipitation, growing degree days and an annual moisture index are monitored by the Canadian Forest Service and the Province to gauge the change in climate and identify trends and patterns.

Based on these observations, one can expect winters to trend warmer with increased precipitation, spring and summer periods are predicted to be earlier but with reduced soil moisture, and there will be a longer frost-free growing season. The climate is expected to be more variable with more frequent extreme weather events and increases in water scarcity[27]. It can be assumed that this will have significant impacts to:

- forest hydrology
- competition from shrubs, grasses and invasive species
- forest biodiversity
- forest growth and productivity
- natural forest disturbances (drought, wildfire, outbreaks)

Without clear evidence as to how climate change will affect the Defined Forest Area, Weyerhaeuser will commit to following emerging research and responding as necessary. As a member of the Forest Products Association of Canada (FPAC), Weyerhaeuser subscribes to the "30 by 30" Climate Change Challenge, which seeks to lower forest sector carbon emissions in Canada by 30 MT, by 2030.[28] One of the measures to achieve this target is to maximize the carbon storage potential of forests through intensive management practices, as described in this plan.

6.6. Land base Definition

The land base is a spatial representation of the DFA as at May 1, 2017. Primarily developed to support the timber supply analysis (TSA) process, the land base contains attributes such stand age, timber yield strata, timber productivity and areas to be deferred or excluded from timber harvesting activity. Development of the classified land base is described in detail in *Annex 4: Classified Landbase*.

[27] Climate Change and Alberta's Forests, HF Cerezke, April 2008
[28] FPAC News release, May 2, 2016

6.7. Divided Land base

Discussions regarding how to model this land base began in the early stages of planning activities. Modeling the contributing land base as a single land base was proposed to as an approach that could better address the ecological forest values as well as to maximize flexibility in the coniferous and deciduous timber supply. This approach would create a total coniferous and deciduous annual allowable cut for the area without assigning incidental and primary volumes.

A successful single land base management strategy is heavily dependent on a fully functional joint operation between the FMA holder and the quota holders which, at the time of planning activities, there has been a continued lack of success in this area. At this time, this approach was not supported by Weyerhaeuser, however all three operators are committed to improving the joint working relationship and this strategy will be revisited in the next plan.

For the 2019 Forest Management Plan FMA6900016 will continue to operate as a divided land base where the conifer operator operates in stands identified as Pure Conifer (CX); Conifer Leading Mixed woods (CD); Deciduous Leading Mixed woods (DC) and Deciduous overstory/ Conifer Understory Switch Stands (D_US). This is referred to as the <u>conifer land base</u>. The deciduous quota holders operate in Pure Deciduous (Dx) stands. This is referred to as the <u>deciduous land base</u>. All stands, regardless of broad cover group (D, DC, CD, C, and Du) contributed to both AAC's as either primary or incidental volume.

6.8. Sustained Yield Unit

This Forest Management Plan represents all of Forest Management Unit G16. Weyerhaeuser Grande Prairie's FMA does not cover the entire FMU area so final harvest levels include both FMA and non-FMA areas.

6.9. Planning Period/ Horizon

The effective date of the land base and the modelling start date is May 1, 2017. A 202-year planning horizon was used for the TSA modeling process. The first period is 2 years (2017-2019) and the remaining 40 periods are 5 years each (2 years + 200 years).

6.10. Growth and Yield

Weyerhaeuser Company Ltd. developed 38 new yield curves for the Grande Prairie Timberlands Forest Management Area (FMA #6900016). The yield curve development process was based on permanent sample plots from natural fire-origin and pre-1991 managed stands and RSA performance survey data collected across the defined forest area.
Stratification was based on Weyerhaeuser's base yield strata using either Alberta Vegetation Inventory attributes in natural stands and pre-1991 managed stands or a combination RSA stratification/ silviculture declaration plus treatment information in managed stands. The strata

are a modification of the Alberta Planning Standard base 10 yield strata, minus the Douglas-fir (Fd) stratum.

A detailed description of the data, methods, assumptions and processes used to develop yield estimates for natural and managed stands in the net land base can be found in *Annex 5: Yield Curve Development.*

6.10.1. Conifer and Deciduous Utilization

The following describes the utilization used to determine the harvest levels in the Preferred Forest Management Scenario as well as the operational utilization for FMU G16 for all companies, all dispositions, all AAC types and all species.

Top diameter=	10cm
Stump Diameter=	15cm
Stump Height=	15cm
Minimum Length=	3.66m

6.10.2. Cull

Cull information was developed based on the document titled "Tree Length Utilization in Harvest Operations" (AAF 2015c) that speaks to the importance of all yield estimates being compiled to a tree length utilization standard and the scaling system being dependent on all harvested timber crossing an approved scale.

Weyerhaeuser has long term contractual volume obligations to deliver roundwood pulp to International Paper's on-site facility. In order to meet this obligation, as well as deliver the fibre needed for their own lumber facility, Weyerhaeuser processes each stem down to a 4" top and include crook, sweep and forked stems as acceptable pulp loads. Both pulp loads and saw log loads are captured in their yard scaling program. Roundwood pulp accounts for, on average, 20% of the fibre brought across the scales in Grande Prairie. This practice satisfies the Province's requirement to account for tree length utilization and all harvested timber crossing an approved scale.

The cull deductions below are applied within the Timber Supply Analysis.[29]

Conifer cull deductions for all broad cover groups is 2.3%.

Deciduous cull deduction is 6.33% for pure conifer and mixed wood stands and 4.73% for pure deciduous stands.

[29] GY-0003 Deciduous and Conifer Cull Deductions; AIP July 31, 2017; with endorsement from Norbord and Tolko.

6.11. Minimum Harvest Ages

Based on the variance created using the 2009 Spatial Harvest Sequence, Weyerhaeuser started to move away from considering only minimum harvest ages to assess merchantability. Stand volume and stand height proved to be far more accurate in determining stand merchantability and feasibility of harvest.

We applied a minimum volume criterion to each yield group to determine the age at which the minimum volume would be achieved. This age is typically below the Culmination MAI age and the MHAs normally accepted by the province. The minimum ages described below were proposed to the province and accepted for the purpose of developing the TSA.[30]

- Natural stands=
  - (CX) = min 100 m^3/ha of conifer volume, or 70 years, whichever was most constraining
  - CD, DC, D_US = min 125 m^3/ha of conifer volume, or 70 years, whichever was most constraining
  - DX = min 125 m^3/ha of deciduous volume, or 60 years, whichever was most constraining

- Existing and future managed stands=
  - CX= min 150 m^3/ha conifer volume, or 70 years, whichever was most constraining
  - CD, DC, D_US= min 125 m^3/ ha of conifer volume, or 70 years, whichever was most constraining
  - DX= min 125 m^3/ha of deciduous volume, or 60 years, whichever was most constraining

6.11.1. Impact of Reducing Minimum Harvest Ages

The PFMS relies heavily on harvest from within the Caribou Ranges (up to a maximum of 550,000m^3/ year) where most of the overaged stands are found. As shown in Figure 6-1, there is a significant amount of 120-200year old stands being harvested. This trend continues heavily through year 35 when it starts to reduce.

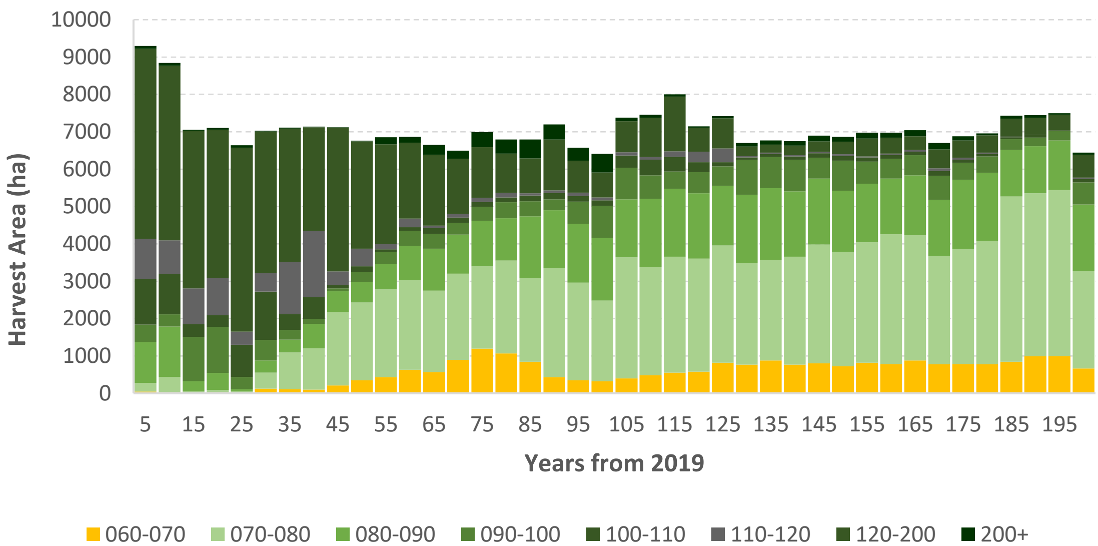
There is virtually no difference between the unaccelerated (Baseline) scenario and the PFMS in the number of young stands contributing to the AAC.

Conifer stands between 70-80 years old start to have a significant presence in the sequence after the second decade and harvest in the caribou range is limited and continue to contribute to the AAC throughout the planning horizon, providing minimum merchantability requirements for height and volume are also met.

[30] TSA-0004-Minimum Harvest Ages; September 28, 2018

Deciduous stands between 60-70 years old start to show up in the sequence around year 40, peak at 15% of the harvest area in year 70 and then slowly decline again to around 10% of the sequenced cut.

Figure 6-1. Harvest Area by Average Stand Age (PFMS)



6.12. Operationalizing stands with 10-40% Larch

The focus for improvement in overall stand utilization was initially driven by the Healthy Pine Strategy/ accelerated harvest PFMS in the previous FMP and resulting midterm fibre drop. The 2019 FMP focusses on accessing enough conifer to meet wood flow needs for the facility. One of these strategies has Weyerhaeuser committed to ensuring all accessible stands with at least 125m^3/ha of merchantable stems are sequenced and are harvested, including stands with 10-40% Larch. Although Weyerhaeuser understands that including stands that we have normally avoided is associated with some risk, it is recognized that leaving large areas of unmanaged forest significantly elevates the risk of forest health infestation as well as risk of wildfire.

The criteria for the removal of stands due to >40% Larch or <8 calculated site index is described in *Annex 4: Classified Landbase*. The formula to adjust for the Larch within a contributing stand is described in *Annex 5: Yield Curve Development.*

Merchantable stands with 10-40% Larch and a calculated site index > 8 have been included in the contributing land base and will be operated as they become eligible for harvest with efforts being made to schedule these stands within the first decade of the planned sequence.

Table 6-1. Proportion of Harvest from 10-40% Larch stands

Period (harvest years)	Annual Harvest Area of stands with 10-40% Larch (ha/yr)	Total Annual Harvest Area (ha/yr)	Proportion of Harvest Area with Larch between 10-40% (%)
1 (2019-2024)	464	9,309	5.00%
2 (2024-2029)	362	8,840	4.10%
3 (2029-2034)	224	7,050	3.20%
4 (2034-2039)	316	7,105	4.50%

An overview map showing these stands has not been included as such low proportions are hard to identify spatially.

Planned openings with 10-40% larch will be clearly identified in the block book descriptions and will receive intensified planning activities including laid out retention, stem identification and strategic roading. The overall operational strategy to mitigate the risk for stands with a 10-40% Larch component would be to avoid the larch wherever possible by marking individual stems and/ or including larch stems in laid out patch and clump retention. Temporary harvest road plans will be developed to avoid the larch stems wherever is possible. Where larch cannot be avoided, a portion may be used in crossing installation. The following photos are examples of how we are currently marking Larch stems in the approved harvest openings to facilitate avoidance by the harvest operators. These photos are also useful in demonstrating the productivity of the growing sites and the merchantable species in the stand we are targeting for harvest.

Photo credit: Apical Forestry Consulting; Pinto/ Pinto Cut Across Cost Zones

Weyerhaeuser fully intends to utilize any Larch stem that cannot be avoided and is harvested. Potential markets currently being explored include- commercial firewood operators, local sawmill operators, Weyerhaeuser Sawmill, International Paper and Norbord. If interest from a local market is not available, Weyerhaeuser has several existing relationships to provide firewood to local indigenous communities and campgrounds and the Larch stems will be used to fill this need. Larch that is harvested will be tracked and drained from the conifer annual allowable cut. Dues will be paid on this volume per the Timber Management Regulation.

It is anticipated harvested Larch will form an extremely small percentage of the overall stand volume and for this reason, Weyerhaeuser chose not to create a separate stratum for it. These stands will be transitioned as per the reforestation strategy described *Table 6.2 Silviculture Matrix*. Weyerhaeuser does not intend to plant larch in these openings as it will come back naturally as ingress using the standing volume left as a reliable seed source. Leave for Natural (LFN) for Larch is included as the preferred method of Seedling Establishment in the reforestation strategy and there are options for site preparation on cold and wet soils where required.

Weyerhaeuser commits to reporting utilization and reforestation performance of stands with a 10-40% larch component in the 5-year Stewardship Report using establishment and performance survey data.

6.13. Structure Retention Strategy

For the 2019 FMP, Weyerhaeuser's target for merchantable retention is 4% of the approved area to be harvested. Weyerhaeuser has reduced the amount of contributing land base by 4% which replaces the need to account for retained volume by reducing the Annual Allowable Cut. The hectares that represent the 4% of retention will be removed from each model block polygon aspatially and will be illustrated within the classified land base table (4.7).

<u>Definitions</u>
Single Tree retention refers to single trees left standing in the harvested area. There is a higher potential for blowdown, but single trees still have biodiversity value and after falling, large decaying logs can provide habitat for a whole community of organisms.

Small clump retention refers to small groups of trees (~20) growing together that are left undisturbed. Clumps should be distributed throughout the block.

Patch Retention is a large group of trees (>30) left within harvest blocks. The shape and size should be highly variable and may include understory trees and shrubs. A series of patches can act as potential wildlife corridors.

To achieve the 4% merchantable target, larger cut blocks with have larger and more frequent clumps and patches left undisturbed.

6.13.1. In Block Structure Retention Practices

Retention areas provide an important source of dead wood, standing and down structure and intact forest floor that increases biodiversity and habitat value throughout the stand rotation. In block structure retention is designed to create and/ or maintain structurally complex stands (e.g. a combination of large old trees, snags, downed trees etc.) and more closely mimic natural disturbance events at a landscape scale.

The structure retention target is 4% representative retention. The contributing land base has been reduced using a modeling function by 4%, which will replace the need to reduce the AAC volume.

Retention will be comprised of a combination of single stems, clumps, and patches. The 4% area retention target is a target and the focus should be on finding opportunities to create representative structure retention. Retention will be representative of the stand and will be spatially well-distributed within all harvested openings to provide vertical structure, a variety of wildlife habitats, travel corridors and coarse woody debris over the long term.

6.13.2. Operationalizing Retention

Retention will be a combination of pre-planned (laid out) and operational (at the operator's discretion). Forest Planners and Forest Operators will strive to retain structure in the following manner:

a) Retain residual structure around riparian areas including lakes, rivers, creeks, streams and wetlands.
b) Retain residual patches around unique ecological sites such as clusters of downed woody debris, wolf trees, rock outcrops, dens, nests and mineral licks.
c) Retention patches will take advantage of protecting rare plants, culturally valued plant species or medicinal plants (i.e.: Diamond Willow) identified during layout and/ or Indigenous consultation.
d) Retain residual structure near the harvest area boundary to create a gradual ecotone between the harvest area and un-harvested forest.
e) Retain residual structure in patterns and locations that minimize the potential for blowdown.
f) Leave a combination of patches, clumps, single trees and snags.
g) Leave as many individual stems of non-merchantable trees, shrubs and snags as operationally and silviculturally feasible.
h) Leave as many snags as safely possible to provide perching and cavity nesting opportunities.
i) Leaning snags or trees of non-merchantable species that are greater than 6 m in height that create a safety hazard may be felled to create safe working conditions.
j) Snags within 40 m of roads, camps, landings, fence lines, power lines and machine maintenance areas may be felled to create safe working conditions
k) The following types of blocks may have less than 4%, but will be greater than 0%, representative structure retention:
    - Block openings smaller than 10 hectares
    - Narrow blocks (blocks that are less than 120 meters[31] wide)

[31] 120m was identified as being the area required to be able to safely facilitate road plans through a strip of timber (60m on either side) without the risk of retained trees blowing over onto roads, wood decks or into the adjacent standing timber.

6.13.3. Measuring/ Monitoring & Reporting

a) Retention patches that are totally contained within the block boundary will contribute to retention targets.
b) Retention patches that exist adjacent to the boundary but were originally identified as part of the approved block polygon (i.e.: harvestable area that was intentionally left) will contribute to retention targets.
c) Retention patches that are part of riparian buffers or are adjacent to the block boundary that were not part of the approved block polygon will not contribute to retention targets.
d) The retention target will be achieved for each harvest opening. The area of retention will be captured and reported through the cut block delineation process as detailed in the Spatial Data Directive.
e) Single tree and snag retention will be observed and recorded on the Block Monitoring Form. Single tree retention can be converted to an area by using the following formula:

Area = (number of live trees/piece size) / (average volume per ha)
where piece size = number of trees equaling 1 m^3 net merchantable volume
E.g. # live trees = 50, piece size = 2.5 trees / m^3, average volume/ha = 200 m^3/ha
Area = (50 trees/2.5 trees/ m^3) / (200 m^3/ha) = 0.1 ha of structure retention

f) Existing mapped insular retention patches are identified in the land base and tagged as "retention". Post 2019 mapped insular retention will be identified and tagged annually as part the cut block update process and deferral will be as described above.
g) It will be the responsibility of each operator to provide a summary of their performance towards achieving the structure retention target for the most recent available retention data in the Annual Operating Plan and in the Stewardship Report.
h) Mapped insular patches are deferred for a full rotation and are only available for harvest once the rest of the block becomes merchantable. This is providing the patch is still standing as it will undergo natural succession (as per a natural stand).


Photo credit: Wendy Crosina- examples of stand level structure retention

6.14. Forest Health Strategy

6.14.1. Mountain Pine Beetle

At present, Weyerhaeuser has harvested much of the pine dominated stands in lower elevation areas. There is some remaining MPB in higher elevation areas, but rate of spread is relatively low and is in caribou range. Weyerhaeuser is not proposing a surge cut as a strategy to address Mountain Pine Beetle infestation.

Heavily impacted stands are stands that have been identified as having beetle killed stems and/ or a significant snag count and as having A density crown closure with A density or less understory. Heavily impacted stands were identified and removed from the land base. These stands were scattered throughout the FMA and were largely represented by slivers, retention patches and low density stands that had a minor component of pine when the stand was hit.

The PSP measurements used in the development of FMP yield curves in natural stands needed to adequately reflect MPB mortality. To accomplish this, Weyerhaeuser performed an assessment of the plot measurement to identify the plot measurements that must be excluded from modeling so that the curves would not over-estimate live pine basal area and volume in FMP yield projections. A detailed description of the process is included in *Annex 5: Yield Curve Development.*

The Alberta Stand Susceptibility Ranking (ASSI), compartment risk and r-value are combined to form a final stand ranking system used to develop the Pine Strategy for the current FMP planning and implementation. This Mountain Pine Beetle Ranking process is described in *Section 6 of Annex 4: Classified Landbase.*

Weyerhaeuser has prioritized harvest of available stands identified as high to very high risk of Mountain Pine Beetle infestation in Periods 1-4. Based on learnings from the last 10 years of working in MPB infested stands, Weyerhaeuser did not forecast mortality in susceptible stands. This will allow enough time to salvage affected stands. Stands that suffer mortality within the first 4 periods that are not harvested will be reflected in the next update of the inventory.

6.14.2. Deciduous Mortality

The DFA has been hit repeatedly by deciduous defoliators and drought. This has resulted in varying levels of mortality in deciduous and mixedwood stands where they occur on the landbase. The 2018 Forest Health aerial surveys identified general areas of mortality (*Chapter 4; Map 4-13)* but did not go into stand level details such as impacts to volume. The Spatial Harvest Sequence was guided to target the compartments with identified deciduous mortality as well as the oldest Dx stands, which are typically, though not always, the hardest hit. We acknowledge that as the impacts of the mortality are field verified, some of the sequenced stands will be found to be no longer be merchantable. Efforts will be made to harvest these stands as sequenced to get them onto a managed yield curve however, some may need to be dropped which will create variance in the sequence. Forest Harvest Plans will rationalize additions and deletions required. Deletions because of forest health and/ or low merchantability will be tracked and removed from the contributing landbase in the next FMP.

6.14.3. Other Insects and Disease

Forest operators and the province have a shared responsibility for pest monitoring on the DFA. Forest operators will report instances of significant (>100ha) outbreaks or infestations (VOIT 2.1.2.2). The SHS associated with this plan sequences stands determined to be at risk of known agents and forest operators will work with the province to direct timber harvesting operations to infested or attacked stands outside of the sequence if necessary, to help control spread and salvage damaged timber.

6.14.4. Abiotic Damaging Agents

Forest operators will work with local provincial forest health officers to salvage harvest areas where natural events (e.g. windthrow, snow or hail damage) have occurred causing extensive damage. This is especially important in mature spruce stands to minimize risk of infestation of Spruce Beetle which is currently becoming an issue in British Columbia. In large tracts of impacted area (>100ha) forest operators with aim to leave 10% unsalvaged to contribute to unique habitats (VOIT 1.1.1.5).

6.15. Sites of Biological and Historical Significance

6.15.1. Unique Areas

Unique areas are identified based on uncommon plant communities, the surrounding landforms, uncommon use by wildlife, historical use (oral history) and/ or significant wildfire history. Several unique areas have been identified on the FMA through consultation with recreational users, members of the public or Indigenous traditional users or through a review of historical documents. Identification and protection of these unique areas are carried forward from previous plans. 19 Unique areas have been identified in the 2019 FMP and are described in *Chapter 4: Landscape Assessment*.

6.15.2. Wildlife Features

In a forest ecosystem, a variety of unique landscape features can often host rare plant communities and/or species and provide habitat for small mammals, amphibians, reptiles, and invertebrate species. Examples of these may include riparian areas, swamps and bogs, fens, natural mineral licks, natural springs, dens, nests or breeding sites. When these features are large enough, or previously identified, the feature and associated buffered area (if applicable) are protected from harvest through removal from the contributing land base. When these sites are identified during the operational planning phase, consideration will be given through adherence to the Operational Ground Rules for the FMA. Trumpeter Swan Lakes and associated buffers have been removed from the contributing land base. The operational ground rules for the FMA provide direction for planning and operating within vicinities of lakes known to have (or have had) populations of Trumpeter Swan. Key Wildlife Biodiversity Zones (KWBZ) have been identified and where possible, operations within these zones are scheduled for summer or late fall to avoid disturbing animals during critical periods when energy reserves are low. If operations within the suggested timing restriction is unavoidable, operations should be compressed to minimize the time spent within the zone and concentrated to smaller areas to allow ungulates access to escape terrain and to provide continuing secure habitat.

6.15.3. Historical and Cultural Sites

All harvest plan preparation activities undergo review from a cultural and historical resource perspective.

Historical Resources Overview and Impact Assessments

Weyerhaeuser submits the Annual Operating Plan (AOP) each year so that proposed areas of operation can be screened to determine the annual in-field heritage assessments. The pre-impact fieldwork is conducted during non-frozen conditions and focuses mainly on areas where subsurface (below ground level or dirt work) impacts will be high. Areas identified and having high potential for being archeologically sensitive would undergo further evaluation and potentially a field survey. Mitigation efforts include implementing harvest practices that will minimize ground impacts or, in the case of a significant site, avoidance.

Aboriginal Consultation

Upcoming harvest plans (generally the next three years of harvest) are shared with applicable Aboriginal communities to determine if Weyerhaeuser's proposed plans could affect their respective culturally sensitive sites. Identified sites within the buffered area are field checked as part of the consultation process to determine if any changes are required to the submitted plans. Mitigation efforts may include adjusting the timing of harvest activities or, in the case of a significant site, avoidance.

Photo credit: Sarah Martin (2016)

Consultation field visits with Aseniwuche Winewak Nation and Nose Creek Settlement elders

6.16. Species of Special Management Strategies

Weyerhaeuser strongly believes that research, good science and data, and the use of long-term monitoring programs should form the foundation of good forestry practices. These elements are the basis for our strategies for Species of Special Management. In addition to generating information to improve our management activities, Weyerhaeuser is focused on the ongoing development of programs and projects that will help maintain fiber security and enhance fibre supply on the FMA, now and into the future. A detailed list and description of the research projects, and long-term monitoring programs Weyerhaeuser currently supports on the FMA is described in *Chapter 1: Background Information.*

6.16.1. Non-Timber Value Assessments

The Province provided a package of scripts and tools to assist Weyerhaeuser in undertaking a non-timber assessment for this Forest Management Plan. These tools use current forest conditions as well future conditions to quantify the relative change in non-timber metrics resulting from changes in forest conditions over time. A detailed description of the modeling approach and methodology as well as the results for the baseline scenario and the Preferred Forest Management scenario are provided in *Annex 9- Non-Timber Value Assessments.* Mitigation strategies are also included in *Chapter 7- VOIT Report*.

The 2011 Forest Management Plan had two main objectives:

1) Accelerated conifer harvest focused on removing pine stands at risk to Mountain Pine Beetle, and

2) constrained harvest from the Caribou Ranges

These objectives/ constraints resulted in a spatial harvest sequence with increased harvest pressure in pure conifer stands outside of the caribou Ranges and an imbalance of mature stands within the caribou range.

For the 2019 Forest Management Plan, Weyerhaeuser was directed by the Province to constrain harvest to 550,000m^3/ year from the caribou range for the first decade and further constrained to 200,000m^3/ year applied from the second decade on. As in the 2011 FMP, these constraints apply more pressure to an already heavily fragmented landbase outside of the caribou range. Many of the species of special management depend on unfragmented mixedwood stands for their habitat. Outside the caribou range, much of the mature timber exists within mixedwood stands. Weyerhaeuser anticipates that less of a volume constraint within the Caribou range would have eased harvest pressure outside the Caribou range and that some of the non-timber results would have been more favourable.

6.16.2. Woodland Caribou

The Redrock-Prairie Creek and Narraway are Southern Mountain caribou ranges that overlap the Weyerhaeuser FMA in Alberta. These ranges are found within the Southern Mountain Central Group subpopulation and both ranges are transboundary, extending across the Alberta - British Columbia border. The Redrock-Prairie Creek winter range is entirely within Alberta, as well as a significant part of the summer range, which is already protected by Willmore Wilderness Park and the Kakwa Wildland Provincial Park. The Narraway herd winter range is partly within Alberta, while the remainder of the winter range and the entirety of the summer range are within British Columbia. The focus for this Forest Management Plan will be on the Alberta winter ranges for both herds, which predominantly fall within the Weyerhaeuser Forest Management Area (FMA). The Forest Management Agreement provides the authority to enter the designated caribou range areas to establish, grow, harvest and remove timber and obligates the company to continuously operate a production facility that relies on access to public lands. Access to publicly owned forest resources is subject to the company preparing Detailed Forest Management Plans (DFMP's), which incorporate strategies for caribou and other values, for Government of Alberta approval.

Weyerhaeuser's Caribou Habitat Management Strategy is detailed in *Chapter 6- Appendix 2.*

6.16.3. Grizzly Bear

The FRI Grizzly Bear Research Program 2016 Habitat States Model was used to generate current habitat metrics for each of the Grizzly Bear Watersheds within FMU G16.

To support the continued existence of grizzly bear on the DFA, forestry planning and operations should be conducted in such a way as to minimize the risk to bears within core and secondary habitat.

Suggested mitigation strategies for compartments with GBWU where there is an increased primary sink and/ or a decrease in primary habitat include:

- Minimize construction of new permanent forestry roads by utilizing existing roads where possible and practical
- Reclaim permanent roads that are no longer required into the reasonable future
- Reclaim temporary roads within 2 years and prior to the end of the denning season (~May 1st)
- Utilize non-traditional silviculture access (helicopters) to facilitate timely reclamation of non-permanent AOP roads
- Continue to support research and the development of forest management tools that help to better understand and mitigate impacts to Grizzly Bears.
- Site specific mitigation tools will be discussed during the development of Forest Harvest Plans.

Weyerhaeuser has no plans to add permanent road to the existing infrastructure.

Due to the structure of the current process, consideration can only be given to forest harvesting impacts on grizzly bear in this FMP. There are other issues, such as education, other industrial activity, and human use restrictions that Weyerhaeuser has little or no control over and cannot be addressed here.

6.16.4. Barred Owl

Weyerhaeuser used a regionally specific Barred Owl model based on a Resource Selection Function (RSF) model first developed in 2008[32]. The outputs of this model are the probability of Occurrence and Potential Breeding Pair Habitat. These outputs were based on several variables, including distance to both young and old seral openings, overstory species mix, and the effect of forest edge or perimeter. To continue to support barred owl on the DFA, forest operators will implement the following operational strategies where possible:

1. Timing of Harvest Activities should aim to avoid high risk nesting and fledgling periods (March 14 to July 15).
2. All blocks planned for harvest during high risk nesting periods are assessed with the Migratory Bird Nesting Tool.
3. Blocks scheduled for harvest between March 15 and April 15 in a medium or higher risk category will be assessed utilizing Owl calls. If a response is received, a nest sweep will be conducted. When a nest is located, potential actions include:
    - Move to a block with a lower risk rating, or
    - Shift the timing of harvest, or
    - Buffer the nest area with a 30m or greater buffer, which will be used as part of the structure retention plan for the block.
4. Where they exist, and with consideration to site safety objectives, large diameter snags and decadent overstory aspen/poplar will be retained.
5. Locate roads to avoid high risk barred owl habitat, as determined by the Risk Assessment Tool
6. Incorporate barred owl habitat values where possible when planning structure retention
7. Site specific mitigation tools will be discussed during the development of Forest Harvest Plans.

6.16.5. American Marten

Weyerhaeuser used a model provided by the province which determines habitat suitability for American marten by considering variables such as stand density, availability of mature conifer (specifically spruce and fir) as well as stand height.

Site specific mitigation tools will be discussed during the development of Forest Harvest Plans. In harvest areas identified as high-quality marten habitat, operators will try to favour larger patches of structure retention over single stem and as much downed woody debris as is feasible, with consideration to fire risk. Weyerhaeuser understands that marten is a high value

[32] Russell, M.S., 2008. Habitat selection of barred owls *(Strix varia)* across multiple spatial scales in a boreal agricultural
landscape in north-central Alberta. M.Sc. Thesis, University of Alberta.

species to stakeholders that use the DFA. We will make every reasonable effort to accommodate site specific concerns through mutually agreed upon operational practices.

6.16.6. Songbirds

Weyerhaeuser used a resource abundance model provided by the province which considers variables such as linear features and percent coverage of each tree species. To support the continued existence of a viable populations of songbirds on the DFA, forest operators will implement the following operational strategies wherever possible:

1. Timing of Harvest Activities should aim to avoid critical nesting and fledgling periods (March 14 to July 15).
2. All blocks planned for harvest during specific nesting periods are assessed with the Migratory Bird Nesting Tool.
3. Blocks scheduled for harvest between March 15 and April 15 in a medium or higher risk category will be further assessed. If a nest is located, potential actions include:
    - Move to a block with a lower risk rating, or
    - Shift the timing of harvest, or
    - Buffer the nest area with a 30m or greater buffer, which will be used as part of the structure retention plan for the block.
4. Where they exist, and with consideration to site safety objectives, large diameter snags and decadent overstory aspen/poplar will be retained.
5. Where possible and practical, strive to locate roads to avoid high risk songbird habitat, as determined by the Migratory Risk Assessment Tool
6. Where possible and practical, incorporate songbird habitat values when planning structure retention
7. Site specific mitigation tools will be discussed during the development of Forest Harvest Plans.

6.16.7. Cold Water Fish

Sensitive cold-water fish species of concern in the DFA include Bull Trout and Arctic Grayling. In the absence of a fish specific model, Equivalent Clearcut Area per watershed was used as a surrogate to measure fish habitat disturbance.

In watersheds that are above 30% ECA Weyerhaeuser will commit to incorporating as many of the following mitigation options as possible:

- Anchor retention of vegetative structure along ephemeral & intermittent streams

- Plan cut blocks and roads using Lidar and wet areas mapping to minimize impacts to hydrologically sensitive areas
- Review access construction plan to avoid high risk fish-bearing watercourses
- Implement access management (seasonal closure, partial reclamation)
- Enhanced monitoring in areas deemed to be high risk
- Follow accepted practices for road and water crossing construction, maintenance, removal and remediation
- Participate in shared or integrated access plans with other road owners as appropriate
- Conduct operations so that soil surface disturbance is minimized, and sediment is prevented from entering the stream
- Reclaim roads as soon as possible and under frozen conditions where possible
- Minimize variance through additions
- Site specific mitigation tools will be discussed during the development of Forest Harvest Plans.

6.17. Watershed Assessments using the Equivalent Clear-cut Area

Watershed assessment in the development of FMPs is a requirement of the *Alberta Forest Management Planning Standard* under timber supply analysis *(Section 5.9.13)* and Objective 3.2.1.1.

The purpose of watershed assessment is to:

1. Determine the potential for water yield increases that would result from forest harvesting
2. Use Equivalent Clear-cut Area (ECA) as a measure of disturbance and an indicator of potential water yield increase.
3. Constrain, using timber supply analysis, forestry operations to minimize the potential for adverse changes in water yields.

Weyerhaeuser used the Provincial watershed layer in forest management planning assessments. Slivers of watersheds adjacent to the FMA boundary less than or equal to 500 hectares were omitted from analysis resulting in 184 watersheds being used.

Hydrologic recovery related to vegetation regrowth post-harvest is complex, involving both physical and biological processes spanning long time periods. The time for water yields to return to pre-disturbance levels is a function of the rate of stand development and stand level factors related to rain/snowfall interception storage capacity. In Alberta, hydrologic recovery has been defined in terms of stand volume accrual (i.e. periodic or current annual increment) and found to be related to maximum leaf area of the stand (Brabender, 2005). Using these relationships, complete or total hydrologic recovery coincides with the maximum annual growth rate (current/periodic annual increment) of the stand.

Weyerhaeuser used the provincial recovery curves to calculate hydrologic recovery. The provincial recovery curves calculate Equivalent Clear-cut Area using the FMA AVI data simplified to 5 dominant ECA strata combined with provincial hydrologic recovery regression coefficients.

6.17.1. Stand Level ECA Calculations

1. For each stratum, the current annual increment (CAI) was calculated for each time step. CAI is the annual growth of the stand at a given age. It is defined as the difference between yield and age a and the yield in the previous year:
$$CAI_n = Y_n - Y_{n-1}$$
2. The maximum CAI was determined for each stratum.
3. The hydrologic recovery (%ECA) was calculated for each year up to, and past the year of that maximum:
$$100 - \left(\left(\frac{CAI_{\mathrm{n}}}{\mathrm{CAI_{max}}}\right) * 100\right)$$
4. For all years past the point of maximum CAI the hydrologic recovery was set to zero until another disturbance occurs.

6.17.2. Watershed Level ECA Calculations

1. Once stand level ECA values were determined, the amount of ECA in each watershed was divided by the gross or total watershed area to arrive to a watershed level ECA proportion.
$$\text{Watershed ECA} = \frac{\text{(sum of Stand level ECA)}}{\text{Total watershed area}}$$
2. The level of anthropogenic permanent disturbance (roads, oil and gas developments) was included in the determination of the watershed level ECA calculation.
3. An ECA analysis would be required for Forest Harvest Plans where > 20% variance from the SHS is planned to assess the impacts to the watershed values.

A detailed description of the ECA results for the baseline scenario and the Preferred Forest Management scenario are provided in *Annex 9- Non-Timber Values Assessments.*

6.18. Visual Quality/ Aesthetics Strategy

One of the objectives of the Forest Management Plan is to understand which areas are of high visual importance to Indigenous groups, stakeholders and members of the public. These conversations usually take place during consultation activities and are taken into consideration during the development of Forest Harvest Plans.

A visual quality assessment was completed for the first two periods (10 years) on the 11 areas listed below within the FMA that have been identified as having high visual importance during previous consultation activities as well as areas identified by stakeholders from the Public Advisory Group.

1. Hilltop Lake Recreation Area
2. Kakwa Provincial Recreation Area
3. Lick Creek
4. Musreau Lake Provincial Campsite
5. Sherman Meadows
6. Shuttler Flats Provincial Recreation Area
7. Southview Provincial Recreation Area
8. Spring Lake Recreation Area
9. Torrens Falls
10. Two Lakes Provincial Campsites
11. Nose Creek Settlement

Weyerhaeuser chose observer locations at each of the identified areas. For small sites with little to no variation in vegetation or topography, one point was chosen. For larger sites with a lot of variance (i.e.: a campsite and a lakeshore) more than one point was chosen. The vegetation height was reduced to 0 meters in the canopy height model for proposed harvest in periods 1 and 2 to simulate what a person could reasonably see from the point if harvesting was to occur. This canopy height model was then combined with the elevation data in the bare earth digital elevation model to generate the raster surface layer for use as an input into the viewshed analysis.

Maps showing the Viewshed Analysis of the 20-year SHS (PFMS) for these eleven sites can be found in *Annex 9: Non-Timber Value Assessments.*

Specific strategies and mitigation efforts to reduce the impact of timber harvesting on visual quality for openings within sensitive viewsheds will be identified in Forest Harvest Plans and may include one or more of the following strategies:

- Rescheduling a polygon to allow adjacent vegetation to grow
- Modification of the harvest sequence polygon shape or size
- Strategic placement of forest structure retention and lesser vegetation
- Utilizing natural topography to break up the line-of-sight

6.19. Reforestation Strategy

6.19.1. Stand Transition

As the planning horizon for the Patchworks™ model exceeds the lifespan of most tree species in the FMA area, the model requires rules by which complex changes over times in a stand species composition and density can be modeled. This requires two main assumptions about how Patchworks™ will "grow" these stands from their present state to the end of their lifespan. The first assumption for stand dynamics is straightforward: stands are assumed to retain the same species composition until death/ senescence. The second assumption is that as a stand dies or is harvested, it regenerates back to that same species composition and structure as it develops over time.

Regenerating stands grow at a rate defined by empirical yield curves that are based on data collected from natural forest stands (no silvicultural intervention); from managed forest stands (silviculture treatments) and from modified stands where genetically improved stock has been planted. Realistic transition models are important because they reflect the succession trends that affect yields over the entire planning horizon. Transition models that use stand conversion rules or modified yield curves are only as reliable as the underlying data. Weyerhaeuser's permanent sample plot program and other research initiatives provide ongoing enhancements to stand dynamics data that are periodically used to adjust transition rules and yield curves.

6.19.2. Death Transitions

Evidence of significant decline in conifer volumes could not be found and therefore unharvested conifer stands did not transition because of mortality due to maturity.
To capture deciduous mortality, an age-based mortality constant was implemented like the functions used in the 2011 FMP. Deciduous volume in yield tables is capped at 110 years, flatlined to 130 years and then it declines at such a rate that the pure deciduous component has 75 m^3/ha at 180 years.

6.19.3. Transitioning a DC Stand to a CD Stand

The exception to the second assumption, that as a stand dies or is harvested, it regenerates back to that same species composition and structure as it develops over time, is deciduous leading mixed wood (DC) stands. The Growth & Yield model assumes that all harvested deciduous leading mixedwood stands (DC) within the FMU, regardless of operator, will transition to a coniferous leading mixedwood stand (CD).

This strategy to transition DC stands to CD stands was first approved in the 1989 plan to meet the reforestation stocking standards that were in place at that time. To meet 80% conifer stocking level, the most reliable way to accomplish this was to create CDs out of DCs. The conifer cut level was then set and has been part of the silviculture strategy for the FMA area ever since.

The Timber Supply Analysis Report *(Annex 10: Section 8.5, Scenario #8113)* shows that this transition strategy has very little impact (<1% reduction) on both the conifer and the deciduous harvest flows.

In the Silviculture Treatment Matrix[33] (*Chapter 6; Table 6-2*), there is no path for a DC stand to transition to a DC stand. At the time of the stocking or establishment survey, on managed stands where the deciduous proportion is over-achieved to the detriment of the survival and/or productivity of the coniferous, Weyerhaeuser will implement a stand tending intervention and/ or fill-in plant with spruce or pine.

Weyerhaeuser openings are given a year four (non-legislated) stocking survey and blocks with low stocking or un-stocked patches are fill planted. This is followed with an establishment survey by year 8. We acknowledge that despite the activities in the Silviculture Matrix being executed as planned, some blocks or portions of blocks will be stocked to a DC standard. Based on the performance data from the previous two periods we anticipate transition performance to be approximately 98.5% successful. The 2,285 ha of DC stands (HwPl & HwSx) in the 2017 version of the managed landbase are assigned to RSA based DC yield curve.

Herbicide application constraints around riparian buffers, unfavourable weather during the herbicide application season, small and narrow blocks that are difficult to obtain good herbicide coverage in and site-specific mitigative actions resulting from Indigenous consultation are examples of why this strategy may not be 100% successful on every hectare.
Weyerhaeuser continues to monitor and improve our silviculture practices, including herbicide application, in mixedwood stands.

This includes:

- an increased focus on planting in year 1
- an increased focus on planting 400 series (larger) stock on competitive sites
- prompt herbicide treatments (up to 70% of the area of a mixedwood opening)
- high risk blocks assessed at year 9 or 10 for a second herbicide treatment where needed

6.19.4. Switch Stands

A switch stand is a Pure Deciduous (Dx) stand where there is enough conifer understorey to base management decisions on the understorey age rather than the overstory. For the 2019 FMP Weyerhaeuser is using the following revised criteria[34] to assign switch stands (D_US).

A stand is defined as a Switch Stand (Du) based on the conifer understorey density call (not the understorey call). A stand may be pure DX over a pure DX, but if the conifer understory or tertiary storey meets the criteria described below, it would qualify as a D_US. Typically, the conifer is not yet merchantable, but the strategy assumes that it will be if left for future management.

[33] The Silviculture Matrix has been developed as per the ABFMPS Appendix C- Reforestation Strategies
[34] As agreed by the PDT; May 14, 2018; Issue Document GY0006

Switch Stands applies to all:

- an understory crown closure of at B, C, or D (A excluded); and
- the leading species of the understory is Sw or Se

and;

- an overstory Broad Cover Group of Pure Deciduous with an 'A' density overstory; and
- an understory with ≥250 stems per hectare

Or

- an overstory Broad Cover Group of Pure Deciduous with a 'B' density overstory; and
- an understory with ≥to 501 stems per hectare; and
- a canopy pattern > 2

Or

- an overstory Broad Cover Group of Pure Deciduous with a 'C' density overstory; and
- an understory with ≥751 stems per hectare; and
- a canopy pattern > 2

Or

- an overstory Broad Cover Group of Pure Deciduous with a 'D' Density overstory; and
- an understory with ≥1001 stems per hectare; and
- a canopy pattern > 2

6.19.5. Regeneration Transition

Weyerhaeuser uses a Silviculture Matrix to illustrate how a stand transitions from a source stand to a managed stand. The matrix includes strategies around preferred method of harvest, site preparation, seedling establishment and intervention, where required.

Table 6-2. Silviculture Matrix

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**FMP Yield Strata Transition Sources** (Regenerating Strata)	**Managed FMP Yield Strata Landbase Designation Code**	**Stand Structure** (Species Proportions)	**Limitations to Crop Establishment** (Site, Climate)	**Silviculture System**	**Site Preparation**	**Seedling Establishment (includes LFN)**	**Seedling Density** (SPH Target per Species Type)	**Reforestation Phase Intervention** (Post-seedling establishment)
1	Deciduous AB, CD density D_AB D_CD	Pure Deciduous CD density BASIC D_CD		Pure hardwood (Aw, Pb or Bw) by stocking at Establishment and by crown closure/density at Performance.	Cold, wet soils, competition (grass, forbs), possible low suckering potential, insects and disease, and soil compaction	Clearcut clearcut with retention understory avoidance where feasible	site prep to create microsites is not required; debris management where required	Deciduous = LFN Coniferous= may plant where objectives are to replace harvested secondary conifer volume on the landscape or to reforest areas affected by compaction that do not regenerate from onsite deciduous suckering	Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering to capture site and reduce effects of competition Coniferous= may plant between 1400 -1800 sph of conifer, focusing on roads, landings and other areas likely to have low D stocking (conifer replacement strategy)	None anticipated. Fill planting with coniferous or deciduous will be used where there are non-productive voids, to reforest roads and landings or to meet conifer replacement strategy targets.
2	Deciduous with conifer understory D_US Mixedwood-Hardwood/ Spruce DC_Sx Mixedwood-Spruce/ Hardwood CD_Sx *Sx= Sw or Sb	Mixedwood-Spruce/ Hardwood CD density BASIC SwHw		Spruce leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance	Cold, wet soils, competition (shrubs, grass, forbs), possible low suckering potential (dry sites with coarse soils), insects and disease, deep duff, soil compaction. Deciduous domination of over story canopy may reduce coniferous growth & survival.	Clearcut clearcut with retention understory avoidance where feasible	dry soils= straight plant cold/ wet soils = mechanical site prep to create elevated microsites rich sites= mechanical site prep to create elevated microsites to reduce competition	Deciduous= LFN suckering Coniferous= Plant Sw or Sb Larch replacement= LFN	Coniferous= planting density 1200 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**FMP Yield Strata Transition Sources** (Regenerating Strata)	**Managed FMP Yield Strata Landbase Designation Code**	**Stand Structure** (Species Proportions)	**Limitations to Crop Establishment** (Site, Climate)	**Silviculture System**	**Site Preparation**	**Seedling Establishment (includes LFN)**	**Seedling Density** (SPH Target per Species Type)	**Reforestation Phase Intervention** (Post-seedling establishment)
3	Mixedwood-Hardwood/ Pine DC_PL Mixedwood-Pine/ Hardwood CD_PL	Mixedwood-Pine/ Hardwood CD density BASIC PlHw		Pine (Pl) leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance	Pine-leading mixed wood stands are typically a drier moisture regime, with increased potential for effects of drought & lower deciduous suckering potential. Pine species are less tolerant to shade and competition in association with hardwood species grown on the same site; past insect and disease on the site may affect Pine regenerating stands (esp. Armillaria).	Clearcut clearcut with retention understory avoidance where feasible	dry soils= straight plant cold/ wet soils = mechanical site prep to create elevated microsites rich sites= mechanical site prep to create elevated microsites to reduce competition	Deciduous= LFN suckering Coniferous= Plant Pl Larch replacement= LFN	Coniferous= planting density 1200 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.
4	Conifer-Pure Sw AB density C_SW_AB Conifer-Pure Sw CD density C_SW_CD Conifer-Sw leading with other conifers (AB,CD density) C_SWOC	Pure conifer White Spruce leading CD density BASIC Sw		Spruce (Sw) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sw stands tend to favour the mesic to subhygric, medium to rich sites. Higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs). Insects and disease. Soil compaction from anthropogenic disturbance may limit establishment and growth. At higher elevations cold soils, short summers may increase winter desiccation.	Clearcut clearcut with retention understory avoidance where feasible	dry soils/ shallow duff= straight plant cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites rich sites= mechanical site prep that does not elevate microsites to help reduce competition	Plant Sw as leading species. Potential to low density or fill plant Pl or Sb if found onsite originally. Larch replacement= LFN	planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. LFN= leave for seed **see Reforestation Phase Intervention if the result is underachieved	Grass and shrub competition (as well as deciduous at lower elevations) may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**FMP Yield Strata Transition Sources** (Regenerating Strata)	**Managed FMP Yield Strata Landbase Designation Code**	**Stand Structure** (Species Proportions)	**Limitations to Crop Establishment** (Site, Climate)	**Silviculture System**	**Site Preparation**	**Seedling Establishment (includes LFN)**	**Seedling Density** (SPH Target per Species Type)	**Reforestation Phase Intervention** (Post-seedling establishment)
5	Conifer-Pure Sw AB density C_SW_AB Conifer-Pure Sw CD density C_SW_CD Conifer-Sw leading with other conifers (AB,CD density) C_SWOC	Pure conifer White Spruce leading CD density GENETIC Sw_G351p1 (G1 zone, G351 Phase 1)		Spruce (Sw) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sw stands tend to favour the mesic to subhygric, medium to rich sites. Higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs). Insects and disease. Soil compaction from anthropogenic disturbance may limit establishment and growth. At higher elevations cold soils, short summers may increase winter desiccation.	Clearcut clearcut with retention understory avoidance where feasible	dry soils/ shallow duff= straight plant cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites rich sites= mechanical site prep that does not elevate microsites to help reduce competition	Plant Enhanced Sw as per deployment schedule. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density	Grass and shrub competition (as well as deciduous at lower elevations) may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
6		Pure conifer White Spruce leading CD density GENETIC Sw_G351p2 (G1 zone, G351 phase 2)								
7	Conifer-Pure Pine AB density C_PL_AB Conifer-Pure Pine CD density C_PL_CD Conifer-Pine leading with other conifers (AB,CD density) C_PLOC	Pure conifer Pine leading CD density BASIC Pl		Pine (Pl) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	High elevation: cold, wet soils, short summers, and the potential for unfavorable conditions for seed cone opening and germination. Winter desiccation especially on Southwest slopes is also a limiting factor. L/M/U elevations: Potential for drought conditions on coarse-textured well-drained soils. In association with Sb, the sites tend towards mesic, with some areas of heavy grass & shrub competition. The mesic sites may experience cold, wet soils from rising soil water after harvest. Insects and disease create a higher mortality potential in Pine	Clearcut clearcut with retention understory avoidance where feasible	dry soils/ shallow duff= straight plant; mechanical site preparation to create small elevated microsites Cold/ mesic soils = mechanical site preparation to create small elevated microsites LFN prescription (L/M/U elevations) = mechanical site preparation (drag or lightly scarify) for mixing and exposure of mineral soil and distribution of cone-bearing branches	Plant Pl as leading species with option to low density/ fill plant with Sw or Sb if found onsite naturally. Low risk/ high Pl cone density sites= option to LFN. Larch replacement= LFN	Planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. LFN= leave for seed with option to low density or fill plant Pl or Sw/ Sb if found onsite originally.	Grass and shrub (+ deciduous at lower elevations) competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**FMP Yield Strata Transition Sources** (Regenerating Strata)	**Managed FMP Yield Strata Landbase Designation Code**	**Stand Structure** (Species Proportions)	**Limitations to Crop Establishment** (Site, Climate)	**Silviculture System**	**Site Preparation**	**Seedling Establishment (includes LFN)**	**Seedling Density** (SPH Target per Species Type)	**Reforestation Phase Intervention** (Post-seedling establishment)
8	Conifer-Pure Pine AB density C_PL_AB Conifer-Pure Pine CD density C_PL_CD Conifer-Pine leading with other conifers (AB,CD density) C_PLOC	Pure conifer Pine leading CD density GENETIC Pl_G147p1 (B1 zone, G147 phase 1)		Pine (Pl) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	High elevation: cold, wet soils, short summers, and the potential for unfavorable conditions for seed cone opening and germination. Winter desiccation especially on Southwest slopes is also a limiting factor. L/M/U elevations: Potential for drought conditions on coarse textured well-drained soils. In association with Sb, the sites tend towards mesic, with some areas of heavy grass & shrub competition. The mesic sites may experience cold, wet soils from rising soil water after harvest. Insects and disease create a higher mortality potential in Pine	Clearcut clearcut with retention understory avoidance where feasible	dry soils/ shallow duff= straight plant; mechanical site prep that does not elevate microsites (i.e. power disc trenching) Cold/ mesic soils = mechanical site preparation to create small elevated microsites	Plant Enhanced Pl as per deployment schedule. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density	Grass and shrub (+ deciduous at lower elevations) competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
9		Pure conifer Pine leading CD density GENETIC Pl_G147p2 (B1 zone, G147 phase 2)								
10		Pure conifer Pine leading CD density GENETIC Pl_G804 (B1 zone, G804)								
11		Pure conifer Pine leading CD density GENETIC Pl_G303 (B2 zone, G303)								
12	Conifer-Black Spruce leading C_SB (AB, CD density)	Pure conifer Black Spruce leading CD density BASIC C_SB		Black spruce (Sb) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sb stands favour a wetter moisture regime. Rising water table and/or imperfect/poor drainage, wet, cold soils, low nutrient regime, significant vegetative competition (grass, forbs), deep duff, shallow rooting leading to higher wind throw potential, soil compaction from operations and anthropogenic disturbance are all limiting factors	Clearcut clearcut with retention understory avoidance where feasible	dry sites/ duff <10cm= straight plant cold/ wet soils/ deep duff= mechanical site prep to create elevated microsites	Plant Sb as leading species. Potential to low density or fill plant Pl or Sw if found onsite originally. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils.	Grass competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**FMP Yield Strata Transition Sources** (Regenerating Strata)	**Managed FMP Yield Strata Landbase Designation Code**	**Stand Structure** (Species Proportions)	**Limitations to Crop Establishment** (Site, Climate)	**Silviculture System**	**Site Preparation**	**Seedling Establishment (includes LFN)**	**Seedling Density** (SPH Target per Species Type)	**Reforestation Phase Intervention** (Post-seedling establishment)
13	All Strata with Larch component 20-40%	All Strata with Larch component 20-40%	As per designation above	Conifer leading with >=20% - 40% Lt	Stands with higher percentages of Lt establishment tend to favour the mesic to subhygric, medium to rich sites. There is a higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs) and mortality and may result in poor growth performance.	Clearcut with Lt avoidance where feasible Retention opportunities where on Lt grows in patches or clumps and in cold, low, wet pockets where growth may be limited	dry soils/ shallow duff= straight plant cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites	Plant conifer leading species as per current yield group. Potential to low density or fill plant Pl, Sw or Sb if found onsite originally. Larch replacement= LFN	Planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils.	Grass competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
14	All Strata	Temporary block roads, landings, processing areas and burn pile locations	TBD	All stand structures	cool, wet soils; compaction, nutrient deficiency	Clearcut	ripper decompaction & roll-back, or decompaction & roll-back, or roll-back	plant conifer (Pl, Sw) aerial seeding Dx- may plant deciduous	planting density 1400-1800 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density aerial seeding density= 12 seeds per square meter	Calamagrostis canadensis and shrub competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.

Column Explanations/expectations:

1. FMP Yield Strata Transition Sources	Natural Yield Types; Current Yield Group (defined in G&Y Plan)
1a. Fd leading strata	Not applicable
1b. D_US (deciduous with conifer understory)	Switch stands as defined in GY-0006
2. FMP Yield Strata Transition Sources	Regenerating Strata. Basic yield curves- planted with natural stock and Genetic yield curves- planted with enhanced stock; defined in G&Y Plan
2a. DC to CD Transition	DC stands transition to CD stands (Sw/Hwd or Pl/Hwd) as agreed to in the 1989, 1999, 2004 and 2011 FMP Reforestation Management Strategies.
2b. Incorporating Genetic Gain Approval Dates	Genetic gain will be effective May 1 of the timber year in which it was approved (May 1, 2017) GoA direction 05/30/2018
3. Managed FMP Yield Strata Landbase Designation Code	To be determined
4. Stand Structure:	The target proportion of coniferous and deciduous in the regenerated stand based on a standard or productivity objectives set out in the TSA assumptions.
5. Limitations to Crop Establishment:	The factors in climate and on the site that are expected to significantly increase the risk of NOT reaching establishment of the regenerated stand (survival) or the regenerated yield objective (productivity). This will contribute to the justification (good science) for the treatments chosen.
6 Silviculture System:	Harvest method. Choosing a silviculture system as a strategy should be about working with the regenerative silvics of the species to be reforested, operational delivery logistics and productivity objectives.
7. Site Preparation:	Operational site treatment strategies to alleviate site or climatic limitations and/or species to be established. Could be raised bed, drag, mixing and sometimes chemical.
8. Seedling Establishment:	The operational strategy to introduce the seedling to the site. Includes planting, artificial seeding, Leave-for-Natural (LFN). Enhanced regenerating strata will not have an LFN prescription. Larch reestablishment is always LFN.
9. Seedling Density:	An operational strategy that is applied to achieve full site coverage (stocking/density targets) in the initial stages of regeneration to reduce the effects of mortality on the objective. May also be a target set as a minimum objective reached during the and used as an early target in an Alternative Regeneration Standard (ARS) objective, a surrogate measure of early productivity. Reforestation Phase (first 14 years after harvest)
10. Reforestation Phase Intervention:	The Reforestation Phase is Year 0 to Year 14. The objective is to get the regenerated stand to the Performance Stage. In the Reforestation Phase there is the Establishment Stage and Performance Stage and in each of these stages one might choose some type of intervention to ensure the objective is reached. This could include chemical, mechanical or manual treatments for grass and for deciduous competition, fill-in-plant for mortality, etc.

The Silviculture Matrix has been developed as per the ABFMPS Appendix C- Reforestation Strategies.

6.20. Seed Availability

The following tables summarize the current and expected inventories for enhanced stock and wild seed. Weyerhaeuser has enough seed inventory to meet reforestation requirements for at least the next 20 years and beyond and we also collect seed annually.

6.20.1. Seed Availability and Deployment Schedule for Enhanced Stock

Deployment of orchard stock will comply with Forest Genetic Resource Management and Conservation Standards 2016 (FGRMS 2016) and will consider cumulative diversity levels of stock deployed together with the limits on deployment outlined in Appendix 21A (FGRMS 2016).[35]

Table 6-3. Orchard G147 and G804 Low Elevation Pine

Species	Orchard	Phase	Height Gain %	Date Approved	Comments
Pl	G147	1	4.00	2011 DFMP	seed is almost used up, only a couple of kg's remain in inventory- not scheduling
Pl	G147	1	6.17	21-Jul-17	initial parent forest after rogueing
Pl	G804	2	9.26	21-Jul-17	new phase 2 orchard, just starting to produce enough seed to collect, as of 2018

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	6.17	4,000,000	2,857,143	10,204	10,204
	9.26	500,000	357,143	1,276	1,276
2	6.17	2,000,000	1,428,571	5,102	15,306
	9.26	2,500,000	1,785,714	6,378	7,653
3	6.17	500,000	357,143	1,276	16,582
	9.26	4,000,000	2,857,143	10,204	17,857
4			0	-	
	9.26	4,500,000	3,214,286	11,480	29,337
5			0	-	
	9.26	4,500,000	3,214,286	11,480	40,816
6			0	-	
	9.26	4,500,000	3,214,286	11,480	52,296

[35] S.E.T. John, Ph.D.; Isabella Point Forestry Ltd.-August 30, 2018

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
7			0	-	
	9.26	4,500,000	3,214,286	11,480	63,776
8			0	-	
	9.26	4,500,000	3,214,286	11,480	75,255
9			0	-	
	9.26	4,500,000	3,214,286	11,480	86,735
10			0	-	
	9.26	4,500,000	3,214,286	11,480	98,214
11			0	-	
	9.26	4,500,000	3,214,286	11,480	109,694
12			0	-	
	9.26	4,500,000	3,214,286	11,480	121,173
13			0	-	
	9.26	4,500,000	3,214,286	11,480	132,653
14			0	-	
	9.26	4,500,000	3,214,286	11,480	144,133
15			0	-	
	9.26	4,500,000	3,214,286	11,480	155,612
16			0	-	
	9.26	4,500,000	3,214,286	11,480	167,092
17			0	-	
	9.26	4,500,000	3,214,286	11,480	178,571
18			0	-	
	9.26	4,500,000	3,214,286	11,480	190,051
19			0	-	
	9.26	4,500,000	3,214,286	11,480	201,531
20			0	-	
	9.26	4,500,000	3,214,286	11,480	213,010

Table 6-4. Orchard G303 High Elevation Pine

Species	Orchard	Phase	Height Gain %	Date Approved
Pl	G303	1	2.18	21-Jul-17

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	2.18	1,000,000	714,286	2,551	2,551
2	2.18	1,500,000	1,071,429	3,827	6,378
3	2.18	1,500,000	1,071,429	3,827	10,204
4	2.18	1,500,000	1,071,429	3,827	14,031
5	2.18	1,500,000	1,071,429	3,827	17,857
6	2.18	1,500,000	1,071,429	3,827	21,684
7	2.18	1,500,000	1,071,429	3,827	25,510
8	2.18	1,500,000	1,071,429	3,827	29,337
9	2.18	1,500,000	1,071,429	3,827	33,163
10	2.18	1,500,000	1,071,429	3,827	36,990
11	2.18	1,500,000	1,071,429	3,827	40,816
12	2.18	1,500,000	1,071,429	3,827	44,643
13	2.18	1,500,000	1,071,429	3,827	48,469
14	2.18	1,500,000	1,071,429	3,827	52,296
15	2.18	1,500,000	1,071,429	3,827	56,122
16	2.18	1,500,000	1,071,429	3,827	59,949
17	2.18	1,500,000	1,071,429	3,827	63,776
18	2.18	1,500,000	1,071,429	3,827	67,602
19	2.18	1,500,000	1,071,429	3,827	71,429
20	2.18	1,500,000	1,071,429	3,827	75,255

Table 6-5. Orchard G351 Spruce

Species	Orchard	Phase	Height Gain %	Date Approved	Comment
Sw	G351	1	2.60	2011 DFMP	original Sw orchard
Sw	G351	2	5.04	2-Mar-18	phase 1 after rogueing

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	2.60	4,500,000	3,214,286	11,480	11,480
	5.04	0	0	-	
2	2.60	0	0	-	
	5.04	4,500,000	3,214,286	11,480	11,480
3	2.60	0	0	-	
	5.04	4,500,000	3,214,286	11,480	22,959
4			0	-	
	5.04	4,500,000	3,214,286	11,480	34,439
5			0	-	
	5.04	4,500,000	3,214,286	11,480	45,918
6			0	-	
	5.04	4,500,000	3,214,286	11,480	57,398
7			0	-	
	5.04	4,500,000	3,214,286	11,480	68,878
8			0	-	
	5.04	4,500,000	3,214,286	11,480	80,357
9			0	-	
	5.04	4,500,000	3,214,286	11,480	91,837
10			0	-	
	5.04	4,500,000	3,214,286	11,480	103,316
11			0	-	
	5.04	4,500,000	3,214,286	11,480	114,796
12			0	-	
	5.04	4,500,000	3,214,286	11,480	126,276
13			0	-	
	5.04	4,500,000	3,214,286	11,480	137,755
14			0	-	
	5.04	4,500,000	3,214,286	11,480	149,235

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
15			0	-	
	5.04	4,500,000	3,214,286	11,480	160,714
16			0	-	
	5.04	4,500,000	3,214,286	11,480	172,194
17			0	-	
	5.04	4,500,000	3,214,286	11,480	183,673
18			0	-	
	5.04	4,500,000	3,214,286	11,480	195,153
19			0	-	
	5.04	4,500,000	3,214,286	11,480	206,633
20			0	-	
	5.04	4,500,000	3,214,286	11,480	218,112

6.20.2. Wild Seed Availability and Cone Collection Program

Weyerhaeuser has enough wild seed inventory to meet reforestation objectives and the seed orchard continues to produce as expected. However, we intend to continue annual collections in the seed zones we are operating with a heavier focus on increasing inventories in seed zones with a lower current inventory, or seed zones we anticipate higher than historical harvest levels, such as the Caribou Ranges.

Table 6-6. Lodgepole Pine

Seed Zone	KG	Seedlings	Hectares
CM3.4	16.64	2,238,842	1,599
DM1.3	51.94	6,988,307	4,992
LF1.2	30.67	4,126,519	2,948
LF1.4	534.60	71,928,305	51,377
M2.1	1.92	258,328	185
SA1.1	15.36	2,066,354	1,476
UF1.3	751.13	101,061,232	72,187
Total	**1,402.23**	**188,667,886**	**134,763**

Table 6-7. Black Spruce

Seed Zone	KG	Seedlings	Hectares
CM3.4	0.64	277,242	198
LF1.4	3.53	1,530,356	1,093
UF1.3	1.95	844,080	603
L2	5.05	2,188,020	1,563
Total	**11.16**	**4,839,698**	**3,457**

Table 6-8. White Spruce

Seed Zone	KG	Seedlings	Hectares
CM3.4	125.88	30,413,466	21,724
LF1.2	612.68	148,031,126	105,737
LF1.4	491.77	118,817,112	84,869
LF2.1	48.62	11,746,868	8,391
SA1.1	10.17	2,457,905	1,756
SA2.1	8.25	1,993,288	1,424
UF1.3	31.39	7,584,400	5,417
Total	**1328.77**	**321,044,165**	**229,317**

Grand Total	**2,742.19**	**514,551,749**	**367,537**

Source Information
WEG (Weyerhaeuser Grande Prairie); Jun 2019; Donna Palamarek, Provincial Seed Officer, GoA
WEW (Weyerhaeuser Grande Cache); Jan 2019; Donna Palamarek, Provincial Seed Officer, GoA

Assumptions
Average seeds per kg: Pine= 269,092; White spruce= 483,221; Black spruce= 867,058
Seedlings = kg of seed x average seeds per kg/ 2 seeds per cavity
Hectares to plant= seedlings/ 1400 trees per hectare

6.20.3. Seed Availability for Conifer Replacement on Deciduous Landbase

Deciduous operators purchase seed from Weyerhaeuser's inventory to reforest conifer within FMU G16.

6.21. Genetic Integrity of Natural Tree Populations

6.21.1. In-Situ Tree Gene Conservation Reserves

Partners in tree improvement programs are required to ensure the genetic integrity of natural tree populations by retaining "wild forest populations" for each native tree species in each seed zone (VOIT 1.3.1.1). Owners of the tree improvement program will determine, as directed by the Alberta Forest Genetic Resource Management and Conservation Standards (FGRMCS), the number of in situ gene conservation stands. Tree improvement program partners are allocated the reserves and are responsible for the establishment and maintenance of in situ reserves.

On April 20, 2004 the province communicated to tree improvement program partners that "until regional gene conservation needs are identified and direction on implementation is provided through the provincial plan, companies with planning and reporting requirements under STIA refer to co-ordination with the provincial conservation plan implementation schedule[36]." In-situ conservation requirements have yet to be finalized[37]. The company will comply with FGRMCS requirements for gene conservation when they are finalized and shared by the province.

6.21.2. Ex-Situ Conservation for Species under Controlled Parentage Plan Programs

Partners in tree improvement programs are also required to establish and maintain an active ex-situ conservation program for species under controlled parentage plan (CPP) programs (VOIT 1.3.1.2). Weyerhaeuser is a partner in the B1 and B2 lodgepole pine, G1 white spruce and L2 black spruce-controlled parentage programs. Table 6-9 below shows details of the progeny trials of these programs for which Weyerhaeuser is responsible. We will consult Alberta on future termination or retention of these trials.[38]

Table 6-9. Controlled Parentage Progeny Trials

Program	Trial ID	Location	Families
B1 pine	G127B	Nose Mtn. Blk 32	400
B1 pine	G127C	Nose Mtn. Blk 11	336
B1 pine	G356C	Bald Mountain	228
B2 pine	G154A	Norris	466
B2 pine	G154B	Red Rock	465
B2 pine	G329C	Shetler Creek	186
G1 white spruce	G135B	Saddle Hills	73
G1 white spruce	G365 A	Pinto Cut Across	323
L2 black spruce	N/A		

[36] Doug Skylar, Executive Director, Forest Management Branch, April 20, 2004
[37] Sima Mpofu March 8, 2018
[38] S.E.T. John, Ph.D.; Isabella Point Forestry Ltd.-January 31, 2019

6.22. Mixedwood Management Strategy

Although Weyerhaeuser is the FMA holder and has forest management planning responsibilities, there are two also two forestry companies with timber allocations within the Defined Forest Area (FMU G16). Weyerhaeuser has conifer and deciduous timber interests and the other companies have deciduous timber interests.

Improving operational efficiencies and balancing all the ecological forest values has been long identified by the timber operators and by local government area foresters as a necessary focus area for this forest management plan. The three primary forest tenure holders (Weyerhaeuser, Norbord and Tolko) as well as local provincial area foresters, worked together to develop a Mixedwood management Strategy. This strategy supports integrated forest management and the interests of the individual companies.

6.22.1. Joint AOP or FHP Submissions

The sequence includes a significant amount of harvest from mixedwood (DC and CD) stands. To ensure that all forest operators can fully operate their AAC's, there will not be room to defer mixedwood stands in favor of pure stands. Minimizing environmental footprint and operating costs going forward is also a focus for all operators. The most effective way to do that is to consolidate operating packages and minimize access roading and mobility costs. In these situations, this would move away from the traditional strategy and allow for joint FHP submissions.

A joint AOP or FHP does not separate harvest by authority or responsibility but rather it assigns harvest responsibility as a package of blocks, using road systems and adjacency as the key decision tool.

The successful execution of joint submissions would indicate a working relationship between the FMA holder and the deciduous operators that would facilitate the move to a single landbase for the 2029 Forest Management Plan.

<u>Link to Operational Ground Rules</u>
Section 3.0 "Operational Planning" of the Operational Ground Rules will be updated to clarify the expectations for a Joint FHP and/ or AOP submission.

<u>Link to traditional FHP submissions</u>
A joint FHP would have all the components of a traditional FHP including a map and a report that clearly show and document the harvest area boundaries, roads and water crossings for the compartment.

<u>Link to the Annual Operating Plan</u>
The AOP gives approval for harvest in the current timber year and confirms intended integration or joint operations including the handling of AAC drain.

Layout/ Consultation
The operator tagged to harvest the block would be responsible for all layout and consultation activities.

Harvesting
The operator harvesting the block will do so as per all applicable operating ground rules. Documentation of block monitoring and compliance with the OGRs will be the responsibility of each company.

Major Amendments
Major amendment requests for joint blocks require sign off by both operators.

Reclamation
The operator tagged to harvest the block would be responsible for the timely completion of all reclamation activities including road and crossing reclamation, debris piling and debris disposal. Weyerhaeuser will assume reclamation responsibility where they have identified access to be left open for silviculture operations.

Reforestation Liability
Weyerhaeuser will retain reforestation liability for all blocks declared to C, CD and DC and Norbord or Tolko will retain reforestation liability for all blocks declared to D. This would include ARIS submissions as well as survey responsibility.

Validation
Joint FHPs and AOPs must be validated by an RFP from all operators included in the submission, regardless of who is the primary developer.

As Built Reporting
The reforestation liability holder is responsible for all post harvest reporting.

6.22.2. Incidental First Deciduous Harvest

As per the wording in Deciduous Timber Allocation Certificates held by Norbord and Tolko-
16. The Certificate Holder shall harvest and accept deciduous timber from integrated operations on a priority basis over the harvest of pure deciduous stands. The Minister has final say over the order of priority of harvest.

6.22.3. Link to AAC Drain and Dues

The operator that is tagged to the volume will hold the responsibility for AAC drain and dues payment for that volume as agreed to with the Province.

6.22.4. Conifer Incidental Deliveries

The coniferous AAC is calculated using incidental volume produced from harvest in Dx stands. Outside of the 8,634 m^3 of coniferous volume set aside for local use, Weyerhaeuser is the only facility with rights to the coniferous timber produced from FMA 6900016.

As per the wording in Deciduous Timber Allocation Certificates held by Norbord and Tolko-

> *C1. Unless otherwise set out in the approved AOP, all merchantable coniferous trees harvested by the Certificate Holder shall be felled, skidded, decked and left for removal by the coniferous disposition holder(s).*

It has been a long-standing practice within FMA 6900019 that the prime contractor for a harvest unit is responsible for delivering all merchantable wood to the appropriate facility. This ensures that operators can successfully meet the required timelines for reclamation and debris disposal. Exceptions to this strategy will be supported by a written waiver from Weyerhaeuser.

6.22.5. Incidental Volume Replacement Strategy

It is recognized that even in pure stands, there will likely be a component of both conifer and deciduous in the stand. Weyerhaeuser's incidental volume replacement strategy is to ensure that all volumes, once harvested, will be replaced back on the landscape as per the appropriate reforestation and transition strategies. In a divided landbase, the incidental volume is the volume that is produced in order to produce the targeted volume in a stand. For example, in C, CD, and DC stands the coniferous volume is the targeted (primary) volume and the deciduous volume is incidental. In D stands, the deciduous volume is the targeted (primary) volume, and the coniferous volume is incidental.

<u>Conifer Landbase</u>
Deciduous content in regenerating stands regenerates through suckering and is typically not a concern. Excessive deciduous stocking in conifer stands is controlled through Weyerhaeuser's stand tending program as described in *Table 6-2 Silviculture Matrix*. Weyerhaeuser's process for chemical stand tending typically targets less than 100% coverage of pure conifer openings, allowing for some natural suckering and survival of deciduous stems in pure conifer cutblocks. For mixedwood (CD) blocks, chemical stand tending typically targets a maximum of 70% of the opening area.

<u>Deciduous Landbase</u>
Coniferous content in deciduous stands will be addressed through a combination of strategies including planting of conifer in reclaimed roads and decking areas and through understory avoidance within the harvested opening. Natural ingress of conifer in the deciduous landbase can be successful depending on site characteristics and is tracked during performance surveys. Establishment surveys are performed via aerial surveys and ingress would not be visible leaf on.

Incidental volume replacement strategies in both landbases are described in the Silviculture Annual Operating Plans. Reforestation information is reported and tracked through ARIS.

6.22.6. <u>Landbase Balancing</u>

Strata balancing will be completed each year as per *Section 5.4 Strata Balancing* in the Reforestation Standard of Alberta document (current version May 1, 2018).

6.23. Access Plans

6.23.1. In-Block Roads

Temporary harvest roads and the crossing structures within them (both in block and inter block) are planned to be constructed and reclaimed within 3 years. The road surface is reclaimed by rolling back the organic matter and the site is returned to full productivity through reforestation consistent with the blocks they are associated with. Reclaimed roads may also receive the same mechanical site preparation treatment as the block.

6.23.2. Long Term Access Plans

Weyerhaeuser is not proposing any new permanent road construction to access fiber in this spatial harvest sequence. Much of the fiber identified in this FMP is accessible using the existing road infrastructure (*Landscape Assessment 4.8; Map 26*). Wherever feasible, forest operators attempt to integrate operations and access plans with external stakeholders in support of the concept of minimizing the linear footprint on the landscape.

In the Caribou Range, some road systems are planned for construction that may be required to remain in place longer than 3 years. The intent is not to create new permanent road, but in order to accomplish aggregated harvest objectives outlined in the Caribou Management Strategy. Where temporary roads will need to stay in place for up to 5 years, the access and reclamation plans will be developed with input from local AAF area foresters and biologists and will be described in the Annual Operating Plan and the Final Harvest Plans.

Table 6-10. Caribou Range Cost Zones with potential access open > 3yrs

Calahoo Zone 3
Lingrell Zone 3
Narraway Zone 1
Narraway Zone 2
Prairie Creek Zone3
Redrock Prairie Zone 1
Redrock Zone 2
Redrock Zone 3
Stetson Zone 2
Two Lakes Zone 3

Chapter 6- Appendix 2: CARIBOU HABITAT MANAGEMENT STRATEGY

1. Background Information

In 2002, the Southern Mountain population of woodland caribou (*Rangifer tarandus caribou*) was assessed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A recovery strategy was published in 2014, which outlines the recovery goal of self-sustaining caribou populations. Management thresholds for disturbance are identified for achieving this goal, as well as metrics around maintaining biophysical habitat.

The Redrock-Prairie Creek and Narraway are Southern Mountain caribou ranges that overlap the Weyerhaeuser FMA in Alberta. These ranges are found within the Southern Mountain Central Group subpopulation and both ranges are transboundary, extending across the Alberta - British Columbia border. The Redrock-Prairie Creek winter range is entirely within Alberta, as well as a significant part of the summer range, which is already protected by Willmore Wilderness Park and the Kakwa Wildland Provincial Park. The Narraway herd winter range is partly within Alberta, while the remainder of the winter range and the entirety of the summer range are within British Columbia. The focus of this management strategy will be on the Alberta winter ranges for both herds, which predominantly fall within the Weyerhaeuser Forest Management Area (FMA). The Forest Management Agreement provides the authority to enter the designated caribou range areas to establish, grow, harvest and remove timber and obligates the company to continuously operate a production facility that relies on access to public lands. Access to publicly owned forest resources is subject to the company preparing Detailed Forest Management Plans (DFMP's), which incorporate strategies for caribou and other values, for Government of Alberta approval.

Weyerhaeuser began establishing baseline caribou habitat data in the FMA as early as 1995 and initiated a GPS collaring program on the FMA starting in 1998. This long-term caribou data set served as the basis for a robust monitoring and research program, which in turn, has informed all of Weyerhaeuser's long-term forest management plans.

<u>Weyerhaeuser Multi Stakeholder Project</u>
In 2016, Weyerhaeuser initiated a multi stakeholder project to begin developing caribou strategies for incorporation in the DFMP. The purpose of the project was to develop credible solutions for presentation to the Province for maintaining sufficient habitat for caribou populations to be self-sustaining, while also ensuring opportunities for economic development. In collaboration with a range of stakeholders Weyerhaeuser used the best available scientific evidence and traditional knowledge to develop these recommendations. The key participants in this project were Weyerhaeuser Company Limited, the Aseniwuche Winewak Nation (AWN) and the Canadian Parks and Wilderness Society (CPAWS). In addition, DUC wetland mapping and waterfowl distribution models were used to help develop caribou management strategies.

We stratified the caribou ranges into zones (1,2,3) based on their importance as caribou habitat and developed management strategies for these areas. These include long-term deferrals in areas of high value caribou habitat, and varying degrees of restriction on forest harvesting in other parts of the ranges. Further strategies are designed to minimize the required road network and overall footprint where harvesting does occur, by implementing aggregated harvest patterns. This will also help ensure sufficiently large habitat patches are maintained in an undisturbed state. In addition, targeted sequencing and fine-scale restrictions on harvest in certain areas are intended to ensure that connectivity within the ranges is effectively maintained.
As a part of this multi stakeholder project, Weyerhaeuser also supports the establishment of a protected area in a location of particular importance for caribou. This 35,000ha area would extend

existing protection from the Kakwa Wildland in an area with high use by the Redrock-Prairie Creek caribou herd, particularly for migration between summer and winter range. The process of caribou range planning has also been used to identify areas of particular importance to biodiversity, and special consideration is given to these locations in this package of recommendations.

Weyerhaeuser Company Limited is committed to funding continued monitoring and research for both caribou herds, including estimation of population trends using telemetry collars, fecal DNA collection and analysis, and surveys.

2. Guiding principles

While consensus may be reached on caribou strategies with other parties (e.g. the CPAWS / AWN / Weyerhaeuser collaboration process), it is necessary to also agree on guiding principles and caveats that apply to the actual implementation of the strategies.

The Weyerhaeuser Forest Management Planning Overriding Guiding Principles[39] are as follows:

1. *Best Available Science*: We base our proposed strategies and outcomes on the best available science and information.
2. *Minimize Social and Economic Impacts*: Where there are two or more potential outcomes that are ecologically equivalent, we will select the one that, first, minimizes overall social and economic impacts at regional levels.
3. *Precautionary Approach*: We will adopt a precautionary approach, while providing for continuous improvement through a process of active adaptive management.
4. *Address impacts on Wood Supply and Costs:* We will minimize, mitigate, and/or otherwise address the impact of new actions on wood supply and costs.
5. *Recognize Changing Forest Health and Protection Circumstances:* We will recognize that in some circumstances the need to address forest health and protection regulations or requirements (e.g. to address occurrences such as fire, insect infestation, and disease) may take precedence over actions agreed to under this agreement (including voluntary or temporary) in a manner consistent with collaborative process.

Weyerhaeuser, CPAWS, and AWN also adopted several its own guiding principles for the “collaborative agreement” to help guide the potential for further refinement of zones and management options:

1. The zonation and timing aspects of agreement may be revisited by mutual agreement, providing caribou habitat and wood supply outcomes are maintained.
2. Periodic review and re-planning may be necessary as a result of external changes in the planning area. Potential triggers for re-planning include changes in land use policy, regulatory requirements for caribou management, and large natural disturbances.
3. Weyerhaeuser, CPAWS, and AWN will advance the collaborative agreement in a constructive and non-adversarial manner.

[39] Based on May 2010 Guiding principles and implementation of the CBFA Agreement.

4. Public materials will be created for the purpose of communicating the collaborative agreement. Other materials will not be shared without agreement of the signatories.

3. Overview of caribou ranges

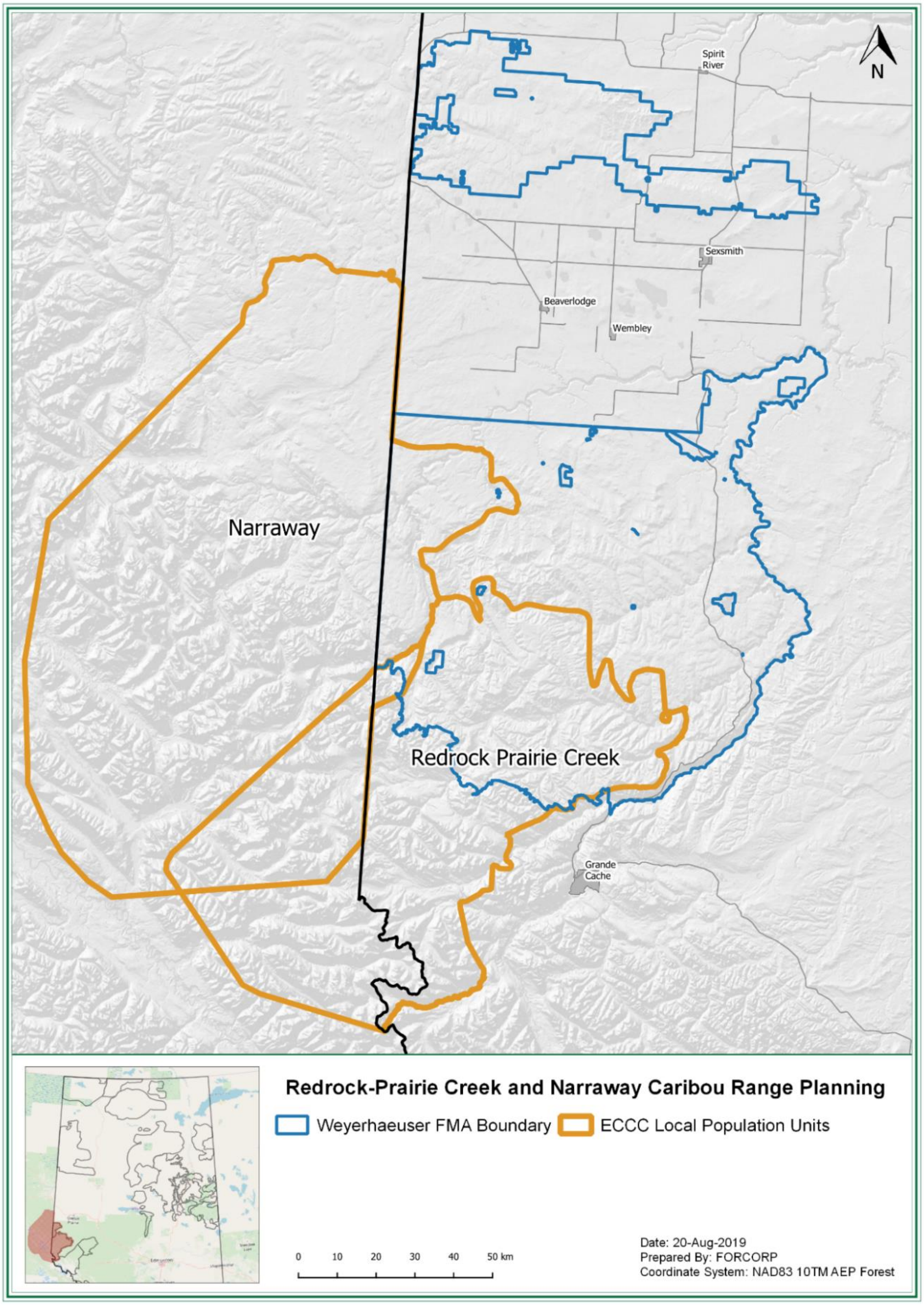
Both the Narraway and Redrock-Prairie Creek herds are transboundary and for the Narraway much of the range is within British Columbia *(Recovery Strategy for the Woodland Caribou, Southern Mountain population, 2014, page 79*), (Map 6-1).

For the Narraway herd, all the range within Alberta is considered winter range and is entirely within the Weyerhaeuser FMA (Map 6-2). The winter range also extends into British Columbia. For the Redrock-Prairie Creek herd, all the winter range is within Alberta, and the majority is within the Weyerhaeuser FMA. All the Redrock-Prairie Creek summer range that is within Alberta is already protected by the Kakwa Wildland and Willmore Wilderness Park. In total 33% of the FMA area overlaps caribou ranges. Winter ranges have been defined by the Government of Alberta using telemetry and other data sources (*pers. comm., GoA*).

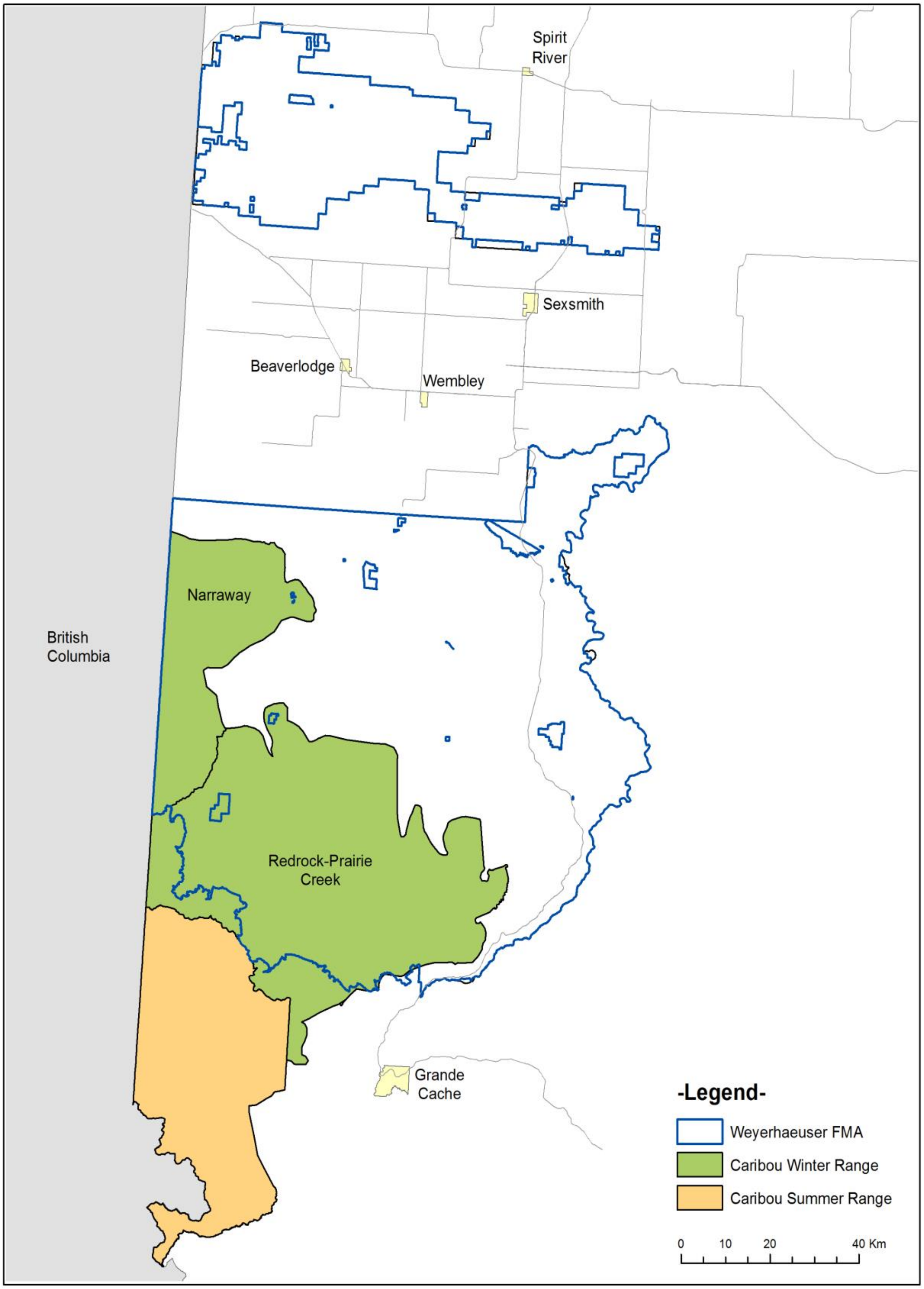
The focus of this project is on the parts of the ranges that are within Alberta.

Table 6-11. Area of Local Population Units in Alberta and BC for the Narraway and Redrock-Prairie Creek herds. Data prepared by Forcorp 20 Aug-2019

Range	LPU Area (ha)	Area in AB (ha)	% in AB	Area in BC (ha)	% of AB portion of range in Weyerhaeuser FMA
Redrock-Prairie Creek	786,271	482,893	61	303,379	56
Narraway	1,313,425	114,502	9	1,198,923	100



Map 6-1. Woodland Caribou, Southern Mountain population, 2014.



Map 6-2. The Redrock-Prairie Creek and Narraway caribou ranges within Alberta, shown in the context of the Weyerhaeuser FMA.

4. Current State Assessment

Weyerhaeuser conducted an analysis of current disturbance footprint for the ranges, based on the best available data (Alberta Biodiversity Monitoring Unit Human Footprint, 2014 and Alberta Wildfire, 2016). A 500m buffer was applied to all anthropogenic disturbances to represent the disturbance zone of influence, while natural disturbances such as wildfire were not buffered (Environment Canada, 2011). It is important to note that the ABMI Human Footprint dataset is more detailed (higher resolution) than the 'visible from 1:50,000 Landsat data' criteria used in the boreal caribou scientific assessment (Environment Canada, 2011). While a 1:50,000 Landsat analysis has yet to be carried out for the Southern Mountain caribou ranges, it is likely that the disturbance values reported would be lower than those calculated from ABMI data. The relationship between the disturbance metrics calculated using ABMI data and the 65% undisturbed habitat threshold are therefore unclear.

4.1. Redrock-Prairie Creek

The recovery strategy describes the target for high elevation areas (summer range in this case) to be "minimal disturbance" but no exact definition is provided. The Redrock-Prairie Creek summer range is 82% undisturbed, and 91% undisturbed if wildfires are excluded. The winter range is currently 29% undisturbed and overall when combining the winter and summer range Redrock-Prairie Creek is 48% undisturbed (Appendix B: Map 6-7).

4.2. Narraway

The Narraway (winter) range is currently 15% undisturbed (Appendix B: Map 6-8).

5. Important areas for caribou (Zone 1, 2, 3)

As recommended in the boreal population range plan guidance (Environment Canada, 2016) Weyerhaeuser identified important areas for caribou in order to guide where undisturbed habitat should be located within the range. This was led by the fRI Caribou Program (Dr. Laura Finnigan lead) and achieved using analyses developed from an extensive telemetry dataset. This resulted in empirically based and scientifically justifiable zones within the ranges, which were then used to design appropriate management strategies. In addition, we identified an area between the Kakwa Wildland and the FMA boundary as being of particular importance and an opportunity for an additional protected area.

Zone 1

Zone 1 was developed by selecting areas predicted as high selection value by the RSFs and combining those with areas identified as being heavily used for connectivity. Connectivity areas were identified using a combination of Traditional Knowledge from AWN, long term telemetry data and science generated through the fRI Caribou Program (see below for detailed description). The total area of zone 1 is 140,768 ha, or 33.5% of the winter ranges (Map 6-2).

Resource Selection Functions

We used Resource Selection Functions (RSFs) developed by fRI Research (Rudolph et al. 2016) to define the basis of zone 1. These were created using data from Global Positioning System (GPS) telemetry collars collected since 1998 (subset used for this analysis Redrock-Prairie Creek: n = 53 individuals, Narraway n = 25 individuals). RSFs use a statistical framework to compare the attributes of telemetry locations of collared caribou to randomly sampled locations that are considered available for use by caribou. They provide an empirical assessment of the areas and habitats selected by caribou in relation to the habitat available to them, permitting spatial predictions of the relative probability of habitat use. fRI Research developed separate RSF models for each herd for the early winter and late winter seasons at both the 2nd and 3rd order of selection. Seasons were determined based on daily movement rates (MacNearny *et al.* 2016). In consultation with fRI Research we determined that the models developed at the 2nd order of selection were at the most appropriate scale for identifying habitat for important areas (Appendix C: Map 6-14 & Map 6-15).

To identify and map higher value habitat we reclassified each RSF probability map into 10 quantiles and selected areas falling within the top 3 quantiles as representative of higher quality habitat. This method replicated that used in the Environment Canada woodland caribou scientific assessment (Environment Canada, 2011). The top 3 quantiles were identified for each of the seasonal RSFs (early winter and late winter) and the resulting areas were combined. This ensured that higher value habitats in both seasons were represented even if an area was identified as important in only one season.

Path Analysis

A 'path analysis' was completed to help identify areas of particular importance for connectivity. The analysis was completed using the GPS telemetry data and the ArcMET extension (Movement Ecology Tools for ArcGIS, University of British Columbia). The tool connects the locations for each collared animal in order of collection date and time. We identified how often each part of the landscape was crossed by caribou (using 2.6-hectare hexagons as units) and assigned a score representing the number of paths crossing over a particular area (Appendix C: Map 6-18). A threshold value was identified (> 12 paths / hexagon, approximately the top 3 quantiles of the count distribution) to identify and map potential corridors and these areas were added to the higher value caribou habitat that was identified using the RSFs. More fine-scale connectivity considerations were also addressed, guided by AWN traditional knowledge data (see section 7.4 and Map 6-11).

Zone 2

Zone 2 was developed using population home ranges. The total area of zone 2 is 72,905 ha, or 17.4% of the winter ranges.

Kernel Density Estimate home ranges

As part of ongoing research by the Caribou Program at fRI Research 95% KDE isopleth home ranges were developed using Weyerhaeuser caribou GPS data (1998-2015). The 95% isopleths were created from KDE raster layers for each collared animal for each season and year, and then individual isopleths were dissolved together to create a population-level isopleth for each season and year. These isopleths were then combined to create 95% isopleths for all years and all seasons (Appendix C: Map 6-13). The population-level KDE home ranges provide an estimate of current and recent caribou range use and were used to define the boundary of zone 2.

Zone 3

Zone 3 was considered to be the remaining areas outside of zone 1 and 2 but still within the caribou ranges in the Weyerhaeuser FMA. The total area of zone 3 is 158,544 ha, or 37.8% of the winter ranges.

5.1. Validation

The zones were validated using a second telemetry dataset, collected by Government of Alberta using Very High Frequency (VHF) collars. Data from 186 VHF collared animals with at least 1 location within the winter range were available for the Redrock-Prairie Creek herd (2,620 locations, 1981-2016) and data from 70 VHF collared animals with at least 1 location within the winter range were available for the Narraway herd (390 locations, 1995-2016). This dataset provides less detail and accuracy than the GPS telemetry but gives a snapshot of caribou distribution over a longer timeframe.

For the Redrock-Prairie Creek data 58% of VHF locations fell within zone 1, 21% within zone 2, 4% within zone 3, and 14% within the proposed protected area. The remaining 3% fell in existing protected areas or in areas outside of the FMA and proposed protected area but within the winter range. For the Narraway data 86% of VHF locations fells within zone 1, 8% within zone 2, and 6% within zone 3. There were also a small number of locations outside of the caribou ranges (Appendix C: Map 6-10).

5.2. Calving

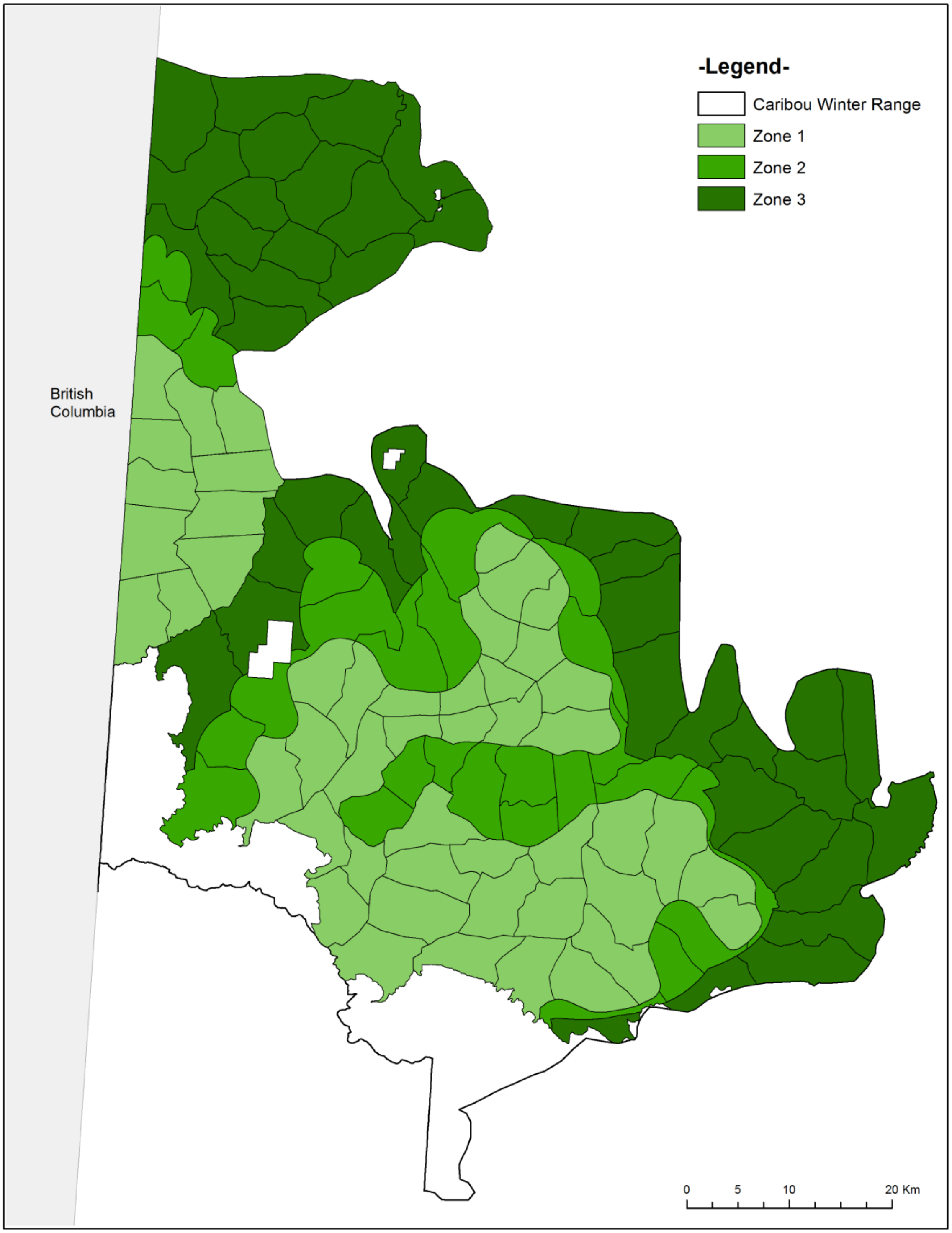
Because this management plan is for the winter ranges only, caribou calving areas were not a major focus. However, calving locations for both herds have been identified using changes in movement rate from GPS telemetry data (Nobert *et al.* 2016). There were only two identified calving sites located within the Weyerhaeuser FMA (~2%), with most of the calving occurring in summer ranges in higher elevation areas in the southern (protected) part of the Redrock-Prairie Creek range and in British Columbia. An RSF has also been developed from the calving locations (Nobert *et al.* 2016) and within the winter ranges there was uniformly low probability of selection for calving habitat (Appendix C: Map 6-16).

6. Access Units

The zones were further subdivided into access units (mean area of 3,156 ha, min of 1,075 ha, max of 5,968 ha, Map 6-3) in order to provide finer scale units for sequencing of harvest. Access Units were delineated manually by following existing features where possible. Creeks, rivers, ridges, and roads were used for most compartment boundaries.

These access units served two main purposes.

1. We designed them to allow for specific management strategies to ensure maintenance of within-range connectivity in areas identified by the AWN as important migration routes, and to protect areas of particularly high biodiversity identified by the CPAWS Blueprint for Conservation. The access units were used as a basis for controlling the sequencing of forest harvesting activity. This included short- and long-term deferrals in certain access units and limiting of the number open at any given time for harvest in certain sensitive areas.
2. The access units were used to design aggregated harvest patterns by only allowing harvesting in a certain number of compartments at any one time.



Map 6-3. Winter ranges with the zones and showing access units

7. Habitat management

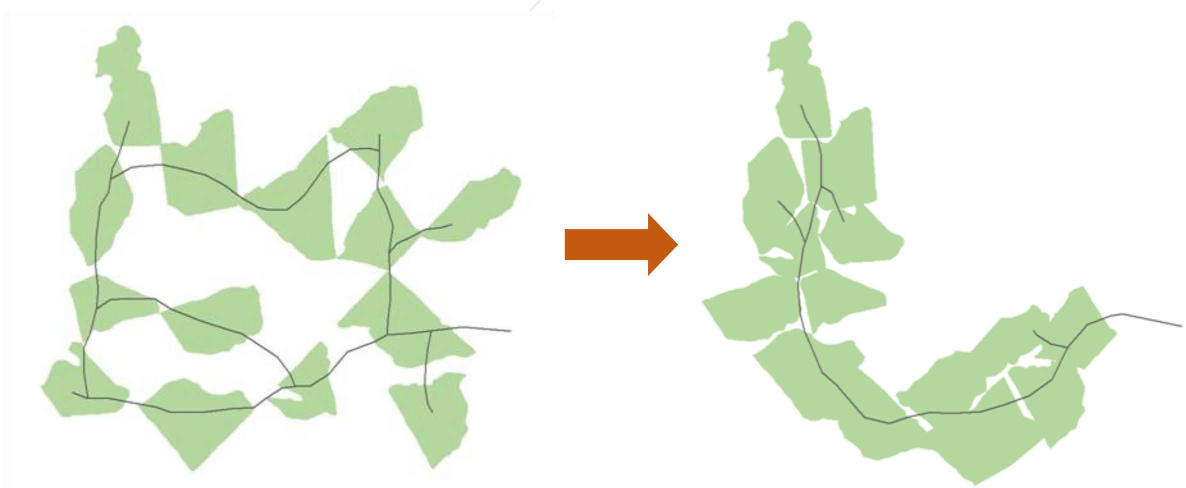
A comprehensive package of management strategies has been developed to minimise the impacts of forest harvesting on caribou, while maintaining sufficient timber supply for Weyerhaeuser Grande Prairie.

7.1. Increasing forest harvest aggregation

Traditionally, forest harvesting used a two-pass harvest system, where approximately half of the available timber in an operating area was harvested using a quilt pattern of small harvest blocks averaging 20 ha in size. Approximately 20 years later, the remaining available timber is harvested. This system results in a fragmented forest with extensive road networks that remain on the landscape for longer periods of time. When including the 500m buffer on all disturbances, this creates a large ratio of disturbed habitat to forest harvested.

Based on the concept of the Natural Range of Variation (NRV, Andison *et al.* 2016) a change in forest management to implement natural forest pattern harvesting methods in the caribou ranges is proposed. The natural forest pattern method uses larger harvest blocks that more closely emulate natural disturbance patterns resulting from wildfires. This reduces the buffered disturbance footprint from forest harvesting and reduces the extent of the road network required for access.

Map 6-4 shows a conceptual view of a traditional harvest block pattern (left) compared to a natural forest harvest pattern (right). The total timber harvest is the same, but the road network is smaller, and the disturbance footprint more closely resembles a natural disturbance event such as a wildfire



Map 6-4. Traditional harvest block pattern compared to a natural forest harvest pattern

7.2. Long-term deferral in core caribou habitat

The areas identified as zone 1 are those that currently have the highest value for caribou and therefore the most restrictive management strategy is proposed for these areas. Weyerhaeuser tested scenarios that included a long-term deferral in these higher value areas.

This zone makes up approximately one third of the ranges and is designed to ensure that this habitat remains as a low priority for harvest. The current management plan has a 60-year deferral in both Zone 1 areas found in the Narraway and Red Rock/Prairie Creek caribou ranges. Weyerhaeuser will work to maintain these long-term deferrals and where possible, extend them into subsequent plans. This will be dependent on fibre supply needs, as well as the occurrence of any catastrophic events, such as fire or large-scale beetle infestation. Restricted harvesting in important areas for caribou

The areas identified as zone 2 are those that are within the current population home range but have a lower habitat value than zone 1. Zone 2 includes areas that are particularly important for connectivity as identified by AWN and others, and additional measures are described in section 7.4 to ensure that this connectivity is maintained.

7.3. Reducing loss of timber to Mountain Pine Beetle (MPB)

The proposed harvest strategy targets areas with the highest MPB susceptibility within the caribou ranges. The Shore and Safranyik Index (SSI) has been successfully used to determine pine susceptibility in Alberta and has been an effective predictive tool for the Grande Prairie FMA. The SSI model has been further refined based on field observations and discussions with Devin Letourneau (Grande Prairie Forest Health Officer) and Kathy Bleiker (Entomologist with the Canadian Forest Service) to consider only pine stands below 1400m elevation as priorities for management. This is a conservative cut-off, as the province of Alberta carries out control measures at up to 1500m elevation. Following the methods used in Weyerhaeuser's 2011 approved Detailed Forest Management Plan (DFMP) SSI scores of 31-50 are considered "high risk" and scores of 51 or greater are considered "very high risk". Within the caribou ranges there are significant quantities of susceptible pine, with 79,677 ha classified as high risk and 10,647 ha as very high risk (Appendix C: Map 6-17).

7.4. Maintaining connectivity identified by AWN migration routes

As part of the traditional knowledge dataset the AWN identified migration/travel routes used by caribou within the winter range. The most recent of these identify routes across the Kakwa River valley between large habitat patches in zone 1 (Appendix C: Map 6-11, red lines). These areas are within the zone 2 boundary and were given particular consideration in the planning process with the aim of maintaining connectivity in this area. Vertically orientated access units were placed across the Kakwa River valley between areas of zone 1 (Map 6-2 and Map 6-4). This ensures that contiguous mature forest is maintained in these areas, allowing for continued connectivity.

The AWN also identified historical migration routes between Redrock-Prairie Creek and the A La Peche caribou range (Appendix C: Map 6-11, dark green lines). While these routes have not been used in the timeframe that telemetry data has been collected, their historical importance is recognised, and further sequencing rules were developed to ensure that limited disturbance is maintained between the boundary of zone 1 and the southern boundary of the range (Map 6-4 and see Section 7.5).

7.5. Maintaining high biodiversity areas identified by CPAWS Conservation Blueprint

CPAWS used the Conservation Blueprint methodology (Ronson & Pendlebury, 2015) to identify and prioritize restoration and protection areas within the Redrock-Prairie Creek and Narraway caribou ranges (Appendix C: Map 6-12). These were delineated using an optimization strategy performed in Marxan software (http://marxan.net/), based on coarse filter conservation features, species-level datasets, habitat intactness, and density of anthropogenic features. Areas were prioritized based on conservation value (irreplaceability) and where trade-offs were possible, on also minimizing socioeconomic costs.

This process identified several areas requiring further consideration in the planning process. An area (8,725 ha) in the southeast of Redrock-Prairie Creek within zone 3 was identified as particularly high biodiversity value and also an area historically used as a caribou migration route (see Section 7.4). As a result, a management strategy was developed using compartments in this area to ensure that the forest in approximately half of this area would be maintained in a mature state over 40 years of age (Map 6-4). A second area (4,626 ha) in the Kakwa river valley was also identified as having high biodiversity value.

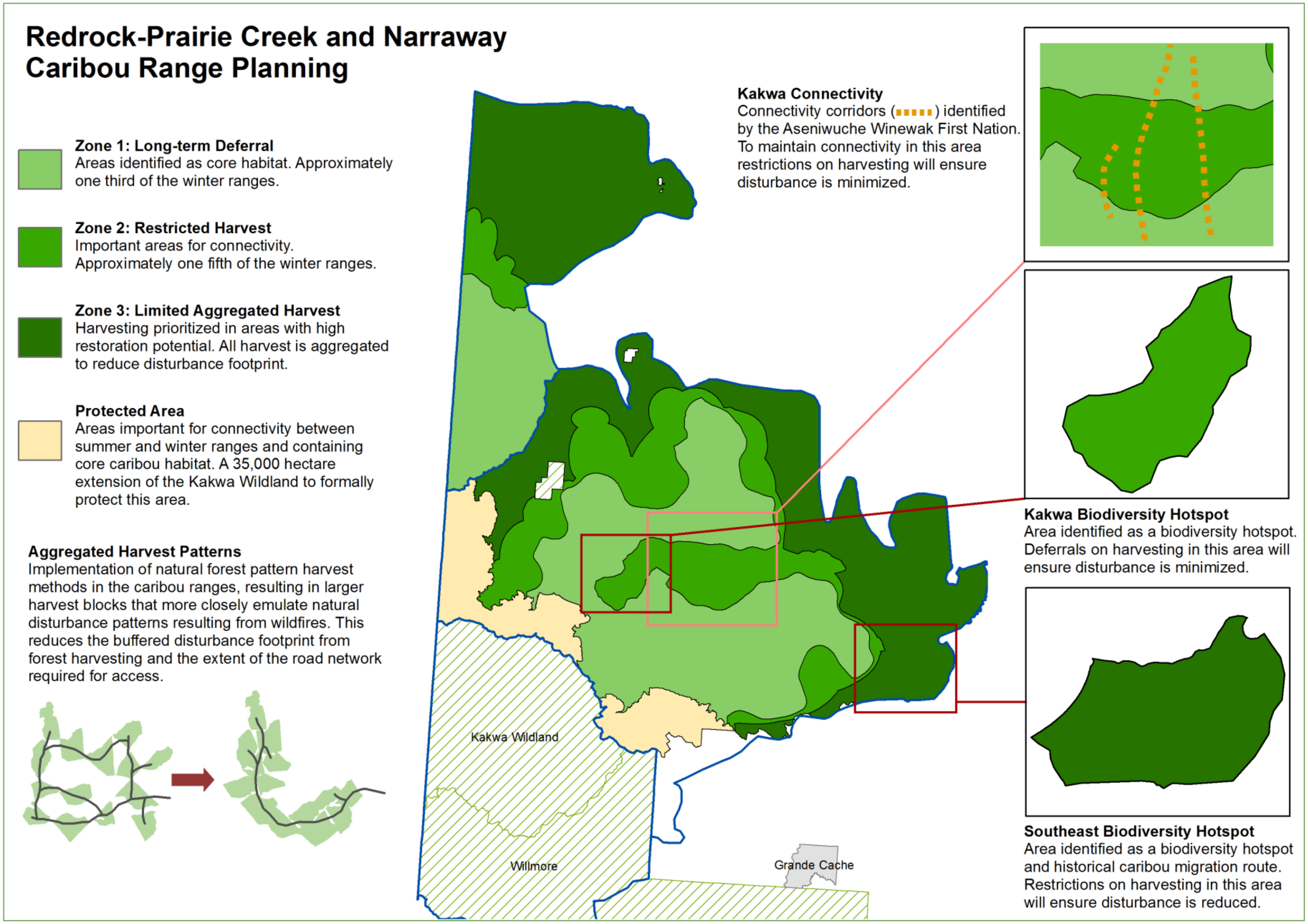
7.6. Protected area extending the Kakwa Wildland

Another important outcome of the multi stakeholder work is the proposed creation of an additional protected area to the north and northeast of the Kakwa Wildland. This area is approximately 35,000 hectares (8.3% of the ranges) and lies between the Weyerhaeuser FMA boundary and the Kakwa Wildland. It has a high concentration of movement paths and telemetry locations for caribou from the Redrock-Prairie Creek herd and is an important area for migrations between winter and summer range (Appendix C: Maps 9, 10 and 18). The area also has a relatively low disturbance level (77% undisturbed habitat, including 500m buffers).

Much of the area is within the subalpine natural subregion, with a small proportion in the alpine and upper foothills subregions. There may be an opportunity for the Province to work with ANW to develop this area as an IPCA (Indigenous Protected and Conservation Area). Weyerhaeuser will follow the lead of AWN on this initiative and support if asked.

8. Legacy Linear Disturbance Restoration in Areas of Forest Harvesting

Seismic lines (linear corridors cut through the forest and used for surveying subsurface geology in oil and gas exploration) are a major contributor to disturbance in the Redrock-Prairie Creek and Narraway caribou ranges. Seismic lines within harvest blocks are treated and planted as part of the harvest block, ensuring their reforestation. Similarly, any seismic lines that are developed into harvest road access are reclaimed and reforested after use, ensuring removal of the linear disturbance as the forest grows. Weyerhaeuser will continue to work with AEP staff and AWN on a larger scale, restoration priority plan for both caribou ranges.



Map 6-5. Management strategies for the Redrock-Prairie Creek and Narraway ranges

9. Management scenarios

Approximately forty different management scenarios were developed and tested using Patchworks timber supply software (Spatial Planning Systems). These scenarios were designed to test management strategies for their impacts on undisturbed habitat metrics for caribou and on timber supply from the FMA. The process of scenario development was iterative, with many different scenarios used to test the impacts of various management strategies

For each scenario we present several outputs:

1. A graph showing the predicted undisturbed habitat condition over time, including a 500m buffer on all disturbances, as mandated in the federal scientific assessment (Environment Canada, 2011). This metric is representative of the disturbance impact of forestry only and does not include possible disturbances from other users of the landscape, such as energy sector development, or from natural disturbances such as wildfire.
2. Statistics on Annual Allowable Cut (AAC), a coarse measure of timber supply. The AAC metric was used in a comparative way to assess the relative impact of different management options. It should not be interpreted as an accurate measure of the volume of timber to be harvested because a variety of other values (e.g. other species, hydrological) must be considered in a DFMP before operations can commence.
3. Forest age class distribution
4. A graph showing the availability of biophysical habitat over time (see Appendix A for a description of biophysical habitat definitions).

From this work a preferred harvest scenario (Scenario 923) was chosen in which Weyerhaeuser felt struck a balance between maintaining caribou habitat and minimising socioeconomic impacts (Appendix C: Map 6-19). This compartment sequence was reviewed with the Government of Alberta (GoA). GoA responded with an alternative compartment sequence.

The final harvest compartment sequence appearing in this plan is based on GoA recommendations and does not necessarily reflect the caribou compartment sequence Weyerhaeuser would prefer to use. Weyerhaeuser will continue to work with the Province in an effort to further refine the compartment sequence after the official submission of the DFMP.

10. References

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MacNearney, D., K. Pigeon, G.B. Stenhouse, W Nijland, N.C. Coops, & L. Finnegan (2016). Heading for the hills? evaluating spatial distribution of woodland caribou in response to a growing anthropogenic disturbance footprint. Ecology and Evolution, 6(18), 6484-6509. doi:10.1002/ece3.2362

Nobert, B.R., S. Milligan, G.B. Stenhouse, L. Finnegan. Seeking sanctuary: the neonatal calving period among central mountain woodland caribou (*Rangifer tarandus caribou*). Canadian Journal of Zoology, 2016, 94:837-851, 10.1139/cjz-2015-0262

Rudolph, T., D. MacNearney and L. Finnegan. 2016. Woodland caribou resource selection in relation to Alberta Vegetation Index habitat data within the Weyerhaeuser Grande Prairie Forest Management Area. Technical Report prepared for Weyerhaeuser Co. Ltd. Grande Prairie, November 2016. pp. 34 +vii.

Ronson, A., and D. Pendlebury. 2015. Conservation Blueprint of Northern Alberta: Prioritizing areas for protected areas planning. CPAWS Northern Alberta. 69pp. ISBN: 978-0-9949229-0-8.

Appendix A: Biophysical habitat

This appendix describes the biophysical attributes that define critical habitat for Central Group southern mountain caribou.

Table 6-11. Biophysical attributes for Central Group southern mountain caribou critical habitat (Environment Canada, 2014).

		Function	Features	Attributes
Early Winter Range	High elevation	• Security • Foraging • Travel	• Windswept alpine slopes • High elevation subalpine parkland and subalpine forests • Lakes	• Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low elevation	• Security • Foraging • Travel	• Low elevation forested habitats (pine, spruce, pine/spruce mixed stands), meadows, wetlands, forested wetlands • Lakes	• Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
Late Winter Range	High elevation	• Security • Foraging • Travel	• Windswept alpine slopes • High elevation subalpine parkland and subalpine forests • Lakes	• Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low elevation	• Security • Foraging • Travel	• Low elevation forested habitats (pine, spruce, pine/spruce mixed stands), **black spruce fringes around wetlands**), meadows, wetlands, forested wetlands • Lakes	• Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions

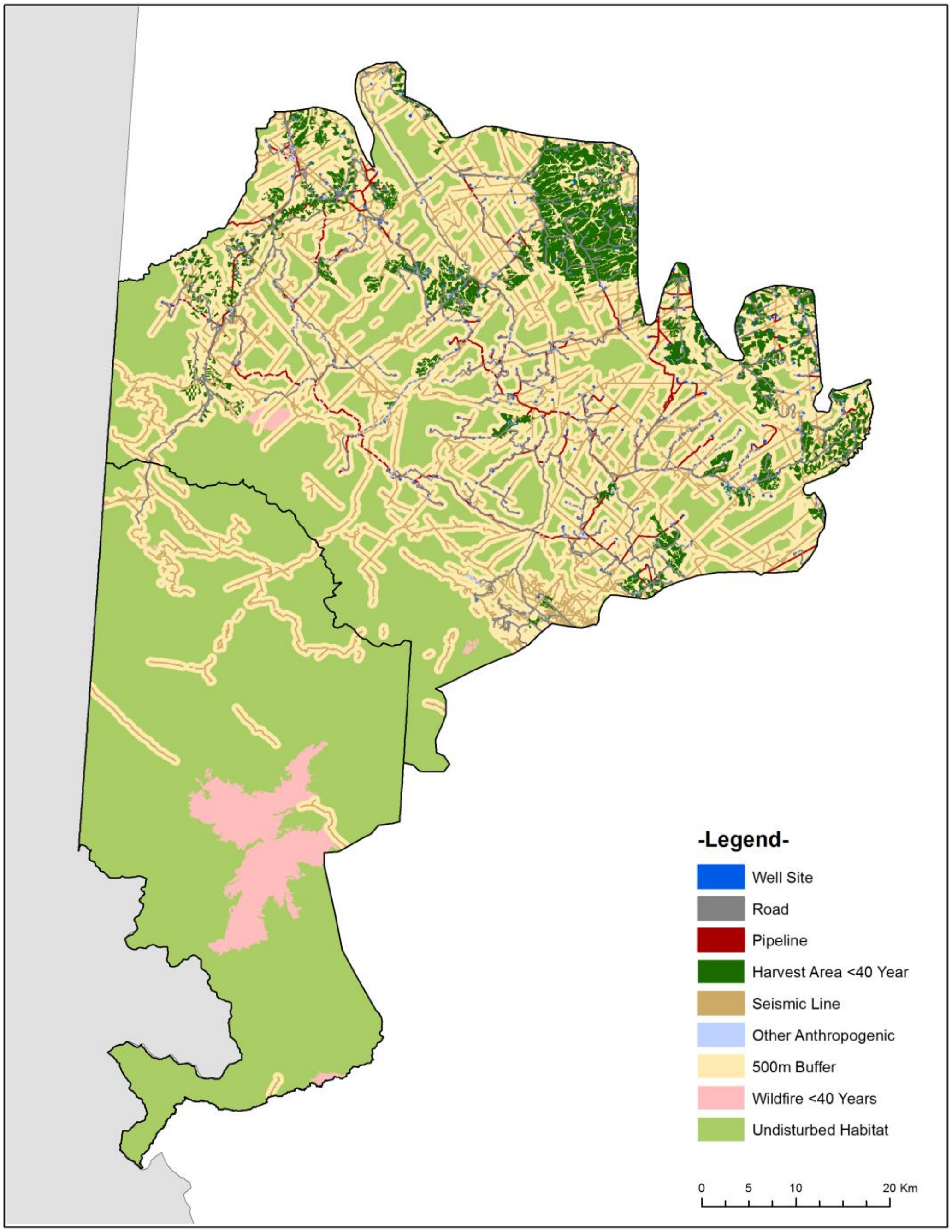
Appendix B: Current state assessment

This appendix displays the current state assessment for disturbance footprint in the caribou ranges. We conducted this analysis using the following data sources:

- Alberta Biodiversity Monitoring Unit Wall-to Wall Human Footprint, 2014. Accessed 2017-05-03: http://abmi.ca/home/data-analytics/da-top/da-product-overview/GIS-Land-Surface/HF-inventory.html
- Alberta Wildfire, 2016. Accessed 2017-04-17: http://wildfire.alberta.ca/resources/historical-data/default.aspx

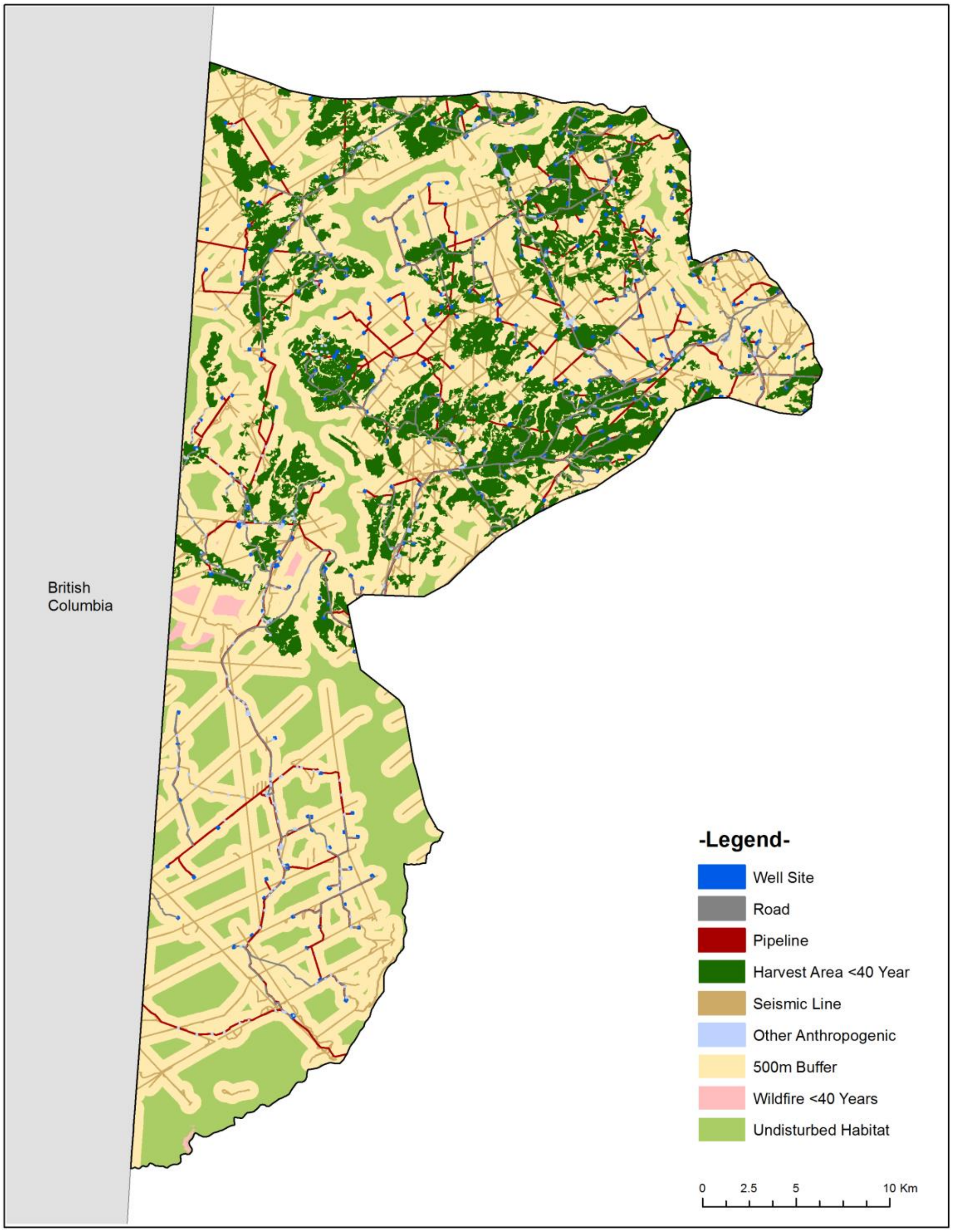
A 500m buffer was applied to all anthropogenic disturbances to represent the disturbance zone of influence, while natural disturbances such as wildfire were not buffered (Environment Canada, 2011). It is important to note that the ABMI Human Footprint dataset is more detailed (higher resolution) than the 'visible from 1:50,000 Landsat data' criteria used in the boreal caribou scientific assessment (Environment Canada, 2011).

While a 1:50,000 Landsat analysis has yet to be carried out for the Southern Mountain caribou ranges, it is likely that the disturbance values reported would be lower than those calculated from ABMI data. The relationship between the disturbance metrics calculated using ABMI data and the 65% undisturbed habitat threshold are therefore unclear.



Map 6-6. Current disturbance for the Redrock-Prairie Creek range.

All anthropogenic features are buffered by 500m and areas within this zone of influence are considered disturbed habitat. The winter range has 29% undisturbed habitat, the summer range 82%, and overall the range has 48% undisturbed habitat (solid black line shows winter/summer boundary).



Map 6-7. Current disturbance for the Narraway range.

All anthropogenic features are buffered by 500m and areas within this zone of influence are considered disturbed habitat. The range has 15% undisturbed habitat.

Appendix C: Data

This appendix displays the data sources used in this report in detail.

A. Telemetry

Telemetry data was collected for the Redrock-Prairie Creek and Narraway caribou herds using Very High Frequency (VHF) and Global Positioning System (GPS) telemetry collars. Weyerhaeuser data was available since 1998 for the Redrock-Prairie Creek herd (108 GPS collared animals) and since 2000 for the Narraway herd (67 GPS collared animals). Government of Alberta (GoA) GPS and VHF data was available since 1981 (10 GPS, 195 VHF collared animals) for the Redrock-Prairie Creek herd and since 1995 (4 GPS, 85 VHF collared animals) for the Narraway herd (Map 6-9).

B. Aseniwuche Winewak Nation Traditional Knowledge

The AWN provided a caribou traditional knowledge dataset collected in collaboration with Elders from the community (Map 6-10). The information provided included a range of caribou related data:

- Habitat points - locations where caribou were sighted, tracks were seen, sheds found, etc.
- Migration points - locations where caribou tracks were seen, or caribou were sighted travelling
- Mortality points - locations where dead caribou were found
- General points - general locations where caribou activity was observed – some of these overlap with other point locations
- Behaviour lines - lines indicating where caribou spring habitat is for calving
- Migration lines - routes caribou have been observed using
- Trails - trails used by Elders from which caribou were observed
- Habitat areas - areas identified as being core caribou habitat areas
- Migrating areas - areas identified as being secondary caribou habitat areas
- Interest areas - general areas that Elders have observed caribou

C. Canadian Parks and Wilderness Society Conservation Blueprint

CPAWS used the Conservation Blueprint methodology (Ronson & Pendlebury, 2015) to identify and prioritize restoration and protection areas within the Redrock-Prairie Creek and Narraway caribou ranges (Map 6-11). Zones are based on irreplaceability values with zone 1A having the highest priority for restoration, followed by zones 1B, 2, 3, and 4.

D. Kernel Density Estimate Home Ranges

As part of ongoing research by the Caribou Program at fRI Research 95% KDE isopleth home ranges were developed using Weyerhaeuser caribou GPS data (1998-2015). The 95% isopleths were created from KDE raster layers for each collared animal for each season and year, and then individual isopleths were dissolved together to create a population-level isopleth for each season and year. These isopleths were then combined to create 95% isopleths for all years and all seasons. (Map 6-12)

Resource Selection Functions

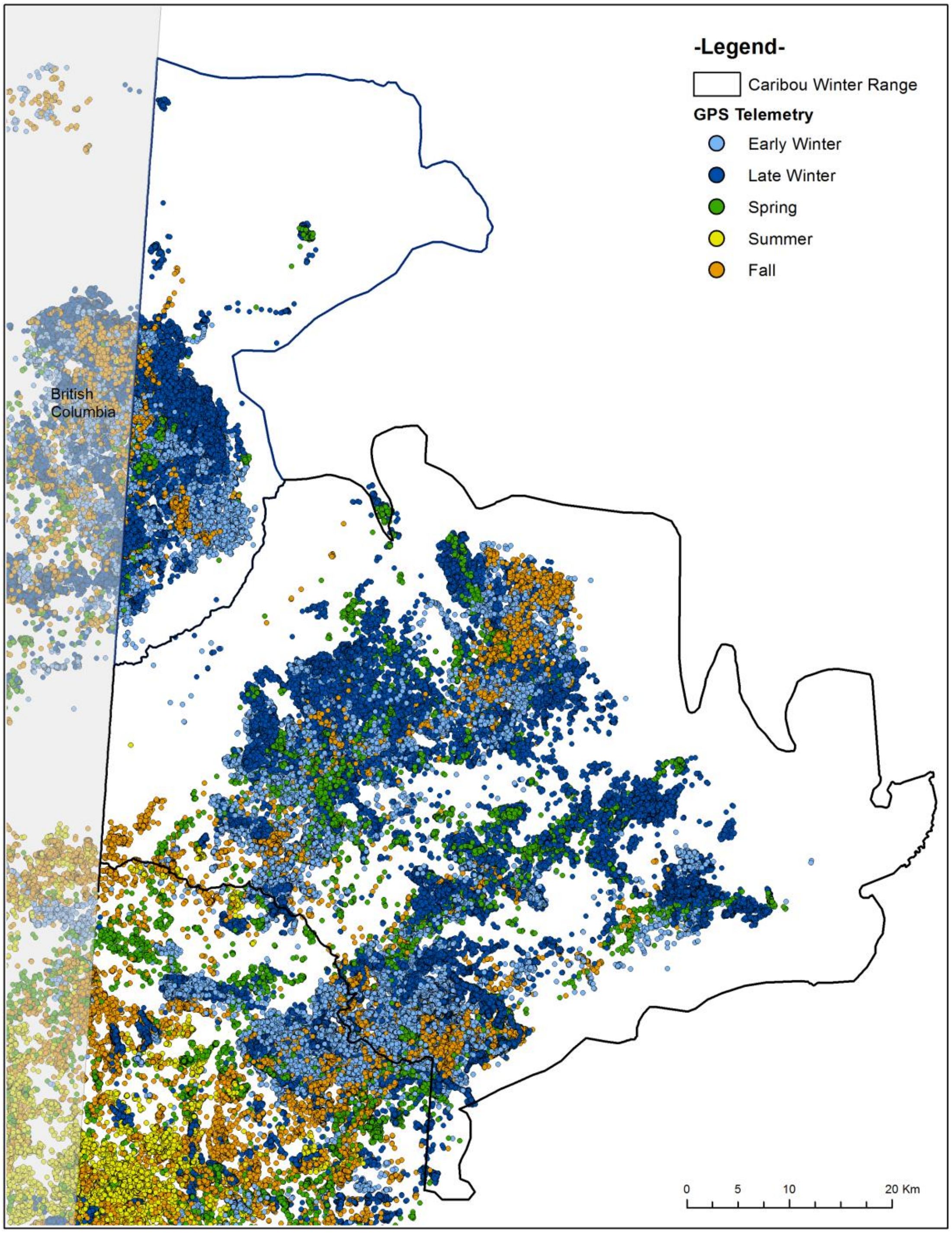
Resource Selection Functions (RSFs) were developed by fRI Research (Rudolph *et al.* 2016) using data from Global Positioning System (GPS) telemetry collars collected since 1998 (subset used for this analysis Redrock-Prairie Creek: n = 53 individuals, Narraway n = 25 individuals).

RSFs use a statistical framework to compare the attributes of telemetry locations of collared caribou to randomly sampled locations that are considered available for use by caribou. They provide an empirical assessment of the areas and habitats selected by caribou in relation to the habitat available to them, permitting spatial predictions of the relative probability of habitat use.

fRI Research developed separate RSF models for each herd for the early winter and late winter seasons at both the 2nd and 3rd order of selection. Seasons were determined based on daily movement rates (MacNearny *et al.* 2016). In consultation with fRI Research we determined that the models developed at the 2nd order of selection were at the most appropriate scale for identifying habitat for important areas (Maps 6-13 and 6-14).

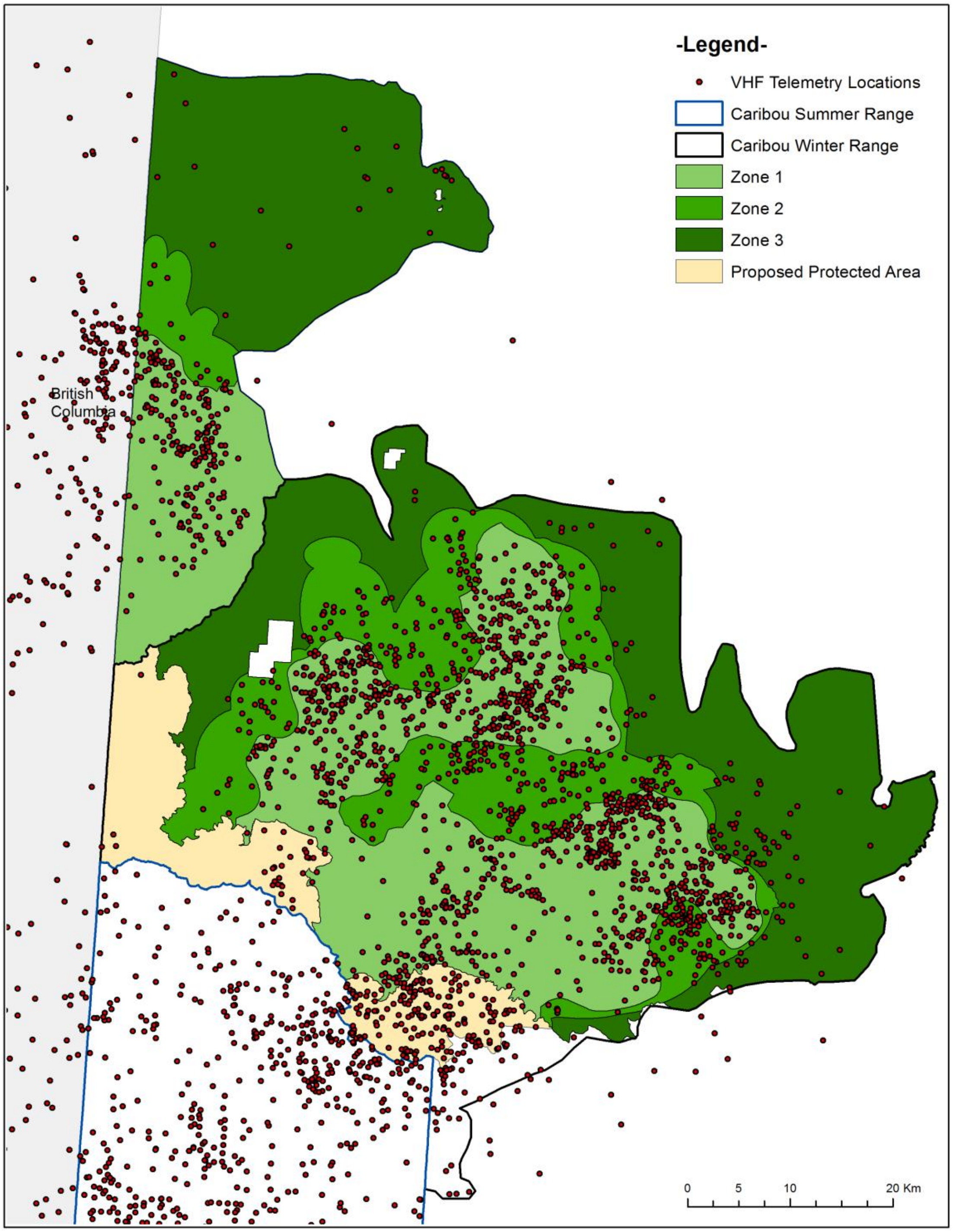
E. Mountain Pine Beetle (MPB) Susceptibility

Mountain Pine Beetle (MPB) susceptibility was measured using a refined Shore and Safranyik Index (SSI). Only stands with a high risk (score of 31-51) or very high risk (score of 51+) are displayed (Map 6-16)

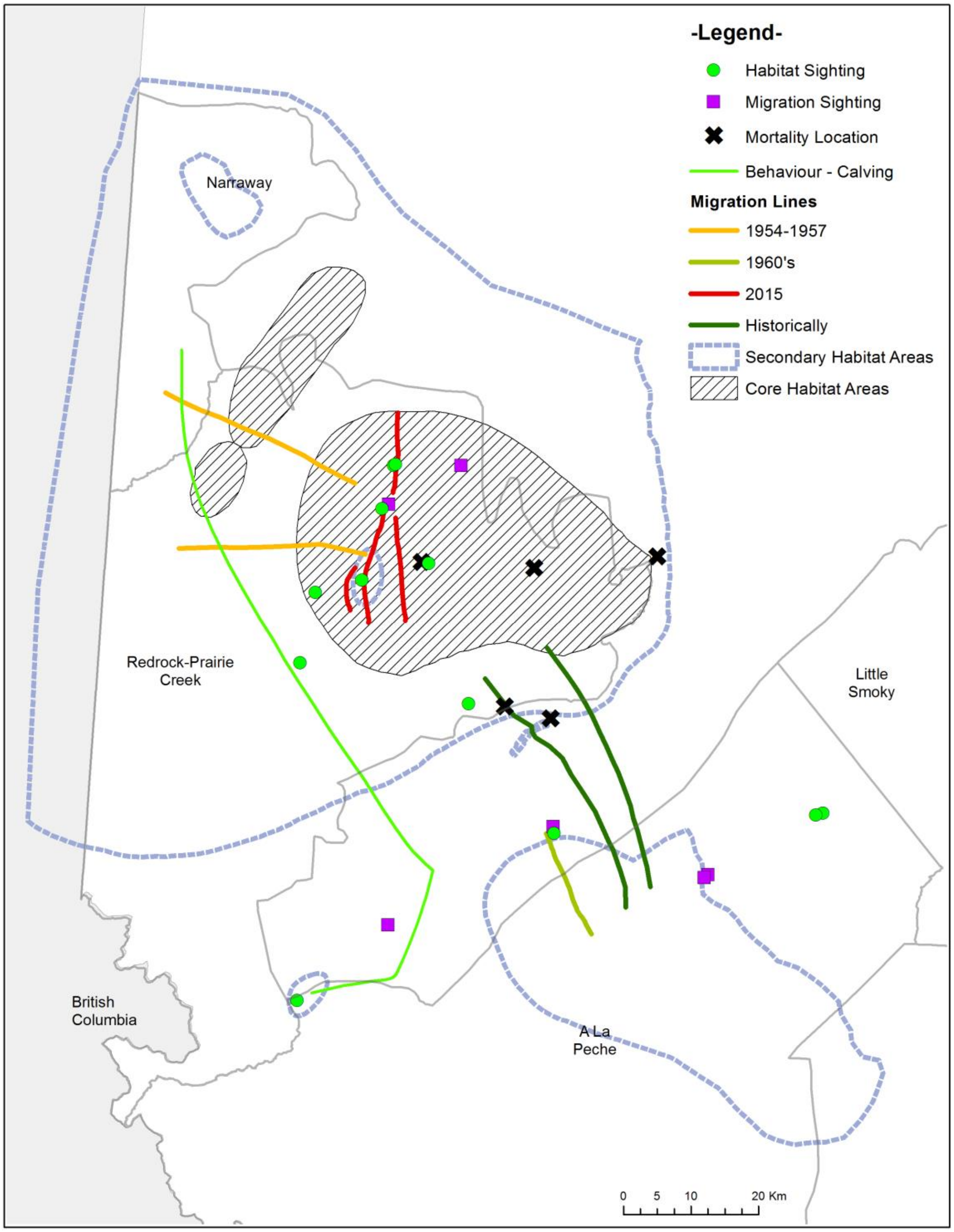


Map 6-8. GPS telemetry data by season for the Redrock-Prairie Creek and Narraway herds

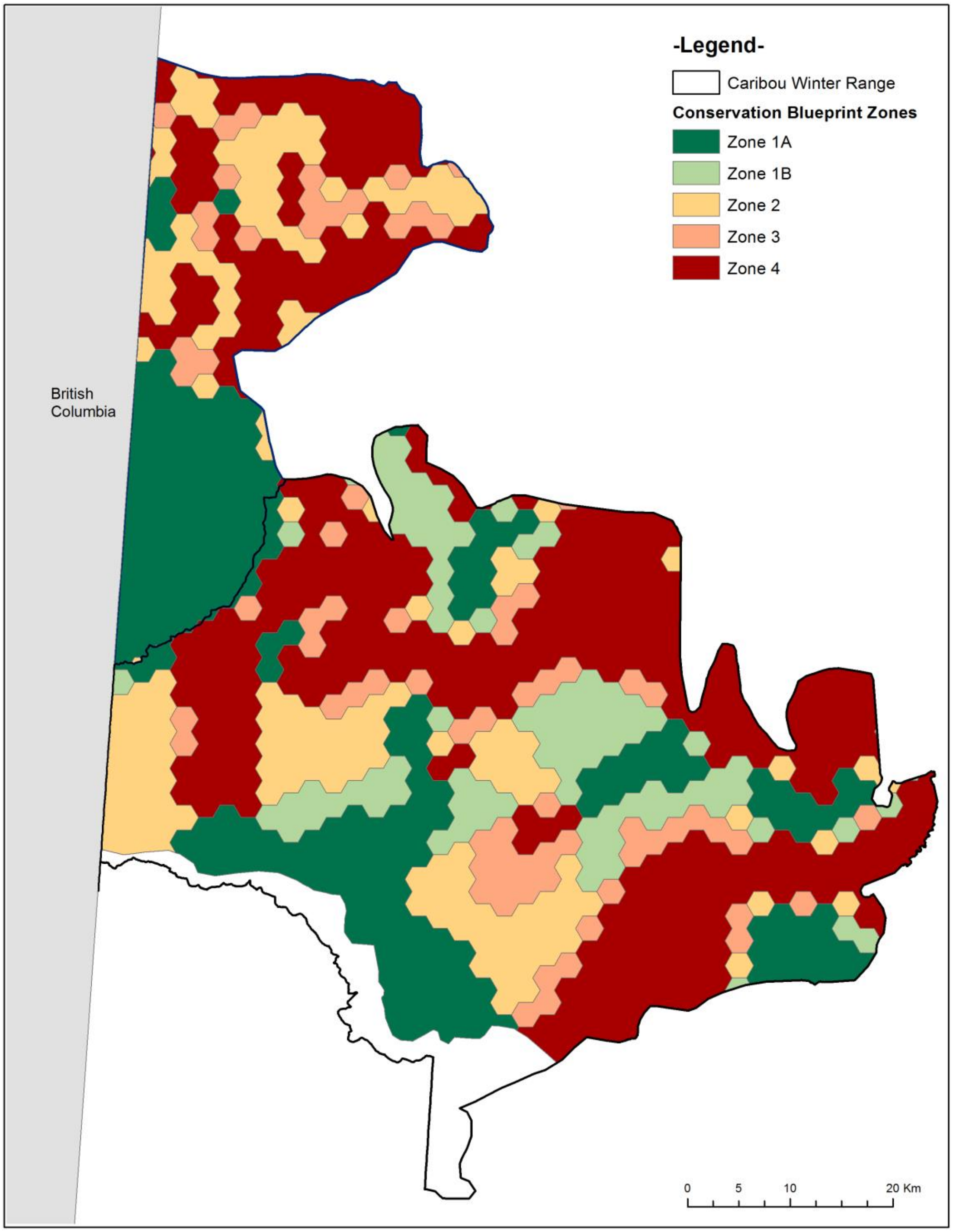
Seasons were determined based on daily movement rates (MacNearny et al. 2016).



Map 6-9. VHF telemetry data for the Redrock-Prairie Creek and Narraway herds.

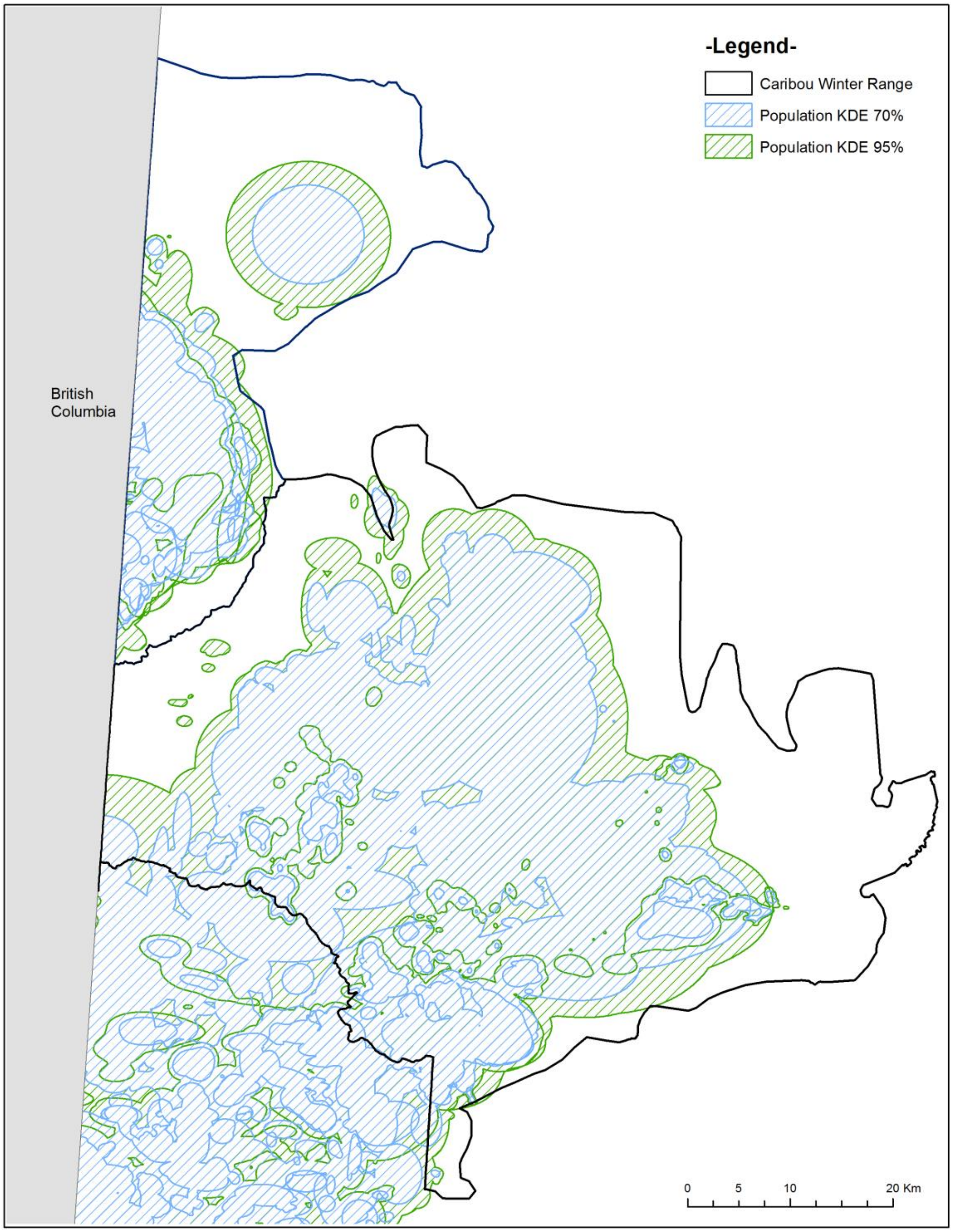


Map 6-10. AWN traditional knowledge dataset.

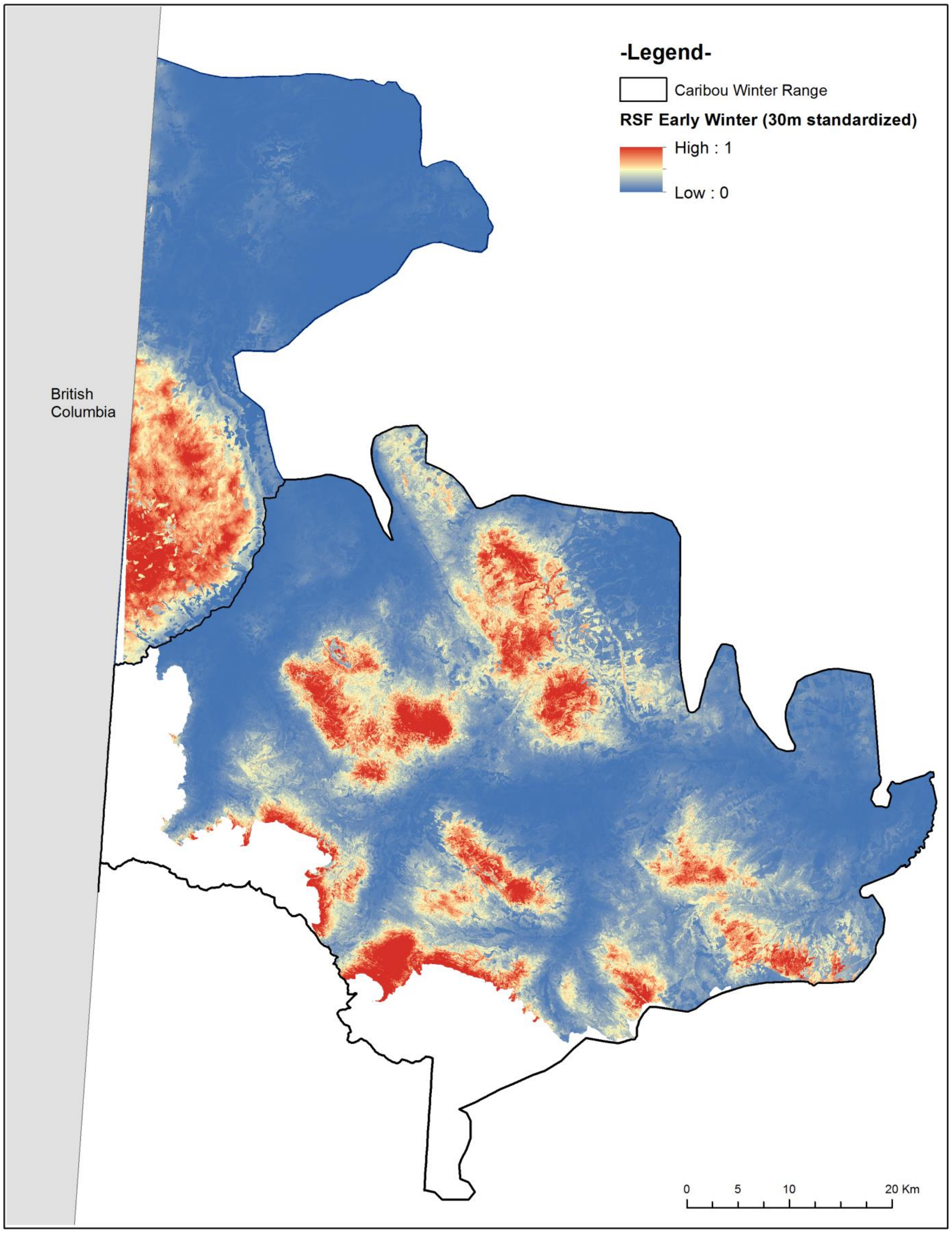


Map 6-11. CPAWS conservation blueprint zones

For all caribou ranges based on irreplaceability value with a focus on prioritization for restoration.

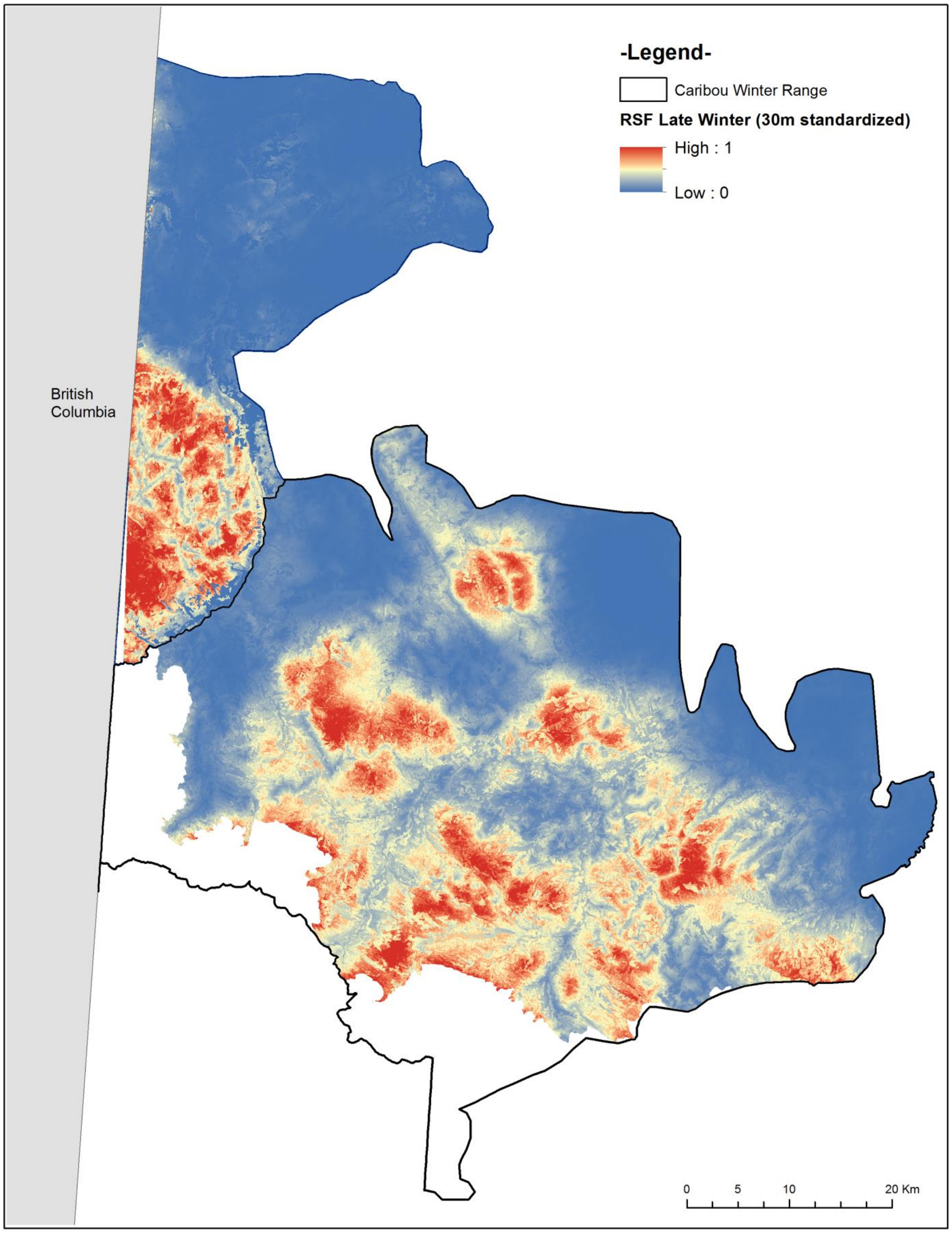


Map 6-12. The population-level Kernel Density Estimate home ranges at 70% (blue) and 95% (green) for both ranges.



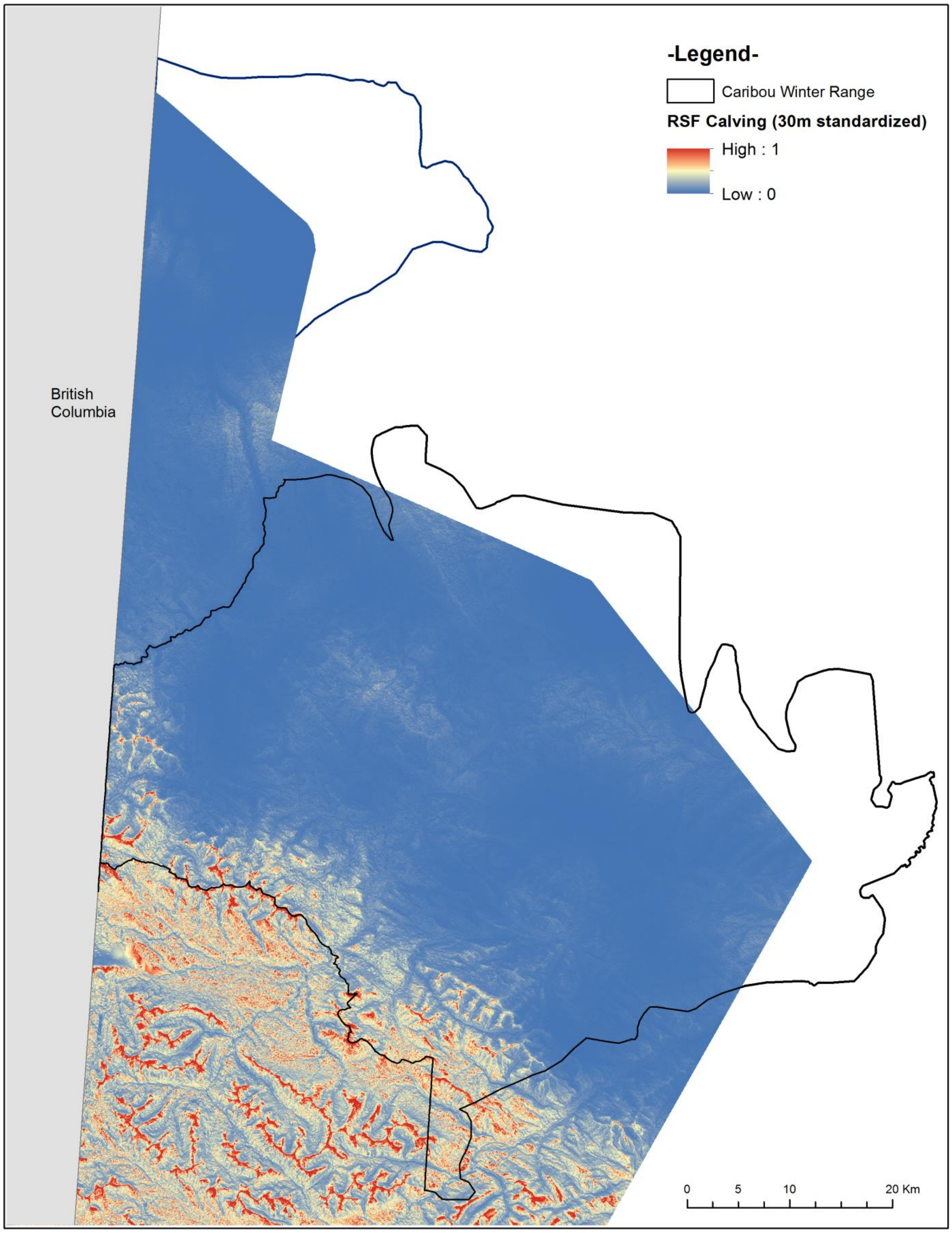
Map 6-13. Probability of selection based on the early winter Resource Selection Functions.

The RSF is scaled between areas with a high probability of selection by caribou (red) and areas with a low probability of selection by caribou (blue).



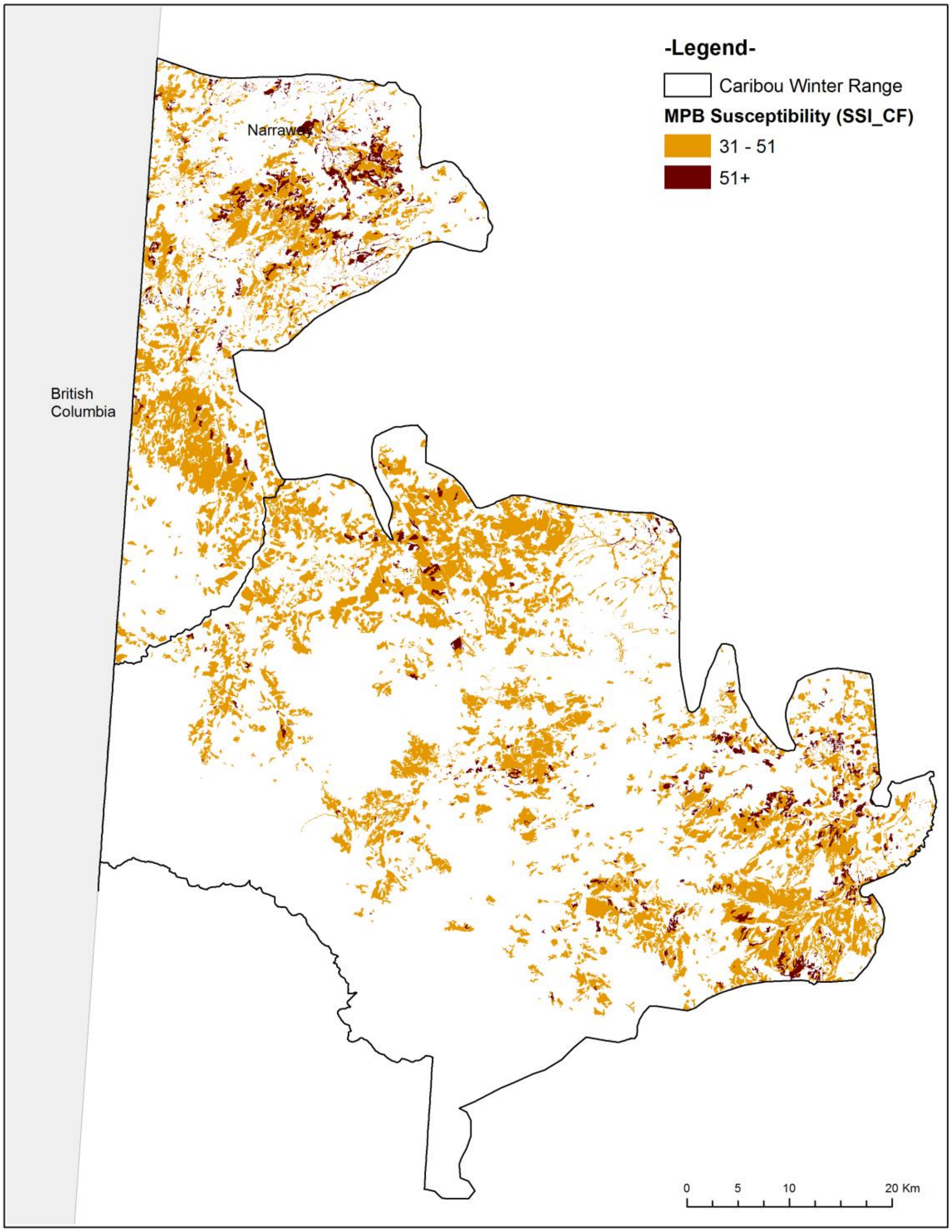
Map 6-14. Probability of selection based on the late winter Resource Selection Functions.

The RSF is scaled between areas with a high probability of selection by caribou (red) and areas with a low probability of selection by caribou (blue).



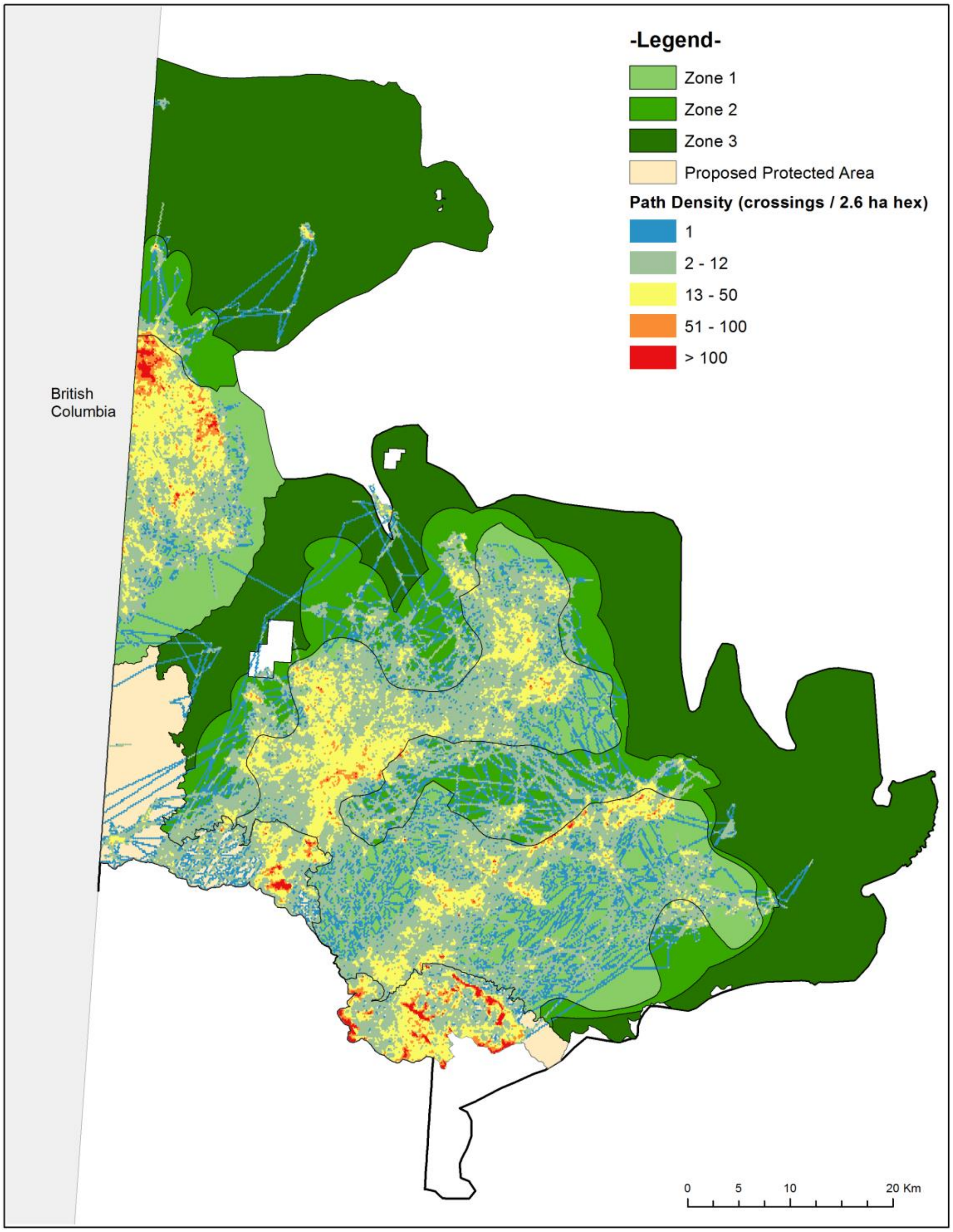
Map 6-15. Probability of selection surfaces for caribou calving at the second order of selection.

For the Redrock-Prairie Creek and Narraway ranges. The RSF is scaled between areas with a high Probability of selection by caribou (red) and areas with a low probability of selection by caribou (blue).



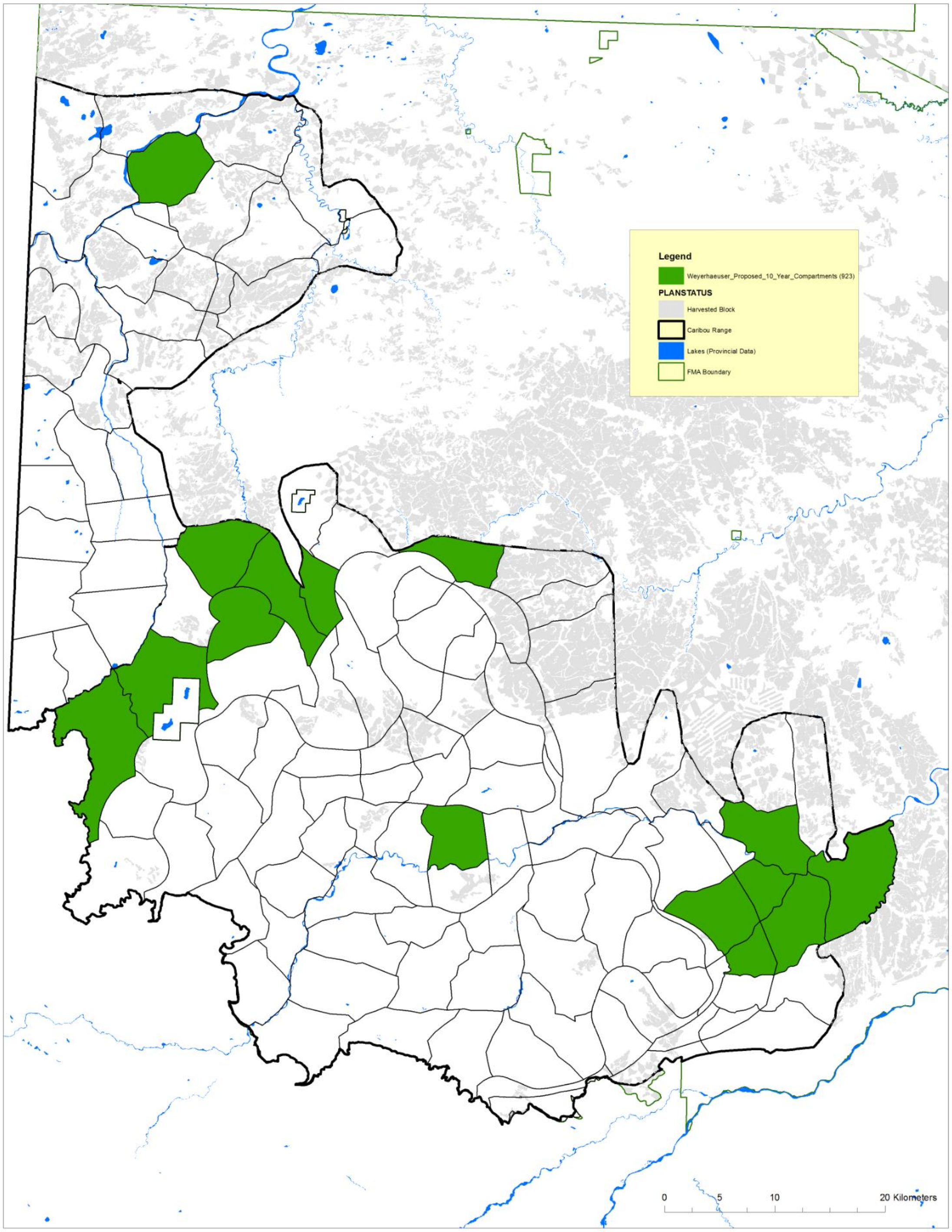
Map 6-16. Mountain Pine Beetle (MPB) susceptibility

As measured by a refined Shore and Safranyik Index (SSI). Only stands with a high risk (score of 31-51) or very high risk (score of 51+) are displayed.



Map 6-17. Path density

Calculated as the number of caribou paths (straight line segments linking successive GPS telemetry locations) crossing each 2.6 ha unit of the landscape, overlaid on the management zones and proposed protected area.



Map 6-18. Weyerhaeuser's Original Proposed Compartment Sequence (Scenario 923)

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CHAPTER 7 VALUES, OBJECTIVES, INDICATORS AND TARGETS

The Alberta Forest Management Planning Standard (2006) identifies specific performance values, objectives, indicators and targets (VOITs) over the FMA area. These VOITS are a mandatory component of a Forest Management Plan. The Values and Objectives described in the VOITs form the backbone of Weyerhaeuser's Preferred Forest Management Strategies.

Weyerhaeuser, in consultation with the Province and with Stakeholders, has established measurable Indicators and Targets based on social acceptance and sound science related to the Values and Objectives.

This chapter summarizes the Values, Objectives, Indicators and Targets (VOIT) table that is detailed with monitoring and performance expectations in *Annex 8: VOIT Table.* A comparison is made between the results for the Baseline Scenario and the PFMS scenario. Mitigation Strategies are listed for results outside the threshold range for the PFMS scenario.

Weyerhaeuser acknowledges that several targets set by the Province are not entirely under our control. For these targets Weyerhaeuser has committed to reporting the impacts rather than trying to control the results.

Information regarding the modelling approach and methodology as well as resulting graphs and maps for both the Baseline scenario and the Preferred Forest Management Scenario are included in *Annex 9: Non-Timber Value Assessment Reports.*

- In all scenarios, the year zero results or indicators include the disturbance up to May 1, 2017 (CLB effective date), the harvest updates between May 1, 2017-April 30, 2019, as well as the potential Decade 1 harvest from the "Priority 2-Reserves" in the caribou range.

- Current (time 0) reporting is only shown in the Baseline scenario as it is a snapshot in time and is not influenced by the preferred forest management strategy (PFMS).

CHAPTER 7 VALUES, OBJECTIVES, INDICATORS AND TARGETS

7.1. Summary of Changes from the Previous VOIT Table

Table 7-1 describes significant changes to the VOITs since the approval of the 2011 Forest Management Plan. Changes to wording or grammar that does not alter the intent of the VOIT has not been listed.

Table 7-1. Summary of Changes

ALL	Included Indigenous Traditional Knowledge as a "means to identify target" based on Indigenous consultation
1.1.1.1	Adjustments made to cover type and seral stage definitions & targets
1.1.1.2	Adjustment made to patch size definition and reporting subunit & targets
1.1.1.3	Removed Grizzly Bear Zone as the subunit; adjustment made to target; adjustment made to allowable timing for temporary roads
1.1.1.4	Included "culturally valued plant species" as per Indigenous consultation
1.1.1.5	Adjustment to targets reflecting current PFMS; included condition to salvage due to Spruce beetle risk
1.1.1.6	No change
1.1.2.1	Adjustment to targets reflecting current PFMS
1.1.2.2	No change
1.1.2.3	No change
1.2.1.1	Indicators and Targets updated to represent all Species of Management Concern
1.2.1.3	Dropped
1.3.1.1	Adjustments made to reflect the intent of FGRMS (2016)
1.3.1.2	Adjustments made to reflect the intent of FGRMS (2016)
1.4.1.1	No change
2.1.1.1	Combine all reforestation targets here
2.1.1.2	NEW- Reporting requirements regarding target and actual MAIs
2.1.2.1	Wording changed from "manage" to "recognize" landbase shifts
2.1.2.2	No change
2.1.3.1	Change "noxious weeds" to "invasive weeds"
3.1.1.1	No change
3.1.1.2	No change
3.2.1.1	Changes to target maximum water yield/ ECA
3.2.2.1	No change
4.1	Dropped
4.2.1.1	(mislabelled) Dropped
5.1.1.1	Adjustments made to reflect intent of Annex 1
5.2.1.1	Included high, very high and extreme fire behaviour potential rating
5.2.1.2	Dropped
5.2.2.1	No change to intent of target- dropped specific wording regarding allocations and public consultation (covered in 6.2.1.1)
5.2.3.1	No change
6.1.1.1	Expanded indicators and targets to include consultation, protection of rights and promotion of mutual healthy working relationships
6.2.1.1	No change to intent- adjustments to wording to reflect current processes

7.2. BASELINE SCENARIO #8109

VOIT 1.1.1.1a
Area of old + very old, mature and young forest for the DFA by Cover Class by Classified Landbase.

Table 7-2. VOIT targets for percent % area of young, mature and old + very old forest by BCG in the Classified Landbase

Cover Class	Young (< than)	Mature (> than)	Old + very old (> than)
Cx-Pl	31.0	4.0	18.0
Cx-Sw	27.5	3.5	26.0
Cx-other	9.0	1.0	35.5
MW	40.0	3.0	13.5
Dx	31.5	2.5	3.5

Table 7-3. Baseline Scenario actuals for percent % area of young, mature and old + very old forest by BCG in the Classified Landbase at years 10, 20, 100 and 200

Cover Class		Young	Mature	Old + Very Old
Cx-Pl	Year 0	26.2	31.4	22.4
	Year 10	22.1	17.3	33.0
	Year 20	12.7	9.9	37.6
	Year 100	11.2	18.5	37.6
	Year 200	14.7	7.1	41.4
Cx-Sw	Year 0	13.5	23.4	37.9
	Year 10	18.1	20.6	40.9
	Year 20	24.8	18.4	38.2
	Year 100	17.9	11.3	39.6
	Year 200	15.8	7.6	38.6
Cx-other	Year 0	3.1	42.0	44.0
	Year 10	7.1	29.1	62.0
	Year 20	8.1	19.7	69.6
	Year 100	1.6	7.8	83.3
	Year 200	4.8	1.9	84.2
MW	Year 0	11.6	29.3	17.5
	Year 10	18.3	35.1	19.2
	Year 20	22.6	35.7	18.1
	Year 100	20.8	7.6	24.5
	Year 200	28.8	5.1	22.6
Dx	Year 0	12.0	42.7	7.4
	Year 10	14.4	48.0	16.6
	Year 20	18.5	43.0	19.3
	Year 100	22.8	4.4	24.7
	Year 200	26.5	3.0	21.0

VOIT 1.1.1.1b Contributing
Area of old + very old, mature and young forest for the DFA by Cover Class by Contributing Landbase.

Table 7-4. VOIT targets for percent % area of young, mature and old + very old forest by BCG in the Contributing Landbase

Cover Class	Young (< than)	Mature (> than)	Old + very old (> than)
Cx-Pl	35.0	2.5	16.5
Cx-Sw	37.0	2.0	7.5
Cx-other	46.0	1.5	15.0
MW	46.5	1.5	3.5
Dx	38.5	1.5	3.5

Table 7-5. Baseline Scenario actuals for percent % area of young, mature and old + very old forest by BCG in the Contributing Landbase at years 10, 20, 100 and 200

Cover Class		Young	Mature	Old + Very Old
Cx-Pl	Year 0	29.6	28.8	20.2
	Year 10	25.4	16.6	27.7
	Year 20	15.0	9.4	31.4
	Year 100	13.3	20.4	27.7
	Year 200	17.4	8.4	30.6
Cx-Sw	Year 0	17.6	20.6	33.4
	Year 10	24.2	19.5	32.0
	Year 20	33.4	17.3	26.5
	Year 100	24.1	14.6	19.2
	Year 200	21.3	10.2	17.2
Cx-other	Year 0	15.3	32.6	46.2
	Year 10	35.3	19.7	41.9
	Year 20	40.7	11.2	40.0
	Year 100	8.0	38.8	17.3
	Year 200	23.9	9.5	21.2
MW	Year 0	13.8	27.3	14.9
	Year 10	22.1	33.7	14.1
	Year 20	27.4	35.0	11.3
	Year 100	24.6	8.6	11.2
	Year 200	33.5	5.9	10.1
Dx	Year 0	15.1	40.2	6.8
	Year 10	19.7	42.4	14.1
	Year 20	23.7	36.8	15.2
	Year 100	27.1	4.0	9.9
	Year 200	32.3	2.8	3.0

VOIT 1.1.1.2a
Range of patch sizes by DFA for young seral stands

Table 7-6. VOIT targets for range of patch sizes of young seral stands (DFA)

Young Seral Patch Sizes	Target
0-5 ha	<5%
6-19 ha	<20%
20-99 ha	<50%
100-250 ha	>15%
>250 ha	>10%

Table 7-7. Baseline Scenario actuals for patch sizes of young seral stands (DFA) at year 0, 10 and 50

Young Seral Patch Sizes	Year 0	Year 10	Year 50
0-5 ha	2.7	3.6	4.4
6-19 ha	16.2	17.1	17.7
20-99 ha	42.9	42.2	46.7
100-250 ha	19.2	19.8	18.2
>250 ha	19.1	17.3	13.0

VOIT 1.1.1.2b
Area of old interior forest by DFA and by Cover Class

The VOIT target for area of old interior forest will not be less than 10% over the next 200 years.

Table 7-8. Baseline Scenario of old interior forest at years 0, 10 and 50

	Year 0	Year 10	Year 50
% Area of old interior forest	38%	46%	43%

CHAPTER 7 VALUES, OBJECTIVES, INDICATORS AND TARGETS

VOIT 1.1.1.3_Baseline and PFMS

a) Permanent all-weather road density by DFA.

The VOIT target for permanent all-weather road density is less than 0.6km/km^2 for the DFA.

Although some individual compartments exceed the target, the DFA currently has 0.5km/km2 of permanent all-weather road. Information for current state only is provided for this VOIT.

Table 7-9. Permanent Roads (DLO and LOC) by Compartment

Compartment (km2)		DLO Roads		LOC Roads		TOTAL	
		Existing DLO Road (km)	Existing DLO km/ km2	Existing LOC Road (km)	Existing LOC km/ km2	Total Road (km)	Total km/km2
1800 Timber Berth	381.3	36.3	0.1	206.5	0.5	242.8	0.6
Bull Creek	548.2	90.7	0.2	356.0	0.6	446.6	0.8
Calahoo	174.7	0.0	0.0	113.8	0.7	113.8	0.7
Calahoo Zone 3	151.4	1.3	0.0	67.8	0.4	69.0	0.5
Hammer Head	193.1	0.0	0.0	88.5	0.5	88.5	0.5
Kakwa Tower	572.6	49.8	0.1	320.9	0.6	370.8	0.6
Lingrell Zone 3	476.9	35.5	0.1	260.7	0.5	296.1	0.6
MA2 GP North	213.3	16.7	0.1	40.2	0.2	56.9	0.3
Musreau	618.8	24.6	0.0	360.8	0.6	385.4	0.6
Narraway Zone 1	335.9	0.0	0.0	92.7	0.3	92.7	0.3
Narraway Zone 2	74.8	3.7	0.0	42.2	0.6	45.9	0.6
Nose Mountain	196.3	24.4	0.1	52.1	0.3	76.4	0.4
Pine Rat	422.1	87.4	0.2	187.1	0.4	274.4	0.7
Pinto	624.1	18.1	0.0	413.1	0.7	431.2	0.7
Pinto Cut Across	427.5	44.9	0.1	267.4	0.6	312.3	0.7
Prairie Creek	4.7	0.0	0.0	0.2	0.0	0.2	0.0
Prairie Creek Zone3	301.5	5.5	0.0	117.9	0.4	123.4	0.4
Redrock Prairie Zone 1	1,071.7	76.3	0.1	265.0	0.2	341.3	0.3
Redrock Zone 2	475.8	28.0	0.1	141.0	0.3	169.0	0.4
Redrock Zone 3	420.8	37.7	0.1	175.5	0.4	213.2	0.5
Saddle Hills East	599.6	6.4	0.0	238.9	0.4	245.2	0.4
Saddle Hills North	621.1	12.9	0.0	393.2	0.6	406.1	0.7
Saddle Hills South	956.0	19.1	0.0	638.8	0.7	657.9	0.7
South East Kakwa	273.4	26.4	0.1	152.7	0.6	179.1	0.7
Stetson Zone 2	179.9	23.2	0.1	39.9	0.2	63.1	0.4
Two Lakes Zone 3	219.0	18.7	0.1	67.2	0.3	86.0	0.4
Wanyandie	159.1	5.3	0.0	22.7	0.1	28.0	0.2
Wapiti	338.7	55.9	0.2	98.9	0.3	154.9	0.5
Wilson Lake	248.3	30.4	0.1	132.4	0.5	162.7	0.7

b) Not required

VOIT 1.1.1.4

Reporting on Unique Areas is included in Chapter 4- Landscape Assessment.

VOIT 1.1.1.5

Reporting on Unsalvaged Burned Areas and Blowdown Areas is included in Chapter 4- Landscape Assessment.

VOIT 1.1.1.6

Not Required

VOIT 1.1.2.1

Not Required

VOIT 1.1.2.2

Not Required

VOIT 1.1.2.3

Not Required

VOIT 1.2.1.1

Detailed reporting for these species, including tables and maps as required, is included in *Annex 9- Non- Timber Value Assessments.*

VOIT 1.3.1.1 and 1.3.1.2

Reporting on the Genetic Integrity of natural tree populations is included in *Chapter 6 Forest Management Strategies.*

VOIT 1.4.1.1

Not Required

VOIT 2.1.1.1

Not Required

VOIT 2.1.1.2

Reporting on Mean Annual Increment is included in *Annex 5 Yield Curve Development*.

VOIT 2.1.2.1

Not Required

VOIT 2.1.2.2

Not Required

VOIT 2.1.3.1

Not Required

VOIT 3.1.1.1

Not Required

VOIT 3.1.1.2

Not Required

VOIT 3.2.1.1

The VOIT target for the Equivalent Clearcut Area (ECA) is <30% by watershed.

Detailed reporting for watershed ECAs, including tables and maps as required, is included in *Annex 9- Non- Timber Value Assessments.*

VOIT 3.2.2.1

Not required.

VOIT 5.1.1.1

Reporting on sustainable Annual Allowable Cuts is included in *Annex 10- Timber Supply Analysis Report.*

VOIT 5.2.1.1

Reporting on efforts to reduce the wildfire threat are included in *Annex 3- Wildfire Threat Assessment* and *Annex 10- Timber Supply Analysis Report.*

VOIT 5.2.2.1

Not Required

VOIT 5.2.3.1

Reporting on the Long Run Sustained Yield (LRSY) is included in *Annex 10- Timber Supply Analysis Report.*

VOIT 6.1.1.1

Not Required

VOIT 6.1.1.2

Not Required

VOIT 6.1.1.3

Not required

VOIT 6.2.1.1

Not Required

7.3. PREFERRED FOREST MANAGEMENT SCENARIO #8110

VOIT 1.1.1.1a Classified

Area of old + very old, mature and young forest for the DFA by Cover Class by Classified Landbase

Table 7-10. VOIT targets for percent % area of young, mature and old + very old forest by BCG in the Classified Landbase

Cover Class	Young (< than)	Mature (> than)	Old + very old (> than)
Cx-Pl	31.0	4.0	18.0
Cx-Sw	27.5	3.5	26.0
Cx-other	9.0	1.0	35.5
MW	40.0	3.0	13.5
Dx	31.5	2.5	3.5

Table 7-11. PFMS Scenario for percent % area of young, mature and old + very old forest by BCG in the Classified Landbase at years 10, 20, 100 and 200

Cover Class		Young	Mature	Old+ Very Old
Cx-Pl	Year 10	22.0	17.3	33.1
	Year 20	12.8	9.9	37.5
	Year 100	11.3	18.5	37.5
	Year 200	14.4	6.8	41.7
Cx-Sw	Year 10	18.3	20.4	40.8
	Year 20	24.9	18.2	38.3
	Year 100	17.9	11.0	39.7
	Year 200	16.2	7.2	38.3
Cx-other	Year 10	7.3	29.0	61.8
	Year 20	8.2	19.7	69.5
	Year 100	1.3	8.1	83.5
	Year 200	5.1	1.6	84.4
MW	Year 10	18.3	35.0	19.3
	Year 20	22.3	35.8	18.3
	Year 100	21.0	7.4	24.1
	Year 200	28.7	4.9	22.4
Dx	Year 10	15.1	47.4	16.4
	Year 20	20.8	40.7	19.4
	Year 100	22.0	5.3	24.8
	Year 200	25.0	3.4	21.0

There is very little difference in the classified landbase between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 1.1.1.1b Contributing

Area of old + very old, mature and young forest for the DFA by Cover Class by Contributing Landbase

Table 7-12. VOIT targets for percent % area of young, mature and old + very old forest by BCG in the Contributing Landbase

Cover Class	Young (< than)	Mature (> than)	Old + very old (> than)
Cx-Pl	35.0	2.5	16.5
Cx-Sw	37.0	2.0	7.5
Cx-other	46.0	1.5	15.0
MW	46.5	1.5	3.5
Dx	38.5	1.5	3.5

Table 7-13. PFMS Scenario for percent % area of young, mature and old + very old forest by BCG in the Contributing Landbase at years 10, 20, 100 and 200

Cover Class		Young	Mature	Old + very old
Cx-Pl	Year 10	25.2	16.6	27.8
	Year 20	15.1	9.4	31.3
	Year 100	13.3	20.4	27.5
	Year 200	17.1	8.0	31.0
Cx-Sw	Year 10	24.5	19.3	31.9
	Year 20	33.6	17.1	26.6
	Year 100	24.1	14.2	19.4
	Year 200	21.8	9.7	16.8
Cx-other	Year 10	36.4	19.5	41.1
	Year 20	41.2	11.5	39.2
	Year 100	6.6	40.1	18.1
	Year 200	25.2	7.8	22.3
MW	Year 10	22.1	33.6	14.2
	Year 20	27.1	35.1	11.5
	Year 100	24.8	8.3	10.8
	Year 200	33.4	5.6	9.9
Dx	Year 10	21.6	41.0	14.1
	Year 20	27.3	33.0	15.4
	Year 100	26.4	5.3	10.0
	Year 200	30.0	3.6	3.1

There is very little difference in the classified landbase between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 1.1.1.2a

Range of patch sizes by DFA for young seral stands

Table 7-14. VOIT targets for range of patch sizes of young seral stands (DFA)

Young Seral Patch Sizes	Target
0-5 ha	<5%
6-19 ha	<20%
20-99 ha	<50%
100-250 ha	>15%
>250 ha	>10%

Table 7-15. PFMS Scenario for patch sizes of young seral stands (DFA) at year 0, 10 and 50

Young Seral Patch Sizes	Year 10	Year 50
0-5 ha	3.4	4.2
6-19 ha	17.0	18.4
20-99 ha	43.1	45.1
100-250 ha	19.2	18.6
>250 ha	17.2	13.3

There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 1.1.1.2b

Area of old interior forest by DFA.

The VOIT target for area of old interior forest will not be less than 10% over the next 200 years.

Table 7-16. PFMS Scenario for area of old interior forest at years 0, 10 and 50

	Year 10	Year 50
% Area of old interior forest	46%	43%

There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 1.1.1.3

a) Permanent Roads are reported as per time zero in 7.2 Baseline Scenario.
b) Not required

VOIT 1.1.1.4

Reporting on Unique Areas is included in Chapter 4- Landscape Assessment.

VOIT 1.1.1.5

Reporting on Unsalvaged Burned Areas and Blowdown Areas is included in Chapter 4- Landscape Assessment.

VOIT 1.1.1.6

Not Required

VOIT 1.1.2.1

Not Required

VOIT 1.1.2.2

Not Required

VOIT 1.1.2.3

Not Required

VOIT 1.2.1.1

Detailed reporting for these species, including tables and maps as required, is included in *Annex 9: Non- Timber Value Assessment Reports.*

- Grizzly Bear: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Barred Owl: There is no difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- American Pine Martin: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Canada Warbler: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Black Throated Green Warbler: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Brown Creeper: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Ovenbird: There is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.
- Varied Thrush: There is no difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 1.3.1.1 and 1.3.1.2

Reporting on the Genetic Integrity of natural tree populations is included in Chapter 6 Forest Management Strategies.

VOIT 1.4.1.1

Not Required

VOIT 2.1.1.1

Not Required

VOIT 2.1.1.2

Reporting on Mean Annual Increment is included in *Annex 5 Yield Curve Development.*

VOIT 2.1.2.1

Not Required

VOIT 2.1.2.2

Not Required

VOIT 2.1.3.1

Not Required

VOIT 3.1.1.1

Not Required

VOIT 3.1.1.2

Not Required

VOIT 3.2.1.1

Detailed reporting for watershed ECAs, including tables and maps as required, is included in *Annex 9: Non- Timber Value Assessment Reports.* There is very little difference in the first 50 years of the planning horizon between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target.

VOIT 3.2.2.1

Not required.

VOIT 5.1.1.1

Reporting on sustainable Annual Allowable Cuts is included in *Annex 10- TSA Report.*

VOIT 5.2.1.1

Reporting on efforts to reduce the wildfire threat are included in *Annex 3- Wildfire Threat Assessment* and *Annex 10- Timber Supply Analysis Report*.

VOIT 5.2.2.1

Not Required

VOIT 5.2.3.1

Reporting on the Long Run Sustainable Yield Average (LRSYA) is included in *Annex 10- TSA Report.*

VOIT 6.1.1.1

Not Required

VOIT 6.1.1.2

Not Required

VOIT 6.1.1.3

Not required

VOIT 6.2.1.1

Not Required

7.4. Variance- PREFERRED FOREST MANAGEMENT STRATEGY

This section indicates whether an Indicator is within the threshold of the target at time 0 and at designated periods in the future. For each indicator that is not within range of targets or thresholds, mitigation strategies have been listed.

Table 7-17. Indicator Variance Summary-PFMS

Indicator	Variance Description	Mitigation Strategy
1.1.1.1 Area of old + very old by cover class	Variance outside of the target is not anticipated for this plan for most of the targets. Old + Very Old deciduous stands drop slightly (-0.4%) at year 200.	Not required at this time.
1.1.1.1 Area of mature by cover class	Variance outside of the target is not anticipated for this plan.	Not required at this time.
1.1.1.1 Area of young by cover class	Variance outside of the target is not anticipated for this plan.	Not required at this time.
1.1.1.2 a Patch Sizes	Variance outside of the target is not anticipated for this plan.	Not required at this time.
1.1.1.2 b Old Interior Forest	Variance outside of the target is not anticipated for this plan.	Not required at this time.
1.1.1.3 a Permanent All-weather road density	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.1.3 b open seasonal road	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.1.4 uncommon plant communities/ unique areas	This indicator is not modelled for future state performance. Variance would include failure to identify or preserve sites and would be reported in the Stewardship Report.	Not required at this time.

Indicator	Variance Description	Mitigation Strategy
1.1.1.5 area of unsalvaged burned forest	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.1.6 compliance within riparian zones	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.
1.1.2.1 a structural retention	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.2.1 b downed woody debris	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.2.2 sensitive sites	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.1.2.3 water crossing compliance	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.
1.2.1.1 a grizzly bear	Over the DFA, total (primary and secondary) grizzly bear habitat decreases slightly (-2%) over the next 20 years.	a. Minimize construction of new permanent forestry roads by utilizing existing roads b. Reclaim permanent roads that are no longer required into the reasonable future c. Reclaim temporary roads within 2 years and prior to the end of the denning season (~May 1st) d. Utilize non-traditional silviculture access (helicopters) to facilitate timely reclamation of non-permanent AOP roads

Indicator	Variance Description	Mitigation Strategy
1.2.1.1 b barred owl	In 2017 the mean Barred Owl RSF is at 0.125. Over the planning horizon the RSF indicators reduce gradually to a -22.9% change by year 200. In the first 2 decades the RSF reduces -9.4%. In 2017 the mean Barred Owl breeding pairs indicator is at 0.313. Over the planning horizon the breeding pair indicators reduce to a -74.8% change by year 200. In the first 2 decades the breeding pair indicators reduce -24.8%.	a. Timing of Harvest Activities should aim to avoid critical nesting and fledgling periods (March 14 to July 15). b. All blocks planned for harvest during specific nesting periods are assessed with the Migratory Bird Nesting Tool. c. Blocks scheduled for harvest between March 15 and April 15 in a medium or higher risk category will be assessed utilizing Owl calls. If a response is received, a nest sweep will be conducted. When a nest is located, potential actions include: • Move to a block with a lower risk rating, or • Shift the timing of harvest, or • Buffer the nest area with a 30m or greater buffer, which will be used as part of the structure retention plan for the block. e. Where they exist, and with consideration to site safety objectives, large diameter snags and decadent overstory aspen/poplar will be retained. f. Locate roads to avoid highly sensitive barred owl habitat g. Incorporate barred owl habitat values when planning structure retention
1.2.1.1 c American martin	In 2017 the total area contributing to American marten habitat (Habitat Suitability Index (HSI) is 392,117ha. HSI decreases over the first 20 years (maximum % change is -11.6%) and then recovers by year 60 and steadily increases for the rest of the planning horizon.	a. favour larger patches of structure retention over single stem b. leave as much downed woody debris as is feasible (with consideration to fire risk). c. Work with stakeholders, adjust operational practices (within reason) where high value marten habitat is identified

Indicator	Variance Description	Mitigation Strategy
1.2.1.1 d Canada warbler	In 2017 the relative abundance (RA) area of the Canada warbler is 39,929ha. RA area increases over the first 60 years (maximum change is -36.1%) and then slowly decreases, levelling out 18% higher than 2017.	For all songbirds: a. Timing of Harvest Activities should aim to avoid critical nesting and fledgling periods (March 14 to July 15). b. All blocks planned for harvest during specific nesting periods are assessed with the Migratory Bird Nesting Tool. c. Blocks scheduled for harvest between March 15 and April 15 in a medium or higher risk category will be assessed utilizing Owl calls. If a response is received, a nest sweep will be conducted. When a nest is located, potential actions include: • Move to a block with a lower risk rating, or • Shift the timing of harvest, or • Buffer the nest area with a 30m or greater buffer, which will be used as part of the structure retention plan for the block. d. Where they exist, and with consideration to site safety objectives, large diameter snags and decadent overstory aspen/poplar will be retained. e. Locate roads to avoid high risk habitat where possible f. Incorporate songbird habitat values when planning structure retention
1.2.1.1 d black throated warbler	In 2017 the relative abundance (RA) area of the Black throated warbler does not decrease more than 15% change until the very end of the first century and then continues to decrease to a maximum -27.1% change.	
1.2.1.1 d brown creeper	In 2017 the relative abundance (RA) area of the Brown Creeper is 6,987ha. RA area increases over the first 15 years (maximum change is -11.4%) and then slowly decreases, levelling out 2.8% lower than 2017.	
1.2.1.1 d ovenbird	In 2017 the relative abundance (RA) area of the Ovenbird is 345,599ha. RA area decreases over the first 35 years (maximum change is -16.2%), levelling out right around -15% lower than 2017.	
1.2.1.1 d varied thrush	In 2017 the relative abundance (RA) area of the Varied thrush is 12,732ha. RA area stays stable over the planning horizon. Percent change ranges from -0.2% to -7.5% but does not exceed the -15% maximum.	

Indicator	Variance Description	Mitigation Strategy
1.2.1.1 e cold water fish	There are many watersheds that are between 20-30 ECA throughout the planning horizon. Several watersheds exceed 30 ECA at some point during the planning horizon of this plan. Most recover below 30 within 1 or 2 periods.	For watersheds that are approaching or exceeding a 30% ECA, operators may choose to implement the following mitigation strategies: a. Anchor retention of vegetative structure along ephemeral & intermittent streams b. Plan cut blocks and roads using Lidar and wet areas mapping to minimize impacts to hydrologically sensitive areas c. Review access construction plan to avoid high risk fish-bearing watercourses d. Implement access management (seasonal closure, partial reclamation) e. Enhanced monitoring in areas deemed to be high risk f. Follow accepted practices for road and water crossing construction, maintenance, removal and remediation g. Participate in shared or integrated access plans with other road owners as appropriate h. Conduct operations so that soil surface disturbance is minimized, and sediment is prevented from entering the stream i. Reclaim roads as soon as possible and under frozen conditions where possible j. Minimize variance through additions Mitigative strategies beyond what is listed above is not required for watersheds that exceed 50 as recovery occurs quickly without action.

Indicator	Variance Description	Mitigation Strategy
1.3.1.1 in-situ reserves	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.3.1.2 ex-situ conservation	This indicator is not modelled for future state performance. Variance will be measured and reported in the Stewardship Report.	Not required at this time.
1.4.1.1 minimize disturbances	This indicator is not modelled for future state performance. Performance will be measured and reported in the Stewardship Report.	Not required at this time.
2.1.1.1 reforestation compliance	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.
2.1.1.2 MAI	This indicator is not modelled for future state performance. Variance would be reported in the Stewardship Report.	Not required at this time.
2.1.2.1 conversion of forested landbase	This indicator is not modelled for future state performance. Updates to the landbase would be reported in the Stewardship Report.	Not required at this time.
2.1.2.2 forests affected by insects, disease, natural events	This indicator is not modelled for future state performance. Impacts to the landbase from events would be reported in the Stewardship Report.	Not required at this time.
2.1.3.1 control non-native plant species	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
3.1.1.1 minimize roading impacts	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.

Indicator	Variance Description	Mitigation Strategy
3.1.1.2 minimize erosion incidents	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.
3.2.1.1 ECA	There are many watersheds that are between 20-30 ECA throughout the planning horizon. Several watersheds exceed 30 ECA at some point during the planning horizon of this plan. Most recover below 30 within 1 or 2 periods.	For watersheds that are approaching or exceeding a 30% ECA, operators may choose to implement the following mitigation strategies: a. Anchor retention of vegetative structure along ephemeral & intermittent streams b. Plan cut blocks and roads using Lidar and wet areas mapping to minimize impacts to hydrologically sensitive areas c. Review access construction plan to avoid high risk watercourses d. Implement access management (seasonal closure, partial reclamation) e. Enhanced monitoring in areas deemed to be high risk f. Follow accepted practices for road and water crossing construction, maintenance, removal and remediation g. Participate in shared or integrated access plans with other road owners as appropriate h. Conduct operations so that soil surface disturbance is minimized, and sediment is prevented from entering the stream i. Reclaim roads as soon as possible and under frozen conditions where possible j. Minimize variance through additions Mitigative strategies beyond what is listed above is not required for watersheds that exceed 50 as recovery occurs quickly without action.

Indicator	Variance Description	Mitigation Strategy
3.2.2.1 Riparian Buffers	This indicator is not modelled for future state performance. Variance would include non-compliance penalties and would be reported in the Stewardship Report.	Not required at this time.
5.1.1.1 AAC	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
5.2.1.1 reduce wildfire threat	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
5.2.2.1 integration of other users	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
5.2.3.1 stand yields	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
6.1.1.1 indigenous consultation	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
6.1.1.2 indigenous cultural sites	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
6.1.1.3 indigenous relationships	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.
6.2.1.1 public involvement	This indicator is not modelled for future state performance. Performance would be reported in the Stewardship Report.	Not required at this time.

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CHAPTER 8 PERFORMANCE MONITORING AND REPORTING

8.1. Annual Reporting

Annual Reporting will inform on the current status of the indicators identified in the VOITs table (Annex 8). A separate Annual Report will not be developed. Annual reporting requirements are described in the VOIT table and will be met through the submission of the following:

- Spatial Data Submission
- ARIS Reporting
- Timber Production Reporting & Audit
- General Development Plan
- Annual Operating Plans
- Forest Harvest Plans
- Final Clearance Inspection Reporting
- Debris Disposal (Burn) Plan & Performance Reporting
- Indigenous Consultation ROC Logs

All reports and plans (excluding Indigenous Consultation ROC Logs) are made available to the public at the Annual Open House and Public Advisory Group meetings.

8.2. Stewardship Reporting

Stewardship reporting is required by the ABFMPS, *Section 2 – FMP Process and Content Standards, Section 1.4 – Submission Requirements.* The requirements for a monitoring program and the evaluation of actual versus expected outcomes are identified in *Section 2.2.6*.

A Stewardship Report is a report that accounts for all activities, undertaken as a steward of a given article, resource, area or process, related to strategies to achieve stated stewardship goals. Measures of performance are included and linked to plans that express the desired goals. All timber operators are expected to contribute relevant information to the Stewardship Report.

8.2.1. Responsibilities of Embedded Non-FMA Quota Holders

FMP embedded Quota Holders are responsible for preparing summaries of their forest management activities as coordinated by Weyerhaeuser for the SR submission. Required information is described in *section 2.5 of the Forest Management Planning Standard Interpretive Bulletin: Stewardship Reporting Requirements* (version June 15, 2017).

8.2.2. Frequency and Transparency

The Stewardship Reports covered by this FMP will be submitted to the province at the following frequency:

- Period covering May 1, 2014-April 30, 2019 submitted by December 31, 2019
- Period covering May 1, 2019-April 30, 2024 submitted by December 31, 2024
- Period covering May 1, 2024-April 30, 2029 submitted by December 31, 2029

The Stewardship Report is made available to the public at the Annual Open House and Public Advisory Group meetings.

8.2.3. Reporting Requirements

Stewardship Reports will be developed as per the *Forest Management Planning Standard Interpretive Bulletin: Stewardship Reporting Requirements* (version June 15, 2017) including required reporting on VOITS as well as mandatory components from the Bulletin.

8.2.3.1. Mandatory Components

- FMP Approval Decision Conditions
- Regional and DFA Specific Management Objectives
- SHS Variance Reporting
- Landbase Changes
- AAC Review
- Growth and Yield Program Maintenance
- Seed Availability and Usage
- FGRMS Reporting

8.2.3.2. VOITs

- Dynamic (Operational VOITs
- Modeled VOITs
- Non-FMPS VOITs

8.2.3.3. Forest Management Plan Commitments

The Stewardship Report will also include the following information based on Forest Management Plan commitments.

DC to CD Transition Strategy[40]

a) A summary of the establishment survey results of openings declared to CD that are moving in the direction of a DC in the annual Silviculture Plan and Stewardship Reports. This will include prescription to ensure these harvest areas will be put back onto the CD trajectory and meet the Reforestation Standard of Alberta.
b) An explanation of why any DCs that were declared to CD didn't meet the target is required.
c) A separate account of the C stands that ended up DCs.

Operationalizing stands with 10-40% Larch[41]

Weyerhaeuser commits to reporting utilization and reforestation performance of stands with 10-40% Larch in the 5-year Stewardship Report using establishment and performance survey data.

[40] DC to CD Strategy, FMB response, April 1, 2019
[41] Version Feb 28, 2019 as presented to the PDT and implemented in the CLB and SHS

Structure Retention Strategy[42]

Weyerhaeuser commits to reporting ongoing performance of this strategy in the 5-year Stewardship Report using data from the Spatial Data Submission as well as operational block monitoring reports.

Incidental Volume Replacement[43]

Reforestation information for incidental volume on the conifer and the deciduous landbase is monitored through establishment (year 8) and performance (year 14 surveys). This includes reforested volume and leave for natural (LFN)/ ingress volume. Silviculture treatments, including LFN, as well as results from surveys are tracked through ARIS.

8.3. Planned vs. Actual Volumes

The 2011 FMP approval included a condition (18.1) that a Delivered Timber Volume Program was to be submitted for approval. A program was submitted, and an approval was provided on July 12, 2012. This program summarizes the main components and steps included to monitor and reconcile the anticipated volumes from the spatial harvest sequence to the delivered volume to the mill. This internal process includes block by block inventory and woodflow monitoring using field inventory records and LIMS reporting.

For the 2019 FMP submission, information regarding the drain of Annual Allowable Cut by quadrant (Annual Timber Production Reports (TPRS)) is included in *Annex 12: Stewardship Report- AAC Review.*

Currently, there is no procedure for incorporating planned vs. actual delivered timber volumes into the development of yield curves.

8.4. Spatial Harvest Sequence Validation

8.4.1. Forest Harvest Plan Validation to the Spatial Harvest Sequence

The validation requirements for each Forest Harvest Plan Submission are outlined in the current Operational Ground Rules and will be reported in the five-year Stewardship Report.

8.4.2. Validation of Actual Harvest to Spatial Harvest Sequence

Variance Tracking (planned versus harvested) is reported per cost zone in each Forest Harvest Plan as well as summarized for the entire FMA area in the General Development Plan. Variance tracking will be completed as per the approved Operational Ground Rules. Specific requirements for area and volume reconciliation within Caribou Range is detailed in Chapter 10.

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[42] TSA0003 Resolved May 2, 2018; Structure Retention Discussion resolved December 17, 2018 (PDT)

[43] Mixedwood Management Strategy developed by WY, NB & GoA January 30, 2019

8.5. Timber Chargeability and Reporting Process

The Preferred Forest Management Strategy (PFMS) was modelled on a divided landbase. This results in volume being considered as either Primary or Secondary depending on the overall Broad Cover Group of the stand. This designation, as well as assignment of responsibility, influences AAC chargeability, dues calculations and reforestation liability.

Conifer stands are identified as Cx, CD, DC and D_US stands. Conifer produced from conifer stands is considered primary volume while deciduous produced from these stands is considered secondary or incidental volume.

Deciduous stands are identified as Dx. Deciduous produced from deciduous stands is considered primary volume while conifer produced from these stands is considered secondary or incidental volume.

Table 8-1. Chargeability and Broad Cover Group

Broad Cover Group	Conifer	Deciduous	Responsibility
C	Primary	Secondary	Weyerhaeuser
CD	Primary	Secondary	Weyerhaeuser
DC	Primary	Secondary	Weyerhaeuser
D- Main Block	Secondary	Primary	Norbord
D- Saddle Hills	Secondary	Primary	Norbord or Tolko
D_U	Primary	Secondary	Weyerhaeuser

***Local Use (C or D) can be sourced from the entire FMA area*

8.5.1. Weyerhaeuser's Coniferous Allocation

Weyerhaeuser reports the amount of merchantable coniferous volume produced from the Forest Management Area to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section. This includes all roundwood coniferous volume (sawlogs and pulpwood) harvested by Weyerhaeuser.

8.5.2. Deciduous Quota Allocations

Deciduous Quota Holders report the amount of merchantable deciduous volume produced under their respective Quota Certificates from the Forest Management Area to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section. This includes all roundwood deciduous volume harvested under Norbord and Tolko's quota certificate as well as the Province's unallocated volume, should it be operated during this plan.

8.5.3. Local Use

Alberta Agriculture and Forestry, Grande Prairie reports the amount of merchantable coniferous volume from FMA 6900016 generated through local use to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section.

All coniferous local use volume is charged to the 8,634m^3 allocation as outlined in the current Forest Management Agreement for FMA6900016. Any deciduous local use volume will be charged to Norbord Inc.

8.5.4. Sterilized Deciduous Volume

Sterilized deciduous volume is volume that is part of the Timber Harvesting Landbase, included in the designed and planned cutblock area and for various reasons was not harvested or harvested but not delivered with the corresponding cutblock. This volume is left isolated and not feasible to be deferred for harvest within the current rotation.

Sterilized deciduous volume is calculated using the following formula:

a - (b + c + d)

a) Total pre-harvested deciduous volume
b) Total deciduous volume delivered or staged for delivery
c) Targeted deciduous structural retention
d) Merchantable deciduous volume used for crossings

The entire sequence has been tagged with a conifer and a deciduous operator. Sterilized deciduous volume (as defined above) will be charged to the tagged operator's deciduous allocation. Sterilized deciduous volume is reported at the end of the timber year to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section.

8.5.5. Merchantable Timber Used for Watercourse Crossings

The company reports the amount of merchantable volume used for crossings at the end of each timber year to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section. Merchantable timber used in crossings is charged to each operator's allocation.

8.5.6. Salvage Wood

Timber salvage volumes will be determined based on the Weigh Scale Method[44], as outlined in Forest Management Branch Directive 2008-03.
All coniferous salvage wood delivered to Weyerhaeuser from FMA 6900016 is charged to Weyerhaeuser's coniferous allocation. All deciduous salvage wood delivered to Norbord or Tolko from FMA 6900016 is charged to the corresponding deciduous quota allocation.

[44] Approved February 23, 2016 by AAF Timber Production, Auditing and Revenue Section

8.5.7. Purchased Volume from outside FMA6900016

Volume purchased from sources outside of FMA6900016 are not part of the coniferous or deciduous allocations and are not reported to the Alberta Agriculture and Forestry Timber Production, Auditing and Revenue Section to be charged against FMA allocations.

8.5.8. Retention

The amount of merchantable retention left on the FMA area has been accounted for by using a 4% merchantable area reduction as part of the Classified Landbase process. No further volume chargeability process is required.

8.6. Timber Dues Payments

The operator that is tagged to the volume will hold the responsibility for AAC drain and dues payment for that volume as agreed to with the Province.

Chapter 8-Appendix 3: Growth and Yield Monitoring Program

Weyerhaeuser Forest Management Plan

Growth and Yield Monitoring Program

AUTHOR: Gyula Gulyas

DATE: August 20, 2019

2019

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

CHAPTER 8 PERFORMANCE MONITORING AND REPORTING

Executive Summary

Weyerhaeuser Company Ltd. (Weyerhaeuser) received an agreement-in-principle for the 2019 FMP Yield Projections on April 1, 2019. In this document, the Government of Alberta requested the development of a robust Growth and Yield Program to gather key information for use in future timber supply analyses and to monitor the 2019 FMP timber yield assumptions.

Weyerhaeuser assembled a GYP as part of the 2019 FMP submission for the Grande Prairie Timberlands Forest Management Area (FMA #6900016). This document outlines the growth and yield requirements and describes the means by which these requirements will be met.

Glossary of Common Acronyms

AAC	Allowable Annual Cut
AAF	Alberta Agriculture and Forestry
ARIS	Alberta Regeneration Information System
AVI	Alberta Vegetation Inventory
EFM	Enhanced Forest Management
DFMP	Detailed Forest Management Plan
FMA	Forest Management Agreement
FMP	Forest Management Plan
FMU	Forest Management Unit
FRIAA	Forest Resource Improvement Association of Alberta
FTG	Free-to-grow
GYPSY	Growth and Yield Projection System
LiDAR	Light Detection and Ranging
LRSY	Long Run Sustained Yield
MGM	Mixedwood Growth Model
MPB	Mountain Pine Beetle
PGYI	Provincial Growth and Yield Initiative
PSP	Permanent Sample Plot
RSA	Reforestation Standard of Alberta
TSA	Timber Supply Analysis
TSP	Temporary Sample Plot

CHAPTER 8 PERFORMANCE MONITORING AND REPORTING

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CHAPTER 8 PERFORMANCE MONITORING AND REPORTING

1 Introduction

1.1 Background

Weyerhaeuser Company Ltd. (Weyerhaeuser) is assembling a Growth and Yield Program (GYP) as part of the 2019 FMP submission for the Grande Prairie Timberlands Forest Management Agreement Area (FMA # 6900016). Weyerhaeuser received agreement-in-principle (AIP) for the FMP Yield Projections on April 1, 2019 (AAF 2019b). In the AIP, the Government of Alberta (GoA) requested the development of a robust GYP with a focus on the managed and genetically improved stands. The GYP must gather key information for use in future timber supply analyses and to monitor the 2019 FMP timber yield assumptions.

1.2 Report Objectives

This report documents the guiding principles, objectives, sampling design and data collection protocols used in Weyerhaeuser's GYP. The intent is to provide AAF with the information necessary to review and approve the program.

1.3 Guiding Principles

A set of guiding principles provides structure for the objectives of the GYP through all program phases, including sampling design, plot establishment and data collection, analysis and reporting. The GYP is designed so that it will:

1. Be fiscally responsible.
    - Utilize existing growth and yield programs and data to reduce overall costs.
    - Collect only the necessary data to maintain cost-effectiveness.
    - Use RSA performance survey data as an important component of the program.
    - Continue to evaluate opportunities to utilize emerging technologies such as LiDAR and other remote sensing methods that have the potential for long-term cost savings.
2. Be scientifically defensible.
    - Develop an objective-driven sampling design.
    - Obtain a sample size that is sufficient to meet program objectives.
    - Collect unbiased, local, representative data for the target populations.
    - Aim for the highest possible data quality.
3. Be efficient.
    - Build upon existing data collection systems and data format standards.
    - Participate in the PGYI program for growth model development.
    - Cooperate with others on tree improvement and realized gain trials.
    - Design sampling programs that represent the target population over time.

- Apply a sampling design that allows for the timely accumulation of data.
- Facilitate continuous improvement of the programs.
- Use spatially explicit data systems for referencing and analysis.

4. Be consistent.
   - Align growth and yield program objectives with the assumptions made in the TSA.
   - Stabilize plot configuration and data collection protocols for the next FMP cycle.
   - Use generally accepted protocols during data compilation and analysis.

2 Growth and Yield Monitoring Plan 2015

2.1 Overview

As part of the DFMP process, Weyerhaeuser developed a Growth and Yield Monitoring Plan (GYMP) in 2015 (Weyerhaeuser 2015) for the Grande Prairie FMA area. This plan established Weyerhaeuser's growth & yield monitoring objectives for the fire-origin and post-harvest regenerated (PHR) stands on the FMA.

The primary goal of the plan was to provide data to check growth and yield predictions. The intent was that the GYMP would be robust and provide data to check the different yield projection systems that are developed over time.

The specific objectives were to:

1. Monitor change in volume, species composition, stand top height, and site index in natural stands on the FMA, including the assessment of the growth and yield impact of Mountain Pine Beetle (MPB). This data will be compared with predicted values of the same attributes used in timber supply analyses to provide a level-of-comfort that predictions are accurate.
2. Provide data on natural stand growth that can be used as a subset of the data to develop new G&Y models and calibrate or validate existing models.
3. Monitor change in volume, species composition, stand top height, and site index (growth intercept) in regenerated stands on the FMA. This data will be compared with predicted values of the same attributes and regeneration assumptions used in the timber supply analyses to provide a check that predictions are accurate.
4. Provide data on competition and succession in regenerated stands that can be used to link early stand performance to late stand conditions, especially in succession-based mixedwood stands.
5. Provide data on stand height, volume growth, seedling mortality, and ingress that can be used as a subset of the data to develop new G&Y models or calibrate existing ones for regenerated stands.
6. Provide data that could be used to develop relationships between ecological classification and stand development.

Weyerhaeuser were to maintain and re-measure only 325 natural stand PSPs based on a less intense reduced grid pattern to meet objectives 1, 2 and 6 in natural stands. The remainder of the original 949 natural plots were to be dropped without further re-measurements and only maintained in the database for future analyses.

In order to meet objectives 3, 4, 5 and 6, Weyerhaeuser were to continue establishing new PSPs at harvested grid locations and re-measuring the existing 273 PSPs in managed stands based on the original grid design of 12 grid points per township.

There have been several key changes regarding growth and yield since the 2011 DFMP:

- The emergence of the RSA and its potential use in FMP yield curve development.
- The development of the GYPSY growth model for natural and managed stands in May 2009 and its adaptation for RSA projections and FMP yield curve development.
- The establishment of PGYI in 2014.
- The Grande Prairie FMA area was hit with a second major MPB inflight from British Columbia in 2009 and its continuous spread in the FMA.
- Accelerated harvest levels as per the Healthy Pine Initiative, the requirement for a new spatial harvest sequence and a new AVI updated for beetle kill resulted in the need to complete the new FMP much earlier than the original scheduled date of April 30, 2021.

These changes played a role in shaping Weyerhaeuser's growth and yield data collection and modeling efforts related to the commitments made in the 2015 GYMP. The focus shifted to an accelerated re-measurement schedule of existing natural stand PSPs and the re-measurement of due or over-due managed stand PSPs.

Natural stand PSPs that were in MPB-attacked stands had to be scheduled for a re-measurement to ensure that the last measurement reflected the new AVI photos and interpreted stand attributes after the MPB attack. Over 260 natural stand PSPs were re-measured on an accelerated schedule between 2015 and 2018 to ensure that the ground measurement accurately captured MPB mortality in the stand so that they can be used in the 2019 FMP yield curve development.

The PSP field manuals were updated, including the introduction of the genetic tagging in plots located in openings where improved stock has been deployed. The manuals were approved for use in 2015.

Weyerhaeuser remeasured over 170 managed stand PSPs that were due or overdue on their measurement cycle (5 years). Only 37 new managed stand PSPs were established due to limited resources.

Weyerhaeuser also converted and submitted 75 natural and 100 managed stand PSPs to the PGYI online database in early 2017.

EFM tree improvement strata were identified as a separate population of openings in the RSA performance survey sampling protocols starting in 2014.

2.2 Proposed Changes Based on the 2019 FMP

Weyerhaeuser reviewed their 2015 GYMP, data collection efforts based on the 2019 FMP and considered the following broad modifications:

1. **Review the PSPs that are outside of the current natural stand active landbase.**

   Weyerhaeuser excluded 265 natural stand PSPs that were outside of the active landbase in the 2019 FMP. There were also over 180 plots on the reduced grid that were measured more than 10 years from the AVI photo year. There was considerable amount of investment made in the collection of these data without return. Data collection efforts will focus on plots that are either currently in the natural stand active landbase or potentially will be included in the next FMP. Weyerhaeuser will keep some of the operational and subjective deletions, operational buffers. Natural stand PSPs on steep slopes, in DIDs deletions, non-forested, unproductive (TPR=U) or disturbed (in harvested cutblocks, or subject to windthrow, fire or other natural disturbance) would be dropped.

2. **Revise the sampling design of the managed stand PSP program.**

   While the current sampling grid provides an unbiased sample of managed stands, it does not allow for the timely accumulation of representative plot data. This is especially true regarding the validation and monitoring of growth and yield of RSA-based yield curves beyond 14 years of stand age. The existing plots will be maintained, but the grid-based sampling frame will be abandoned. New plots will be established in RSA-surveyed openings. These new plots will follow the same layout and field data collection protocol as the original grid-based, PGYI-compatible plots established to date (Apical Forestry Consulting 2015).

3. **Reconcile and organize all spatial and aspatial RSA performance survey data in the FMA area.**

   It took considerable effort to assemble the RSA plot data for the 2019 FMP yield curve development. Given the importance of this data in developing managed stand yield curves in the next FMP, Weyerhaeuser will need to ensure that the information is readily available.

3 Current Growth and Yield Program

3.1 Proposed Framework

The general proposed framework and minimum requirements for the GYP are outlined in AAF's Growth and Yield Guidelines Series in the draft document titled "*Growth and Yield Programs*" (AAF 2016).

The basic objective of a GYP is to provide data for model development, monitoring and the localization and validation of FMP yield estimates in natural fire-origin and PHR stands.

In addition, there may also be several other company-specific objectives that must be met such as developing volume estimates for operational planning purposes, localization of taper coefficients, calibration of a new photo inventory or the collection of information necessary to support silviculture decision making.

The GYP needs to address three primary strategic elements:

1. Growth Modeling
2. FMP Yield Curve Development
3. Performance Monitoring

The strategic elements and associated objectives will determine the scope, sampling design and intensity of the data collection programs that may be required. The following sections provide detailed discussion of these strategic elements and associated objectives in Weyerhaeuser's GYP. On-going data collection programs in the FMA area and their role in meeting the objectives of these strategic elements are also discussed.

3.1.1 Growth Modeling

Forest growth modeling is the development of statistical models that help quantify change in forest attributes over time. In Alberta, growth models are primarily used for creating yield curves in support of FMP development. These models are also used for assessing silviculture performance under the RSA.

Objective: to collect data suitable for the calibration of existing growth models (e.g., GYPSY and/or MGM) and/or the development of new growth models that work in both natural fire-origin and PHR managed stands.

Growth modeling requires repeated measures of individual trees over time; therefore, PSPs that cover a wide array of stand conditions across the entire age range of forest stands are required. This is problematic in PHR stands where sampling historically has been less intensive (less area was available for sampling), age range of stands is limited and stands are subjected to evolving silviculture treatment regime (site preparation, planting densities, stock types and tending). Empirical modelling is not an option in PHR stands due to the lack of representative data in the older, merchantable age range.

Forestry companies and AAF recognized that a collaborative effort was needed. The PGYI program under the Alberta Forest Growth Organization[45] was formed in 2011 to build a system of PSPs across Alberta that is maintained by member companies based on a set of minimum standards and best practices. Weyerhaeuser signed the memorandum of understanding (MOU) in June 2014 (AFGO 2014).

[45] The organization is now known as Forest Growth Organization of Western Canada (FGrOW).

The objective of PGYI is to collectively obtain data on tree growth through repeated measurements of PSPs to develop, calibrate and validate growth models for FMP yield curve development. FGrOW published guidelines for minimum standards for PGYI plot establishment and measurement (AESRD 2015).

The main focus of the PGYI data collection is to fill the gap in PHR stands based on a plot allocation matrix and thus enable the calibration of growth models that will help quantify and link early stand performance and future productivity under a variety of silviculture regimes and resulting stand conditions.

3.1.2 FMP Yield Curve Development

Yield curve development for the next FMP timber supply analysis will follow different methodologies depending on the available data, growth model and stand types in the defined forest area (DFA).

Objective: to develop unbiased yield estimates for natural stands that are representative of the mean current yields by stratum and age class that are observed on the current active landbase and to develop FMP yield estimates for managed stands that are representative of expected future yields.

3.1.3 Performance Monitoring

The company needs to evaluate whether the growth and yield assumptions made in the current FMP are being achieved. In a very simplistic sense, observed yield needs to be compared to the predicted yield in the active landbase using unbiased, independent plot data that represents the target population over time. The change in forest attributes in young managed stands need to be monitored where merchantable yields are not yet available.

In the context of the GYP, performance monitoring is restricted to collecting data to validate yield assumptions made in the FMP. Other monitoring requirements (e.g., climate change) at the landscape and landbase level are generally addressed via external programs such as the Alberta Biodiversity Monitoring Institute (ABMI), Values Objectives, Indicators and Targets (VOITs), NFI and others.

Objective: to assess the risk and uncertainty around the yield assumptions underlying the AAC determination of the current FMP (2019) with a special focus on the managed and genetically improved stands.

3.2 Natural Stand PSP Program

3.2.1 History

The natural stand PSP program was initiated in 1975 by Procter & Gamble Cellulose on their Grande Prairie FMA. The initial objectives were to replace or update the base inventory and to provide a better estimate of future forest growth. Over the past 44 years, over 1,000 plots have been established and re-measured. Within the current FMA boundary, there are 928 PSPs in natural stands.

3.2.2 Sampling Design

The PSPs provide up-to-date volume and growth information for the FMA and are located on a predetermined systematic fixed grid. This grid layout is identical for each township and consists of 12 plots per township. The locations of the plots in each township are depicted in **Figure 1**.

PSPs were established in the following locations:

Center of northwest quarter, section 1
Center of northeast quarter, section 3
Center of northwest quarter, section 4
Center of northeast quarter, section 6
Center of southwest quarter, section 13
Center of southwest quarter, section 16
Center of northeast quarter, section 19
Center of northwest quarter, section 21
Center of northeast quarter, section 22
Center of northwest quarter, section 24
Center of southwest quarter, section 33
Center of southwest quarter, section 36

In 2006, Weyerhaeuser decided to scale back the natural stand PSP program by using a subset of the original sample grid (sections 1, 4, 21 and 24 in each township) to be maintained and remeasured on a 10-year measurement cycle (Weyerhaeuser 2015). In 2012, Weyerhaeuser undertook a log profile study using LiDAR. As part of this study, about 100 natural stand PSPs that were not on the proposed reduced grid had been remeasured.

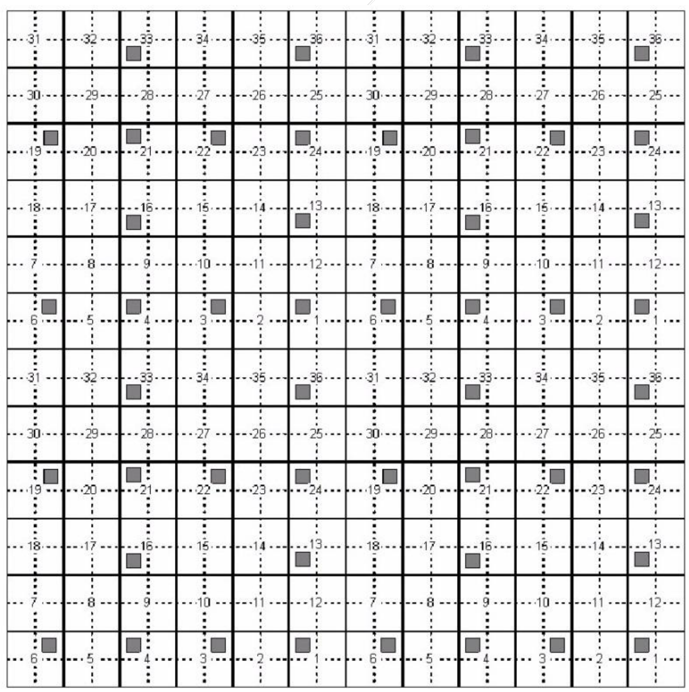

Figure 1. Original PSP sample grid design.

3.2.3 Plot Layout & Data Collection

The PSPs are composed of three nested plots; the main plot is square with an area of 0.08 ha (0.04 ha in reduced size plots) and aligned in the cardinal directions. All trees greater than 50 mm DBH are tagged and measured in the main plot. The 0.02 ha sapling plot is nested in the northwest corner of the main plot. Trees from 1.3 m height to 50 mm DBH are tagged and measured in regenerated stands. There are four 0.001 ha regeneration plots within the sapling plot[46], located at cardinal bearings from the center post. All live trees less than 1.3 m are measured for height in the regeneration plots with no tagging.

Age at stump height (30 cm)[47] is collected inside the main plot for 3 largest DBH conifer trees if the conifer tally is greater than 90% and the 3 largest DBH deciduous trees if deciduous tally is greater than 90%.

Age is collected on 2 conifer trees and 1 deciduous if greater than 50% of the tally is conifer and at least 10% is deciduous. Weyerhaeuser collects ages on 2 deciduous trees and 1 conifer if greater than 50% of the tally is deciduous but there is at least 1 conifer. Age tree selection was based on the largest DBH live trees without height damage or excessive defects and/or disease.

Plots are numbered according to their location in the grid system and whether they are in a natural or managed stand. Plot numbers are composed of 12 digits; the first digit corresponds to the meridian, the next three to the township, the following two to the range, and the final six to the section (survey number). For example, PlotID = 605606000003_NAT represents natural plot #3 in township 56, range 6, and meridian 6.

A detailed description of Weyerhaeuser's PSP program and data collection protocols can be found in the *Weyerhaeuser PSP Manual* (Apical Forestry Consulting 2015).

3.2.4 Current Status

Weyerhaeuser undertook the development of natural stand yield curves in their 2019 FMP using 928 natural stand PSPs. However, over 50% of the plots were lost (477) as a result of landbase netdown and various other deletions resulting in a significant loss of investment.

Given the shrinking natural stand landbase, a good understanding of growth and yield in most natural stand types in the Grande Prairie area and the need to allocate funding to growth model development and monitoring of managed stands, Weyerhaeuser decided to reduce the size of the natural stand PSP program.

The active plot list was rebuilt based on the following considerations:

- Keep all plots that are part of the PGYI program.
- Drop plots that have been harvested since the last measurement.
- Drop plots that are not on the reduced grid and were last measured before 2004.
- Drop plots in non-merchantable, non-forested, administrative removal (grazing leases) or in permanent deletions as per the 2019 FMP active landbase.
- Drop plots that are located outside of the FMA boundary.

[46] Sapling and regeneration plots in natural stand PSPs were only established starting in the 2007 field season.
[47] Although ages were collected at stump height, they were always recorded as total age by using the AVI 2.1 years to reach stump height correction factors (ASRD 2005).

- Drop plots that have been impacted or destroyed by roads, pipelines or fire.
- Drop plots in hydro-buffers as per the 2019 FMP active landbase, if the creek is visible on the LiDAR hill shade.
- Drop plots that are scheduled for harvest by the spring of 2020.
- Drop plots that have been harvested around (in a retention patch) and may represent a windthrow hazard.
- Drop plots that have known data quality issues (i.e. missing tags, re-numbered trees, plot boundary issues, significant number of missed trees etc.).

There are 377 active natural stand PSPs in the Grande Prairie FMA area[48], 75 of these plots are part of the PGYI program. The plots are listed in Appendix I.

The spatial distribution of the active natural PSPs is presented in **Figure 2**.
Plot and area[49] distributions by Base 10 yield strata are presented in

Table 2-1 and **Figure 3**.

Table 2-1. Distribution of natural stand PSPs and net area by Base 10 strata.

Broad Cover Group	GoA Base 10 Stratum	Net Area (ha)	Net Area (%)	Plots (#)	Plots (%)
D	Hw	185,175	31	80	21
D	Hw (D_US)*	38,051	6	19	5
DC	HwPl	7,825	1	2	1
DC	HwSx	38,901	6	33	9
CD	SwHw	34,479	6	27	7
CD	PlHw	10,380	2	11	3
CD	SbHw	389	0	0	0
C	Sw	110,809	18	82	22
C	Pl	159,749	27	101	27
C	Sb	15,291	3	21	6
N/A				1	0
Totals		**601,049**	**100**	**377**	**100**

** Conifer understorey "switch" stands*

[48] Plots that are removed from the program and dropped are being kept “dormant”. No tags are removed, nails pulled or Industrial Sample Plot (ISP) reservations cancelled until the re-assessment of the status of the plot data in the Forest Stewardship Report in 2024.

[49] The area summaries are based on the 2019 FMP landbase provided by Forsite on July 31, 2019.

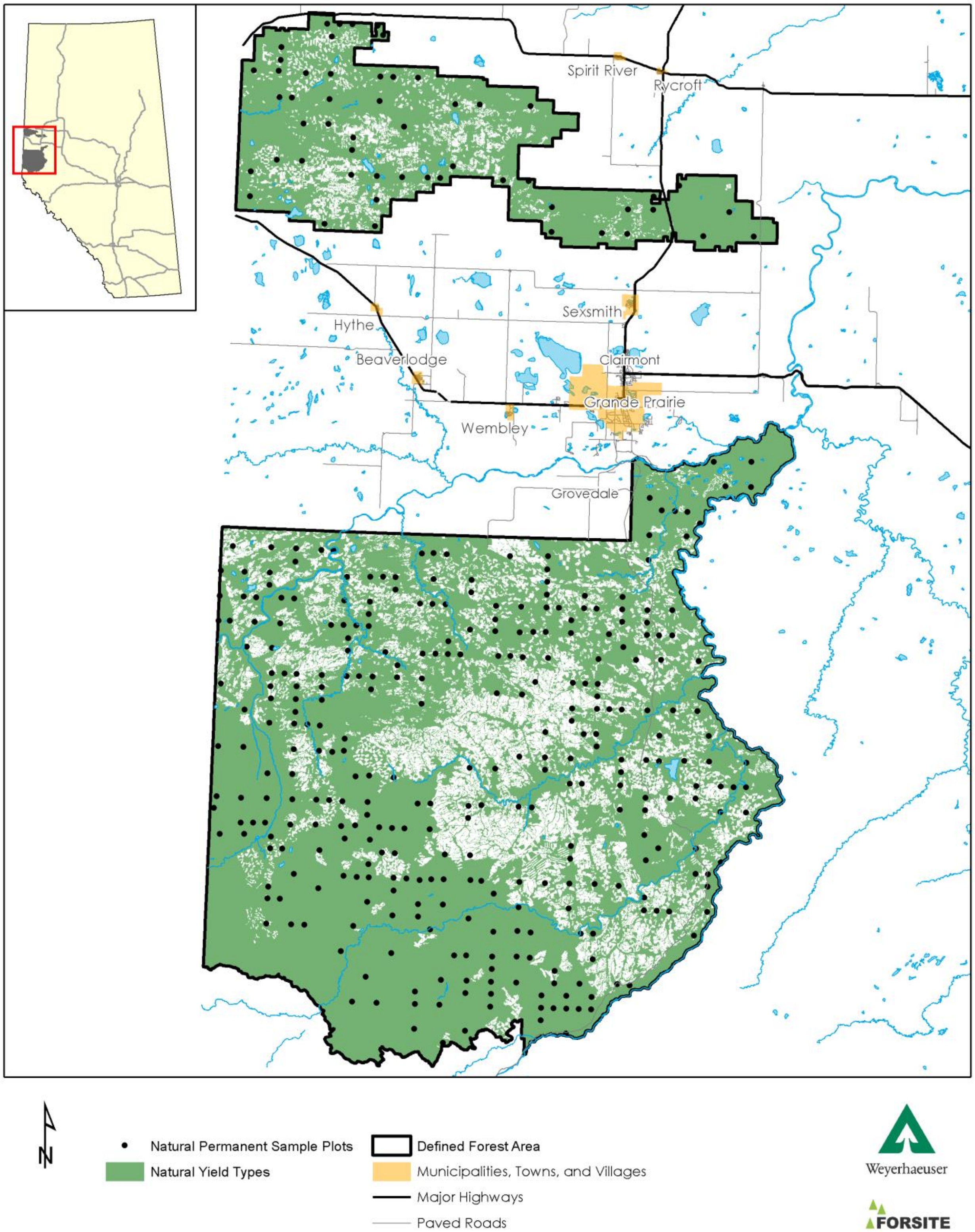

Figure 2. Active natural stand PSPs in the Grande Prairie FMA area.

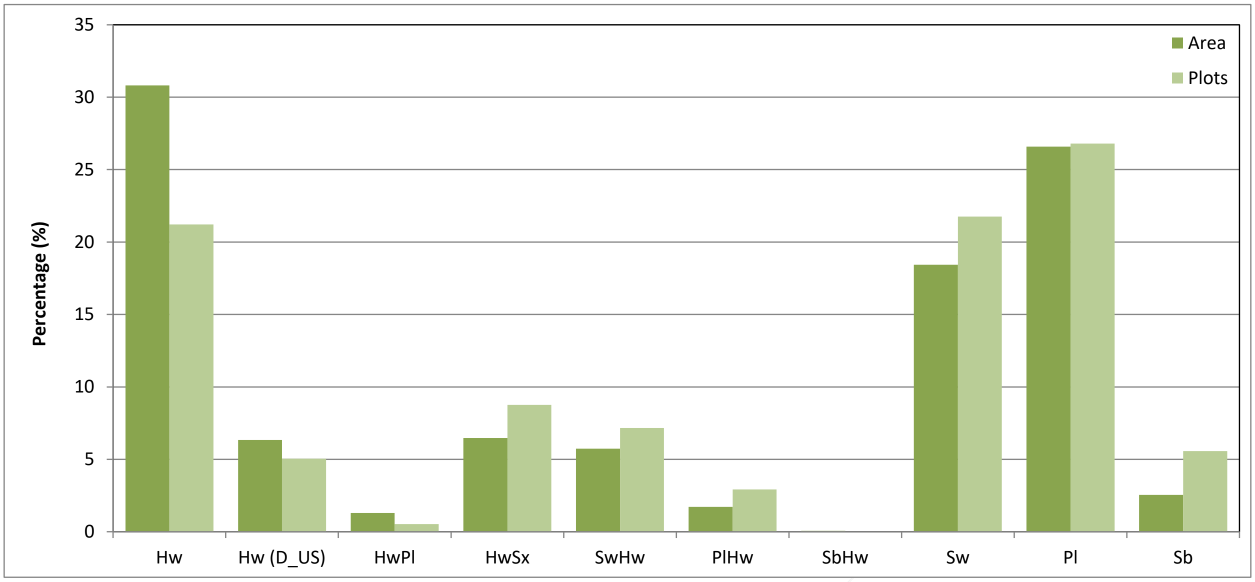

Figure 3. Net area and plot distribution by Base 10 strata in natural stands.

The distribution of natural stand PSPs by Base 10 strata follows the distribution of area reasonably well in the active conifer landbase (C/CD/DC broad cover types). There is slight over-representation in the Sw, HwSx and the Sb strata. One PGYI plot fell outside of the forested landbase and will be reviewed[50].

There is an under-representation of the Hw stratum in the active deciduous landbase (31% of the area represented by 21% of the plots). This is mostly due to historical reasons of Weyerhaeuser's focus of the original sampling design on the conifer landbase.

The distribution of net area and plots by natural subregion is shown in

Table 2-2 and **Figure 4**. The distribution of plots is in good agreement with the distribution of area in the active landbase.

Table 2-2. Distribution of natural stand PSPs and net area by natural subregion.

Natural Subregion	Net Area		Plots	
	(ha)	(%)	(#)	(%)
Alpine	36	0	0	0
Central Mixedwood	64,770	11	44	12
Dry Mixedwood	27,583	5	17	5
Lower Foothills	289,047	48	180	48
Montane	4,764	1	2	1
Sub-Alpine	95,234	16	63	17
Upper Foothills	119,615	20	71	19
Totals	**601,049**	**100**	**377**	**100**

[50] Plot 606410000004 is a PGYI plot (stratum: Sw based on the ground observed basal area). Three-quarter of the plot is in the creek or creek bank and may need to be replaced.

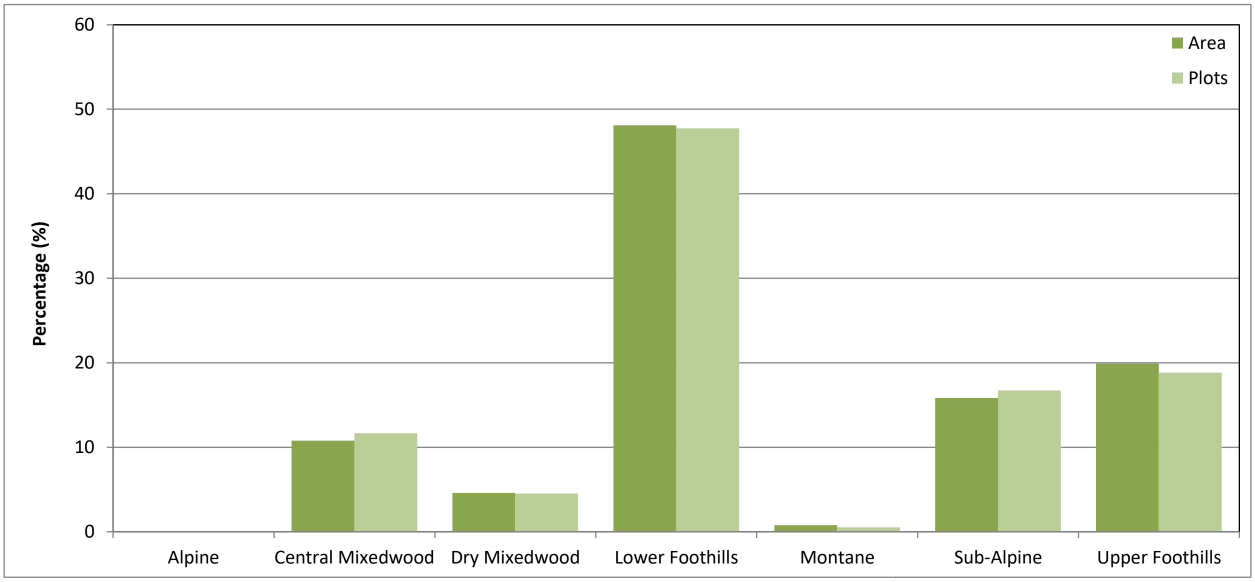

Figure 4. Net area and plot distribution by natural subregion in natural stands.

The distributions by inventory age class and height class are presented in Appendix II. There is a good agreement between the plot and area proportions in the active landbase by overstorey age and height.

3.2.5 Scheduling

All natural stand PSPs will be scheduled for a measurement before the next FMP in 2029 on a 10-year cycle (**Table 2-3**).

Table 2-3. Natural stand PSP measurement schedule by Base 10 strata.

GoA	Measurement Year											Total
Base 10	Overdue	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Hw	1	5	1	5	28	5		1	3	19	12	80
Hw (D_US)	1	1		3	2	3				7	2	19
HwPl		1								1		2
HwSx	1	2		3	6	1	3		1	13	3	33
SwHw	1	1	2	8	2	2	3		2	5	1	27
PlHw				3		2			2	3	1	11
SbHw												0
Sw	8	4	6	7	3	11	5	8	2	22	6	82
Pl	12	2	10	13	5	26	3	3	5	8	14	101
Sb	2	3	4	3	1	2		1		2	3	21
N/A			1									1
Total	**26**	**19**	**24**	**45**	**47**	**52**	**14**	**13**	**15**	**80**	**42**	**377**

There are 26 plots that are now overdue and will need to be measured. Based on the plot measurement schedule, we may need to shift some of the PSPs for a better balance. Re-scheduling plots should only be done, if necessary, using only non-PGYI designated plots, as the measurement cycle for growth model development should stay at 10 years. The long-term goal is to have a roughly equal number of PSPs re-measured per year providing stability for budgeting and the planning and availability of field crews. However, Weyerhaeuser also must consider the re-measurement of managed stand PSPs when building the schedule.

3.2.6 Strategic Elements

Weyerhaeuser's natural stand PSPs will contribute to all three strategic elements of the GYP.

Growth Modeling

The growth modeling function is fulfilled by maintaining 75 natural stand PSPs in the Grande Prairie FMA area. Weyerhaeuser's PGYI commitments in natural stands are shown in

Table 2-4. All natural stand commitments have met the PGYI allocation requirements (Weyerhaeuser 2016).

Table 2-4. Weyerhaeuser's PGYI plot allocation matrix in natural stands.

Yield Stratum	Natural Subregion Group								Total	
	CMW		LFH		UFH		RM*			
	Target	Estab	Target	Estab	Target	Estab	Target	Estab	Target	Estab
1_Hw	4	4	9	9					**13**	**13**
2_HwPl			2	2	1	1			**3**	**3**
3_HwSx	4	4	3	3					**7**	**7**
4_SwHw			1	1	1	1			**2**	**2**
5_PlHw	1	1	6	6	2	2	1	1	**10**	**10**
6_SbHw			1	1					**1**	**1**
7_Sw	1	1	8	8	4	4	3	3	**16**	**16**
8_Pl	1	1	3	3	7	7	6	6	**17**	**17**
9_Sb	4	4	1	1	1	1			**6**	**6**
Total	**15**	**15**	**34**	**34**	**16**	**16**	**10**	**10**	**75**	**75**

** Rocky Mountain group includes Alpine, Sub-Alpine and Montane natural subregions.*

The collected PGYI data with all historic measurements to 2017 have been submitted to the PGYI database in a set of comma-delimited (CSV) files.

FMP Yield Curve Development

The last measurement of the 377 natural stand PSPs will be used to develop/calibrate the natural stand yield curves in the next FMP. Stratification will be based on the inventory as per Planning Standard requirements using the Base 10 stratification. Additional plots may be needed in some mixedwood strata (

Table 2-1) and the conifer understorey "switch" stands to meet minimum sample size requirements (AAF 2016).

Performance monitoring

Natural stand yield monitoring can be achieved by directly comparing the natural stand PSP growth trajectories with the current FMP yield curves.

Weyerhaeuser will compare the average PSP rate of growth over the active landbase by yield group and at the forest-level to the estimate of volume per hectare as predicted from the FMP yield curves. It provides an estimate of annual growth and total growing stock and allows for a useful comparison to the AAC. It also helps with the overall validation of the FMP yield prediction.

In addition to calculating average growth rates, Weyerhaeuser will also calculate the average volume per hectare by 20-year age class based on the last measurement of the natural stand PSPs. The information will be compared to FMP yield curve predictions by yield group on a series of scatterplots for the conifer and deciduous gross merchantable volumes.

There will be over 200 plot measurements by 2024 that also meet the important criterion of being independent from the modeling data set used in the development of the 2019 FMP yield curves (**Table 2-3**).

These plot measurements will be added to the modeling data set of the next FMP if they are eligible for inclusion (i.e., inside the active landbase based on the new forest inventory and netdown methodology).

Monitoring results will be compiled and reported in 2024 as part of the Forest Stewardship Report. Depending on the outcome, Weyerhaeuser will be able to adjust their strategy to obtain the data necessary for the development of yield curves in the next FMP in 2029.

Although forest inventories, FMP yield curve development and TSA are only completed periodically, the maintenance of an effective GYP requires on-going effort and support from all stakeholders of the DFA.

3.2.7 Future Commitments

Based on the review of the current status of the natural stand PSP program and its role in meeting the strategic elements of the GYP, Weyerhaeuser will undertake the following:

1. *Protect PGYI plots from harvesting activities.*

Weyerhaeuser will protect the PGYI from harvesting to ensure stability for the PGYI program. All non-PGYI plots will be maintained as per current policy and will not be protected from harvest to ensure that proportional representation of the stand types will be preserved.

2. *Convert all 377 natural plots to FORCORP's online database and data collection system.*

To simplify field data collection protocols and database systems, Weyerhaeuser will transition their PSP data to FORCORP's PLOTS module and associated online database (GY Monitoring Program- Appendix III). All historic measurements of the plots will be converted to PGYI standard.

3. *Maintain a PGYI-compatible data collection protocol across all natural stand PSPs.*

Weyerhaeuser's data collection protocols will be revised to meet PGYI minimum standards. Plot configuration, layout and size will be kept intact and the tree and sapling tagging limits will also remain unchanged. However, the following changes will be implemented starting in the fall of 2019:

- Regeneration will be tallied (counted) by species in the four circular regeneration plots (1.78 m radius). Regeneration is defined as any live conifer with a height between 30 and 130 cm. Deciduous regeneration below 130 cm will not be tallied.
- Age data will be collected in the 200 m^2 sapling plot on the two largest DBH eligible top height trees by GYPSY species group (PL, SW, SB and AW) that represent at least 10% of the basal area of the plot. Eligible trees are those that are live and healthy, have no broken or dead top or other visible impediment to height growth, not leaning, not a wolf-tree and no severe damage to the root, bole or crown[51]. Age measurements for each species group will typically be done once only

[51] Note that crown class is not used as a criterion in selecting suitable age trees, as the largest diameter trees for a species may be in different layers/cohorts during different stand development stages. Crown class could also be subjective or difficult to tell, especially in mixed species stands (AESRD 2015).

by taking a core at breast height. All age measurements must be verified from cookies or cores in the office. Ages from trees with rot are not acceptable.

- Tree condition codes will be collected to PGYI standard in all PSPs.
- Vegetation cover (shrub/herb/grass/moss/lichen), ecosite phase and topographic position will be collected to PGYI standard in all PSPs.
- Ten percent of the PGYI-designated plots are stem-mapped as per PGYI requirements.

Detailed measurement protocols will be included in the PSP manual. All proposed changes are in line with PGYI minimum standards and FORCORP's PLOTS module and field data collection protocols.

4. Submit all backlog natural stand PGYI plot measurements to date.

Once all plot data is converted to the FORCORP on-line database, the submission is streamlined. All PGYI plot measurements are validated after the conversion to ensure that the PGYI submission is as smooth as possible.

5. Review the status of the PGYI-designated natural stand PSPs.

Weyerhaeuser needs to review the PGYI plots for any issues that prevent further measurements and/or should be dropped from the program. This may include plots that have been recently harvested, have been netted out (e.g., in a creek/buffer) or if the plot has significant data quality issues based on plot comments and measurement data.

6. Rationalize natural stand PSP measurement schedules.

Based on the plot measurement schedule presented in **Table 2-3**, we may need to shift some of the PSPs for a better balance. Re-scheduling should only be done on non-PGYI plots, as the measurement cycle for growth model development should stay at 10 years for the PGYI-designated plots. The long-term goal is to have a roughly equal number of PSPs re-measured per year providing stability for budgeting and the planning and availability of field crews. However, Weyerhaeuser also must consider the re-measurement of managed stand PSPs when building the schedule.

There are 26 plots that are now overdue and will need to be reviewed and measured as soon as possible.

7. Review natural stand sample sizes by Base 10 strata and supplement, if required.

Weyerhaeuser reduced their natural stand PSP program to 377 plots that provides excellent spatial coverage (Figure 2) and appears to represent the current active natural landbase well for all major conifer and mixedwood strata (
Table 2-1). There are enough plots in all major strata[52] with the exception of the conifer understorey "switch" stands. Plot distribution will be reviewed at the completion of the new AVI to ensure that the best available information is used, including an assessment of the last measurement of each plot. The last measurement of most plots will be within 5 years of the aerial photography of the next inventory in around 2024-25. As per generally accepted PSP protocols for natural stands in Alberta, Weyerhaeuser's natural stand PSP program is on a 10-year measurement cycle. Weyerhaeuser would like to use 10 years as a cut-off for the inclusion of last measurements of PSPs in FMP yield curve development[53] as per the provision in *Section 4.2.7.g* of the Planning Standard (ASRD 2006).

[52] Major strata are defined as any Base 10 strata that cover 5% or more of the active natural landbase as per the 2019 FMP.
[53] Provided that the last ground measurement is not significantly different from the new inventory label (e.g., increased levels of mortality due to an MPB attack, recent harvest etc.).

If required, supplemental data could be collected by a random selection and re-measurement of dormant PSPs in Base 10 strata that are short. Access is well-known and documented for these plots, they are on a grid, plot size and configuration are compatible with the rest of the data set and most will have their tags in good shape. Even if tags are lost, the measurement could be treated as a TSP without the need to replace missing tags.

Alternatively, an independent natural stand TSP program could be introduced to establish supplemental plots. The sample plan and field data collection protocols would need to be developed and signed off by AAF before implementation.

3.3 Managed Stand PSP Program

3.3.1 History

The managed stand PSP program was initiated in 1983 to monitor early stand development, growth and mortality in young stands. Over the past 36 years, over 270 plots have been established and re-measured. Within the current FMA boundary, there are 274 PSPs in managed stands.

3.3.2 Sampling Design

PSPs in managed stands were established on the same sampling grid that was used for natural stand PSPs. Any natural stand PSP that had been harvested was replaced by a managed stand PSP within two years of planting[54].

3.3.3 Plot Layout & Data Collection

Plot configuration and data collection protocols follow the same specifications used in natural stand PSPs with several additional components. Veteran[55] trees are identified in the data and growth intercept information is collected on planted conifer trees.

Starting in the 2012/13 field season, Weyerhaeuser identified genetically enhanced PSPs that were established in cutblocks that are "green field" planted 100% with genetic stock. Genetic trees are identified and tracked over time to assess their growth and see if these trees eventually become the main crop trees of the stand (Apical Forestry Consulting 2015).

[54] However, this protocol was not always followed due to scheduling conflicts.

[55] Remnants from the previous stand that are not expected to be present at the next harvest.

3.3.4 Current Status

Weyerhaeuser undertook a review of the managed stand PSP program. The active plot list was revised based on the following considerations:

- Keep all plots that are part of the PGYI program.
- Keep all HASOC (tree improvement) plots.
- Drop plots in non-merchantable, non-forested, administrative removal or in permanent deletions as per the 2019 FMP active landbase.
- Drop split-plots (plot "straddles" between managed and mature stand boundary).
- Drop plots that have known data quality issues (i.e. missing tags, re-numbered trees, plot boundary issues, significant number of missed trees etc.).

There are 258 active managed stand PSPs in the Grande Prairie FMA area[56], 100 of these plots are part of the PGYI program. The plots are listed in Appendix IV. The spatial distribution of the active managed stand PSPs is shown in **Figure 5**.

The plot and area distributions by Base 10 strata are presented in

Table 2-5 for managed stands harvested prior to March 1, 1991 (M91).

Table 2-5. Distribution of M91 stand PSPs and net area by Base 10 strata.

Broad Cover Group	GoA Base 10 Stratum	Net Area		Plots	
		(ha)	(%)	(#)	(%)
D	Hw	12,581	24	22	21
D	Hw (D_US)*	5,334	10	16	16
DC	HwPl	1,817	3	6	6
DC	HwSx	1,415	3	3	3
CD	SwHw	1,924	4	6	6
CD	PlHw	4,115	8	3	3
CD	SbHw	0	0	0	0
C	Sw	3,705	7	10	10
C	Pl	21,742	41	35	34
C	Sb	240	0	2	2
Totals		**52,873**	**100**	**103**	**100**

The majority of the M91 stands are in pine-leading stands (41%) with a significant pure deciduous component (24%). There are 103 plots for this block era; however, most strata do not have enough plots for yield curve development or monitoring efforts.

[56] There are 27 additional PSPs that were installed in 2018 as part of a Realized Gain Trial for lodgepole pine, white spruce and black spruce tree improvement programs. These plots are discussed in Section 3.5.

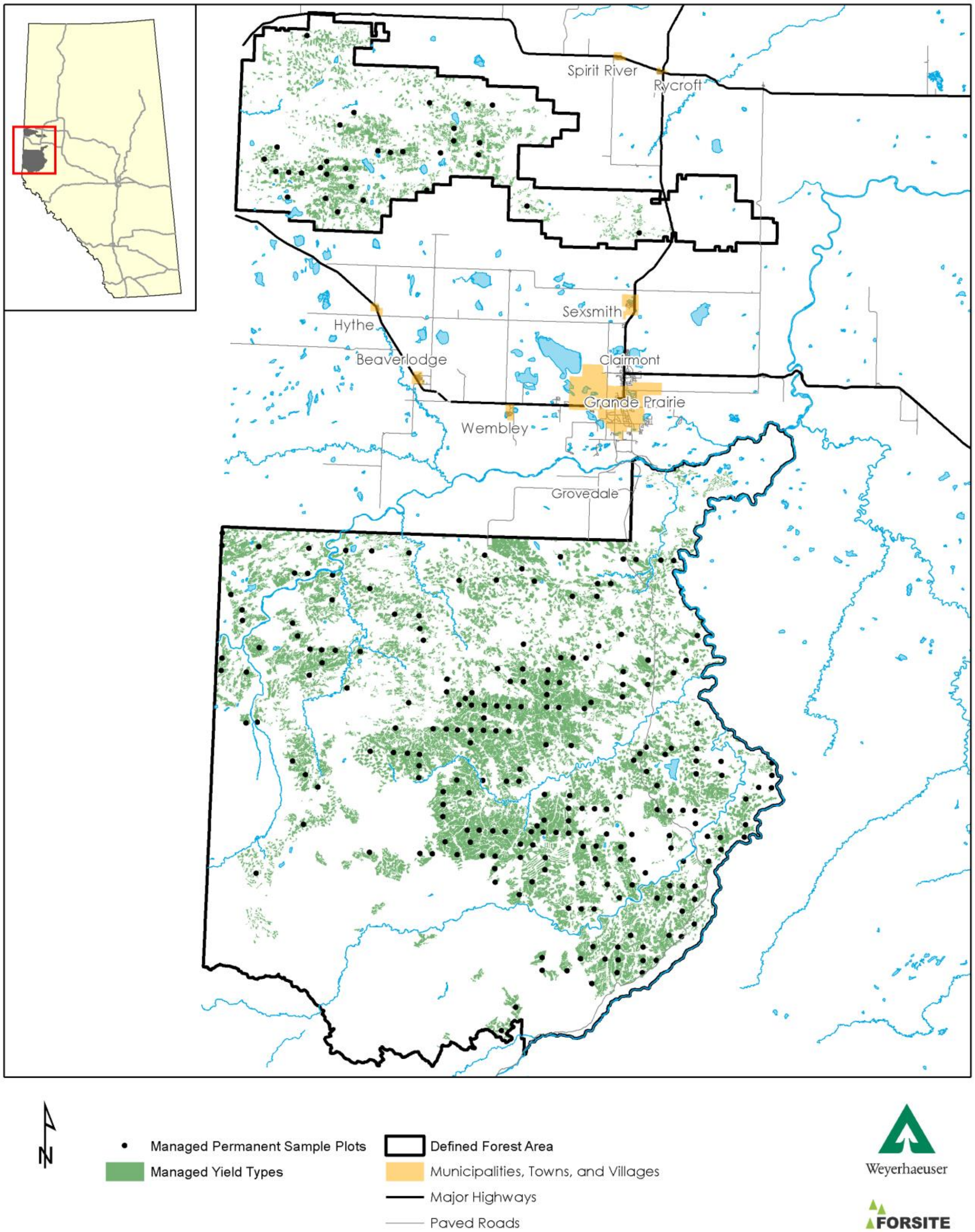

Figure 5. Active managed stand PSPs in the Grande Prairie FMA area.

The plot and area distributions by Base 10 strata are presented in **Table 2-6** for managed stands harvested on or after March 1, 1991 (MGD).

Table 2-6. Distribution of MGD stand PSPs and net area by Base 10 strata.

Broad Cover Group	GoA Base 10 Stratum*	Net Area		Plots	
		(ha)	(%)	(#)	(%)
D	Hw	38,520	22	21	14
DC	HwPl	795	0	0	0
DC	HwSx	1,632	1	3	2
CD	SwHw	8,207	5	7	5
CD	PlHw	2,294	1	5	3
CD	SbHw	0	0	0	0
C	Sw	19,021	11	19	12
C	Pl	74,740	43	73	47
C	Sb	1,024	1	1	1
C	PlG	21,329	12	20	13
C	SwG	4,679	3	6	4
Totals		**172,241**	**100**	**155**	**100**

** Genetic strata are denoted with a 'G' suffix.*

While there is sufficient proportional representation of MGD strata (with the exception of Hw), there is limited number of plots accumulated in the current grid design for all, but the Pl stratum. There are 26 PSPs located in genetic strata.

Approximately 80 plots are in stands that are less than 15 years old (**Table 2-7**).

Table 2-7. Distribution of managed stand PSPs by harvest year.

Harvest Year	Net Area		Plots	
	(ha)	(%)	(#)	(%)
1950-79	19,256	9	43	17
1980-89	30,226	13	50	19
1990-91	3,391	2	10	4
M91 Stands	*52,873*	*23*	*103*	*40*
1991-99	52,187	23	55	21
2000-09	64,336	29	62	24
2010-18	55,718	25	38	15
MGD Stands	*172,241*	*77*	*155*	*60*
Grand Total	**225,114**	**100**	**258**	**100**

3.3.5 Scheduling

All managed stand PSPs will be scheduled for at least one more measurement before the next FMP in 2029 (**Table 2-8**). Plots are re-measured on a 5-year interval until they reach 30 years and they are measured on a 10-year cycle afterward.

Table 2-8. Managed stand PSP measurement schedule.

Meas. Year	First Measurement			Second Measurement			Grand Total
	PGYI-Designated Plot?						
	Yes	No	Sub-Total	Yes	No	Sub-Total	
Overdue	9	8	17			0	17
2019	14	23	37			0	**37**
2020	12	29	41			0	**41**
2021	5	24	29			0	**29**
2022	4	1	5			0	**5**
2023	16	35	51	7	5	12	**63**
2024			0	12	21	33	**33**
2025	22	25	47	7	24	31	**78**
2026		2	2	3	21	24	**26**
2027		2	2	1		1	**3**
2028	18	9	27	4	20	24	**51**
Total	**100**	**158**	**258**	**34**	**91**	**125**	**383**

There are 17 managed stand PSPs that appear to be overdue and will need to be scheduled.

3.3.6 Strategic Elements

Weyerhaeuser's managed stand PSPs will contribute to all three strategic elements of the GYP.

Growth Modeling

The growth modeling function is fulfilled by maintaining 100 managed stand PSPs in the Grande Prairie FMA area. Weyerhaeuser's PGYI allocation targets and commitments in managed stands are shown in **Table 2-9**. (Weyerhaeuser 2019).

Table 2-9. Weyerhaeuser's PGYI plot allocation matrix in managed stands.

Yield Stratum	Natural Subregion Group								Total	
	CMW		LFH		UFH		RM*			
	Target	Estab	Target	Estab	Target	Estab	Target	Estab	Target	Estab
1_Hw	11	12	8	8					**19**	**20**
2_HwPl			9	8	2	2			**11**	**10**
3_HwSx	1	2	5	5					**6**	**7**
4_SwHw	1	2	12	12	1	0			**14**	**14**
5_PlHw			8	8	2	2	1	1	**11**	**11**
6_SbHw									**0**	**0**
7_Sw	2	2	2	2	6	4	3	2	**13**	**10**
8_Pl	1	4	8	8	6	6	9	8	**24**	**26**
9_Sb					2	2			**2**	**2**
Total	**16**	**22**	**52**	**51**	**19**	**16**	**13**	**11**	**100**	**100**

** Rocky Mountain group includes Alpine, Sub-Alpine and Montane natural subregions.*

Based on Weyerhaeuser's review of the PGYI allocation in early 2016, eight plots were deemed ineligible for various reasons (e.g., plot was partially logged or deactivated since the original selection was made). Two plots were successfully replaced in the CMW-1_Hw group, but the other six plots could not be replaced from the available PSP data set. Based on a recent analysis and PGYI data submission reporting, there is a real shortage of plot data in the CMW natural subregion (AAF 2019a). Weyerhaeuser proposed to add six plots from the CMW natural subregion, rather than attempting to meet their original PGYI targets (Weyerhaeuser 2019).

The collected PGYI data with all historic measurements to 2017 have been submitted to the PGYI database in a set of comma-delimited (CSV) files.

FMP Yield Curve Development

Managed stands that were harvested prior to 1991 (M91) will be stratified based on the latest AVI and will be projected using natural stand yield curves with the exception of the Pl stratum (**Table 2-5**). The last measurement of the Pl plots will be used to develop yield projections using GYPSY or MGM that are Alberta's officially approved models of choice.

It's expected that post-1991 (MGD) managed stand yield curve development will be based on RSA performance survey data. However, the last measurement of the managed stand PSPs can be added to help develop/calibrate the managed stand yield curves in the next FMP. Alternatively, the PSP data could be used as an independent data source to check RSA-based yield projections.

Performance Monitoring

In the 2019 FMP, all M91 yield strata were defaulted to the natural stand yield groups and associated curves with the exception of the Pl stratum. New measurements of the managed stand PSPs in the Pl stratum (basic silviculture only) will be used to monitor and compare growth trends to the 2019 FMP yield curve projections.

The major emphasis for post-1991 managed stands is the assessment of risk associated with using RSA-based yield curves and regeneration transition assumptions. RSA-based managed stand basic silviculture yield curves increase the LRSY over 40% for the conifer and over 10% for the deciduous above the FMP baseline[57] (**Table 2-10**).

[57] Assuming each yield stratum regenerates to itself.

Table 2-10. Long Run Sustained Yield in the Grande Prairie FMA area based on the 2019 FMP.

YC Type	Yield Group	Net Area (ha)	All Regenerate to Current YC					All Regenerate to RSA Managed YC (no genetic gain)				
			Culm. Age (years)	Con. MAI (m^3/ha/yr)	Dec. MAI (m^3/ha/yr)	Total Con. (m^3/year)	Total Dec. (m^3/year)	Culm. Age (years)	Con. MAI (m^3/ha/yr)	Dec. MAI (m^3/ha/yr)	Total Con. (m^3/year)	Total Dec. (m^3/year)
NAT	CD_PL	10,380	90	1.70	0.85	17,645	8,823	90	2.70	1.44	28,025	14,947
NAT	CD_SX	34,868	130	1.20	0.78	41,842	27,197	100	2.60	1.26	90,657	43,934
NAT	C_PLOC	68,894	110	2.01	0.03	138,476	2,067	90	3.26	0.47	224,593	32,380
NAT	C_PL_AB	33,897	90	1.86	0.09	63,048	3,051	90	3.26	0.47	110,504	15,932
NAT	C_PL_CD	56,958	110	2.16	0.10	123,030	5,696	90	3.26	0.47	185,684	26,770
NAT	C_SB	15,291	180	1.11	0.00	16,973	0	180	1.11	0.00	16,973	0
NAT	C_SWOC	35,005	120	1.57	0.13	54,958	4,551	100	2.91	0.46	101,866	16,102
NAT	C_SW_AB	58,501	90	1.98	0.32	115,833	18,720	100	2.91	0.46	170,239	26,911
NAT	C_SW_CD	17,302	90	1.98	0.32	34,258	5,537	100	2.91	0.46	50,348	7,959
NAT	DC_PL	7,825	90	1.70	0.85	13,303	6,651	90	2.70	1.44	21,128	11,268
NAT	DC_SX	38,901	110	1.07	1.39	41,624	54,073	100	2.60	1.26	101,143	49,015
NAT	D_AB	50,974	70	0.20	2.61	10,195	133,043	70	0.14	2.96	7,136	150,885
NAT	D_CD	134,200	70	0.14	2.96	18,788	397,232	70	0.14	2.96	18,788	397,232
NAT	D_US	38,051	70	0.47	1.78	17,884	67,731	100	2.60	1.26	98,934	47,945
M91	CD_PL	4,115	90	1.70	0.85	6,996	3,498	90	2.70	1.44	11,111	5,926
M91	CD_SX	1,924	130	1.20	0.78	2,308	1,500	100	2.60	1.26	5,002	2,424
M91	C_SB	240	180	1.11	0.00	267	0	180	1.11	0.00	267	0
M91	DC_PL	1,817	90	1.70	0.85	3,089	1,545	90	2.70	1.44	4,907	2,617
M91	DC_SX	1,415	110	1.07	1.39	1,514	1,967	100	2.60	1.26	3,678	1,783
M91	D_AB	7,745	70	0.20	2.61	1,549	20,215	70	0.14	2.96	1,084	22,926
M91	D_CD	4,836	70	0.14	2.96	677	14,314	70	0.14	2.96	677	14,314
M91	D_US	5,334	70	0.47	1.78	2,507	9,494	100	2.60	1.26	13,868	6,721
M91	PL	21,742	100	3.28	0.42	71,315	9,132	90	3.26	0.47	70,880	10,219
M91	SW	3,705	90	1.98	0.32	7,336	1,186	100	2.91	0.46	10,781	1,704
MGD	C_SB	1,024	180	1.11	0.00	1,137	0	180	1.11	0.00	1,137	0
MGD	D_CD	38,434	70	0.14	2.96	5,381	113,763	70	0.14	2.96	5,381	113,763
MGD	Hw	86	80	0.71	2.46	61	212	70	0.14	2.96	12	255
MGD	HwPl	795	100	2.03	1.75	1,613	1,391	90	2.70	1.44	2,146	1,144
MGD	HwSx	1,632	100	2.02	1.80	3,297	2,938	100	2.60	1.26	4,244	2,057
MGD	Pl	74,740	90	3.26	0.47	243,652	35,128	90	3.26	0.47	243,652	35,128
MGD	PlHw	2,294	90	2.70	1.44	6,194	3,303	90	2.70	1.44	6,194	3,303
MGD	Sw	19,021	100	2.91	0.46	55,352	8,750	100	2.91	0.46	55,352	8,750
MGD	SwHw	8,207	100	2.60	1.26	21,338	10,341	100	2.60	1.26	21,338	10,341
MGD	PL_G147p1	21,329	90	3.42	0.47	72,944	10,025	90	3.26	0.47	69,532	10,025
MGD	SW_G351p1	4,679	100	3.01	0.46	14,085	2,153	100	2.91	0.46	13,617	2,153
Total		826,163		1.49	1.19	1,230,470	985,225		2.14	1.33	1,770,877	1,096,830
											144%	111%

The focus of the GYP is to have a robust long-term monitoring program for the managed stands population. There are three main questions that must be answered via monitoring of post-1991 managed stands:

1. Are we on track regarding managed stand growth and other key stand attributes?
2. Do we meet the average input at 14 years after harvest (performance age) that was assumed in the development of RSA-based FMP yield curves?
3. What happens to managed stand growth beyond 14 years of age?

There are 155 post-1991 managed stand PSPs (129 basic silviculture and 26 genetic) that can be projected by the GYPSY model and superimposed on the RSA-based yield curves to analyze trends and identify potential issues with yield assumptions.

There are 41 managed stand PSPs with a completed RSA program in cutblocks harvested between 1995 and 2003. There are approximately 75 more managed stand PSPs that are currently too young for a performance survey.

Although the RSA standards are based on consistent data collection protocols and a scientifically defensible and statistically sound sampling design, there is significant risk associated with model-based projections of these data. It is not known whether model projections beyond 14 years are an accurate representation of expected future yields.

In order to answer question #3 in a short and medium term, Weyerhaeuser will need to revise the current strategy of establishing new PSPs in recent cutovers at the harvested grid points.

3.3.7 Future Commitments

Based on the review of the current status of the managed stand PSP program and its role in meeting the strategic elements of the GYP, Weyerhaeuser will undertake the following:

1. *Convert all 258 managed stand plots to FORCORP's online database and data collection system.*

To simplify field data collection protocols and database systems, Weyerhaeuser will transition their PSP data to FORCORP's PLOTS module and associated online database. All historic measurements of the plots will be converted to PGYI standard.

2. *Maintain a PGYI-compatible data collection protocol across all managed stand PSPs.*

Weyerhaeuser's data collection protocols will be revised to meet PGYI minimum standards. Plot configuration, layout and size will be kept intact and the tree and sapling tagging limits will also remain unchanged. However, the following changes will be implemented starting in the spring of 2020:

- Regeneration will be tallied by species in the four circular regeneration plots (1.78 m radius). Regeneration is defined as any live conifer with a height between 30 and 130 cm. Deciduous regeneration below 130 cm will not be tallied. Detailed field protocols will be reviewed in the fall of 2019 to finalize the regeneration plot data collection regarding tree tagging, height sampling and other measurements. The finalized protocol will meet PGYI minimum standards and will apply to all plots.
- Age data will be collected in the 200 m^2 sapling plot on the two largest DBH eligible top height trees by GYPSY species group (PL, SW, SB and AW) that represent at least 10% of the basal area of the plot. Eligible trees are those that are live and healthy, have no broken or dead top or other visible impediment to height growth, not leaning, not a wolf-tree or veteran and no severe damage to the root, bole or crown. Record total age for deciduous and total and breast height ages for coniferous post-harvest stands and young fire-origin stands by counting whorls or coring[58]. Coring at breast height should only be done for trees that are at least 10 cm in DBH.
- Tree condition codes will be collected to PGYI standard in all PSPs. Tree origin will be recorded on all tagged trees as per the PGYI standard.
- Vegetation cover (shrub/herb/grass/moss/lichen), ecosite phase and topographic position will be collected to PGYI standard in all PSPs.

[58] Aging young trees in post-harvest stands can be greatly aided by harvest, tending and planting information, as they can provide good information on potential origin ages for trees ("reference ages"). It is highly recommended that field crews obtain silviculture information prior to commencing field work and calculate reference ages before heading into the field.

- Ten percent of the PGYI-designated plots are stem-mapped as per PGYI requirements.

Detailed measurement protocols will be included in the PSP manual. All proposed changes are in line with PGYI minimum standards and FORCORP's PLOTS module and field data collection protocols.

3. Submit all backlog managed stand PGYI plot measurements to date.

Once all plot data is converted to the FORCORP on-line database, the submission is streamlined. All PGYI plot measurements are validated after the conversion to ensure that the PGYI submission is as smooth as possible.

4. Review the status of the PGYI-designated managed stand PSPs.

Weyerhaeuser needs to review the PGYI plots for any issues that prevent further measurements and/or should be dropped from the program. This may include plots that have been recently destroyed, have been netted out (e.g., in a deletion or retention patch), are located in post-1991 openings without a proper ARIS linkage or if the plot has significant data quality issues based on plot comments and measurement data.

5. Rationalize managed stand PSP measurement schedules.

Based on the plot measurement schedule presented in **Table 2-8**, we may need to shift some of the PSPs for a better balance across both PSP programs. Re-scheduling should only be done on non-PGYI plots. The long-term goal is to have a roughly equal number of PSPs re-measured per year providing stability for budgeting and the planning and availability of field crews.

There are 17 managed stand plots that are now overdue and will need to be reviewed and measured as soon as possible.

6. Validate managed stand yield curves.

As per points 7.a and 7.b of the AIP for the FMP Yield Projections (AAF 2019b), Weyerhaeuser will validate FMP post-1991 managed stand yield curves using all managed stand PSPs (basic silviculture and tree improvement[59]) by overlaying GYPSY projections of the PSPs with the average yield curves. The analysis will be completed as part of the Forest Stewardship Report in 2024.

7. Revise strategy for establishing new managed stand PSPs.

Weyerhaeuser's strategy for accumulating managed stand plots was to establish a new PSP at every harvested grid location (**Figure 1**) two years after silviculture treatment.

The current sampling design does not allow for the timely accumulation of data, especially the assessment of risk beyond 14 years of stand age.

In order to address these potential concerns, Weyerhaeuser proposes the following:

A) Abandon the current grid-based sampling frame for managed stand PSPs;

B) Establish five new plots/year in older RSA-surveyed cutblocks; and

C) Maintain the current managed stand PSP configuration and field data collection protocols that are compatible with the minimum standards of PGYI.

[59] There are an additional 27 PSPs that were established in 2018 as per of the RGT project.

Weyerhaeuser proposes to establish five plots per year in Pl and Sw non-EFM strata a minimum of five years after the completion of the RSA performance survey[60]. These plots should be established in sampling units (SUs) that were originally selected for ground sampling in Weyerhaeuser openings. It is anticipated that there will be 100 plots established by 2029, some with an additional measurement. These post-RSA plots will be re-measured on a 5-year cycle until they reach 30 years stand age and on a 10-year cycle afterwards. Depending on the number of plots accumulated and the potential findings of intermittent analyses during Forest Stewardship Reporting or future FMP yield curve development, it is possible that only a subset of these plots will be measured beyond 30 years. Detailed sampling methodology will be developed upon approval of the GYP.

8. Extend measurement cycle for non-PGYI managed stand plots to 10 years.

In order to increase the sample size in post-RSA managed stands, Weyerhaeuser will need to re-allocate resources to meet budget requirements and field logistics. This could be done by extending the measurement cycle of non-PGYI managed stand PSPs from 5 years to 10 years for plots located in openings that are at least 20 years old.

3.4 Reforestation Standard of Alberta Performance Surveys

RSA performance surveys collect detailed plot information within sampling units which can be at the opening or sub-opening level (AAF 2018). The sampling frame for performance surveys in a given year is defined as all openings between 12 and 14 years of age belonging to a specific sustained yield unit.

[60] Weyerhaeuser is currently conducting aerial RSA performance surveys every 2 years which translates to 10 post-RSA GYM plots per year. The goal is to have a stable program for plot establishment that does not fluctuate with the size of the RSA program

3.4.1 Current Status

RSA performance survey data is currently available from 2009 to 2019 as shown in **Table 2-11** and **Table 2-12**.

Table 2-11. RSA performance survey data by system, company and survey year.

Program Type	System Type	Program Year	Company	Population Area (ha)	Population # of SUs	Sampled Area (ha)	Sampled # of SUs	# of Blocks
REG	Aerial	2009	Weyerhaeuser	3,927.1	228	357.4	37	144
REG	Aerial	2010	Weyerhaeuser	9,494.4	509	468.1	42	362
REG	Aerial	2012	Weyerhaeuser	9,619.6	645	901.7	89	424
REG	Aerial	2014	Weyerhaeuser	157.9	14	138.3	14	6
REG	Aerial	2014	Weyerhaeuser	8,374.4	540	810.2	81	313
REG	Aerial	2016	Weyerhaeuser	9,695.9	538	924.1	106	385
REG	Aerial	2018	Weyerhaeuser	8,511.7	493	1,118.7	116	339
REG	Non-Photo	2009	Weyerhaeuser	404.1	29	404.1	29	11
REG	Non-Photo	2014	Weyerhaeuser	533.2	29	533.2	29	28
REG	Non-Photo	2015	Weyerhaeuser	40.2	4	40.2	4	3
REG	Non-Photo	2015	Weyerhaeuser	5.4	1	5.4	1	1
REG	Non-Photo	2016	Weyerhaeuser	74.1	1	74.1	1	1
REG	Non-Photo	2010	Norbord	47.5	1	47.5	1	1
REG	Non-Photo	2014	Norbord	65.7	1	65.7	1	1
REG	Non-Photo	2014	Norbord	154.8	3	154.8	3	3
REG	Non-Photo	2016	Norbord	123.2	2	123.2	2	2
REG	Non-Photo	2009	FRIAA	26.5	5	26.5	5	4
REG	Non-Photo	2010	FRIAA	23.5	5	23.5	5	5
REG	Non-Photo	2011	FRIAA	53.8	9	53.8	9	8
REG	Non-Photo	2012	FRIAA	69.0	10	69.0	10	9
REG	Non-Photo	2013	FRIAA	69.5	10	69.5	10	10
REG	Non-Photo	2014	FRIAA	42.5	8	42.5	8	6
REG	Non-Photo	2016	FRIAA	51.5	3	51.5	3	3
Sub-total of regular programs				**51,565.2**	**3,088**	**6,502.8**	**606**	**2,069**
EFM	Aerial	2014	Weyerhaeuser	138.9	13	106.3	13	9
EFM	Aerial	2016	Weyerhaeuser	517.8	33	311.3	30	27
EFM	Aerial	2018	Weyerhaeuser	2,424.1	116	608.0	57	77
Sub-total of EFM programs				**3,080.8**	**162**	**1,025.6**	**100**	**113**
Total of all RSA Programs 2009-2019*				**54,646.0**	**3,250**	**7,528.4**	**706**	**2,182**

** Quota Holders' programs do not include the 2017-2019 samping years.*

Table 2-12. RSA performance survey data by system and regenerating stratum - regular programs.

Yield	Aerial		Non-Photo		Total	
Stratum	SUs	Area (ha)	SUs	Area (ha)	SUs	Area (ha)
Hw	26	409.0	7	290.9	**33**	**699.8**
HwPl	65	710.3	0	0.0	**65**	**710.3**
HwSx	69	1,144.0	36	411.0	**105**	**1,555.0**
Pl	111	32,132.6	7	107.3	**118**	**32,239.9**
PlHw	67	1,106.5	8	210.4	**75**	**1,316.9**
Sb	0	26.4	0	0.0	**0**	**26.4**
Sw	83	13,117.3	18	177.0	**101**	**13,294.2**
SwHw	64	1,135.0	45	587.7	**109**	**1,722.7**
Grand Total	**485**	**49,781.0**	**121**	**1,784.3**	**606**	**51,565.2**

AAF has recently changed the RSA sampling protocols which will result in larger sample sizes by regenerating strata in a given sampling year (AAF 2018). AAF has also been focusing on improving RSA data quality through the Forest Operations Monitoring Program (FOMP) and revised quality standards for RSA audit protocols.

As per RSA performance survey requirements, Weyerhaeuser has separated eligible openings that contribute to the EFM tree improvement population since 2014 (**Table 2-11**).

Weyerhaeuser reconciled the RSA performance survey data against ARIS records of all their RSA openings from 2009-2019.

3.4.2 Scheduling

The amount of area by performance survey year from 2021-2029 was estimated from Weyerhaeuser's silviculture database (**Table 2-13**). The summary includes all areas of openings eligible for an RSA performance survey.

Table 2-13. Estimated RSA performance survey areas by survey year and stratum.

Survey	Regenerating Stratum			Total
Year	C-2000	CD-2000	D-2000	(ha)
2021	4,263	373	258	**4,894**
2022	4,736	373	158	**5,268**
2023	4,956	331	153	**5,440**
2024	4,487	469	302	**5,258**
2025	4,345	339	143	**4,827**
2026	4,456	392	89	**4,938**
2027	5,330	441	102	**5,873**
2028	4,752	283		**5,035**
2029	5,757	436		**6,192**
Total	**43,084**	**3,437**	**1,205**	**47,725**

Starting in the 2014 sampling year, openings currently declared to the D stratum that have an establishment survey completed after May 1, 2010, are also subject to an RSA performance survey no sooner than 11 years and no later than 14 years after the end of the Timber Year of harvest or clock re-set date or disturbance date (AAF 2018).

3.4.3 Strategic Elements

Weyerhaeuser's RSA performance survey data will contribute to two strategic elements of the GYP.

FMP Yield Curve Development

Weyerhaeuser plans to use RSA performance survey data as the main source for the development of post-1991 managed stand yield curves in the next FMP. There will be close to 100,000 ha of RSA surveys completed by 2029.

Performance Monitoring

RSA performance data can be used to assess the change in performance over time. There may be considerable yearly fluctuation due to historic harvest patterns; however, it is expected that an assessment of 5 years RSA performance survey data will provide significant insight into actual (observed) and expected (FMP yield curves) growth performance.

Comparison can be made for the average stand attributes such as age, site index (top height), density, percent stocking by species group against those assumed during the development of 2019 FMP yield curves. In addition, mean annual increment (MAI) can be compared to the reported MAI targets and yield projections.

The assessment can be done for basic silviculture (regular) and EFM (tree improvement) regenerating strata independently.

3.4.4 Future Commitments

Based on the review of the current status of the RSA performance surveys and their role in meeting the strategic elements of the GYP, Weyerhaeuser will undertake the following:

1. Assemble an integrated RSA database for Weyerhaeuser's programs.

A significant amount of effort was made to verify, clean and compile RSA performance survey data used for ARIS reconciliation and FMP managed stand yield curve development.

Weyerhaeuser will assemble an integrated RSA performance survey database and associated spatial GIS layer which will be used to add new sampling years and accumulate clean, compiled and reconciled data by the next FMP.

2. Carry out 5-year rollup assessment of RSA performance surveys.

There have been over 8,500 ha of Weyerhaeuser openings assessed since 2016 using RSA performance surveys (**Table 2-11**) with an additional 15,000 ha of openings due by 2024. RSA data collected since 2016 can be considered independent of the 2019 FMP yield curve development.

The assessment of 5 years RSA performance survey data will provide insight into actual (observed) and expected (FMP yield curves) growth performance. The analysis will be completed as part of the Forest Stewardship Report in 2024.

3. Validate tree improvement yield curves.

RSA performance data was collected for 113 openings representing over 3,000 ha where genetic stock had been deployed (**Table 2-11**). EFM program size is anticipated to rise over time due the increased deployment of genetic stock in the FMA in the last 10 years.

As per points 7.a of the AIP for the FMP Yield Projections (AAF 2019b), Weyerhaeuser will validate FMP genetic yield curves using RSA performance survey data in the ENH programs by overlaying GYPSY projections of SUs with the yield curves. The analysis will be completed as part of the Forest Stewardship Report in 2024.

3.5 Realized Gain Trials

3.5.1 Overview

Weyerhaeuser participates in the B1 and B2 lodgepole pine CPPs, the G1 white spruce CPP and the L2 black spruce program in the Grande Prairie FMA area. Lodgepole pine B1 genetic stock was first deployed in 1997 and has been steadily increasing ever since. White spruce G1 was first used operationally in 2003. Currently, there are over 26,000 ha of area that was planted with genetic stock (**Table 2-6**).

As tree improvement programs develop elite seedlots and the company deploys genetic stock on larger areas, a refined approach to verifying and monitoring the gains become increasingly critical.

The currently approved genetic height gains in the Grande Prairie FMA area by species, breeding region and seed orchard are summarized in **Table 2-14**.

Table 2-14. Approved genetic height gains in the Grande Prairie FMA area.

Species	Region	Seed Orchard	Phase	Height Gain	Letter of Approval Reference
Pl	B1	G147	1	4.00%	Ken Greenway (ASRD) - January 26, 2011
Pl	B1	G147	2	6.17%	Erica Samis (AAF) - July 21, 2017
Pl	B1	G804		9.26%	
Pl	B2	G303		2.18%	
Sw	G1	G351	1	2.60%	Vicky Bossé (ASRD) - July 29, 2009
Sw	G1	G351	2	5.04%	Erica Samis (AAF) - March 2, 2018

Gain estimates of B1 and G1 breeding programs and the L2 black spruce program[61] are being monitored and quantified in a realized gain trials (RGTs) as a cooperative effort funded by the Forest Resource Improvement Association of Alberta (FRIAA)[62]. These trials are necessary to determine and partition the amount of improvement in growth and volume on an area basis that is attributable to improved stock vs that grown from wild seed in an operational setting via a controlled experiment.

[61] The L2 black spruce program is not included for genetic gain; rather it provides superior parents and significantly better seed quality.
[62] Establishment of Realized Gain Trials - Conifer. FRIP Funds Initiative. FFI_15_011. FRIAA approval date: November 4, 2015.

3.5.2 Current Status

As part of the 2017 RGT Trials, Weyerhaeuser completed 9 installations:

- 5 installations for Pl-B1-G147 (phase 1);
- 3 installations for Sw-G1-G351 (phase 1); and
- 1 installation of Sb-L2-G326.

Weyerhaeuser established 27 PGYI-compatible PSPs in the RGT installations in 2018. There are three plots per installation: one wild control plot, one orchard plot and one elite plot for the Pl and Sw programs; and two wild control plots and one orchard plot for the Sb program. Re-measurements are planned to occur on 5-year intervals.

3.5.3 Strategic Elements

Weyerhaeuser's RGTs will contribute to two strategic elements of the GYP.

Growth Modeling

In addition to quantifying genetic gains, the RGT project should provide data to support and validate growth assumptions as well as to calibrate new growth models that can properly incorporate the effects of improved stock. The current scope of the PGYI program does not include tree improvement (Stream 2 stock).

FMP Yield Curve Development

The current method for implementing genetic gain in FMP yield curves is to convert the approved height gains (**Table 2-14**) to a percent volume gain at rotation and apply it to the managed stand yield curve. It is expected that the operational trials will provide a more accurate picture of the actual growth rates due to improved stock under company specific silviculture regimes, sites and rates of deployment.

3.5.4 Future Commitments

Based on the review of the current status of the RGTs and their role in meeting the strategic elements of the GYP, Weyerhaeuser will undertake the following:

1. Continue with the RGT paired plot installations as per Tree Improvement Alberta guidelines.

Weyerhaeuser plans to establish four more installations in 2020 and two installations/year afterwards based on recommendations by FGrOW/Tree Improvement Alberta guidelines. To date Weyerhaeuser picked realized gain sites, procured seed and ordered seedlings for planting. There will be three plots per installation: one wild control plot, one orchard plot and one elite plot[63] for the Pl and Sw programs.

2. Convert all 27 RGT paired plots to FORCORP's online database and data collection system.

The FTG plot data is currently residing in a Microsoft Excel workbook. All tree and vegetation data should be converted to PGYI format and submitted to the FORCORP online database. New plot data should be collected using FORCORP's field tablets which will eliminate the need for data conversions and additional error checks.

[63] Provided that a sufficient amount of elite seed is available.

3.6 Post-MPB Attack PSP Program

In 2010, Weyerhaeuser began to participate in the Foothills Research Institute (FRI) Mountain Pine Beetle Ecology Program to carry out focused research and investigations related to infestation of MPB. The information collected and analyzed will be used to inform timber supply analysis and operational planning through the improved development of stand regeneration and growth models forecasting post-disturbance conditions. To date Weyerhaeuser has contributed measurement data on seven selected PSP's impacted by MPB. Additional measurement and continuous monitoring of these PSPs will be required.

The new net landbase in the 2019 FMP indicated that there are less than 2,500 ha of area in pine leading stands that are heavily impacted by MPB.

3.7 Other Programs

Volumes will be validated on a regular basis to ensure that actual yields are comparable to predicted yields. Actual deliveries will be compared to planned volumes on a block-by-block basis. Due to the strategic nature of the FMP yield curves, yearly fluctuation is normal. Over time however, it is expected that the delivered volume per hectare is comparable to the yield predictions for each yield group. Given the importance of secondary volumes in a single landbase, comparisons will have to be made for the deciduous and conifer volumes separately. An assessment of the 5-year period from 2019-2024 will be included in the next Forest Stewardship Report.

4 Next Steps

Upon approval of this GYP, Weyerhaeuser will start developing a detailed work schedule listing all necessary steps to achieve project goals and objectives. The current high-level list of tasks and approximate completion dates are shown in

Table 2-15.

Table 2-15. GYP high-level tasks and schedule.

Growth and Yield Program High-Level Tasks	Calendar Year									
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revise PSP data collection protocols & update field manuals										
Convert/import active PSP measurements to FORCORP's database										
Convert/import 27 RGT plots to FORCORP's database										
Submit backlog PGYI measurement data										
Create integrated RSA layer and database (2009-2020)										
Rationalize PSP measurement schedules										
Add new RSA data sets										
Review the status of PGYI plots										
Prepare post-RSA PSP sampling plan										
Establish post-RSA managed stand PSPs in Pl and Sw strata (5/year)										
Field data collection for Realized Gain Trial Project										
Validate managed (basic/EFM) yield curves										
RSA roll-up assessment										
Prepare Forest Stewardship Report - G&Y monitoring and analysis										
Revised GYP workplan based on performance monitoring results										
Collect additional natural stand plot data, if required										
AVI effort										
Re-measurement of existing plots										
Submit plot measurement data to PGYI database										
FMP Yield curve development										
FMP estimated submission year										

Measurement schedules for all plot types are summarized in Appendix V; the schedules will be rationalized and balanced to meet available resources (crews/contractors/budgets) on a yearly basis.

Data analysis and summary of findings will be reported in the *Growth and Yield Performance Monitoring and Analysis* section of the Forest Stewardship Report.

5 References

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Appendix I – List of Active Natural Stand PSPs

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
605809000033	Truck	SA	C_PLOC	350,674	5,991,859	11		2017
605906000019	ATV	SA	CD_PL	377,059	5,998,430	11	Y	2016
605906000021	Truck	UF	CD_PL	379,470	5,998,396	11	Y	2011
605906000033	ATV	UF	CD_PL	379,551	6,000,775	11		2016
605907000001	Truck	M	D_CD	374,524	5,993,663	11		2017
605907000016	Heli	M	C_PLOC	369,658	5,996,288	11		2013
605907000021	Heli	SA	C_PL_AB	369,735	5,998,648	11		2013
605907000022	Heli	SA	C_PL_AB	372,122	5,998,602	11		2013
605907000024	Heli	SA	C_PL_CD	374,619	5,998,514	11		2008
605907000033	Heli	SA	C_PL_CD	369,772	6,001,059	11		2013
605907000036	Heli	SA	C_PL_AB	374,636	6,001,012	11		2013
605908000021	Truck	SA	C_PLOC	359,872	5,998,926	11		2018
605908000033	ATV	SA	C_PL_CD	359,984	6,001,364	11		2013
605909000001	Heli	SA	C_PLOC	354,926	5,994,196	11	Y	2018
605909000021	Heli	UF	C_SWOC	350,006	5,999,238	11		2015
605909000036	Truck	SA	C_PL_CD	355,051	6,001,504	11		2016
605910000001	Heli	SA	C_PLOC	345,049	5,994,610	11	Y	2008
605910000019	Heli	SA	C_SWOC	337,797	5,999,653	11		2017
605910000024	Heli	SA	C_SW_AB	345,204	5,999,453	11		2015
605910000036	Truck	UF	CD_SX	345,227	6,001,812	11		2016
605911000022	Heli	SA	C_SWOC	333,007	5,999,874	11		2017
606005000006	Truck	UF	D_AB	386,888	6,003,015	11		2017
606006000001	Truck	UF	D_CD	384,464	6,003,291	11	Y	2010
606006000006	Heli	SA	C_PL_CD	377,196	6,003,328	11		2013
606006000021	Heli	UF	CD_PL	379,757	6,008,103	11	Y	2018
606007000003	Heli	UF	C_PL_AB	372,248	6,003,413	11		2013
606007000015	Truck	SA	C_PLOC	372,346	6,005,863	11		2012
606007000019	ATV	SA	C_SW_CD	367,545	6,008,425	11		2018
606008000001	Heli	SA	C_SW_AB	364,916	6,003,600	11		2008
606008000004	ATV	SA	C_PL_AB	359,969	6,003,733	11		2015
606008000016	Truck	SA	C_SW_AB	360,160	6,006,209	11		2013
606008000021	Truck	SA	C_PLOC	360,202	6,008,643	11	Y	2010
606008000024	Truck	SA	C_SW_AB	364,935	6,008,598	11		2014
606009000001	Truck	SA	C_PLOC	355,240	6,003,964	11		2017
606009000004	Heli	SA	C_SWOC	350,237	6,004,088	11		2019
606009000022	Heli	UF	C_SB	352,829	6,008,833	11		2009

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606009000024	Truck	SA	C_PLOC	355,170	6,008,874	11		2010
606010000021	Heli	SA	C_PLOC	340,666	6,009,281	11		2011
606011000001	Heli	SA	C_SW_CD	335,618	6,004,666	11		2015
606011000021	Truck	UF	C_PLOC	330,803	6,009,687	11	Y	2011
606104000004	ATV	LF	D_AB	399,442	6,012,661	11		2011
606104000022	ATV	LF	D_US	401,989	6,017,270	11		2017
606105000021	Heli	LF	C_PL_AB	389,723	6,017,562	11		2018
606105000022	Truck	UF	DC_SX	392,142	6,017,484	11		2017
606105000024	Truck	LF	DC_SX	394,606	6,017,372	11	Y	2014
606105000033	Truck	LF	DC_PL	389,793	6,020,054	11		2017
606106000004	Heli	LF	C_PLOC	379,853	6,013,053	11		2018
606106000006	Heli	LF	CD_PL	377,422	6,013,036	11		2013
606107000006	Heli	SA	C_SWOC	367,648	6,013,257	11		2017
606107000024	Heli	UF	C_PL_CD	375,100	6,017,936	11		2018
606108000001	Truck	UF	C_PL_AB	365,130	6,013,591	11		2007
606108000004	Truck	SA	C_SW_AB	360,426	6,013,461	11		2011
606108000024	Heli	LF	CD_PL	365,347	6,018,200	11	Y	2011
606108000033	Heli	UF	C_SWOC	360,547	6,020,808	11		2017
606109000006	ATV	LF	DC_SX	348,145	6,013,873	11	Y	2017
606109000013	Truck	UF	C_PL_AB	355,599	6,016,000	11		2009
606109000021	ATV	SA	C_SW_AB	350,689	6,018,691	11		2012
606110000013	Truck	UF	C_PL_CD	345,864	6,016,406	11		2013
606110000016	Truck	UF	C_PL_CD	340,847	6,016,581	11		2013
606110000024	Truck	SA	C_PL_CD	345,858	6,018,771	11		2012
606110000033	Heli	SA	C_PLOC	341,058	6,021,402	11		2006
606111000003	Heli	SA	C_PLOC	333,278	6,014,582	11		2013
606111000024	Heli	SA	C_PLOC	335,991	6,019,249	11		2010
606112000003	Heli	SA	C_PLOC	323,711	6,014,803	11		2013
606112000004	Heli	SA	C_PL_AB	321,219	6,014,844	11	Y	2018
606112000019	ATV	SA	C_PLOC	318,997	6,019,839	11		2013
606112000036	Truck	SA	C_SW_CD	326,430	6,021,897	11		2017
606113000001	Heli	SA	C_PL_CD	316,334	6,015,045	11		2010
606113000024	ATV	UF	C_PL_CD	316,571	6,019,913	11		2008
606113000036	Truck	UF	C_PLOC	316,707	6,022,213	11		2013
606204000003	Truck	LF	C_PLOC	402,062	6,022,194	11		2017
606204000015	Truck	LF	C_SWOC	402,126	6,024,559	11		2017
606204000016	ATV	LF	C_PL_AB	399,705	6,024,669	11		2014
606204000024	ATV	LF	DC_SX	404,605	6,026,948	11		2011

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606204000033	Truck	LF	C_SW_AB	399,815	6,029,564	11		2017
606205000021	Truck	UF	C_SW_AB	390,045	6,027,319	11		2014
606205000034	Truck	LF	DC_SX	392,490	6,029,635	11		2017
606206000001	ATV	LF	C_SW_AB	384,772	6,022,327	11		2015
606206000004	ATV	UF	D_CD	380,127	6,022,726	11	Y	2011
606207000001	ATV	UF	C_PLOC	375,245	6,022,787	11		2018
606207000004	ATV	UF	C_PLOC	370,493	6,022,895	11		2010
606207000024	Truck	UF	C_PLOC	375,360	6,027,625	11		2014
606207000036	ATV	UF	C_SWOC	375,513	6,030,057	11		2017
606208000001	ATV	UF	C_SWOC	365,533	6,023,080	11		2012
606208000006	ATV	UF	C_PL_CD	358,148	6,023,341	11		2017
606209000001	ATV	UF	C_PL_CD	355,976	6,023,444	11	Y	2011
606209000004	Heli	SA	C_PLOC	350,836	6,023,616	11		2011
606209000006	Truck	SA	C_PL_CD	348,398	6,023,632	11		2016
606209000021	ATV	UF	C_PL_AB	351,023	6,028,425	11		2007
606209000024	Truck	SA	C_SW_AB	355,962	6,028,295	11		2015
606210000001	Truck	SA	C_SB	346,122	6,023,465	11	Y	2013
606210000003	Heli	SA	C_SWOC	343,604	6,023,795	11		2017
606210000004	Truck	SA	C_PLOC	341,103	6,023,912	11		2012
606210000019	Heli	UF	C_PLOC	338,823	6,028,846	11		2013
606210000021	Heli	SA	C_PL_AB	341,282	6,028,673	11		2019
606211000001	Heli	SA	C_PLOC	336,239	6,024,008	11		2011
606211000003	Heli	SA	C_SW_CD	333,899	6,024,077	11		2017
606211000004	Heli	UF	C_SWOC	331,351	6,024,255	11		2011
606211000013	Heli	SA	C_PLOC	336,185	6,026,533	11		2006
606211000033	ATV	UF	C_PLOC	331,586	6,031,516	11		2013
606211000036	Heli	UF	C_PLOC	336,484	6,031,324	11		2013
606212000004	Truck	SA	C_PLOC	321,718	6,024,630	11	Y	2012
606212000019	Truck	SA	C_PL_CD	319,436	6,029,592	11		2017
606212000024	Truck	SA	C_PL_CD	326,697	6,029,257	11	Y	2008
606213000024	Truck	UF	C_SWOC	317,085	6,029,643	11		2010
606213000033	Heli	UF	CD_PL	312,088	6,032,436	11		2017
606213000036	ATV	UF	C_PLOC	317,255	6,031,884	11		2013
606214000036	Heli	UF	C_SWOC	307,310	6,032,428	11		2013
606303000021	Truck	LF	CD_SX	409,476	6,036,570	11		2011
606304000024	Heli	LF	C_SW_AB	404,566	6,036,662	11	Y	2018
606304000033	Truck	LF	DC_SX	399,740	6,039,251	11		2017
606305000004	Truck	LF	C_SB	389,778	6,032,186	11		2015

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606305000021	Truck	LF	C_PLOC	389,894	6,037,030	11		2014
606305000033	Truck	LF	DC_SX	389,997	6,039,467	11		2014
606305000036	Truck	LF	D_CD	394,719	6,039,391	11		2017
606306000024	Truck	LF	DC_SX	385,014	6,037,101	11		2014
606307000019	Heli	LF	DC_SX	367,899	6,037,585	11		2017
606308000019	Truck	LF	CD_PL	358,118	6,037,989	11		2017
606308000024	ATV	LF	C_SB	365,325	6,037,707	11		2011
606309000006	Truck	SA	C_SB	348,105	6,033,330	11		2017
606309000013	ATV	UF	C_PL_AB	355,570	6,035,518	11		2015
606309000019	ATV	UF	C_PLOC	348,241	6,038,271	11		2017
606309000024	ATV	UF	D_AB	355,594	6,037,835	11	Y	2018
606310000003	ATV	SA	C_PL_AB	343,200	6,033,485	11		2013
606310000004	Heli	SA	C_PL_CD	340,779	6,033,581	11		2018
606310000006	Truck	SA	C_PL_CD	338,309	6,033,689	11		2013
606310000024	ATV	SA	C_PL_AB	345,785	6,038,291	11		2011
606311000003	ATV	UF	C_PL_CD	333,613	6,034,066	11		2016
606311000004	Truck	UF	C_PL_CD	330,921	6,033,968	11		2018
606311000013	ATV	SA	C_PL_AB	335,945	6,036,155	11		2013
606311000019	Heli	UF	C_SWOC	328,560	6,038,968	11		2017
606311000021	Heli	UF	C_PL_AB	331,145	6,038,788	11		2007
606311000024	Truck	UF	C_PL_CD	336,035	6,038,640	11	Y	2007
606312000001	ATV	UF	C_PLOC	325,945	6,034,235	11	Y	2010
606312000004	Truck	UF	C_PLOC	321,048	6,034,270	11		2010
606312000021	Truck	UF	C_PLOC	321,386	6,039,173	11	Y	2008
606312000024	ATV	UF	C_PLOC	326,100	6,039,077	11		2011
606313000001	Heli	UF	C_PLOC	316,104	6,034,611	11	Y	2018
606313000003	Truck	UF	C_PL_CD	313,779	6,034,593	11		2013
606313000004	Heli	UF	C_SB	311,355	6,034,608	11	Y	2007
606313000021	Truck	UF	C_PLOC	311,447	6,039,452	11		2011
606313000024	Truck	UF	C_PLOC	316,417	6,039,338	11		2011
606314000013	Heli	SA	C_PL_CD	306,196	6,037,479	11		2013
606314000024	Truck	SA	C_PL_AB	306,679	6,039,751	11	Y	2011
606403000004	Heli	LF	CD_SX	409,521	6,041,502	11		2012
606403000006	Truck	LF	C_SW_AB	407,094	6,041,506	11		2017
606403000021	Truck	LF	DC_SX	409,603	6,046,252	11	Y	2011
606404000001	ATV	LF	C_SB	404,606	6,041,613	11		2010
606404000004	Truck	LF	C_SB	399,830	6,041,675	11		2010
606404000019	ATV	LF	C_SB	397,525	6,046,596	11		2017

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606404000022	ATV	LF	CD_SX	402,347	6,046,459	11		2017
606405000021	Truck	LF	DC_SX	390,128	6,046,724	11		2009
606405000022	Heli	LF	C_SB	392,641	6,046,486	11	Y	2008
606406000001	Truck	LF	C_SWOC	385,054	6,041,830	11	Y	2018
606406000006	ATV	LF	CD_PL	377,634	6,042,163	11		2013
606406000013	Truck	LF	D_CD	385,219	6,044,420	11	Y	2013
606406000024	Truck	LF	C_SW_AB	385,297	6,046,848	11	Y	2014
606406000033	Truck	LF	D_CD	380,493	6,049,362	11		2017
606407000001	Truck	LF	C_SW_AB	375,279	6,042,137	11	Y	2015
606407000016	ATV	LF	CD_PL	370,438	6,044,834	11		2017
606407000021	ATV	LF	DC_SX	370,450	6,047,239	11		2012
606407000024	ATV	LF	C_SW_AB	375,424	6,047,032	11		2018
606408000016	ATV	UF	D_AB	360,830	6,045,120	11		2009
606408000024	Truck	UF	DC_SX	365,519	6,047,425	11	Y	2018
606409000013	ATV	LF	C_PLOC	355,850	6,045,248	11		2013
606410000004	ATV	UF	NA	341,064	6,043,338	11	Y	2010
606411000001	Truck	SA	C_PLOC	336,361	6,043,713	11		2010
606411000003	Heli	UF	C_SWOC	333,733	6,043,598	11		2017
606411000019	Heli	UF	D_AB	329,154	6,048,315	11		2013
606411000021	ATV	SA	C_PLOC	331,443	6,048,524	11	Y	2010
606411000033	Heli	UF	DC_SX	331,571	6,050,881	11		2017
606412000004	Truck	UF	C_SB	321,442	6,044,001	11	Y	2012
606412000021	Truck	UF	C_SW_AB	321,714	6,048,838	11		2011
606412000024	Heli	LF	D_CD	326,619	6,048,539	11		2013
606413000001	Heli	UF	C_PL_AB	316,626	6,044,185	11		2011
606413000021	Truck	UF	C_PL_CD	311,939	6,049,279	11		2018
606414000024	Heli	UF	C_SB	306,999	6,049,458	11	Y	2018
606504000003	ATV	LF	C_SW_AB	402,307	6,051,388	11		2016
606504000021	Truck	LF	CD_SX	400,070	6,056,252	11		2011
606505000003	Truck	LF	D_CD	392,738	6,051,507	11		2016
606505000021	Truck	CM	D_CD	390,346	6,056,396	11		2012
606505000024	ATV	CM	D_CD	395,342	6,056,378	11		2017
606506000004	ATV	LF	D_CD	380,395	6,051,772	11		2018
606506000006	Truck	LF	C_SWOC	377,978	6,051,833	11		2017
606506000021	Truck	LF	C_SW_CD	380,588	6,056,686	11		2018
606506000022	ATV	LF	C_PL_CD	383,015	6,056,633	11		2013
606506000024	Truck	LF	C_PL_AB	385,402	6,056,577	11		2018
606506000033	Truck	LF	C_SW_AB	380,647	6,059,107	11		2017

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606507000004	Truck	LF	D_AB	370,573	6,052,147	11		2013
606507000013	Truck	LF	D_US	375,656	6,054,380	11		2017
606507000024	Truck	LF	C_SW_CD	375,753	6,056,785	11		2010
606508000033	Truck	LF	C_PLOC	361,130	6,059,739	11		2016
606508000036	ATV	LF	D_AB	366,029	6,059,492	11		2017
606510000024	Truck	LF	D_US	346,534	6,057,674	11		2011
606511000036	Truck	LF	D_AB	336,742	6,060,447	11		2017
606512000001	Heli	LF	C_PLOC	326,762	6,053,469	11	Y	2015
606512000003	Heli	LF	C_SW_CD	324,366	6,053,673	11	Y	2013
606512000004	Truck	LF	CD_SX	321,811	6,053,829	11	Y	2011
606512000016	Heli	LF	D_AB	322,011	6,056,128	11		2017
606512000021	Truck	LF	C_SW_AB	322,056	6,058,583	11	Y	2007
606512000024	Heli	LF	CD_SX	327,110	6,058,428	11		2011
606512000033	Heli	LF	D_US	322,227	6,061,069	11		2009
606512000036	Heli	LF	D_AB	327,117	6,060,941	11		2017
606513000001	Truck	UF	C_PLOC	316,963	6,053,952	11		2010
606513000016	ATV	LF	C_SW_AB	312,142	6,056,537	11	Y	2013
606513000024	Truck	UF	C_SWOC	317,295	6,058,698	11		2010
606513000036	Truck	UF	C_SW_CD	317,192	6,061,037	11		2007
606514000036	Heli	UF	C_SB	307,558	6,061,607	11		2009
606604000021	Truck	CM	DC_SX	400,308	6,065,938	11	Y	2018
606605000019	ATV	LF	C_SW_CD	388,159	6,066,203	11		2013
606605000022	ATV	LF	C_SW_AB	393,014	6,066,155	11		2008
606606000004	ATV	LF	CD_SX	380,701	6,061,533	11		2011
606606000006	ATV	LF	C_SW_CD	378,311	6,061,591	11		2013
606606000021	ATV	CM	CD_SX	380,870	6,066,377	11	Y	2008
606606000036	Truck	CM	C_SW_CD	385,725	6,068,642	11	Y	2015
606607000001	ATV	LF	DC_SX	375,909	6,061,707	11		2012
606607000006	ATV	LF	C_SW_AB	368,588	6,061,861	11		2013
606607000021	ATV	LF	D_AB	371,066	6,066,581	11	Y	2017
606608000021	ATV	LF	D_CD	361,421	6,066,959	11	Y	2012
606608000022	Truck	LF	CD_SX	363,793	6,066,917	11		2013
606608000024	ATV	LF	D_AB	366,185	6,066,690	11		2012
606609000019	Truck	LF	D_AB	349,187	6,067,392	11		2017
606609000021	Truck	LF	D_CD	351,634	6,067,353	11		2012
606609000022	Truck	LF	DC_SX	354,053	6,067,251	11		2017
606609000033	Truck	LF	D_US	351,685	6,069,777	11		2017
606610000001	Truck	LF	D_AB	346,583	6,062,586	11	Y	2009

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606610000004	ATV	LF	D_CD	341,784	6,062,770	11	Y	2009
606610000016	Truck	LF	DC_SX	341,835	6,065,170	11		2017
606610000019	Truck	LF	C_SW_AB	339,480	6,067,680	11		2017
606610000024	ATV	LF	D_US	346,768	6,067,429	11	Y	2011
606611000001	Truck	LF	C_SW_AB	336,993	6,062,934	11		2011
606611000003	Truck	LF	C_SW_AB	334,410	6,063,039	11		2017
606611000004	ATV	LF	CD_SX	331,931	6,063,017	11	Y	2011
606611000021	ATV	CM	CD_SX	332,174	6,067,967	11		2018
606611000033	Truck	LF	C_PLOC	332,241	6,070,381	11		2017
606612000001	ATV	LF	C_SW_AB	327,108	6,063,259	11		2015
606612000004	Truck	UF	C_PL_CD	322,237	6,063,477	11		2018
606612000006	Truck	UF	C_PLOC	319,882	6,063,532	11		2017
606613000001	ATV	LF	C_PL_CD	317,415	6,063,623	11	Y	2011
606613000021	Heli	LF	DC_SX	312,633	6,068,790	11	Y	2019
606613000024	ATV	LF	CD_PL	317,494	6,068,503	11		2011
606705000001	Truck	CM	C_SW_AB	395,200	6,070,918	11		2018
606705000003	Truck	CM	D_AB	392,655	6,070,968	11		2017
606705000004	ATV	LF	D_CD	390,261	6,071,036	11		2012
606705000016	Truck	CM	D_US	390,285	6,073,431	11		2017
606705000021	Truck	CM	D_CD	390,370	6,075,828	11	Y	2016
606705000024	Truck	CM	D_AB	395,215	6,075,842	11	Y	2018
606706000003	Truck	LF	C_SW_CD	382,877	6,071,199	11		2008
606706000013	ATV	CM	D_AB	385,442	6,073,539	11		2017
606706000019	Truck	LF	D_CD	378,075	6,076,178	11		2017
606706000021	ATV	CM	D_AB	380,498	6,076,155	11		2012
606706000024	Truck	CM	D_CD	385,470	6,075,962	11		2018
606706000031	ATV	CM	D_US	378,198	6,078,594	11		2017
606706000036	ATV	CM	CD_SX	385,527	6,078,418	11		2009
606707000001	Truck	LF	D_CD	375,543	6,071,395	11		2018
606707000004	ATV	LF	C_SW_AB	370,619	6,071,615	11		2010
606707000006	Truck	LF	D_CD	368,223	6,071,605	11		2018
606707000013	ATV	LF	DC_SX	375,626	6,073,914	11		2017
606707000021	ATV	CM	D_CD	370,737	6,076,352	11		2016
606707000022	Truck	CM	HwSx	373,214	6,076,292	11		2016
606707000033	ATV	CM	D_US	370,864	6,078,814	11		2006
606708000001	Truck	LF	C_SB	365,579	6,071,570	11		2018
606708000004	ATV	LF	D_CD	360,806	6,071,771	11		2011
606708000016	Truck	CM	C_SW_AB	360,856	6,074,055	11		2017

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606708000021	Truck	LF	C_SW_CD	360,946	6,076,696	11		2010
606708000024	Truck	LF	D_AB	365,866	6,076,499	11		2009
606709000001	ATV	LF	CD_SX	355,906	6,072,051	11		2014
606709000019	ATV	CM	D_AB	348,654	6,077,048	11		2017
606709000021	ATV	CM	C_SB	351,146	6,076,991	11	Y	2011
606709000036	ATV	LF	D_US	356,159	6,079,274	11		2017
606710000016		LF	C_SW_AB	341,338	6,074,980	11		2016
606710000024	Truck	CM	D_CD	346,201	6,077,130	11		2012
606710000033	ATV	CM	D_US	341,438	6,079,820	11		2013
606711000001	ATV	CM	D_CD	336,281	6,072,760	11		2011
606711000003	ATV	CM	CD_SX	333,820	6,072,881	11		2017
606711000004	Truck	LF	C_SWOC	331,386	6,073,001	11		2010
606711000006	ATV	LF	C_SWOC	328,932	6,072,950	11		2009
606711000013	ATV	LF	C_SWOC	336,277	6,075,109	11		2009
606711000021	ATV	CM	C_SW_CD	331,528	6,077,701	11		2011
606711000024	Truck	LF	D_US	336,495	6,077,496	11		2012
606712000006	ATV	LF	C_SW_CD	319,060	6,073,266	11		2013
606712000019	Truck	LF	DC_SX	319,291	6,078,235	11		2017
606712000021	ATV	LF	C_PL_CD	321,763	6,078,083	11		2011
606713000003	Truck	LF	C_SWOC	314,108	6,073,594	11		2017
606713000006	ATV	LF	C_PL_CD	309,314	6,073,795	11		2016
606713000021	Truck	LF	CD_SX	311,963	6,078,481	11		2010
606713000022	Truck	LF	D_AB	314,422	6,078,293	11		2017
606713000036	Truck	LF	D_US	316,938	6,080,742	11		2017
606714000001	ATV	LF	C_SWOC	307,128	6,073,800	11		2007
606714000024	Heli	LF	C_SB	307,336	6,078,644	11	Y	2018
606805000021	ATV	DMW	D_CD	390,582	6,085,530	11	Y	2009
606807000004	Truck	CM	DC_SX	370,927	6,081,316	11		2018
606807000016	Truck	CM	CD_SX	370,922	6,083,716	11		2017
606807000021	ATV	CM	C_SB	371,075	6,086,341	11	Y	2013
606808000022	ATV	CM	D_US	363,673	6,086,313	11		2013
606809000001	ATV	LF	D_AB	356,230	6,081,708	11		2018
606809000006	Truck	LF	D_CD	348,836	6,081,873	11		2018
606809000019	ATV	CM	C_SW_AB	348,858	6,086,907	11		2014
606809000021	Truck	CM	CD_SX	351,418	6,086,724	11		2014
606810000004	ATV	CM	D_US	341,475	6,082,234	11		2018
606810000006	ATV	CM	D_US	339,045	6,082,312	11		2013
606810000024	Truck	CM	C_SWOC	346,552	6,086,864	11		2008

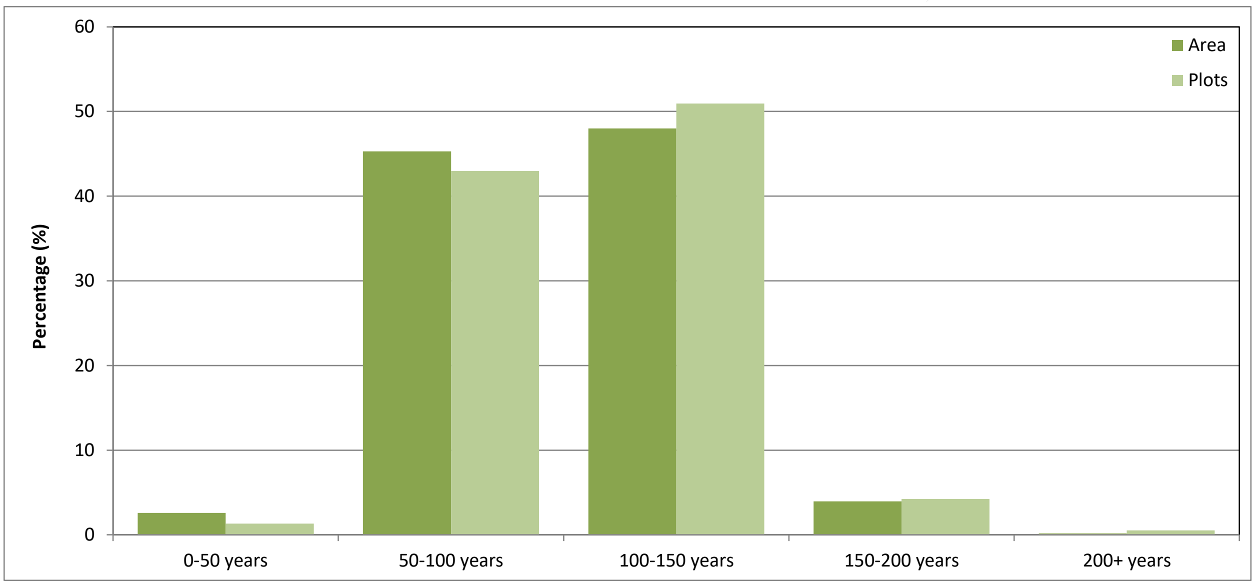
Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606811000001	Truck	CM	D_AB	336,586	6,082,319	11		2012
606811000004	Truck	LF	CD_SX	332,028	6,082,280	11		2012
606811000019	Truck	CM	C_PLOC	329,415	6,087,426	11		2013
606812000016	Truck	CM	CD_SX	322,032	6,085,291	11		2016
606812000021	Truck	CM	CD_SX	322,144	6,087,804	11	Y	2011
606812000024	Truck	CM	D_CD	327,062	6,087,541	11	Y	2018
606813000001	Truck	LF	D_CD	317,035	6,083,149	11		2012
606813000004	ATV	LF	C_PLOC	312,137	6,083,299	11		2012
606813000019	Truck	LF	C_SW_CD	309,894	6,088,278	11		2017
606813000024	Truck	CM	CD_SX	317,305	6,088,082	11		2010
606814000001	ATV	LF	C_PL_CD	307,543	6,083,506	11		2007
606904000006	Truck	DMW	CD_SX	397,964	6,090,192	11		2013
606904000016	ATV	DMW	CD_SX	400,509	6,092,635	11		2017
606904000019	ATV	DMW	C_SWOC	398,166	6,094,901	11		2013
606905000004	Truck	DMW	D_CD	390,709	6,090,360	11	Y	2012
606905000022	ATV	DMW	DC_SX	393,170	6,095,201	11		2013
606905000024	Truck	DMW	D_US	395,679	6,095,057	11		2018
606905000033	ATV	DMW	DC_SX	390,842	6,097,647	11		2017
607003000004	Heli	DMW	C_PLOC	410,475	6,099,711	11	Y	2018
607003000021	ATV	DMW	C_SB	410,560	6,104,593	11	Y	2009
607004000001	ATV	DMW	C_SB	405,512	6,099,859	11	Y	2010
607004000022	Heli	DMW	CD_SX	403,251	6,104,630	11		2017
607503000004	ATV	LF	D_CD	411,050	6,148,304	11	Y	2012
607504000004	ATV	LF	D_CD	401,196	6,148,433	11		2012
607504000024	ATV	DMW	D_CD	406,268	6,153,116	11		2012
607505000021	ATV	LF	D_CD	391,519	6,153,548	11		2012
607505000033	ATV	LF	D_CD	391,556	6,156,071	11		2017
607506000001	ATV	LF	D_CD	386,411	6,148,871	11		2012
607506000004	ATV	LF	D_US	381,512	6,149,008	11		2011
607506000024	ATV	LF	C_SW_AB	386,620	6,153,643	11		2011
607507000004	ATV	LF	D_CD	371,741	6,149,214	11	Y	2012
607507000021	Truck	LF	DC_SX	371,811	6,154,073	11		2012
607511000001	Truck	CM	DC_SX	337,468	6,150,356	11		2011
607511000024	ATV	LF	D_CD	337,734	6,155,492	11		2012
607512000001	ATV	CM	D_CD	327,661	6,150,808	11		2012
607513000021	Truck	LF	DC_SX	313,218	6,156,138	11		2012
607605000001	ATV	LF	D_CD	396,515	6,158,207	11		2012
607608000001	Truck	LF	D_CD	367,274	6,159,078	11		2012

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
607608000004	Truck	LF	C_SW_AB	362,341	6,159,251	11		2014
607609000006	Truck	LF	C_SW_AB	350,099	6,159,711	11		2017
607609000016	Truck	LF	C_SW_CD	352,626	6,161,954	11	Y	2017
607610000001	Truck	LF	D_AB	347,718	6,159,776	11		2018
607610000004	ATV	LF	C_SB	342,726	6,159,829	11		2011
607611000001	ATV	LF	C_SB	337,849	6,160,078	11		2010
607611000004	Truck	LF	D_CD	332,866	6,160,290	11	Y	2011
607611000021	Truck	LF	CD_SX	333,029	6,165,104	11		2011
607611000033	Truck	LF	CD_SX	333,232	6,167,524	11		2014
607612000016	ATV	LF	D_CD	323,272	6,163,054	11		2007
607613000004	ATV	LF	D_US	313,364	6,161,025	11		2012
607613000013	Truck	LF	CD_SX	318,399	6,163,268	11		2015
607708000024	ATV	LF	D_CD	367,651	6,173,636	11	Y	2012
607709000021	Truck	LF	C_SW_CD	353,044	6,174,013	11		2011
607709000024	ATV	LF	DC_PL	357,815	6,173,962	11	Y	2009
607710000004	Truck	LF	DC_SX	343,146	6,169,656	11		2017
607711000024	Truck	LF	D_CD	338,396	6,174,606	11		2012
607712000001	ATV	LF	DC_SX	328,386	6,170,167	11		2012
607712000004	Truck	LF	D_CD	323,618	6,170,240	11		2012
607712000019	Truck	LF	DC_SX	321,324	6,175,282	11		2007
607712000024	Truck	LF	D_CD	328,667	6,174,996	11		2012
607713000024	Heli	LF	C_SW_AB	318,888	6,175,381	11		2007
607810000003	Truck	LF	D_AB	345,811	6,179,175	11	Y	2013
607810000006	ATV	LF	C_SW_AB	341,025	6,179,331	11		2013
607811000001	Truck	LF	D_CD	338,544	6,179,406	11	Y	2017
607811000036	ATV	LF	C_SWOC	339,030	6,187,451	11		2009
607812000001	Truck	LF	D_CD	328,852	6,179,887	11	Y	2012
607812000004	ATV	LF	DC_SX	324,013	6,180,034	11	Y	2012
607812000036	Truck	DMW	D_CD	329,071	6,187,115	11		2017
607813000001	Truck	LF	C_SW_AB	318,794	6,180,512	11		2012
607813000004	ATV	LF	D_CD	313,931	6,180,587	11		2012
607813000013	Truck	LF	C_SW_AB	319,178	6,182,624	11		2013
607813000024	ATV	LF	D_AB	319,277	6,185,088	11		2018
607911000001	ATV	DMW	D_CD	337,999	6,189,227	11		2012
607911000004	Truck	LF	D_CD	333,101	6,189,534	11		2012
607911000006	Truck	DMW	DC_SX	330,605	6,189,573	11		2017
607912000001	Truck	DMW	D_CD	328,191	6,189,635	11	Y	2018

Appendix II – Distribution of Natural Stand PSPs

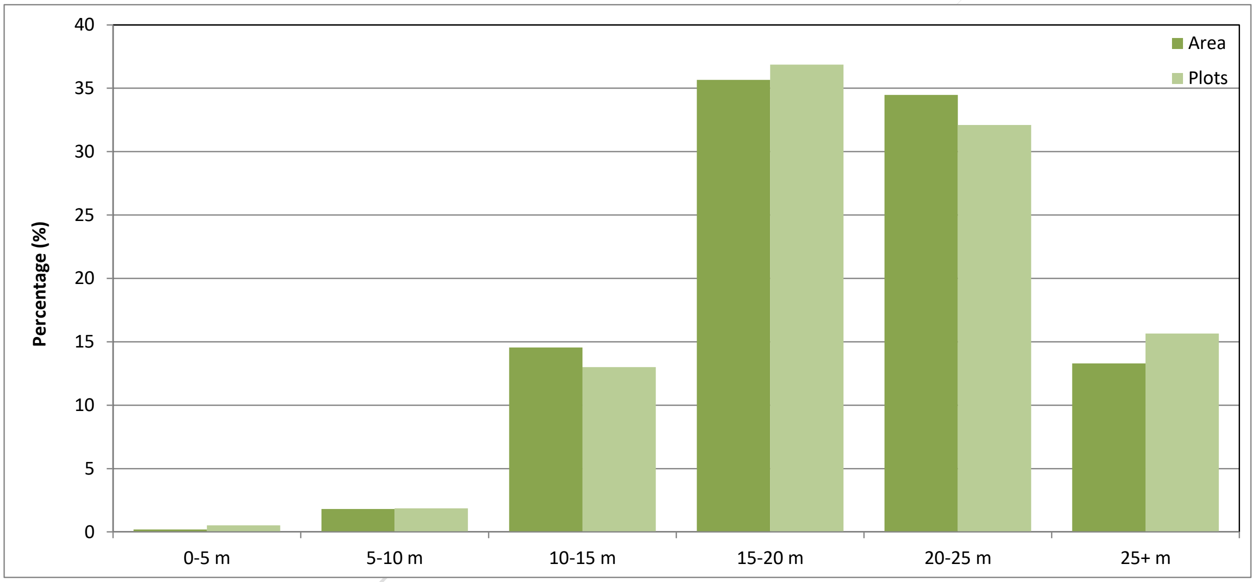
Distribution of Active Natural Stand PSPs by AVI Overstorey 50-Year Age Class

AVI OS Age Class	Net Area		Plots	
	(ha)	(%)	(#)	(%)
0-50 years	15,631	3	5	1
50-100 years	272,236	45	162	43
100-150 years	288,418	48	192	51
150-200 years	23,780	4	16	4
200+ years	983	0	2	1
Totals	**601,049**	**100**	**377**	**100**



Distribution of Active Natural Stand PSPs by AVI Overstorey 5-m Height Class

AVI OS Height Class	Net Area		Plots	
	(ha)	(%)	(#)	(%)
0-5 m	1,151	0	2	1
5-10 m	10,861	2	7	2
10-15 m	87,497	15	49	13
15-20 m	214,381	36	139	37
20-25 m	207,213	34	121	32
25+ m	79,946	13	59	16
Totals	**601,049**	**100**	**377**	**100**



Appendix III – Description of FORCORP's Plots App

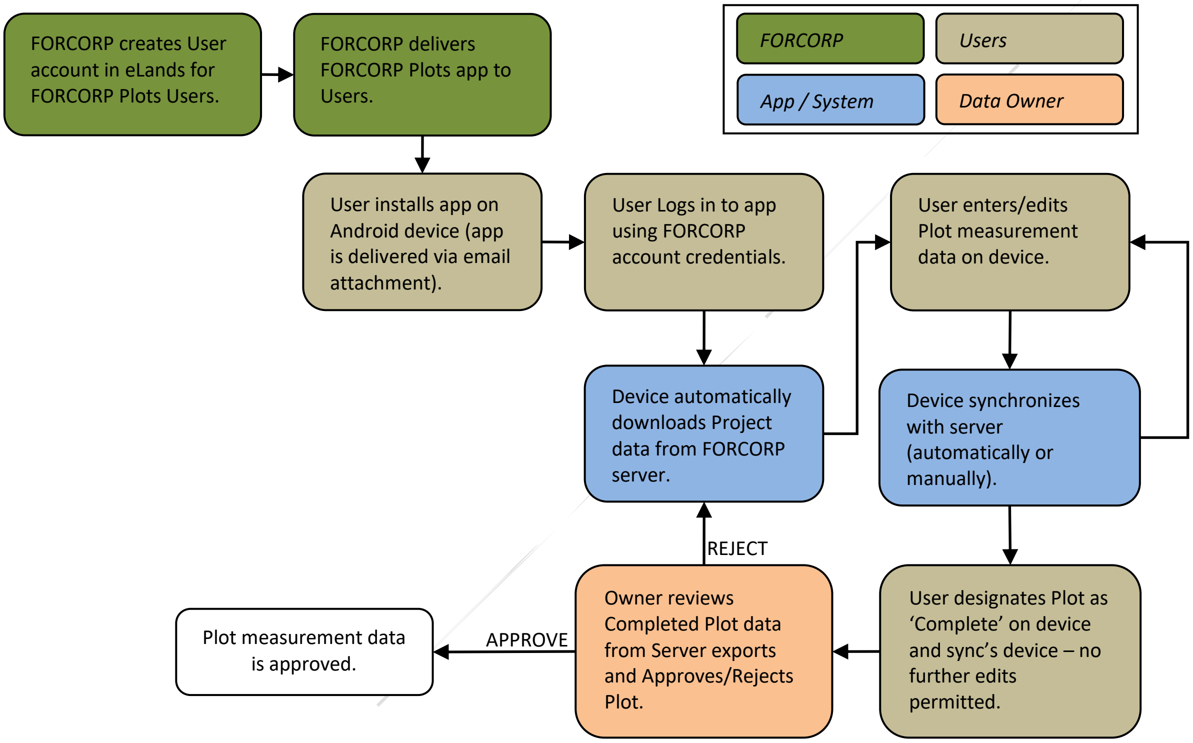
FORCORP Plots App Description

Prepared by Logan Purdy, Mitchell Bösecke and Grant Burkell (FORCORP)

Date: November 13, 2018

1. Introduction

FORCORP Plots is an Android based application developed by Forcorp Solutions Inc. to support the collection of forest growth and mortality data from sample plots. Permanent (PSP) and Temporary Sample Plots (TSP) data are collected using the app and are synchronized and stored in a centralized database on FORCORP's servers. Below is the general process flow for the FORCORP Plots application.



2. App installation and initial data download

The app is installed using an email attachment that FORCORP sends to the user. After installation, the user logs in to the app using credentials provided by FORCORP. The app then immediately begins downloading and synchronizing project information and data from FORCORP's server to the device. This includes the plots set up for measurement, and historical measurement data for PSPs.

3. Data collection

To begin collecting data, the user opens the relevant project and selects from a list of plots. A basic set of information for the plot is displayed in the Plot Details form including location (UTM coordinates), plot shapes and sizes, and stand information. The user uses this form to enter other necessary plot information such as topographic position, ecosite, AVI field call, and vegetation. There is also a comment field to record any other notable information for the plot.

Photos can be taken for the plot by selecting the Photos option at the top of the main screen. Photos are typically captured in all four cardinal directions (N, E, S, W) and skyward. Photos cannot be deleted once captured but can be replaced by over-writing an existing photo.

The user begins adding tree measurements by navigating to the tree list. For previously visited PSPs, trees are pre-loaded into this list with the details of the most recent measurement available. The user either selects an existing tree or adds a new tree to begin recording data, which opens a tree details form. This form is used to enter tree details including species, location (main, sapling, regen, or age plot), health status, condition codes and severity, height, height to live crown, DBH, crown class, crown diameter, azimuth and distance, and age. The required fields vary depending on the project. There is also a comment box to enter tree specific comments if necessary.

To assist with data entry, the plots app has a dynamic validation process with Validation Errors and Warnings. Validation Errors indicate that information or data required for plot completion is missing. Validation Warnings indicate when an unlikely or unexpected measurement has been entered. The user can tap any error or warning on the plot details page to view the details and correct the information if necessary. The comment fields can be used to justify that an error or warning is not applicable.

4. Synchronizing Data

Synchronizing data involves a two-way transfer of new/changed data (data on device data on server at FORCORP), resulting in identical data sets in both platforms upon successful synchronization. The user typically manually initiates the sync process by touching 'SYNC NOW' in the Sync Status panel. The sync status panel displays the date and time of the last successful synchronization, which can be used to confirm a sync has been completed successfully.

5. Plot Completion

Once the user is satisfied that they have finished their collection and have reviewed the data for errors and warnings, they will mark the plot as Completed. Once the completion is confirmed, all the data for that plot will be locked from any further edits on the device. Only FORCORP can unlock a Completed plot if further edits are required.

6. Data Review

Once data collected on the device is synchronized, FORCORP can produce consolidated exports and reports to assist with quality assurance or general data review. These exports and reports are available for download through FORCORP's online *eLands* system.

Appendix IV – List of Active Managed Stand PSPs

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
605908000003		SA	Pl	362,028	5,994,254	11	Y	2012
605908000024		SA	Pl	364,790	5,998,774	11	Y	2015
606005000016		UF	Pl	389,422	6,005,431	11		2016
606005000021		UF	Pl	389,568	6,007,750	11		2013
606005000022		UF	PL_G147p1	392,078	6,007,845	11		2019
606005000033	Truck	UF	Sw	389,563	6,010,433	11	Y	2018
606006000004	ATV	UF	PlHw	379,617	6,003,311	11		2018
606006000013		UF	Pl	384,483	6,005,466	11		2016
606006000019		UF	Pl	377,373	6,008,132	11		2016
606006000022	Truck	LF	Sw	382,154	6,008,087	11		2017
606006000024	ATV	UF	PlHw	384,685	6,007,954	11		2018
606006000033		UF	Pl	379,816	6,010,467	11		2019
606006000036		LF	Pl	384,649	6,010,446	11	Y	2013
606007000013		SA	Pl	374,801	6,005,801	11	Y	2015
606007000016		SA	Pl	369,959	6,005,927	11		2016
606007000021		SA	Pl	369,973	6,008,360	11	Y	2015
606104000006	ATV	UF	Pl	397,002	6,012,453	11	Y	2018
606104000016	ATV	LF	Pl	399,448	6,014,884	11		2018
606104000019	ATV	UF	PL	397,129	6,017,373	11	Y	2018
606104000033	ATV	UF	PL_G147p1	399,569	6,019,724	11		2018
606105000001	Truck	UF	D_CD	394,551	6,012,648	11		2018
606105000006		UF	Pl	387,155	6,012,672	11		2019
606105000034		UF	PL_G147p1	392,286	6,019,893	11		2016
606105000036		LF	PL	394,760	6,019,892	11	Y	2015
606106000019		UF	Pl	377,542	6,017,842	11		2016
606106000021		UF	Pl	380,033	6,017,775	11		2016
606106000036		LF	D_US	384,977	6,020,024	11		2015
606107000033		UF	C_PL_CD	375,100	6,017,936	11		2016
606108000036	ATV	UF	Pl	365,469	6,020,606	11		2018
606204000004		LF	PlHw	399,636	6,022,229	11		2019
606204000006		LF	D_US	397,193	6,022,257	11	Y	2019
606204000019		LF	Mx_SX	397,403	6,027,080	11	Y	2015
606204000022		LF	Mx_PL	402,235	6,027,063	11	Y	2012
606204000036		LF	D_AB	404,662	6,029,344	11	Y	2015
606205000001		LF	C_PL_CD	394,753	6,022,315	11		2016
606205000006	Truck	LF	D_US	387,454	6,022,508	11		2017

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606205000016		LF	D_US	390,018	6,024,835	11		2015
606205000019		LF	DC_PL	387,551	6,027,373	11	Y	2015
606205000036	Truck	LF	Pl	394,938	6,029,663	11		2018
606206000003		UF	D_AB	382,570	6,022,585	11	Y	2015
606206000006		UF	Pl	377,734	6,022,750	11		2013
606206000021		UF	PL	380,299	6,027,566	11		2015
606206000024	Truck	UF	C_SW_AB	385,159	6,027,435	11	Y	2018
606206000031		UF	PL	377,897	6,029,970	11		2015
606206000033		UF	PL	380,396	6,029,998	11		2015
606206000036	Truck	UF	C_PL_AB	385,257	6,029,833	11	Y	2018
606207000006		UF	C_SB	368,004	6,023,110	11		2016
606207000016	ATV	UF	Sw	370,482	6,025,426	11	Y	2018
606207000021		UF	PL	370,559	6,027,724	11		2015
606207000031		UF	SW	368,161	6,030,260	11		2015
606208000004		SA	Pl	360,802	6,022,996	11		2015
606208000016		SA	PL	360,749	6,025,624	11	Y	2018
606208000019	ATV	UF	PL	358,309	6,028,147	11		2018
606208000021	Truck	UF	Mx_PL	360,848	6,028,074	11		2018
606208000024	ATV	UF	Pl	365,720	6,027,841	11		2018
606208000036		UF	PL	365,694	6,030,389	11	Y	2012
606209000019	ATV	SA	PL	348,634	6,028,481	11	Y	2018
606209000022		SA	PL	353,449	6,028,350	11	Y	2013
606209000033	ATV	SA	C_SB	351,084	6,030,811	11	Y	2018
606209000036		SA	Pl	355,996	6,030,742	11		2015
606210000024	Truck	SA	SW	346,175	6,028,571	11	Y	2018
606211000024		SA	Pl	336,446	6,028,841	11		2015
606213000003		UF	Pl	314,432	6,024,705	11	Y	2015
606303000004		LF	D_US	409,191	6,031,776	11		2015
606303000016		LF	D_AB	409,464	6,034,131	11		2015
606303000033		LF	Sw	409,525	6,039,102	11		2012
606304000001		LF	PL_G147p1	404,561	6,031,711	11		2015
606304000003		LF	D_CD	402,027	6,031,889	11	Y	2015
606304000016	Truck	LF	D_US	399,714	6,034,367	11		2018
606304000019	Truck	LF	C_PLOC	397,300	6,036,953	11	Y	2018
606304000021		LF	D_AB	399,652	6,036,894	11	Y	2012
606305000001	Truck	LF	D_CD	394,688	6,032,055	11		2018
606305000006	Truck	UF	C_PLOC	387,340	6,032,284	11		2018
606305000022	Truck	LF	PL_G147p1	392,295	6,037,068	11		2018

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606305000024	Truck	LF	C_PL_CD	394,754	6,036,849	11	Y	2018
606306000003		UF	C_PL_CD	382,450	6,032,391	11		2015
606306000006		UF	PL_G147p1	377,567	6,032,519	11		2018
606306000019		LF	D_CD	377,680	6,037,313	11	Y	2015
606306000021		LF	CD_PL	380,114	6,037,269	11	Y	2013
606306000022		LF	DC_PL	382,426	6,037,156	11		2015
606306000036		LF	D_US	385,104	6,039,570	11		2015
606307000001	ATV	UF	PL_G147p1	375,102	6,032,490	11		2018
606307000003		UF	PL	372,643	6,032,633	11		2015
606307000004		UF	D_CD	370,201	6,032,717	11		2015
606307000006		UF	PL	367,798	6,032,769	11		2015
606307000008		UF	SW	368,991	6,033,912	11		2015
606307000013		LF	PlHw	375,053	6,034,886	11		2015
606307000016		UF	PL	370,330	6,035,085	11	Y	2015
606307000024		LF	Pl	375,075	6,037,298	11	Y	2012
606307000033		LF	PL_G147p1	370,360	6,040,060	11		2013
606307000036		LF	PL	375,271	6,039,828	11	Y	2015
606308000003		UF	PL_G147p1	362,817	6,032,837	11		2019
606308000004		UF	PL	360,383	6,032,968	11	Y	2015
606308000006		UF	Pl	357,756	6,033,073	11		2015
606309000001	ATV	UF	Sw	355,434	6,033,145	11	Y	2018
606309000016	ATV	SA	PL	350,656	6,035,711	11	Y	2018
606309000021		UF	Pl	350,705	6,038,062	11		2015
606309000033		UF	Pl	350,762	6,040,585	11		2015
606309000036		UF	Pl	355,748	6,040,365	11		2015
606312000003		UF	Pl	323,593	6,034,231	11		2019
606312000036	Heli	UF	Sw	326,356	6,041,497	11	Y	2017
606403000001		LF	D_AB	414,451	6,041,294	11	Y	2015
606403000003		LF	D_AB	412,018	6,041,400	11	Y	2018
606403000013		LF	D_US	414,539	6,043,754	11		2015
606403000024	Heli	CM	Pl	414,566	6,046,161	11	Y	2018
606404000013		LF	Pl	404,855	6,043,731	11		2016
606404000016		LF	Sw	399,858	6,044,038	11	Y	2012
606404000021		LF	Sw	399,857	6,046,555	11	Y	2012
606404000024		LF	C_SW_CD	404,709	6,046,412	11		2015
606404000033		LF	D_CD	399,945	6,048,956	11		2012
606405000003	Truck	LF	Pl	392,241	6,041,800	11		2018
606405000016	ATV	LF	Sw	390,199	6,044,470	11	Y	2018

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606405000019	Truck	LF	D_CD	387,714	6,046,706	11		2018
606405000026		LF	Pl	393,821	6,047,789	11		2015
606405000029		LF	Pl	388,941	6,047,960	11		2016
606405000033		LF	D_CD	390,148	6,049,199	11		2016
606405000036	ATV	LF	D_CD	395,024	6,049,026	11		2018
606407000033	Truck	LF	Pl	370,728	6,049,698	11	Y	2018
606407000036		LF	PL	375,572	6,049,527	11	Y	2015
606408000001		UF	PlHw	365,444	6,042,580	11		2016
606408000003		UF	Pl	363,043	6,042,638	11		2015
606408000006		LF	D_AB	358,431	6,042,772	11		2015
606408000013	ATV	LF	SW	365,631	6,044,967	11	Y	2018
606409000003		UF	Pl	353,367	6,042,862	11		2013
606409000036	Truck	UF	Pl	356,011	6,050,073	11		2018
606410000001		UF	Pl	345,963	6,043,255	11		2015
606410000013		UF	Pl	346,018	6,045,650	11		2015
606410000021	Truck	SA	Pl	341,059	6,048,143	11		2018
606410000022		SA	Pl	343,773	6,048,052	11		2014
606410000024		UF	Pl	346,164	6,047,818	11		2019
606411000024		SA	Pl	336,556	6,048,410	11	Y	2015
606412000003		LF	Sw	323,988	6,043,854	11	Y	2015
606412000016	ATV	UF	C_SB	321,480	6,046,525	11	Y	2016
606504000016		LF	HwSx	400,102	6,053,829	11	Y	2018
606506000019		LF	PL	378,125	6,056,691	11	Y	2015
606506000029		LF	Mx_PL	379,432	6,057,923	11	Y	2015
606506000036		LF	Mx_PL	385,535	6,058,994	11	Y	2015
606507000021		UF	SW	370,872	6,056,984	11	Y	2015
606507000022		LF	Pl	373,181	6,056,884	11	Y	2015
606507000033	Truck	LF	Pl	370,861	6,059,414	11		2018
606508000003	Truck	UF	PL	363,435	6,052,292	11		2018
606508000004	Truck	UF	PL	360,959	6,052,420	11		2013
606508000006	Truck	UF	PL	358,541	6,052,441	11		2018
606508000018		UF	PL	358,611	6,054,883	11		2015
606508000019	Truck	UF	PL	358,682	6,057,362	11		2018
606508000021		UF	SW	361,138	6,057,232	11		2015
606508000022	Truck	UF	Pl	363,403	6,057,081	11		2018
606508000024		UF	Pl	365,866	6,057,054	11		2015
606509000001		UF	PL_G147p1	356,117	6,052,524	11		2016
606509000003		UF	SW	353,485	6,052,585	11		2018

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606509000004		UF	PL	351,292	6,052,690	11		2015
606509000006		UF	SW	348,793	6,052,753	11	Y	2015
606509000022	Truck	LF	PL	353,780	6,057,430	11		2017
606509000024		UF	Pl	356,229	6,057,390	11		2015
606509000026		LF	PL	355,052	6,058,631	11		2015
606509000033	ATV	LF	PL	351,431	6,059,953	11	Y	2018
606509000036	Truck	LF	Pl	356,320	6,059,816	11		2018
606510000004		UF	Pl	341,481	6,052,947	11		2015
606510000022		LF	HwSx	344,043	6,057,798	11		2019
606511000033		LF	PL_G147p1	332,005	6,060,668	11		2019
606513000003		UF	Pl	314,641	6,054,041	11		2015
606513000004		UF	Pl	312,457	6,053,883	11		2019
606604000019	Truck	LF	Mx_SX	397,885	6,066,025	11		2018
606605000004		LF	Mx_SX	390,472	6,061,369	11		2018
606605000013	Truck	LF	Mx_SX	395,457	6,063,619	11	Y	2018
606605000021		LF	D_US	390,495	6,066,094	11		2015
606606000001		LF	Sw	385,601	6,061,371	11	Y	2019
606606000013		LF	Mx_SX	385,660	6,063,867	11	Y	2015
606606000019		LF	DC_SX	378,441	6,066,464	11	Y	2015
606606000033		CM	Mx_SX	380,922	6,068,801	11	Y	2018
606607000003		LF	PlHw	373,356	6,061,761	11		2019
606607000004		LF	PlHw	370,907	6,061,758	11		2015
606607000016	Truck	LF	Pl	371,080	6,064,217	11		2018
606607000022		LF	Sw	373,577	6,066,540	11		2015
606607000024		LF	PL	375,982	6,066,556	11	Y	2015
606608000001	Truck	LF	PL	366,299	6,061,896	11	Y	2018
606608000003		LF	Pl	363,735	6,061,973	11	Y	2015
606608000013	Truck	LF	D_AB	366,142	6,064,384	11	Y	2012
606608000016		LF	Pl	361,313	6,064,471	11	Y	2015
606608000036		LF	D_CD	366,304	6,069,177	11	Y	2019
606609000004		LF	D_CD	351,461	6,062,393	11		2016
606610000036	Truck	LF	PL_G147p1	346,910	6,069,937	11		2018
606611000019	Truck	LF	PlHw	329,764	6,067,973	11	Y	2018
606611000022	Truck	LF	Sw	334,624	6,067,802	11		2018
606612000003		LF	D_CD	324,765	6,063,166	11		2015
606612000013		LF	Pl	327,242	6,065,554	11	Y	2012
606612000022		LF	Pl	324,846	6,068,236	11		2015
606612000024	Truck	LF	Sw	327,137	6,068,085	11		2018

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606612000033		LF	Pl	322,489	6,070,794	11		2015
606613000004		LF	Pl	312,527	6,063,797	11		2019
606613000022		LF	Pl	315,034	6,068,520	11		2013
606614000001		UF	PL_G147p1	307,641	6,064,093	11		2016
606614000013		LF	C_PL_CD	307,804	6,066,524	11		2016
606704000004		CM	D_CD	400,050	6,070,888	11	Y	2016
606706000001	Truck	CM	D_CD	385,318	6,071,101	11	Y	2015
606706000033		CM	Sw	380,598	6,078,479	11	Y	2019
606707000036		CM	D_CD	375,799	6,078,445	11	Y	2016
606710000001		LF	Mx_PL	346,199	6,072,226	11		2018
606710000013		LF	Mx_SX	346,088	6,074,713	11		2015
606711000019		CM	Pl	329,155	6,077,783	11	Y	2013
606711000036		LF	D_CD	336,518	6,079,952	11		2016
606712000004		LF	Pl	321,522	6,073,258	11		2019
606713000004	ATV	LF	Pl	311,754	6,073,799	11		2018
606713000016		LF	Pl	311,680	6,075,805	11		2019
606713000019		LF	SW_G351p1	309,480	6,078,828	11		2013
606805000019		DM	D_CD	388,148	6,085,620	11		2016
606805000022	ATV	DM	D_CD	393,014	6,085,471	11	Y	2018
606805000024		DM	D_CD	395,509	6,085,440	11		2015
606806000003	Truck	CM	SW	383,249	6,080,969	11	Y	2018
606806000004	Truck	CM	Mx_SX	380,688	6,080,956	11	Y	2018
606806000024		DM	D_CD	385,720	6,085,730	11		2015
606807000006		CM	D_CD	368,435	6,081,385	11		2016
606807000022	Truck	CM	D_CD	373,472	6,086,126	11	Y	2018
606808000004		LF	SwHw	361,066	6,081,604	11	Y	2019
606808000013		CM	D_CD	366,038	6,083,838	11	Y	2015
606808000019		CM	D_CD	358,822	6,086,449	11	Y	2019
606809000003		LF	D_CD	353,852	6,081,554	11		2016
606810000022		CM	Pl	344,088	6,086,932	11	Y	2019
606811000006		CM	HwSx	329,268	6,082,617	11	Y	2013
606811000021		CM	D_CD	331,838	6,087,394	11	Y	2016
606811000024		CM	D_CD	336,824	6,087,267	11	Y	2019
606812000003		CM	Pl	324,442	6,082,939	11	Y	2019
606812000004		CM	SW_G351p1	321,868	6,082,996	11		2015
606812000022		CM	SW_G351p1	324,684	6,087,809	11		2019
606813000022	ATV	LF	PlHw	314,903	6,088,141	11		2018
606814000024		LF	PL_G147p1	307,750	6,088,343	11		2019

Survey Number	Access	Natural Subregion	Yield Curve	UTM Easting	UTM Northing	UTM Zone	PGYI Plot?	Last Meas
606814000036		LF	Pl	307,844	6,090,783	11	Y	2019
607505000006		LF	D_CD	388,801	6,149,014	11		2019
607508000024		LF	D_CD	367,001	6,154,215	11		2015
607510000036		LF	D_AB	347,548	6,157,278	11		2019
607511000018		CM	D_AB	330,230	6,153,060	11	Y	2015
607511000022		LF	D_CD	335,177	6,155,367	11		2019
607511000033		LF	D_CD	332,839	6,157,955	11		2019
607512000019	Truck	CM	D_CD	320,483	6,155,928	11	Y	2018
607512000024		CM	D_AB	327,889	6,155,714	11	Y	2015
607609000019	Truck	LF	PlHw	350,224	6,164,499	11		2018
607609000024	ATV	LF	Pl	357,615	6,164,183	11		2018
607609000033		LF	D_CD	352,793	6,166,866	11		2016
607609000036		LF	SW_G351p1	357,782	6,166,462	11		2016
607610000019		LF	D_US	340,506	6,164,594	11	Y	2015
607610000021		LF	Sw	342,903	6,164,775	11	Y	2019
607611000008		LF	D_US	331,775	6,161,508	11		2016
607611000024		LF	D_US	338,034	6,164,909	11		2015
607612000001	Truck	LF	D_US	328,093	6,160,419	11		2018
607612000004		LF	D_US	323,195	6,160,639	11	Y	2019
607612000006		LF	D_AB	320,745	6,160,745	11		2015
607612000011		LF	D_AB	326,880	6,161,702	11		2016
607612000013	ATV	LF	D_AB	328,089	6,162,860	11	Y	2018
607613000001		LF	D_US	318,238	6,160,882	11		2019
607613000015		LF	D_US	315,949	6,163,341	11	Y	2016
607613000024	Truck	LF	D_US	318,473	6,165,640	11		2018
607708000019		LF	SW_G351p1	360,302	6,173,781	11		2019
607709000004	ATV	LF	Sw	352,865	6,169,292	11	Y	2018
607709000022	Truck	LF	Pl	355,534	6,173,994	11		2018
607710000024		LF	Sw	348,111	6,174,243	11	Y	2019
607711000006	Truck	LF	SW_G351p1	330,680	6,169,967	11		2018
607711000016		LF	Mx_PL	333,418	6,172,382	11		2015
607812000033		DM	D_CD	324,245	6,187,328	11	Y	2019

Appendix V – Plot Measurement Schedules

Current plot re-measurement and establishment schedules are summarized in this section. The schedules will be balanced and rationalized to ensure that resources are available on a yearly basis without significant fluctuations. Every effort will be made to ensure that plots in the PGYI program are measured on their regular cycle.

Year	Natural	Managed	Post-RSA		RGT***		Total		
	Meas*	Meas**	Est	Meas	Est	Meas	Est	Meas	All
Overdue	26	9					0	35	***35***
2020	24	12	5		4		9	36	***45***
2021	45	5	5		2		7	50	***57***
2022	47	11	5		2		7	58	***65***
2023	52	25	5		2	27	7	104	***111***
2024	14	13	5		2		7	27	***34***
2025	13	83	5	5	2	4	7	105	***112***
2026	15	29	5	5	2	2	7	51	***58***
2027	80	4	5	5	2	2	7	91	***98***
2028	42	65	5	5	2	29	7	141	***148***
2029	19	36	5	5	2	2	7	62	***69***
Total	***377***	***292***	***50***	***25***	***22***	***66***	***72***	***760***	***832***

** some non-PGYI natural stand PSPs will be lost to harvesting activities*

*** non-PGYI plots are scheduled on a 10-year cycle*

**** Realized Gain Trials*

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CHAPTER 9 PREFERRED FOREST MANAGEMENT SCENARIO

9.1. Planning Horizon

The planning horizon for all scenarios in this plan is 202 years (2 + 200 years). The effective date of the landbase is May 1, 2017. At the time of submission, period 1 of the plan covers the first 2 years (May 1, 2017-April 30, 2019) and have been locked in as harvested. Period 2-3 include the first 10 years of the planned sequence. Periods 4-41 include the remaining 190 years of the planning horizon.

9.2. Primary and Incidental Volume

Conifer stands are identified as Cx, CD, DC and D_US stands. Conifer produced from conifer stands is considered primary volume while deciduous produced from these stands is considered secondary or incidental volume. Deciduous stands are identified as Dx. Deciduous produced from deciduous stands is considered primary volume while conifer produced from these stands is considered secondary or incidental volume.

9.3. Forest Management Scenarios

The development of the Preferred Forest Management Scenario is the result of ongoing adjustments to assumptions, targets and target weightings over time to obtain the best possible balance of timber and non-timber values to meet all the objectives.

In some cases, assumptions were constrained or relaxed from the previous plan in order to achieve the goals and objectives set by the Plan Development Team. These would be considered strategic and are described here. All other inputs and assumptions are described in detail in *Annex 4: Classified Landbase Document, Annex 5: Growth & Yield Report* and/ or in *Annex 10: Timber Supply Analysis Report.*

The **Baseline scenario (#8109)** includes:

- minimum total conifer volume of 1,145,000m[1]
- maximum conifer volume of 550,000m^3 being sourced from the CMZ for P2-3 (decade 1)[1]
- maximum conifer volume of 200,000m being sourced from the CMZ for P4 and beyond[64]
- The access units within the caribou range that can be accessed have been hand selected with input from Weyerhaeuser, Environment and Parks, CPAWS and Aseniwuche Winewak Nation.

The **Preferred Forest Management Scenario (#8110)** accelerates the primary deciduous harvest volume established in the Baseline Scenario by 125% for the first 20 years. The conifer assumptions for this scenario do not change from the baseline scenario.

[64] As per direction from Shannon Phillips, Minister of Environment and Parks and Oneil Carlier, Minister of Agriculture and Forestry (March 12, 2019)

Key Assumptions for Scenario 8109 (Baseline) and 8110 (PFMS)

- The volumes presented in Sections 9.4, 9.5 and the comparison in 9.6 are for the entire FMU G16.
- Primary conifer volume is averaged over years 1-10 for decade 1 and years 11-70 for decade 2.
- Secondary conifer is averaged over years 1-20 for both decade 1 and 2.
- For scenario 8109, primary deciduous is averaged over years 1-70 for both decade 1 and 2.
- Scenario 8110 proposes a 20-year accelerated deciduous; therefor, primary deciduous is averaged over years 1-20 for both decade 1 and decade 2.
- For both 8109 and 8110, secondary deciduous is averaged over years 1-20 for both decade 1 and 2.
- The volumes presented in 9.7 are for the FMA for conifer and the FMU for deciduous. Scheduled conifer landbase has been removed outside the FMA which resulted in a minor reduction in scheduled secondary deciduous. Fixed allocations have been capped at their fixed volume. The balance is allocated to Norbord (deciduous) and Weyerhaeuser (coniferous).

9.4. BASELINE SCENARIO #8109

9.4.1. Alberta Forest Management Standard

5.8-Mandatory Assumptions

A. The planning horizon is 200 years
B. Even flow timber supply for the planning horizon
    a. Maximum allowable tolerance in the periodic harvest is +/-5% of the planning horizon average
C. The amount of operable growing stock must be stable over the last quarter of the planning horizon
D. The total coniferous and total deciduous volumes must be projected

9.4.2. Results

<u>Even flow</u>

Implementing the maximum volume out of the caribou zone after the first decade results in a sudden decelerated harvest as the model is not able to find the 350,000m^3 reduction outside of the CMZ. In all scenarios, the conifer volume in the first decade is 30% higher than the average conifer volume of the remaining 190 years.

Figure 9-1. Primary SWD Even flow Harvest Variance- BASELINE

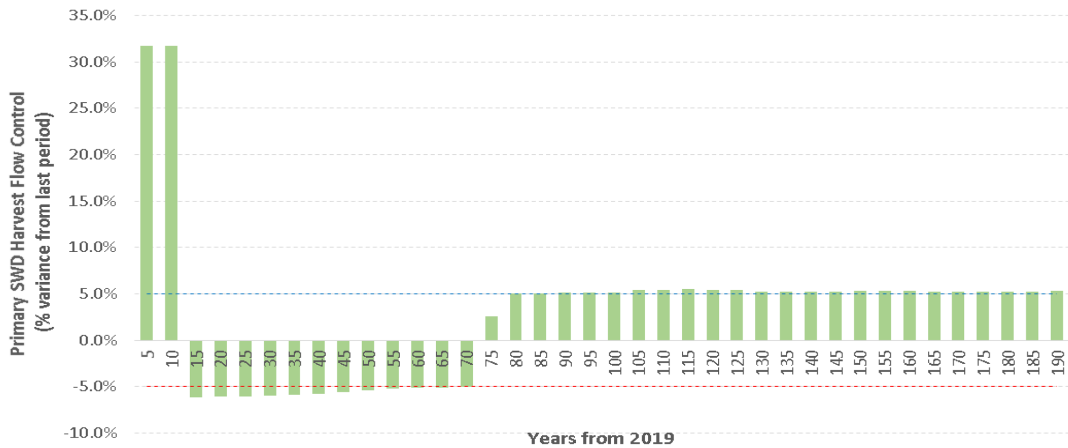
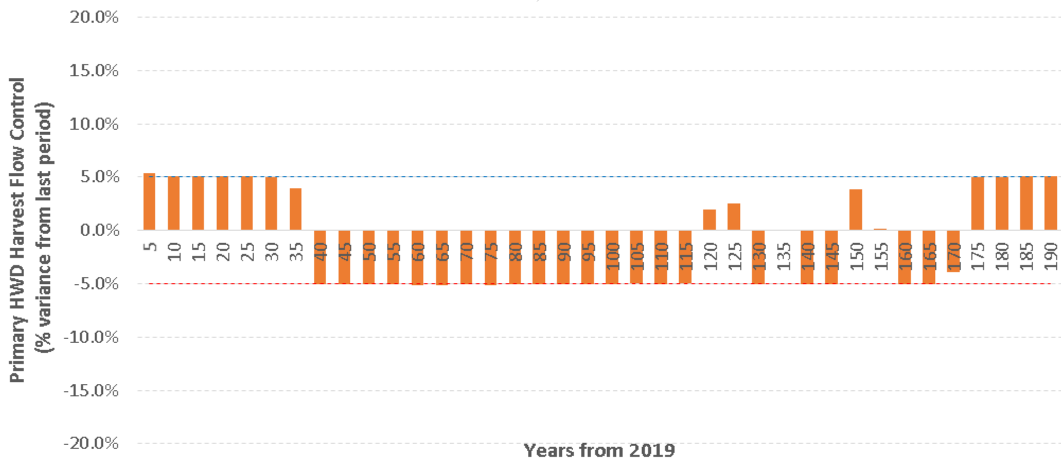


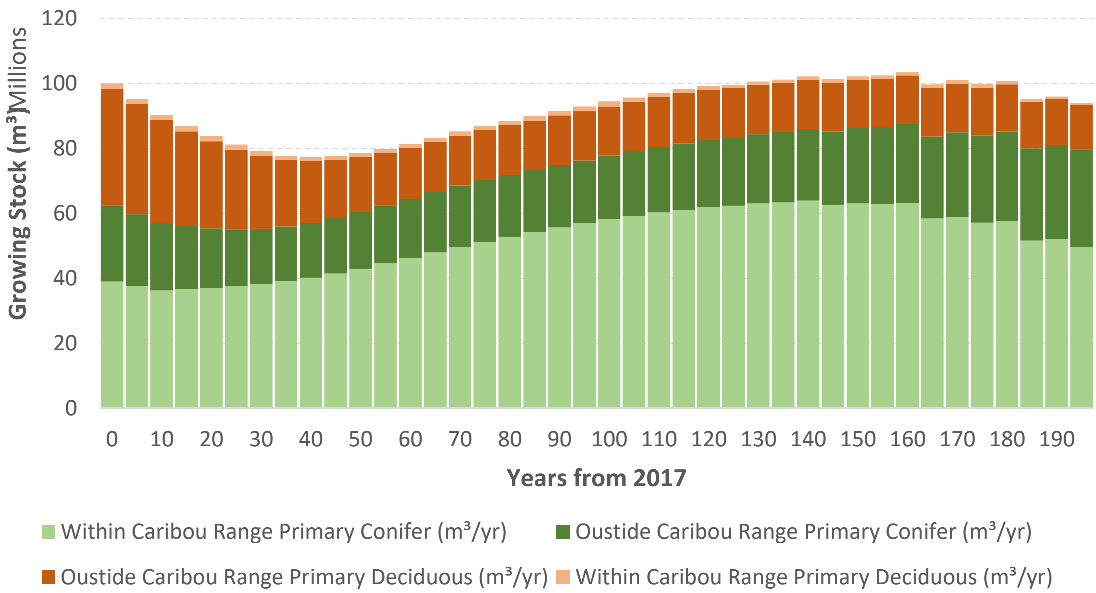
Figure 9-2. Primary HWD Even flow Harvest Variance- BASELINE #8109



Operable Growing Stock

The amount of operable conifer and deciduous growing stock is stable in the last quarter of the planning horizon.

Figure 9-3. Growing Stock- BASELINE #8109



Total Harvest Volumes

Scenario 8109 achieves an average total conifer harvest of 1,230,395 m^3/yr for the first 10 years of the planning horizon. This considers the 550,000m^3/yr maximum allowable volume from the caribou zone and averages the secondary conifer harvest over the first 20 years.

The total conifer harvest drops to 920,766m^3 for periods 3-4 when the allowable volume from the caribou zone is constrained to 200,0000. The primary conifer volume for the second decade is the average of years 11-70 and the secondary volume is the average of years 1-20. Throughout the planning horizon secondary conifer is a small component of the harvest volume (<10%).

The average total deciduous volume available remains steady around 815,592 m^3 for the entire planning horizon with a slight midterm drop in the last half of the first century. Secondary volume contributes to the annual harvest at a rate of 20-35% throughout the planning horizon. The primary deciduous volume is the average of years 1-70 and the secondary deciduous is the average of years 1-20.

Table 9-1. DFA Harvest Volume Description- BASELINE #8109

Harvest Volume Description	Harvest (m^3/yr)
Primary Conifer year 1-10 average	1,152,375
Secondary Conifer 20-year average	78,020
Decade 1 Conifer Harvest	**1,230,395**
Primary Conifer year 11-70 average	831,864
Secondary Conifer 20-year average	78,020
Decade 2 Conifer Harvest	**909,884**
Primary Deciduous 70-year average	650,307
Secondary Deciduous 20-year average	165,285
Decade 1-2 Deciduous Harvest	**815,592**

Figure 9-4. Harvest Levels- BASELINE #8109

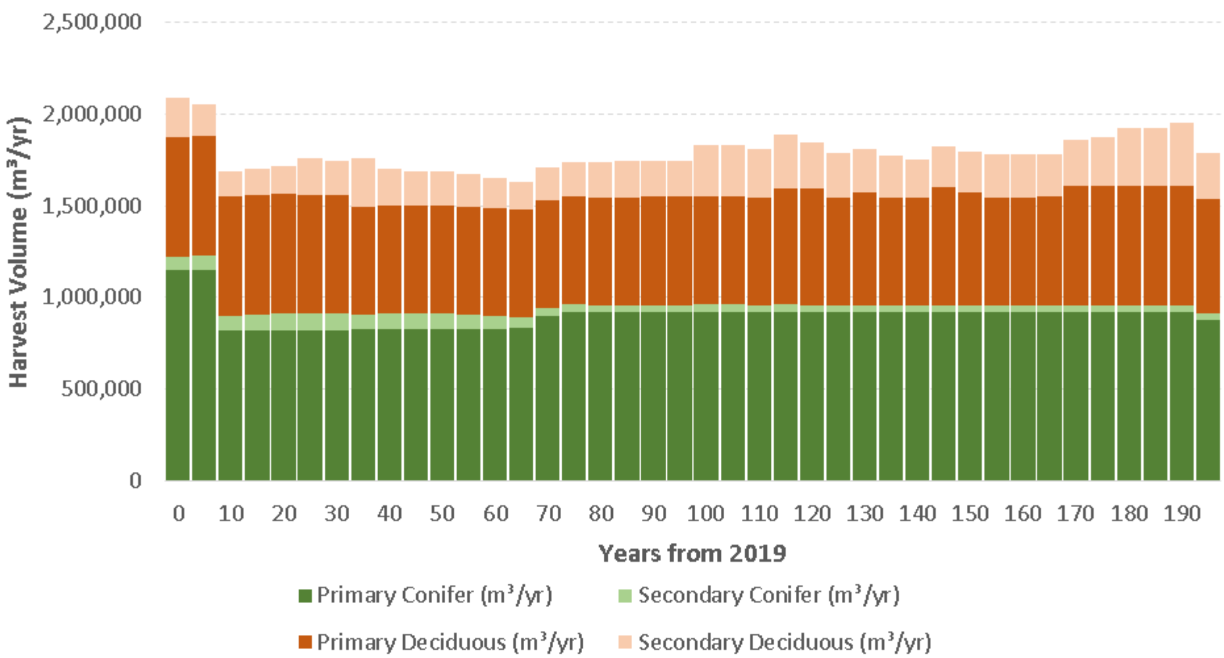


Figure 9-5. Conifer Harvest Levels- BASELINE #8109

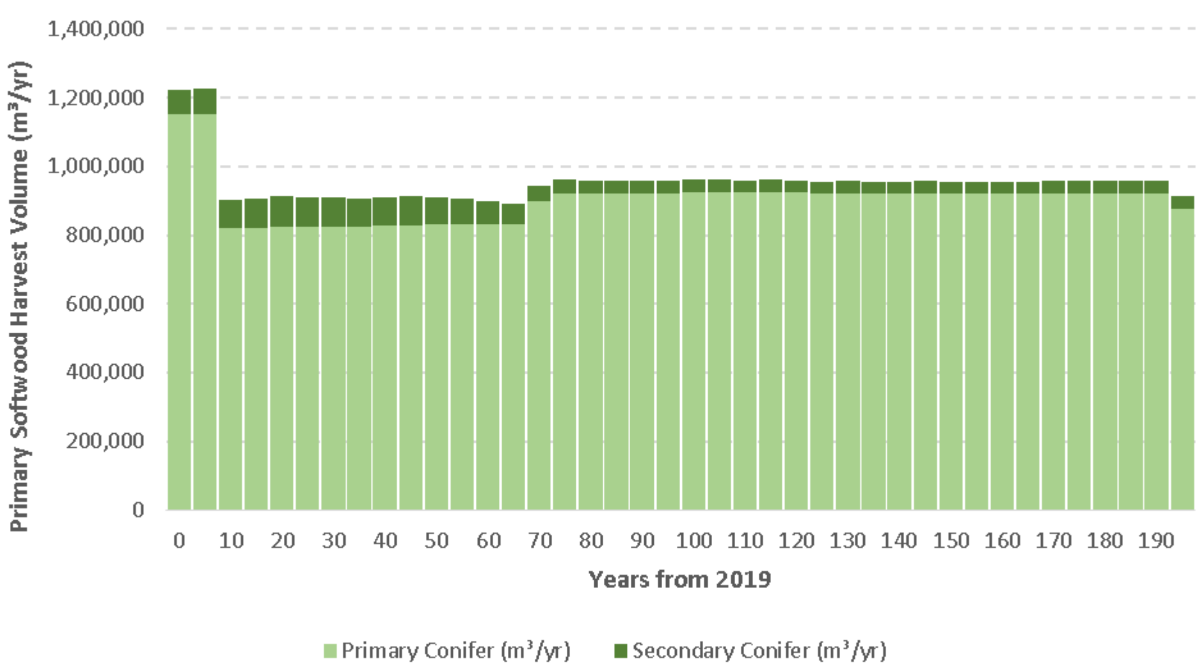


Figure 9-6. Deciduous Harvest Levels- BASELINE #8109

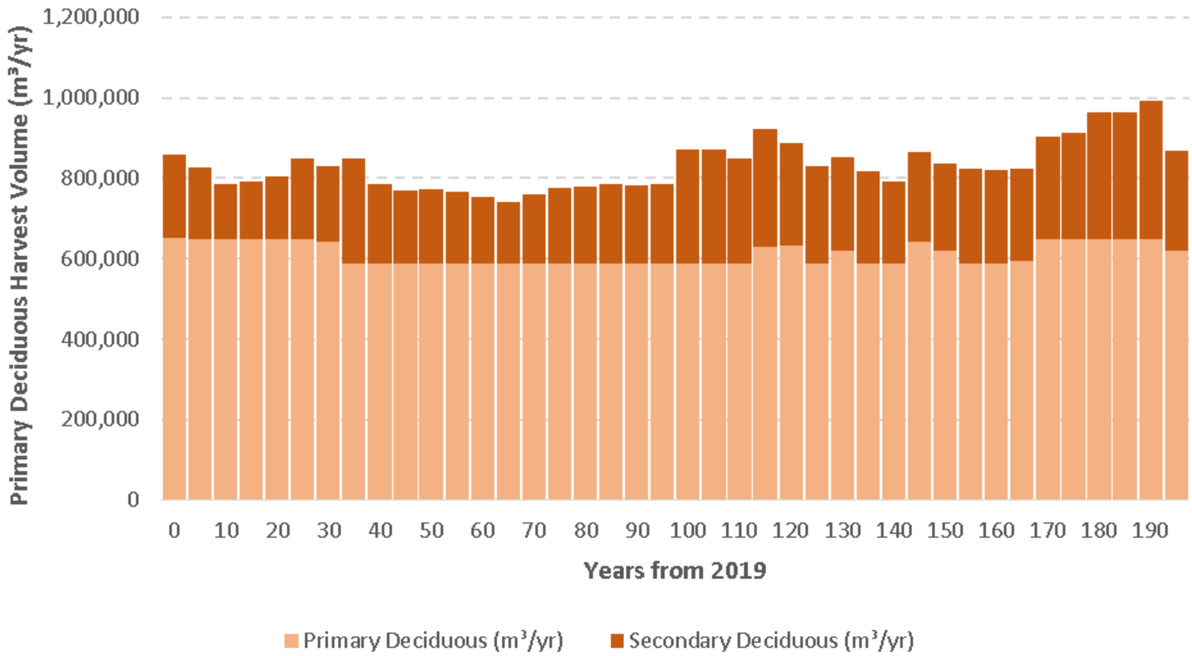
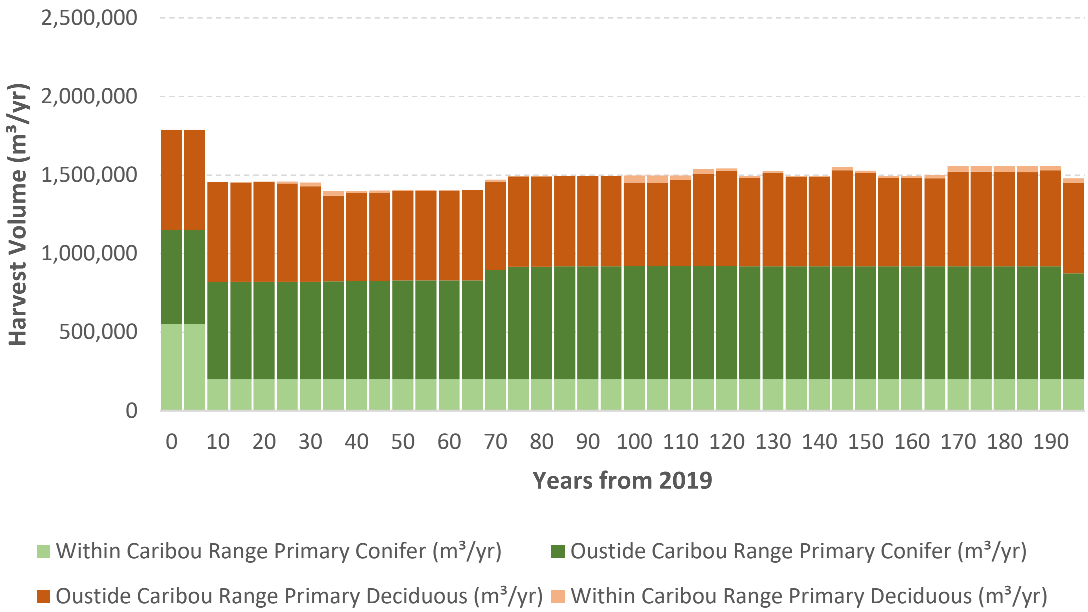
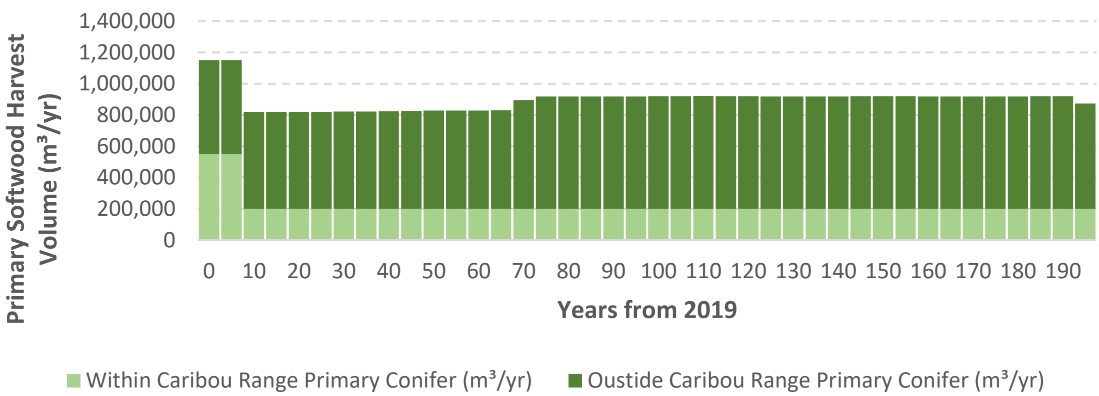
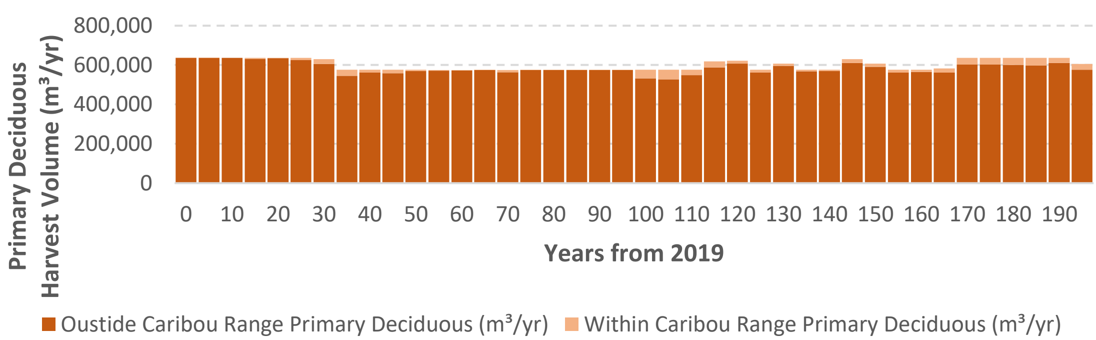


Figure 9-7. Harvest Volume CMZ Split- BASELINE #8109







The conifer volume being sourced from the caribou zone does not exceed the maximum agreed to volume of 550,000m^3/yr in the first decade and maximum 200,000m^3/yr for the remaining 190 years. The amount of deciduous volume being sourced from the caribou range is negligible in the first two decades of this plan.

Table 9-2. DFA Harvest Levels- BASELINE #8109

Year	Primary Conifer (m³/yr)	Primary Deciduous (m³/yr)	Secondary Conifer (m³/yr)	Secondary Deciduous (m³/yr)
0	1,152,361	651,651	71,905	207,872
5	1,152,388	649,900	75,847	176,736
10	821,648	649,870	79,869	135,226
15	822,407	649,807	84,460	141,308
20	822,555	649,812	91,148	154,799
25	823,120	649,564	88,058	199,551
30	823,821	642,993	87,819	188,436
35	824,940	588,700	80,702	261,676
40	826,444	588,563	85,056	197,793
45	827,956	588,371	87,265	182,737
50	830,385	588,324	81,050	183,926
55	830,563	588,142	75,242	178,900
60	830,991	588,076	68,129	164,924
65	831,493	588,002	58,873	152,415
70	897,905	587,013	46,112	174,178
75	919,313	587,219	40,913	188,720
80	919,473	587,368	39,437	190,770
85	920,270	587,378	38,711	199,070
90	920,419	587,428	39,338	195,518
95	920,542	587,372	39,251	197,583
100	923,192	587,660	37,499	282,617
105	923,472	587,577	37,607	283,212
110	923,477	587,868	34,141	261,311
115	923,336	630,018	37,408	293,744
120	923,100	633,396	35,995	253,220
125	921,357	587,613	33,203	241,630
130	921,078	618,327	35,530	234,286
135	921,501	587,704	33,837	229,221
140	921,169	587,643	34,634	204,703
145	922,121	641,226	36,317	223,390
150	921,679	619,215	34,255	217,789
155	921,858	587,596	34,602	235,256
160	921,093	587,577	34,462	233,938
165	921,097	593,997	33,325	230,772
170	921,494	648,676	36,674	253,780
175	921,240	649,555	37,901	262,435
180	921,218	648,939	37,040	316,574
185	922,139	648,815	36,612	314,387
190	922,240	648,647	37,680	344,116
195	875,605	618,548	39,707	249,221

9.5. PREFERRED FOREST MANAGEMENT SCENARIO #8110 (TwentyYearSHS_8110)

9.5.1. 125% Accelerated Deciduous Harvest

Accelerated timber harvesting is an acceptable forest management approach. The impact on long term forecasts shall be calculated. Accelerated harvesting strategies may be approved that vary from the listed conditions provided. Alberta determines the rationale to be sound, supporting documentation valid and risk acceptable.

3.5.1.1. Alberta Forest Management Planning Standard

The Alberta Forest Management Planning Standard contains the following direction for accelerated harvest planning:

iv. Sensitivity of long-term forecasts to accelerated harvests
Accelerated timber harvesting is an acceptable forest management approach (e.g. mitigate wildfire risk or forest health issues, age-class imbalance, address timber productions and quadrant/period balancing).
The impact on long-term forecasts shall be calculated. Accelerated harvesting strategies may be approved that vary from the listed conditions provided Alberta determines the rationale to be sound, supporting documentation valid, and risk acceptable.

Conditions for and accelerated harvest are,
a. Occurs over the first 20 years of the planning horizon, and
b. Recommended harvest level does not exceed 125% of the unaccelerated average even-flow harvest level, and
c. The average even-flow harvest level for the remaining 180 years is not less than 90% of the unaccelerated average even-flow harvest flow for the entire planning horizon.

The accelerated harvest presented in the Preferred Forest Management Scenario meets these conditions.

9.5.2. Background Information/ Rationale

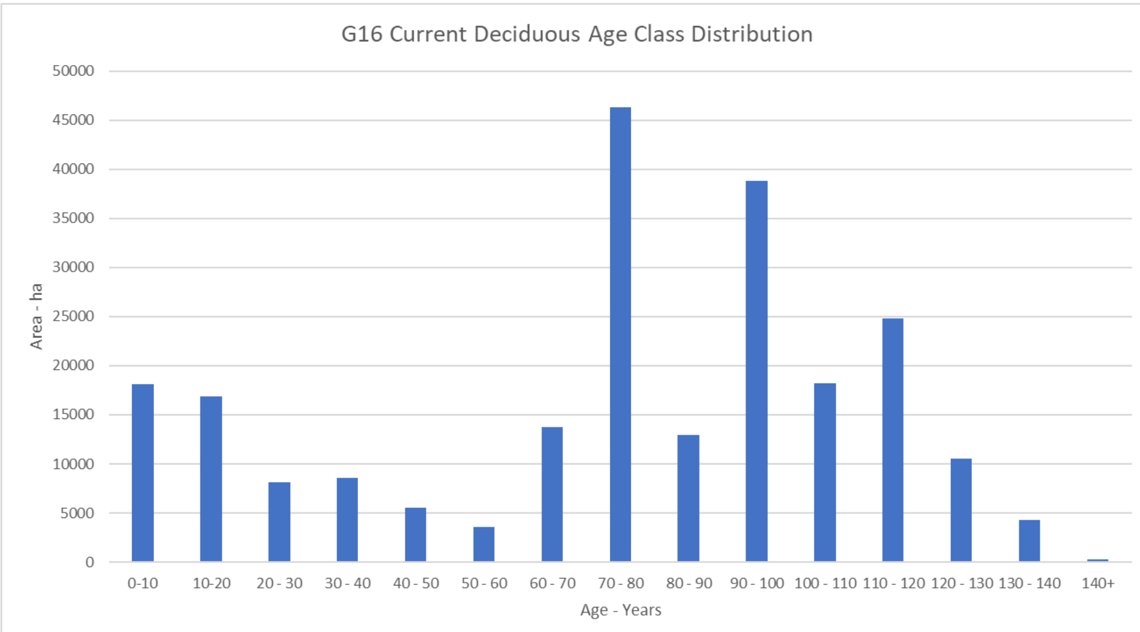
An accelerated harvest of the deciduous landbase was part of the approved PFMS in the 2011 FMP because the age class of the deciduous stands in FMU G16 is skewed towards older age classes with a significant area older than 80 years. Natural mortality and volume loss are expected in these older stands over the next 20-50 years.

Due to market conditions and facility requirements, the facilities with tenure rights to this volume did not use their full allocations and the approved accelerated harvest volume was not utilized in the previous decade (2009-2019). The current CLB is showing that there is still an abundance of over-mature deciduous on the landbase and parts of the FMU have high rates of deciduous mortality. Some of these areas have been mapped with defoliation caused by tent caterpillar and aspen tortrix over the past decade and have been affected by drought during this time as well.

Deciduous Age Class and Growing Stock Decline

The deciduous age class distribution in the FMU G16 is skewed towards older age classes. Fire suppression and the relatively recent history of harvesting deciduous wood in Alberta has resulted in approximately 50% of the deciduous stands in G16 being greater than 80 years old.

Figure 9-8. FMU G16 Deciduous Age Class Distribution



A consequence of the current age class distribution is that there is approximately 44.9 million m^3 of primary operable deciduous wood within the contributing landbase, much higher than would be expected in an even aged forest. As the current deciduous stands age and enter over maturity, some of this volume is projected to be lost as these stands decline. In a paper by Pothier, Raulier and Riopel[65] the authors conclude that *"In even-aged stands composed of pioneer species, such as trembling aspen (Populus tremuloides Michx.), synchronous tree senescence can cause an important and rapid drop in merchantable volume, known as stand breakup."*

The operable growing stock is projected to decline from about 44.9 million m^3 to 16.5 million m^3 at year 65 in the Baseline (unaccelerated) scenario #8109.

[65] Aging and decline of trembling aspen stands in Quebec, David Pothier, Frédéric Raulier, and, Martin Riopel, Canadian Journal of Forest Research, 2004, 34(6): 1251-1258, https://doi.org/10.1139/x04-017

The Alberta Government has monitored forest health in G16 in recent years. Over the past 10 years areas of aspen defoliation by forest tent caterpillar and aspen tortrix have been mapped in G16 with much of this being in the northern portion of the FMU. In addition, there have been years with drought conditions. In 2018, significant areas were mapped that exhibited mortality.

Accelerated Harvest Modeling
The unaccelerated 200-year average of the primary deciduous volume is 612,154 m^3. Accelerated harvest of the primary deciduous volume was modelled at 125%, 135% and 150%. Modeling using the current assumptions show that and accelerated harvest level up to 50% above the unaccelerated level can be sustained for 20 years without resulting in more than a 10% drop in the average harvest level for the remaining 180 years.

Accelerated	20 year accelerated average volume (m^3)	Remaining 180-year Average volume (m^3)	Change Relative to Baseline
@ 125%	765,960	594,992	97.2%
@ 135%	824,057	590,468	96.4%
@ 150%	913,900	586,115	95.7%

Non-Timber Values
Information regarding the modelling approach and methodology as well as resulting graphs and maps for both the Baseline Scenario #8109 and the Preferred Forest Management Scenario #8110 are included in *Annex 9: Non-Timber Value Assessment Reports.*

Chapter 7 summarizes the Values, Objectives, Indicators and Targets detailed with monitoring and performance expectations in *Annex 8: VOIT Table.* Chapter 7 also compares the results for the Non-Timber Value results between the Baseline Scenario #8109 and the PFMS Scenario # 8110. For each of the objectives, there is very little difference between the results using the PFMS (accelerated) scenario and the Baseline (unaccelerated) scenario for this target. Mitigation Strategies are listed for results outside the thresholds for the PFMS scenario.

Spatial Harvest Sequence
The SHS developed using the Preferred Forest Management Scenario is called *"TwentyYearSHS_8110"*. This SHS targets compartments that have older timber and stands that have shown decline and/ or mortality.

9.5.3. Conifer Harvest Limitation in Caribou Range

GoA direction supports an allowable harvest of 550,000 m^3/year from within the Caribou Ranges over the first 10 years, followed by rate of 200,000 m^3/year for decade 2 and beyond. Most of the mature conifer timber on the FMA exists within the caribou zone (*Chapter 4- Landscape Assessment, Section 4.5.3; Map 4-11*). The constraints applied to volumes sourced from the CMZ result in a harvest flow that decreases over time.

Annex 10; Section 8.3- Scenario#8112; No Caribou Management describes what the harvest levels would be without the cap on the volume sourced from the CMZ. When caribou management constraints were removed, the resulting primary conifer harvest averaged 1,240,673 m^3/year over the first century (a 40.4% increase over the base case on average for the same time period) followed by an average of 1,373,932 m^3/year over the second century, an increase over the base case of 49.8%.

9.5.4. Results

<u>Even flow</u>

The available harvest is not even flowed throughout the planning horizon for both the Baseline and the PFMS. The conifer volume drops after the first decade due to the CMZ constraints. The deciduous volume drops after the first 20 years because of the accelerated harvest strategy.

Figure 9-9. Primary SWD Even flow Harvest Variance- PFMS #8110

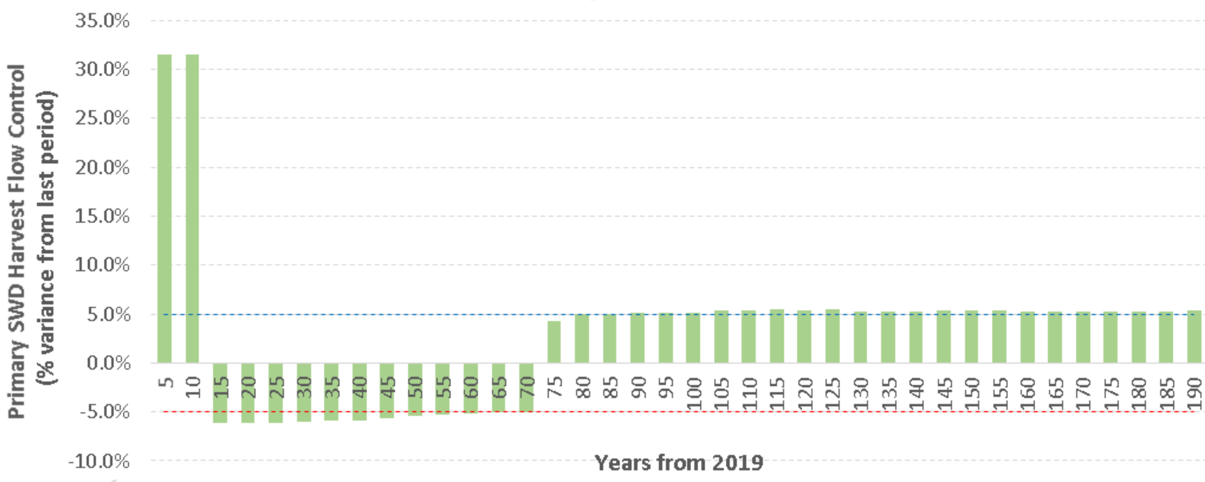
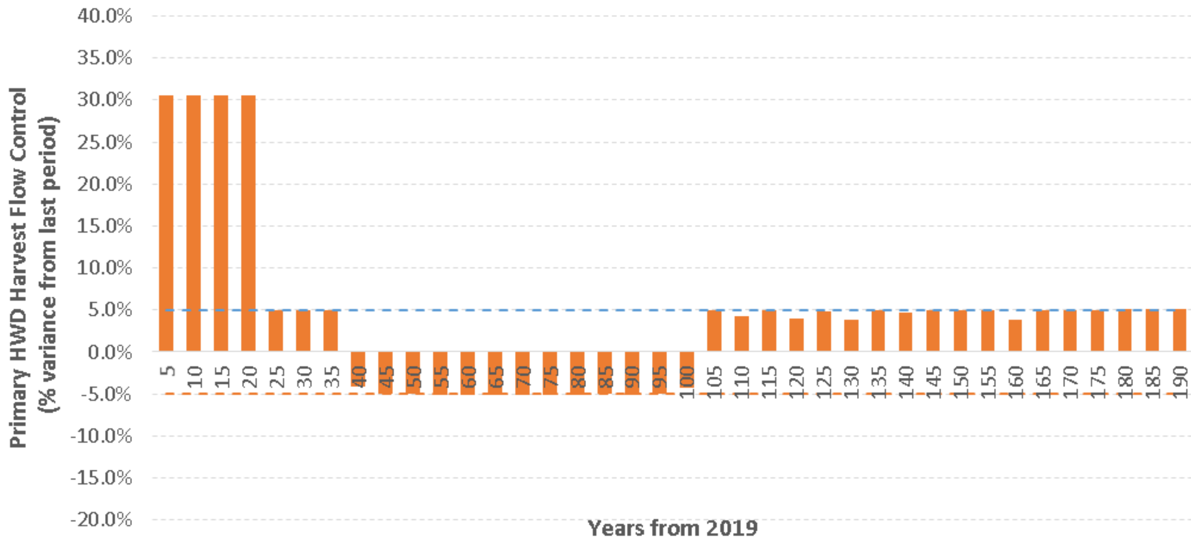


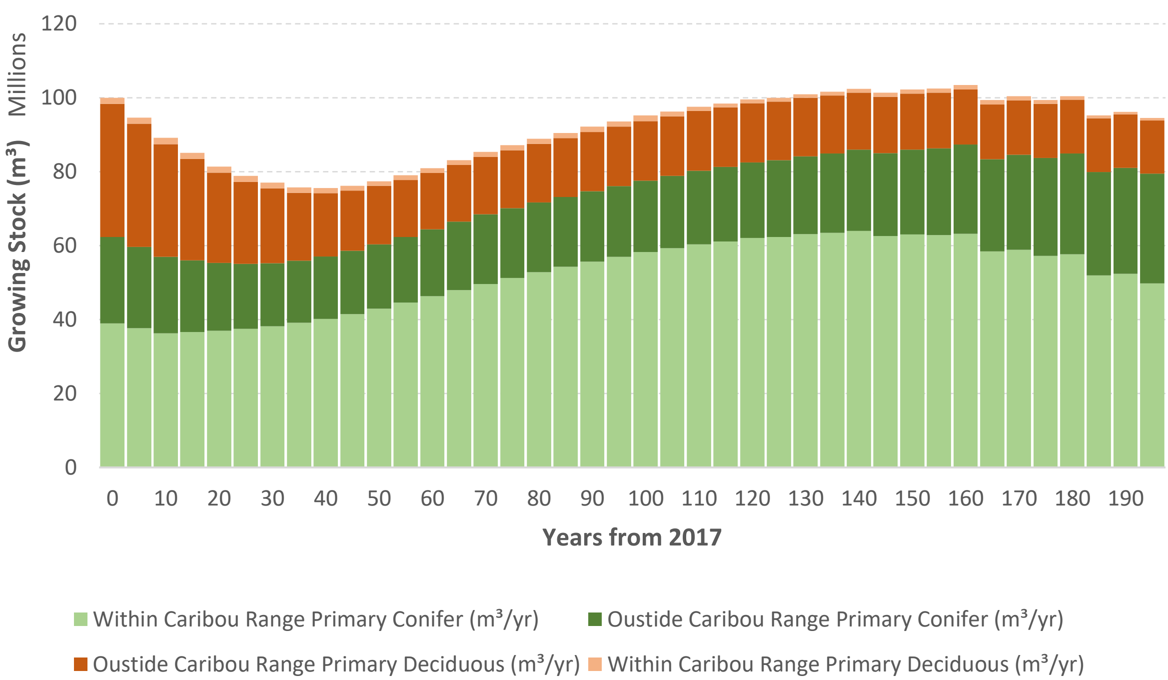
Figure 9-10. Primary HWD Even flow Harvest Variance- PFMS #8110



Operable Growing Stock

The amount of operable conifer and deciduous growing stock is stable in the last quarter of the planning horizon.

Figure 9-11. Growing Stock-PFMS #8110



Total Harvest Volumes

Scenario 8110 achieves an average total conifer harvest of 1,238,802m^3/yr for the first 10 years of the planning horizon. This considers the 550,000m^3/yr maximum allowable volume from the caribou zone and averages the secondary conifer harvest over the first 20 years.

The total conifer harvest drops to 920,756m^3/yr for periods 3-4 when the allowable volume from the caribou zone is constrained to 200,000m^3/yr. The primary conifer volume is the average of years 11-70 and the secondary volume is the average of years 1-20.. Throughout the planning horizon secondary conifer is a small component of the harvest volume (<10%).

The average total deciduous volume available is 927,904 m^3/yr for the first 20 years during accelerated period, after which it drops to round 823,080 m^3/yr for the rest of the planning horizon with a slight midterm drop in the last half of the first century. Secondary deciduous volume is the average of years 1-20 and contributes to the annual harvest at a rate of 20-30% throughout the planning horizon.

Table 9-3. DFA Harvest Volume Description- PFMS #8110

Harvest Volume Description	(m^3/yr)
Primary Conifer year 1-10 average	1,152,442
Secondary Conifer 20-year average	86,360
Decade 1 Conifer Harvest	**1,238,802**
Primary Conifer year 11-70 average	834,396
Secondary Conifer 20-year average	86,360
Decade 2 Conifer Harvest	**920,756**
Primary Deciduous 20-year average	763,960
Secondary Deciduous 20-year average	163,944
Decade 1-2 Deciduous Harvest	**927,904**

Figure 9-12. Harvest Levels- PFMS #8110

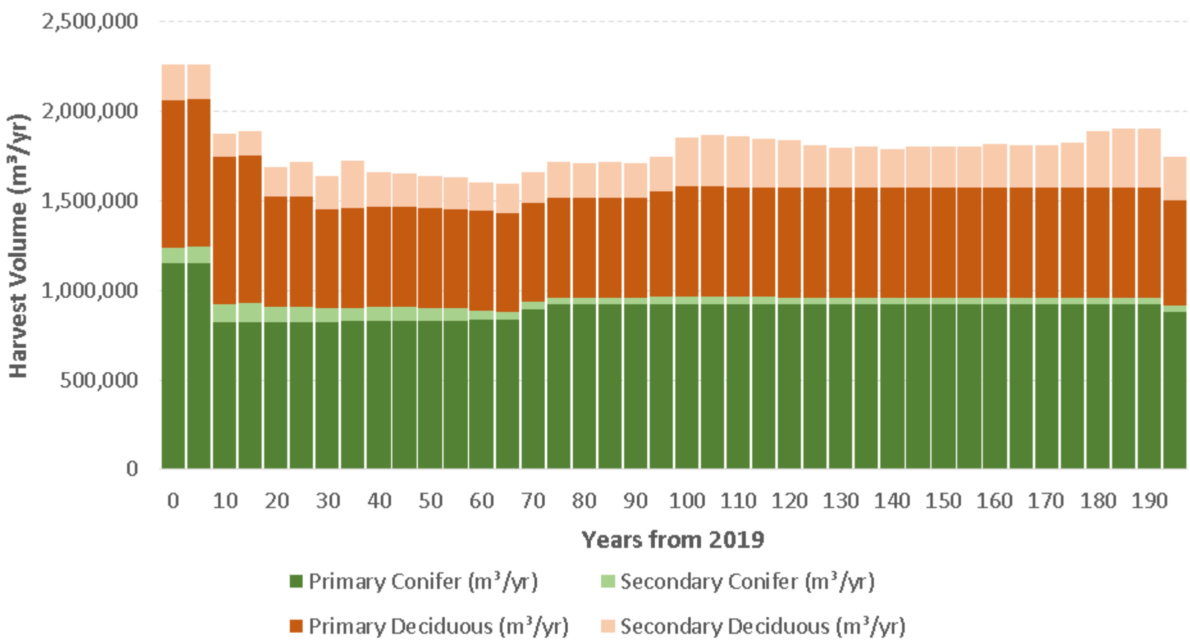


Figure 9-13. Conifer Harvest Levels- PFMS #8110

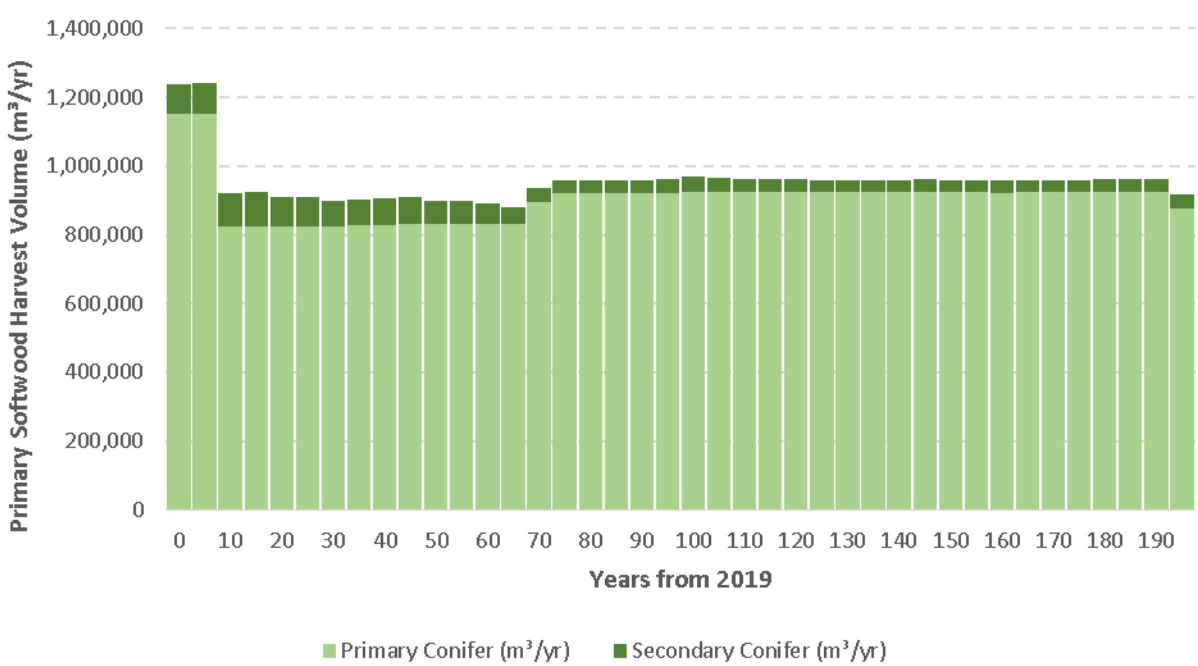


Figure 9-14. Deciduous Harvest Levels- PFMS #8110

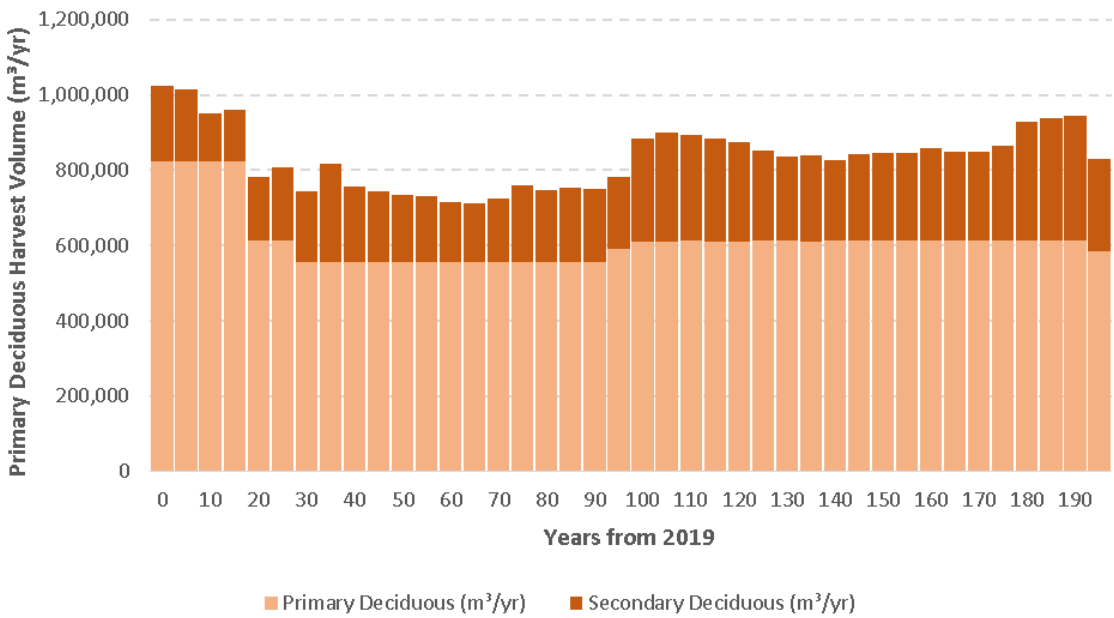
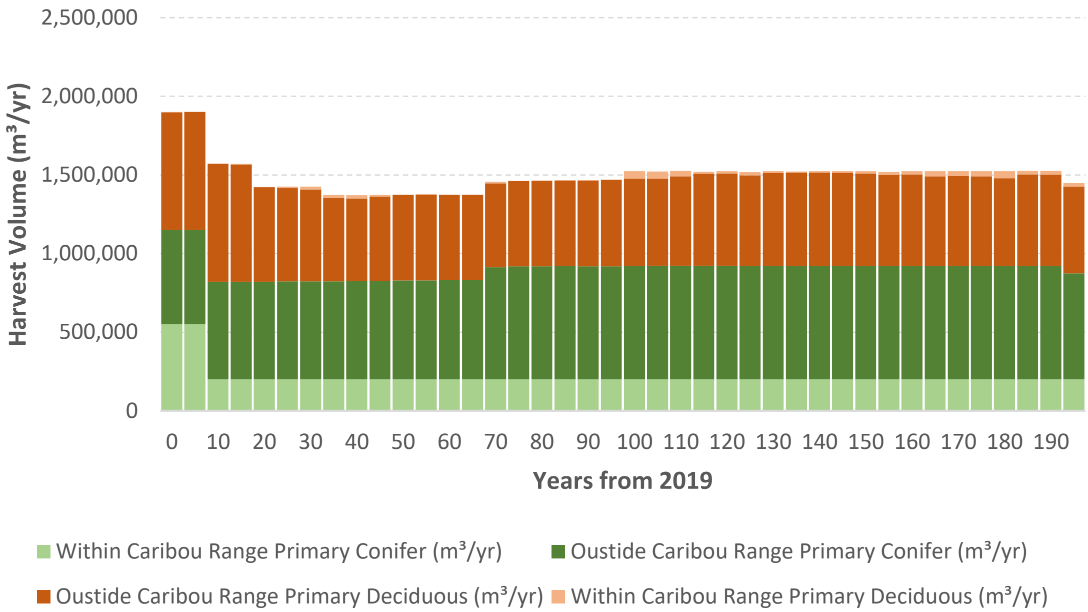
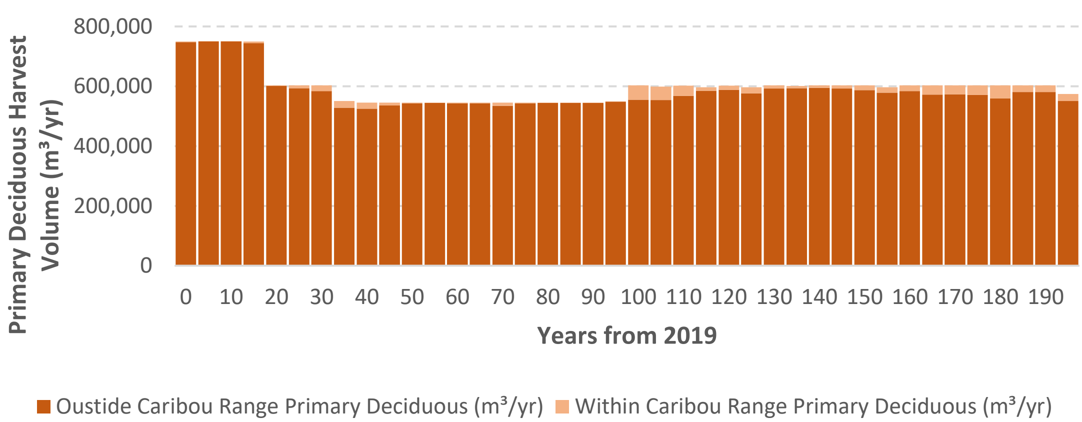


Figure 9-15. Harvest Volume CMZ Split-PFMS #8110





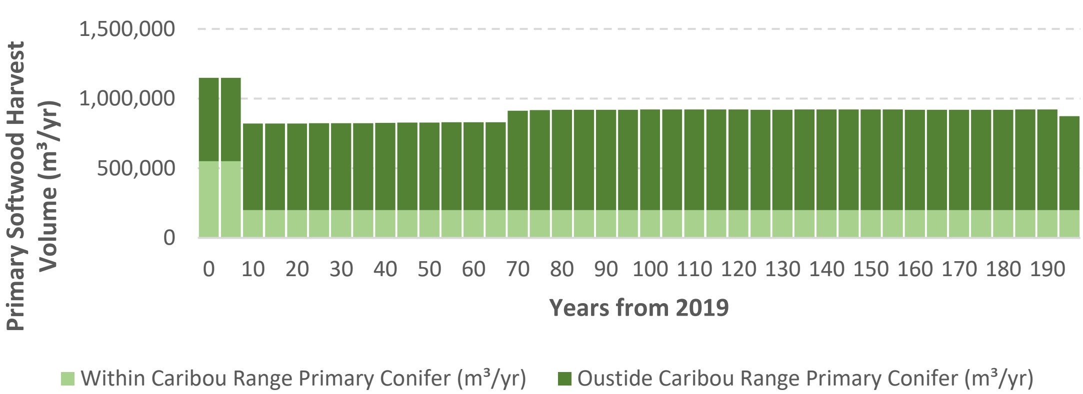


Table 9-4. DFA Harvest Levels by Period – PFMS #8110 (TwentyYearSHS_8110)

Year	Primary Conifer (m^3/yr)	Primary Deciduous (m^3/yr)	Secondary Conifer (m^3/yr)	Secondary Deciduous (m^3/yr)
0	1,152,440	763,997	80,638	207,522
5	1,152,444	763,990	82,636	179,738
10	823,310	763,886	88,381	135,151
15	823,707	763,968	93,785	133,365
20	823,861	617,249	88,418	160,861
25	825,012	616,955	83,633	190,885
30	825,088	617,096	86,755	199,388
35	825,720	564,421	80,129	258,950
40	828,084	559,525	78,959	199,815
45	829,846	559,375	74,884	187,080
50	831,105	559,237	72,409	186,134
55	831,936	559,215	65,951	182,826
60	832,573	558,546	59,841	166,733
65	832,655	559,039	50,376	154,536
70	914,247	557,825	43,384	174,343
75	920,357	558,050	38,428	192,033
80	921,017	558,055	38,789	194,116
85	922,202	557,943	36,541	208,014
90	921,782	558,232	36,919	188,321
95	921,897	562,146	37,942	199,568
100	923,786	615,594	42,699	261,385
105	924,699	611,401	41,015	274,351
110	925,384	615,215	39,069	274,269
115	924,345	609,782	36,498	285,291
120	924,588	614,537	35,627	266,117
125	923,254	609,124	35,509	235,223
130	923,041	615,806	35,901	228,790
135	923,463	614,262	35,550	230,516
140	923,990	616,027	35,528	228,857
145	923,634	615,701	36,825	223,633
150	923,634	615,829	35,936	227,353
155	923,494	609,298	35,286	227,780
160	922,511	616,374	35,301	250,421
165	922,592	616,460	36,135	224,829
170	922,814	616,587	35,858	240,579
175	923,289	617,150	35,870	263,721
180	922,999	616,405	36,068	305,810
185	924,214	616,723	34,990	318,672
190	923,936	616,291	34,950	343,597
195	877,206	587,623	38,109	256,372

9.6. Differences Between Model and SHS (PFMS#8110_TwentyYear_8110)

During a review of PFMS #8110(TwentyYear_SHS8110) SHS file, we found that the polygons within it do not match the model (PFMS#8110) output. There are fewer polygons in the SHS than in the model output. The harvest planning horizon is 202 years with one 2-year transition period followed by forty 5-year periods. This SHS represents the first four 5-year periods. The SHS file only contains harvest polygons that occur after the 2-year transition period (other than the caribou 'reserve' polygons). To correct the 'PERIOD' attribute, a value of 1 was subtracted from the model 'PERIOD' attribute and a value of 2 was subtracted from the model 'TREATMENT_YEAR' attribute. This was done so that the 20-year SHS started in 2019, not 2017; the year the model started. Any polygon designated as 'Caribou reserve' has a 'PERIOD' attribute of 0.

9.7. Available Harvest Comparison: Baseline Scenario 8109 and PFMS Scenario 8110

The primary difference in the assumptions between the Baseline and the PFMS is that the primary deciduous volume is accelerated 125% for the first 20 years. This assumption affects how the volumes are averaged over the two decades as described Table 9-5 below. The volume from primary deciduous increases by 144,126m^3/ year for the first 20 years. In the PFMS the increase in sequenced deciduous stands increases the volume from secondary conifer by 8,265m^3/ year for the first 20 years. Although there is no difference between the Baseline and the PFMS for primary conifer in decade 2 (11-70-year average), there is a minor (+2,532m^3) difference in volume as a result of the heuristics associated with Patchworks™ model.

Table 9-5. Available Harvest Comparison: Baseline #8109 and PFMS #8110

Harvest Volume Description	BASELINE #8109 (m³/yr)	PFMS #8110 (m³/yr)	Comparison (m³/yr)
Primary Conifer year 1-10 average	1,152,375	1,152,442	+67
Secondary Conifer 20-year average	78,020	86,360	+8,340
Decade 1 Conifer Harvest	**1,230,395**	**1,238,802**	**+8,265**
Primary Conifer year 11-70 average	831,864	834,396	+2,532
Secondary Conifer 20-year average	78,020	86,360	+8,340
Decade 2 Conifer Harvest	**909,884**	**920,756**	**+10,872**
Primary Deciduous #8109= 1-70-yr avg/ #8110= 1-20-yr avg	650,307	763,960	+113,653
Secondary Deciduous 20-year average	165,285	163,944	-1,341
Decade 1-2 Deciduous Harvest	**815,592**	**927,904**	**+112,312**

9.8. Volumes as Tagged by Operator-Preferred Forest Management Scenario #8110

The **Block Tagging Process** was an important step in reducing the amount of sterilized volume left on the landscape. Weyerhaeuser, Norbord, Tolko and the province worked together to develop a set of objectives to be met with regards to tagging blocks:

- Fixed allocations will be met as a priority
- In VSA2, consideration is given to the split between primary and secondary deciduous for all operators and consideration is given to geographic areas and cycle times
- The conifer volume tagged to local use is sourced from Cx stands wherever possible
- Focus on minimizing a shotgun pattern- clump blocks together for one operator
- Tolko's allocation and the unaccelerated allocations remain fixed and an uplift is not applied.[66]
- For annual operational planning activities, blocks that are part of a joint FHP will be listed in the tagged operator's AOP.

All sequenced volume in the first 4 periods (20 years) was tagged with a deciduous and a coniferous operator[67] using the 125% accelerated deciduous scenario (PFMS#8110) sequence (TwentyYearSHS_8110). The volumes tagged do not necessarily align with the fixed AAC's for each operator. The contingency volume (Priority 2-Reserves) identified within the Caribou Ranges was tagged separately.

The unallocated coniferous volume exists within FMU G16 but outside of FMA 6900016.

The PFMS can achieve the allocated volumes of the companies and is based on all forest companies operating.

[66] As per direction from FMB; email June 7, 2019
[67] As per GoA-FMB direction at PDT discussions.

Table 9-6. Decade 1 Volume as Tagged by Operator PFMS #8110 (TwentyYearSHS_8110)

OPERATOR	Primary SWD	Secondary SWD	**TOTAL SWD**	Primary HWD	Secondary HWD	**TOTAL HWD**
Local Use	85,267	1,667	**86,934**			
Norbord				6,359,851	1,899,890	**8,259,741**
Tolko				775,123	25,853	**800,976**
Unallocated		13,243	**13,243**	504,959	4,126	**509,085**
Weyerhaeuser	11,414,737	801,464	**12,216,201**			

Figure 9-16. Decade 1 General Operating Area by Deciduous Operator

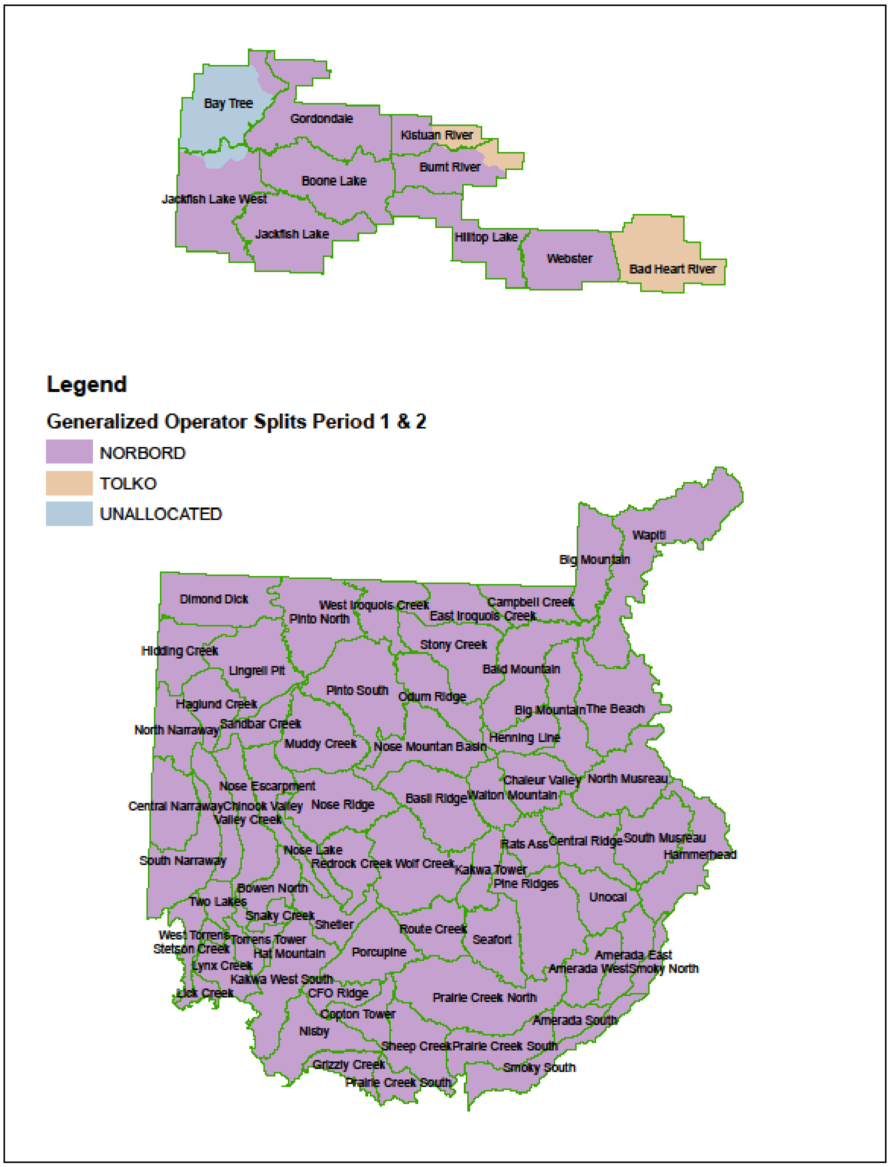
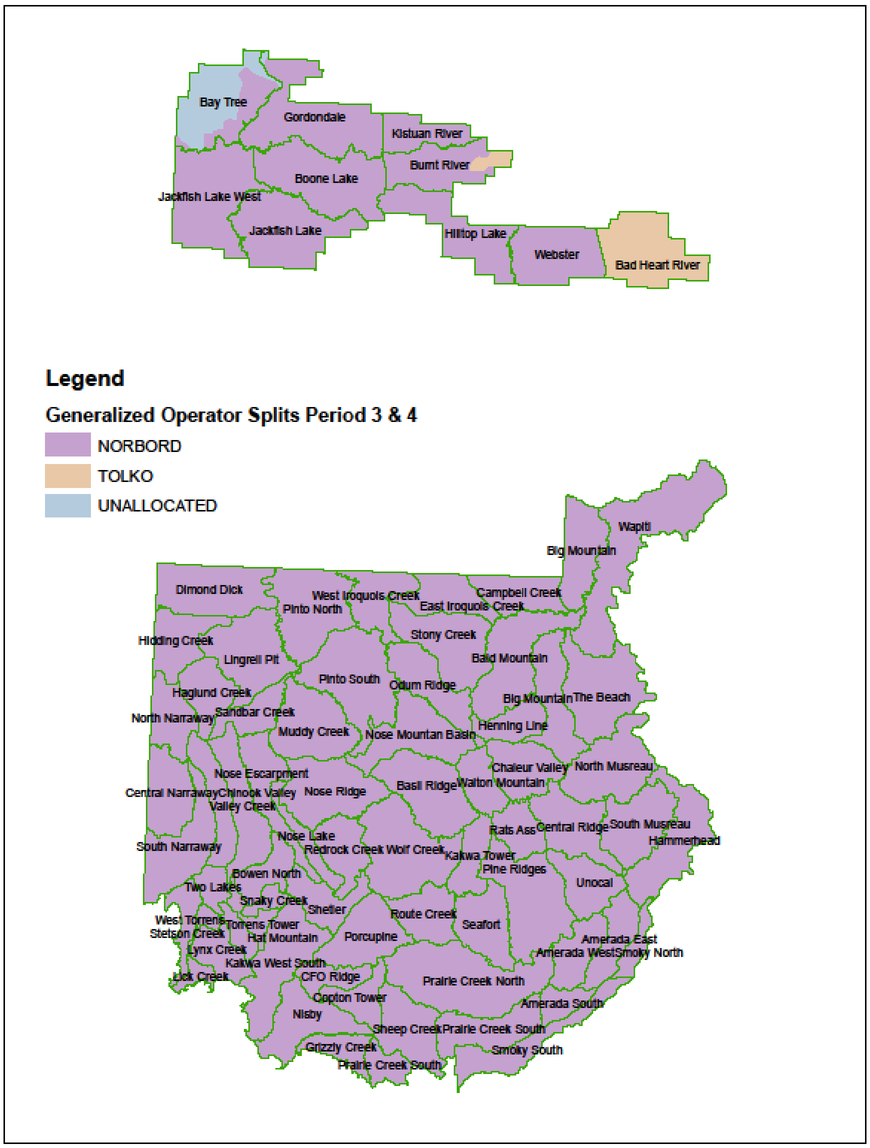


Table 9-7. Decade 2 Volume as Tagged by Operator PFMS #8110 (TwentyYearSHS_8110)

OPERATOR	Primary SWD	Secondary SWD	**TOTAL SWD**	Primary HWD	Secondary HWD	**TOTAL HWD**
Local Use	88,744		**88,744**			
Norbord				6,368,091	1,290,851	**7,658,942**
Tolko				797,303	4,791	**802,094**
Unallocated		17,132	**17,132**	473,875	35,300	**509,175**
Weyerhaeuser	8,121,409	893,699	**9,015,108**			

Figure 9-17. Decade 2 General Operating Area by Deciduous Operator



9.9. Proposed Annual Allowable Cut (PFMS# 8110 (TwentyYearSHS_8110)

The proposed AACs below reflect the harvest levels proposed in *PFMS #8110* and the resulting SHS *TwentyYearSHS_8110*. In PFMS #8110_ TwentyYearSHS_8110, the conifer landbase scheduled outside of the FMA was removed. This removed 13,243m^3 of conifer + 6,430m^3 of deciduous from decade 1 and 17,132m^3 of conifer + 11,640m^3 of deciduous from decade 2.

The fixed allocations for Tolko, Local Use and Unallocated were maintained, which impacted the variable allocations proportionally and results in some very minor differences between the AAC volume and the tagged volume. In Table 9-8 and 9-9, the secondary volumes were adjusted to achieve fixed volumes, the primary volumes were not adjusted.[68]

Table 9-8. Proposed AAC_Total Volume (PFMS#8110_TwentyYearSHS_8110)

Operator	2019-2029 Conifer (m^3)	2019-2029 Deciduous (m^3)	2029-2039 Conifer (m^3)	2029-2039 Deciduous (m^3)
Weyerhaeuser	1,221,679		901,751	
Norbord		825,981		766,021
Tolko (VSA2)-fixed		80,000		80,000
Local Use- fixed	8,634		8,634	
Unallocated VSA2)-fixed		51,000		51,000
Total	**1,230,313**	**956,981**	**910,385**	**897,021**

Table 9-9. Proposed AAC (PFMS#8110_TwentyYearSHS_8110) by Primary/ Secondary

AAC by Operator (m^3)	Primary SWD	Secondary SWD	Primary HWD	Secondary HWD	Total by Operator
	2019-2029				
Local Use	8,527	107			**8,634**
Norbord			635,985	189,995	**825,981**
Tolko			77,512	2,488	**80,000**
Unallocated			50,496	504	**51,000**
Weyerhaeuser	1,141,474	80,205			**1,221,679**
Total Decade 1	**1,150,001**	**80,312**	**763,993**	**192,987**	
AAC by	**2029-2039**				
Local Use	8,634				**8,634**
Norbord			636,809	129,212	**766,021**
Tolko			79,730	270	**80,000**
Unallocated			47,388	3,612	**51,000**
Weyerhaeuser	812,381	89,370			**901,751**
Total Decade 2	**821,015**	**89,370**	**763,927**	**133,094**	

[68] Decade 1: 60m^3 from local use to Weyerhaeuser; 91m^3 from Tolko to Unallocated; 6m^3 from Tolko to Norbord. Decade 2: 240m^3 from local use to Weyerhaeuser; 82m^3 from Tolko to Unallocated; 127m^3 from Tolko to Norbord

CHAPTER 10 FOREST MANAGEMENT PLAN IMPLEMENTATION

10.1. Operational Ground Rules

All forest companies operating under the management strategies of this Forest Management Plan will adhere to the current Operating Ground Rules (OGR) (June 2017) for FMU G16. Upon approval of the FMP, the current OGRs will be amended to ensure alignment with the approved FMP. All forest companies will be encouraged to participate in the OGR renewal process. *Where the FMP indicates "as per the current Operational Ground Rules"; it should be interpreted as the version that replaces the June 15, 2017 version.*

10.2. Annual Operating Plan (AOP)

The AOP is comprised of a series of plan components that are generally submitted at different times of the year due to the approval/reviewing requirements. Each component of the AOP is usually approved separately as submitted and issues with one component usually does not affect approvals of the other component plans for that operating year.

The components of the AOP are as follows:

i. General Development Plan
ii. Fire Control Plan
iii. Silviculture Schedule (Reforestation Program)
iv. Operating Schedule and Timber Production Plan

Also included in the AOP will be a summary of FireSmart strategies being considered and implemented.

10.3. General Development Plan (GDP)

The GDP is submitted in the spring of each year and is a 5-year description of the forest operator's proposed harvest, permanent road building and reclamation schedules. Maps and tables are generalized based on compartment and are not specific to any individual block. A GDP provides a forecast of the areas scheduled for harvest; the status and forecast of the respective cut control periods; a summary of variance from the SHS for completed FHPs by decade by compartment; and long-term road plans scheduled for construction or reclamation.

10.4. Fire Control Plan

The Fire Control Plan is submitted prior to the start of the fire season (March 1) and describes how forest operators will meet requirements for forest fire pre-suppression, prevention, detection, reporting, and suppression as outlined in the Fire Control Agreement between the operator and the province.

10.5. Silviculture Schedule

A silviculture schedule (Reforestation Program or Silviculture AOP) is generally submitted in the spring of each year, and describes prescriptions by stratum, with a schedule of treatments for the upcoming year. The proposed silviculture treatments are directly linked to the reforestation strategy table in the FMP to achieve the FMP objectives for regenerating stand yields, and to meet the Alberta reforestation standards.

10.6. Operating Schedule and Timber Production

The Operating Schedule (referred to as "the AOP") is submitted in the spring with the GDP and describes in detail the activities proposed for the current year. This document must be approved by the province before timber operations begin.

The Operating Schedule can only contain blocks and/or roads approved in an FHP submission and includes at least the following information:

- Maps of blocks scheduled to be harvested, along with associated block and inter-block road with creek crossings.
- A list of blocks with anticipated conifer and deciduous volumes to be generated, summarized by compartment.
- A list of outstanding operations from previous AOPs.

A Timber Production Summary is included with the Operating Schedule and provides a summary of current quadrant production including both audited and unaudited (estimated) quadrant production.

10.7. Harvest and Haul Systems

The harvest and hauling methods utilized by operators are selected with the following focus:

- Prioritize worker safety
- Minimize environmental impacts
- Increase production efficiency
- Minimize the cost of delivered wood

Harvest systems are constantly evolving to react to changing ground conditions and technological advances in the industry. Over the last 10 years, forest operators have implemented the following improvements to their operating systems.

<u>Satellite Storage Yards</u>

Weyerhaeuser began using satellite storage yards in 2008/ 09 in response to the following 3 issues that were negatively affecting our ability to meet woodflow demands: 1) an increase in average cycle time, 2) a decrease in available summer ground and 3) a constant struggle to find and maintain an adequate number of qualified loggers. Satellite yards were constructed with an upgraded all weather road system and allowed contractors to increase harvest in the winter but extend haul into the summer months. This also provided an opportunity for haulers to extend their season, offering closer to year-round employment and balance cycle times with a staggered sat yard vs mill haul schedule.

Cut to Length
In 2015/16 Weyerhaeuser moved completely away from a tree length processing system to a 100% cut to length operation. This was in response to an overall change to a cut to length system within the local industry and the increased difficulty in finding available tree length haul configurations in the Grande Prairie region. The result in this widescale shift increased the pool of qualified haulers and standardized wood processing for the region.

Low Ground Pressure Equipment
The decrease in available summer ground also presented challenges with the conventional equipment being used to harvest and haul. Forest operators continue to work with equipment manufacturers to find harvesting equipment with a lighter footprint that is still able to produce safely and efficiently in the ground conditions of Northern Alberta. Some examples of this include utilizing using a winch system and access mats as well as six wheeled skidders (with tracks). Haulers have been implementing Central Tire Inflation (CTI) systems in combination with truck configurations with more axles such as 8 axle B Trains, 9 axle Super Bs and 10 axle King Bs.

Steep Slope Operations
Many improvements have been made to the safety of harvesting equipment over the last decade including engineering controls to maximize stability on steep or rocky terrain. Self levelling bunchers are a good example of an engineering control that increases the slope that a machine can safely operate on. The six wheeled skidders (with tracks) are designed for steeper slopes and where those aren't available, operators are adding hoe chucking and decking with loaders have proven to be extremely efficient when in steeper ground and helpful in soft ground conditions.

Digital Technology
Forest operators have been increasing the use of digital applications in all areas of the business as it becomes available. This includes the use of multidats in equipment; GPS in trucks; digital mapping in equipment, computerized loader tickets and the use of drones. Monitoring activities and verifying production has allowed companies to identify inefficiencies and make improvements in all aspects of the operation.

The use of Lidar and Wet Areas Mapping (WAM) has been a valuable tool to operational planners when assigning harvest season and scheduling sequenced blocks for harvest. It has also greatly improved road planning and construction.

10.8. Silviculture Systems

One of the underlying goals of this management plan is to increase growth and yield in regenerating stands from an otherwise "natural" state to managed stand conditions. This goal is supported by a set of regeneration assumptions, silviculture strategies, and reforestation standards. Prescribing silviculture treatments prior to harvest and scheduling treatments as soon as logistically feasible after harvest will facilitate prompt and effective regeneration.

The Silviculture Matrix *(Chapter 6 Forest Management Strategies; Table 6-2)* describes for each yield strata the silviculture system, site preparation requirements, seedling establishment criteria, seedling density targets, and any expected interventions that may be required.

10.9. Implementing Recommendations from the Wildfire Threat Assessment

Several recommendations were included in the Wildfire Threat Assessment to assist forest operators in reducing fire behavior potential on the landscape. The overall objective of these recommendations is to:

1) manage the forest landscape to reduce the risk of large fires that can impact values
2) emulate historical disturbance

This Forest Management Plan has attempted to guide the SHS to sequence high, very high and extreme fire behavior potential stands within the community protection zones within the first 2 periods. There are certain compartments where this objective has not been achieved due to commitments made to other values such as wildlife habitat, watershed values or culturally sensitive areas.

Forest operators will, wherever possible:

- Support the province in their decision to manage for low to moderate fires on the landscape where required to reduce fuel loading
- Support the use of prescribed fire in areas to reduce fuel loading or to achieve other objectives identified in the approved Wildfire Management Plan
- Plan to harvest stands that are prioritized in the sequence because of forest health issues
- Develop and execute debris disposal plans that target the quick and complete removal of debris

10.10. Public and Indigenous Involvement in Forest Management Operations

This FMP recognizes that timberlands operations have the potential to impact stakeholders including indigenous peoples, grazing operators, Trappers, Guiding and Outfitters and recreational users.

Stakeholders

This FMP is committed to involving the general public, including commercial and recreational users of the FMA, in operational plan development. It is understood that some forest management activities can directly and immediately affect wildlife habitat and forest operators will work with concerned stakeholders to minimize the impact of forest management activities on these other users' interests. Consultation with these groups may include direct consultation with organized groups and registered stakeholders when operating in their area of involvement and/ or communication of upcoming plans at the annual public houses held in the spring (silviculture) and the fall (harvesting).

Indigenous Communities

Forest operators will continue to consult in good faith with Indigenous communities as per The Government of Alberta's Policy on Consultation with First Nations on Land and Natural Resource Management, 2013, and The Government of Alberta's Policy on Consultation with Métis Settlements on Land and Natural Resource Management, 2015.

Forest operators will use The Government of Alberta's Guidelines on Consultation with First Nations on Land and Natural Resource Management, July 28, 2014, and The Government of Alberta's Guidelines on Consultation with Métis Settlements on Land and Natural Resource Management, April 1, 2016 when engaged in consultation activities.

Forest Education

Weyerhaeuser is a member of the Grande Prairie and Area Environmental Science Education Society (GPESES), a nonprofit organization that works with local educators when delivering environmental related curriculum to local students. The main events this group supports are Walk Through the Forest and Arbour day in May of each year. Walk Through the Forest is a 3 to 4-day event for approximately 1,000 grade 6 students that is geared towards the grade 6 science curriculum *"Trees & Forests"*. Arbour Day is a 1-day event where forest professionals visit grade 1 classrooms within the Grande Prairie region to talk about the importance of trees and the forest industry. Each year, almost 2,000 grade 1 students receive a visit from a forestry professional and a seedling to commemorate the day.

Walk Through the Forest 2017

10.11. Allocations

Sustainable harvest volumes are a primary consideration in the development of the PFMS. These volumes provide the supply of timber to forest companies allowing them to operate their mills in an efficient and cost-effective manner. Harvest levels are described in detail in *Annex 10: Timber Supply Analysis.*

Allocations take the Defined Forest Area Harvest Levels *(Chapter 3 Timber Industry Overview)* and assigns which portion each operator will receive as the annual allowable cut for their facility. This includes considerations made for carry over volume, fixed allocations and primary and incidental volumes.

Table 10-1. Operators that currently hold timber allocations within FMU G16

Tenure Holder	Area Based	Variable or Fixed Allocation	Stand Type
Weyerhaeuser	All FMA 6900016	Variable	Conifer
Local Use (GoA)	All FMA 6900016	Fixed 8,634 m^3	Coniferous
Norbord	DTAG160001	Variable	Deciduous
Tolko	DTAG160002	Fixed 80,000 m^3	Deciduous
Local Use (GoA)*	All FMA 6900016	Variable 10,000 m^3	Deciduous
Unallocated (GoA)	VSA2	Variable 51, 000 m^3	Deciduous

Note * This volume is part of Norbord's DTA and, if awarded, will be drained from this allocation.

10.12. Reconciliation of Unused Volume

Weyerhaeuser has not fully operated the harvest sequence identified in the 2011 FMP. Tolko identified an underutilization of their allocated volumes from their last quadrants due to their facility not being operational throughout most of the relevant time period. Although Norbord was allocated a surge cut (31% on the primary deciduous volume); at this time, they have only operated approximately 60% of their sequence. Carryover or Reconciliation of Unused Volume is not being considered as part of the 2019 FMP.

10.13. Transfer of the 148,000m^3

Section 7(1)(b) of the Forest Management Agreement allocates 148,000m^3 of deciduous volume to Weyerhaeuser. As per *Section 7(1)(c) of the FMA*, Weyerhaeuser's tenure rights to this allocation were to be forfeited effective May 1, 2018 however, in December 2017 Weyerhaeuser requested a 1-year extension to allow time to develop plans to use this fibre in its own facilities.

On April 30, 2018 this deadline was waived until August 1, 2018 to allow the Minister more time to consider possible options for the utilization of the deciduous timber on the FMA area and to provide additional time for Weyerhaeuser to develop a plan to utilize the deciduous AAC. On July 27, 2018 this deadline was further extended to August 1, 2019. This extension required that Weyerhaeuser adhere to the requirement of section 7(1)(c) of FMA6900016 to provide information about Weyerhaeuser's plans to harvest and utilize this deciduous timber in its own facilities or other facility by June 1, 2019.

On May 3, 2019, Weyerhaeuser and Norbord Inc. jointly requested that the Minister of Agriculture and Forestry authorize the assignment of Weyerhaeuser's tenure rights under FMA6900016 to 148,000 m^3 of deciduous annual allowable cut, to Deciduous Timber Allocation G160001, held by Norbord Inc. In June 2019, the Minister of Agriculture and Forestry authorized the assignment of Weyerhaeuser's allocation of 148,000 m^3 to DTAG160001, effective May 1, 2019.

This Forest Management Plan recognizes the assignment of annual allowable cut from Weyerhaeuser to Norbord Inc. for the purpose of planning activities. Weyerhaeuser's Forest Management Agreement and Norbord's Deciduous Timber Allocation have been adjusted to reflect this assignment.

10.14. The Spatial Harvest Sequence

The Spatial Harvest Sequence (SHS) directs harvesting activities for all operators on the DFA for the next 20 years. The stands selected for harvest provide each operator with their recommended harvest levels and the impacts of harvesting the stands in the recommended periods have been evaluated against timber and non-timber values. The PFMS #8110 SHS map(TwentyYearSHS_8110) is included in *Annex 11: Spatial Harvest Sequence*. PFMS #8110 data sets, including modelling assumptions, are described in *Annex 10: Timber Supply Analysis*.

"TwentyYearSHS_8110" was guided where possible to meet several recommendations from an operational, a forest health and a wildfire risk perspective as noted below.

1) Locked in finalized planned blocks and known FireSmart areas
2) Locked out areas of known conflict with other stakeholders and Indigenous traditional use areas as per consultation activities
3) Focused deciduous harvest in periods 1-2 where mortality and dieback
4) Harvest of stands with a 10-40% Larch component in periods 1-2
5) Focused harvest of higher wildfire risk blocks as per Annex 3
6) Amalgamation of harvest to minimize multiple entry into a compartment

It is important to note that some focused SHS recommendations were not achievable due to the hierarchy of objectives within the Caribou Ranges.

Strata Description Tables for the FMU by Cost Zone/ Caribou Access Unit and Yield Strata for Decades 1 and 2 are located in *Chapter 10-Appendix 4.*

10.15. Strategy to Operate Caribou Ranges

Important Note: In general, Weyerhaeuser refers to compartments as cost zones. These should not be confused with the Caribou Access Units. Compartments/ Cost Zones in the Caribou Ranges have been further divided into Caribou Access Units.

Forest Harvest Plans

The compartments (Cost Zones) in the caribou range are large, averaging 2,900 hectares in size, and within each compartment there are 2-4 Caribou Access Units. In the Caribou Range, each Caribou Access Unit will be planned separately, and variance and volume reconciliation will also be tracked separately for each Caribou Access Unit. An FHP submission may bundle multiple Caribou Access Units within the single submission where the planned areas overlap Access Unit boundaries.

Weyerhaeuser's intent is to minimize the number of Access Units that are open at any given time, however the caribou range comprises over a third of the FMA and harvest operations will occur in more than one operating area at the same time. Harvest road development (both winter and summer) and planting/reclamation timelines dictate that even within a local geography multiple Access Units may be open at the same time.

Aggregated Harvest/ Full Utilization

It is Weyerhaeuser's intent to ensure that full utilization of modeled polygons within each Caribou Access Unit occurs. Timber identified as mature and eligible for harvest that is left behind will be spatially identified (tagged) and removed from the net land base during the next FMP renewal.

Sequenced area that is left behind will be spatially identified and categorized into the following:

- **Retention**- pre-planned and operational tree retention
- **Buffers**- creeks that require buffering that are not part of the Provincial Hydrology Layer
- **Steep Slopes**- excessively steep area surrounding an otherwise operable polygon
- **Inoperable**- due to slumping and associated risk of exacerbating a slope stability issue
- **Non-Merchantable**- sequenced timber proven to be non-merch when ground validated
- **Cultural**- Indigenous, Archeological or stakeholder removals

Reserve Caribou Access Units

Over the first decade, 5,500,000 cubic meters will be harvested from within the caribou range. 18 Access Units have been identified as "priority 1" and these first 18 priority Access Units will be accessed, and all available volume will be removed before accessing any of the "priority 2" or reserve access units (see Map 10-1).

These 18 access units contain only 2.2% extra volume (above the 5.5 million m^3 targeted). It is reasonable to assume that more than 2.2% will be left behind as a result of operational planning- the variance threshold is 20% (Operational Ground Rules). Examples include unmapped watercourse buffers, consultation buffers, archeological buffers, nests & dens and other operational buffers. Weyerhaeuser anticipates that some "Priority 2" Reserves will need to be opened before the end of the first decade. More information can be found in *Annex 10: Timber Supply Analysis, Section 4.2.1.*

Planning activities for the 2029 FMP will include how any unharvested Priority 2 Reserve Access Units are brought forward into the next sequence.

Reporting

Weyerhaeuser will report round wood deliveries from the Caribou Range against the 550,000m3 authorized to be removed from this area each timber year. This will include all volume harvested from within the Caribou Range and will be reported as actual volume delivered across the scales and an estimate of volume staged as block inventory. Volumes will be reported in the General Development Plan (GDP) for both conifer and deciduous volume.

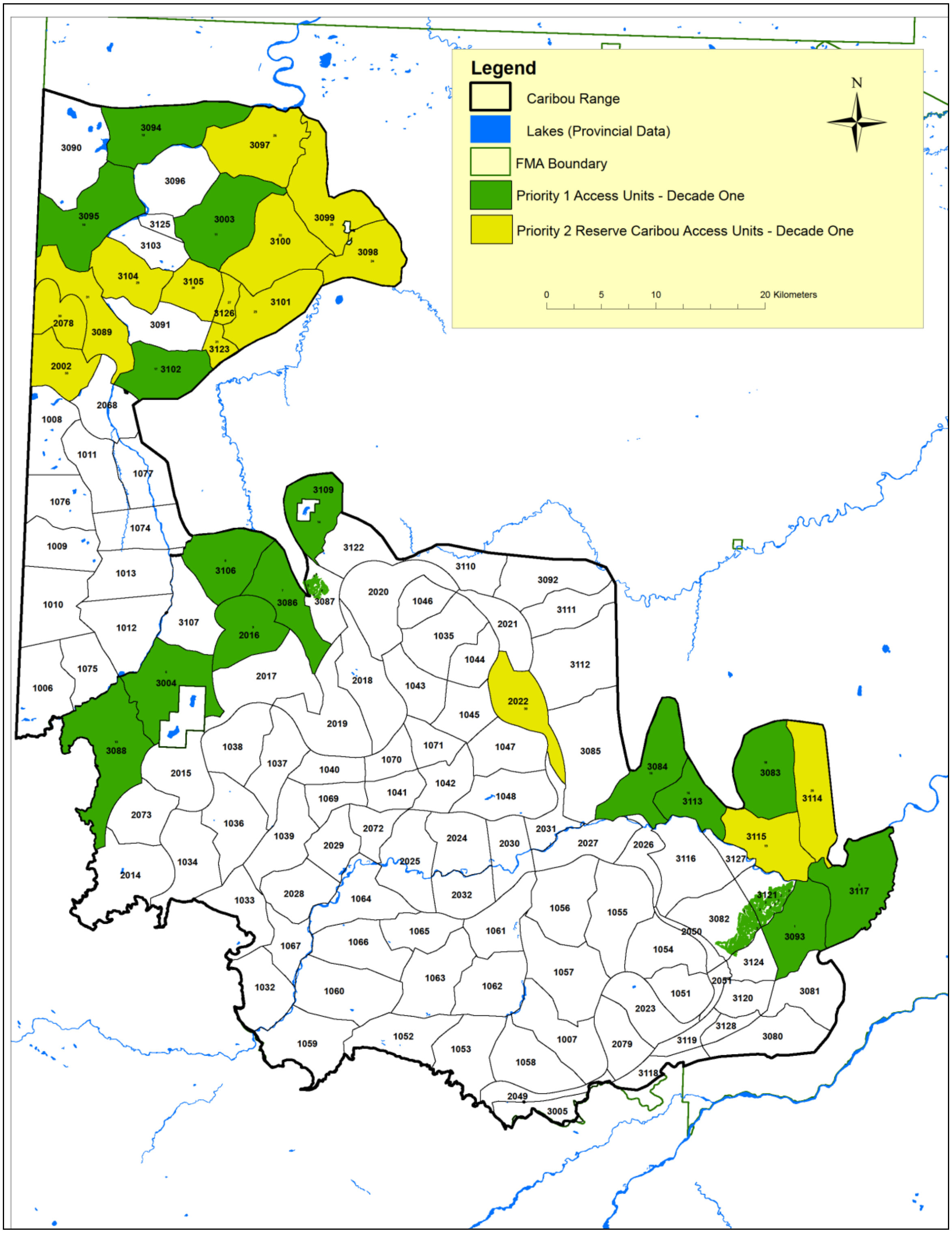
For Access Units that have been fully utilized, Weyerhaeuser will provide in the GDP, a spatially explicit rollup to the Province which details:

- Volume and Hectares in the Access Unit that have been harvested
- Hectares in the Access Unit that were not harvested and will be net landbase deletions in the next Forest Management Plan (steep areas, creek buffers, etc.)
- Hectares in the Access Unit that were not harvested and will be deferred from harvest for a full rotation (tree retention, etc.)

Weyerhaeuser will also provide a 5 year roll up to the Province reconciling the area and volume planned versus the area harvested and volume delivered in the Stewardship Report.

Weyerhaeuser is not aware of another location in Alberta where a harvest strategy similar to this has occurred so there is no established benchmark for realized versus modelled timber volume. Because of this, understanding the specific percentage of modeled timber volume that will remain on the landscape after harvest is complete will be iterative. Given the long-term timber supply implications of full utilization of individual Access Units, the onus is on Weyerhaeuser to achieve the desired outcomes.

Map 10-1. Decade 1: Priority 1 (green) and Priority 2 Reserve (yellow) Access Units in the Caribou Range



Chapter 10-Appendix 4: Strata Description Tables

This section includes the Strata Description Table as required in the ABFMPS Annex 1 Section 6.2.

Compartments / Reporting units that had very little or no area within them have been filtered out. This resulted in less than 1 ha removed relative to the total area in the SHS (i.e., total SHS area = 184,129.7 vs. Strata Description total = 184,129.2). The following reporting units / compartments were filtered out: 1013, 1074, 2015, 2026, 3080, 3091, 3096, and 3118.

The area has been broken out by Base 10 Yield Strata and compartment/ Caribou Access Unit which was established as the reporting unit for Variance tracking[69]. Area outside the FMA but within FMU G16 has been included as its own compartment. The area withing the Caribou Range Priority 2 (reserve) Access Units has also been reported separately from the Decade 1 and Decade 2 Area.

[69] January 21, 2020 meeting between Weyerhaeuser and AAF Area Forest

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
2002	Aw	22.2	5.3%	0.0	0.0%	0.0	0.0%	22.2	5.3%
	AwPl	19.4	4.6%	0.0	0.0%	0.0	0.0%	19.4	4.6%
	AwSx	0.3	0.1%	0.0	0.0%	0.0	0.0%	0.3	0.1%
	Pl	226.7	54.3%	0.0	0.0%	0.0	0.0%	226.7	54.3%
	PlAw	20.0	4.8%	0.0	0.0%	0.0	0.0%	20.0	4.8%
	Sb	2.7	0.7%	0.0	0.0%	0.0	0.0%	2.7	0.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	125.8	30.2%	0.0	0.0%	0.0	0.0%	125.8	30.2%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
2002 Total		**417.1**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**417.1**	**100.0%**
2016	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	25.8	2.0%	0.0	0.0%	25.8	2.0%
	AwSx	0.0	0.0%	10.3	0.8%	0.0	0.0%	10.3	0.8%
	Pl	0.0	0.0%	805.2	61.8%	0.0	0.0%	805.2	61.8%
	PlAw	0.0	0.0%	53.0	4.1%	0.0	0.0%	53.0	4.1%
	Sb	0.0	0.0%	131.1	10.1%	0.0	0.0%	131.1	10.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	258.6	19.8%	0.0	0.0%	258.6	19.8%
	SwAw	0.0	0.0%	19.0	1.5%	0.0	0.0%	19.0	1.5%
2016 Total		**0.0**	**0.0%**	**1,303.1**	**100.0%**	**0.0**	**0.0%**	**1,303.1**	**100.0%**
2017	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	3.3	0.1%	3.3	0.1%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	100.0%	2,288.3	71.2%	2,288.3	71.2%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	50.0	1.6%	50.0	1.6%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	871.0	27.1%	871.0	27.1%
	SwAw	0.0	0.0%	0.0	0.0%	2.9	0.1%	2.9	0.1%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
2017 Total		**0.0**	**0.0%**	**0.0**	**100.0%**	**3,215.5**	**100.0%**	**3,215.5**	**100.0%**
2022	Aw	56.0	4.6%	0.0	0.0%	0.0	0.0%	56.0	4.6%
	AwPl	6.9	0.6%	0.0	0.0%	0.0	0.0%	6.9	0.6%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	780.4	64.5%	0.0	0.0%	0.0	0.0%	780.4	64.5%
	PlAw	19.3	1.6%	0.0	0.0%	0.0	0.0%	19.3	1.6%
	Sb	141.1	11.7%	0.0	0.0%	0.0	0.0%	141.1	11.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	206.9	17.1%	0.0	0.0%	0.0	0.0%	206.9	17.1%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
2022 Total		**1,210.5**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,210.5**	**100.0%**
2050	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	0.0%	179.0	55.5%	179.0	55.5%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	6.2	1.9%	6.2	1.9%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	122.5	38.0%	122.5	38.0%
	SwAw	0.0	0.0%	0.0	0.0%	14.8	4.6%	14.8	4.6%
2050 Total		**0.0**	**0.0%**	**0.0**	**0.0%**	**322.5**	**100.0%**	**322.5**	**100.0%**
2068	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	39.6	87.4%	0.0	0.0%	39.6	87.4%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	4.3	9.5%	0.0	0.0%	4.3	9.5%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	100.0%	1.0	2.2%	0.0	0.0%	1.0	2.2%
	SwAw	0.0	0.0%	0.4	0.9%	0.0	0.0%	0.4	0.9%
2068 Total		**0.0**	**100.0%**	**45.3**	**100.0%**	**0.0**	**0.0%**	**45.3**	**100.0%**

		SHS Area							
		Caribou Range Priority 2 “Reserves”		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
2078	Aw	60.0	7.2%	0.0	0.0%	0.0	0.0%	60.0	7.2%
	AwPl	1.0	0.1%	0.0	0.0%	0.0	0.0%	1.0	0.1%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	647.5	77.8%	0.0	0.0%	0.0	0.0%	647.5	77.8%
	PlAw	13.0	1.6%	0.0	0.0%	0.0	0.0%	13.0	1.6%
	Sb	1.4	0.2%	0.0	0.0%	0.0	0.0%	1.4	0.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	109.2	13.1%	0.0	0.0%	0.0	0.0%	109.2	13.1%
	SwAw	0.1	0.0%	0.0	0.0%	0.0	0.0%	0.1	0.0%
2078 Total		**832.3**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**832.3**	**100.0%**
3003	Aw	0.0	0.0%	2.5	0.2%	0.0	0.0%	2.5	0.2%
	AwPl	0.0	0.0%	33.4	2.6%	0.0	0.0%	33.4	2.6%
	AwSx	0.0	0.0%	146.6	11.4%	0.0	0.0%	146.6	11.4%
	Pl	0.0	0.0%	524.5	40.8%	0.0	0.0%	524.5	40.8%
	PlAw	0.0	0.0%	37.1	2.9%	0.0	0.0%	37.1	2.9%
	Sb	0.0	0.0%	110.0	8.5%	0.0	0.0%	110.0	8.5%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	258.3	20.1%	0.0	0.0%	258.3	20.1%
	SwAw	0.0	0.0%	173.9	13.5%	0.0	0.0%	173.9	13.5%
3003 Total		**0.0**	**0.0%**	**1,286.3**	**100.0%**	**0.0**	**0.0%**	**1,286.3**	**100.0%**
3004	Aw	0.0	0.0%	1.8	0.1%	0.0	0.0%	1.8	0.1%
	AwPl	0.0	0.0%	34.5	1.3%	0.0	0.0%	34.5	1.3%
	AwSx	0.0	0.0%	12.7	0.5%	0.0	0.0%	12.7	0.5%
	Pl	0.0	0.0%	1,580.0	61.0%	0.0	0.0%	1,580.0	61.0%
	PlAw	0.0	0.0%	104.7	4.0%	0.0	0.0%	104.7	4.0%
	Sb	0.0	0.0%	162.1	6.3%	0.0	0.0%	162.1	6.3%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	615.7	23.8%	0.0	0.0%	615.7	23.8%
	SwAw	0.0	0.0%	78.0	3.0%	0.0	0.0%	78.0	3.0%
3004 Total		**0.0**	**0.0%**	**2,589.4**	**100.0%**	**0.0**	**0.0%**	**2,589.4**	**100.0%**
3005	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

		SHS Area							
		Caribou Range Priority 2 “Reserves”		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	6.8	98.7%	0.0	0.0%	6.8	98.7%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.1	1.3%	0.0	0.0%	0.1	1.3%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3005 Total		**0.0**	**0.0%**	**6.9**	**100.0%**	**0.0**	**0.0%**	**6.9**	**100.0%**
3082	Aw	0.0	0.0%	0.0	0.0%	0.7	0.0%	0.7	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.2	0.0%	0.0	0.0%	0.2	0.0%
	Pl	0.0	0.0%	384.9	61.5%	1,068.0	61.4%	1,452.9	61.4%
	PlAw	0.0	0.0%	0.0	0.0%	9.4	0.5%	9.4	0.4%
	Sb	0.0	0.0%	16.1	2.6%	53.4	3.1%	69.4	2.9%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	221.6	35.4%	607.2	34.9%	828.9	35.0%
	SwAw	0.0	0.0%	3.4	0.5%	0.3	0.0%	3.7	0.2%
3082 Total		**0.0**	**0.0%**	**626.2**	**100.0%**	**1,739.1**	**100.0%**	**2,365.2**	**100.0%**
3083	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	62.5	4.4%	0.0	0.0%	62.5	4.4%
	AwSx	0.0	0.0%	6.0	0.4%	0.0	0.0%	6.0	0.4%
	Pl	0.0	100.0%	785.9	55.5%	0.0	0.0%	785.9	55.5%
	PlAw	0.0	0.0%	47.0	3.3%	0.0	0.0%	47.0	3.3%
	Sb	0.0	0.0%	215.7	15.2%	0.0	0.0%	215.7	15.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	250.4	17.7%	0.0	0.0%	250.4	17.7%
	SwAw	0.0	0.0%	49.0	3.5%	0.0	0.0%	49.0	3.5%
3083 Total		**0.0**	**100.0%**	**1,416.6**	**100.0%**	**0.0**	**0.0%**	**1,416.6**	**100.0%**
3084	Aw	0.0	0.0%	5.0	0.3%	0.0	0.0%	5.0	0.3%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	AwSx	0.0	0.0%	56.4	3.2%	0.0	0.0%	56.4	3.2%
	Pl	0.0	0.0%	1,065.0	60.9%	0.0	100.0%	1,065.0	60.9%
	PlAw	0.0	0.0%	12.4	0.7%	0.0	0.0%	12.4	0.7%
	Sb	0.0	0.0%	1.4	0.1%	0.0	0.0%	1.4	0.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	580.2	33.2%	0.0	0.0%	580.2	33.2%
	SwAw	0.0	0.0%	28.5	1.6%	0.0	0.0%	28.5	1.6%
3084 Total		**0.0**	**0.0%**	**1,748.9**	**100.0%**	**0.0**	**100.0%**	**1,748.9**	**100.0%**
3086	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	16.0	0.9%	0.0	0.0%	16.0	0.9%
	AwSx	0.0	0.0%	21.5	1.2%	0.0	0.0%	21.5	1.2%
	Pl	0.0	0.0%	1,151.8	64.9%	0.0	0.0%	1,151.8	64.9%
	PlAw	0.0	0.0%	98.1	5.5%	0.0	0.0%	98.1	5.5%
	Sb	0.0	0.0%	66.3	3.7%	0.0	0.0%	66.3	3.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	338.7	19.1%	0.0	0.0%	338.7	19.1%
	SwAw	0.0	0.0%	81.6	4.6%	0.0	0.0%	81.6	4.6%
3086 Total		**0.0**	**0.0%**	**1,774.0**	**100.0%**	**0.0**	**0.0%**	**1,774.0**	**100.0%**
3087	Aw	0.0	0.0%	5.2	1.6%	0.0	0.0%	5.2	1.6%
	AwPl	0.0	0.0%	8.2	2.4%	0.0	0.0%	8.2	2.4%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	250.1	74.9%	0.0	0.0%	250.1	74.9%
	PlAw	0.0	0.0%	4.6	1.4%	0.0	0.0%	4.6	1.4%
	Sb	0.0	0.0%	31.4	9.4%	0.0	0.0%	31.4	9.4%
	SbAw	0.0	0.0%	1.4	0.4%	0.0	0.0%	1.4	0.4%
	Sw	0.0	0.0%	26.4	7.9%	0.0	0.0%	26.4	7.9%
	SwAw	0.0	0.0%	6.7	2.0%	0.0	0.0%	6.7	2.0%
3087 Total		**0.0**	**0.0%**	**334.0**	**100.0%**	**0.0**	**0.0%**	**334.0**	**100.0%**
3088	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	13.4	0.4%	0.0	0.0%	13.4	0.4%
	AwSx	0.0	0.0%	8.5	0.3%	0.0	0.0%	8.5	0.3%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Pl	0.0	0.0%	2,129.3	66.5%	0.0	0.0%	2,129.3	66.5%
	PlAw	0.0	0.0%	60.8	1.9%	0.0	0.0%	60.8	1.9%
	Sb	0.0	0.0%	36.8	1.1%	0.0	0.0%	36.8	1.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	934.5	29.2%	0.0	0.0%	934.5	29.2%
	SwAw	0.0	0.0%	17.5	0.5%	0.0	0.0%	17.5	0.5%
3088 Total		**0.0**	**0.0%**	**3,200.9**	**100.0%**	**0.0**	**0.0%**	**3,200.9**	**100.0%**
3089	Aw	119.0	12.0%	0.0	0.0%	0.0	0.0%	119.0	12.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	1.2	0.1%	0.0	0.0%	0.0	0.0%	1.2	0.1%
	Pl	381.4	38.3%	0.0	0.0%	0.0	0.0%	381.4	38.3%
	PlAw	6.1	0.6%	0.0	0.0%	0.0	0.0%	6.1	0.6%
	Sb	2.2	0.2%	0.0	0.0%	0.0	0.0%	2.2	0.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	428.4	43.0%	0.1	100.0%	0.0	0.0%	428.5	43.0%
	SwAw	57.0	5.7%	0.0	0.0%	0.0	0.0%	57.0	5.7%
3089 Total		**995.4**	**100.0%**	**0.1**	**100.0%**	**0.0**	**0.0%**	**995.5**	**100.0%**
3090	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	52.9	66.4%	0.0	0.0%	52.9	66.4%
	PlAw	0.0	0.0%	16.4	20.5%	0.0	0.0%	16.4	20.5%
	Sb	0.0	0.0%	7.0	8.8%	0.0	0.0%	7.0	8.8%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	2.3	2.9%	0.0	0.0%	2.3	2.9%
	SwAw	0.0	0.0%	1.0	1.2%	0.0	0.0%	1.0	1.2%
3090 Total		**0.0**	**0.0%**	**79.6**	**100.0%**	**0.0**	**0.0%**	**79.6**	**100.0%**
3092	Aw	0.0	0.0%	3.4	10.2%	0.0	0.0%	3.4	10.2%
	AwPl	0.0	0.0%	7.6	22.6%	0.0	0.0%	7.6	22.6%
	AwSx	0.0	0.0%	2.6	7.6%	0.0	0.0%	2.6	7.6%
	Pl	0.0	0.0%	3.9	11.6%	0.0	0.0%	3.9	11.6%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	16.2	48.0%	0.0	0.0%	16.2	48.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3092 Total		**0.0**	**0.0%**	**33.8**	**100.0%**	**0.0**	**0.0%**	**33.8**	**100.0%**
3093	Aw	0.0	0.0%	1.8	0.1%	0.0	0.0%	1.8	0.1%
	AwPl	0.0	0.0%	31.4	1.8%	0.0	0.0%	31.4	1.8%
	AwSx	0.0	0.0%	1.1	0.1%	0.0	0.0%	1.1	0.1%
	Pl	0.0	0.0%	1,287.5	73.6%	0.0	100.0%	1,287.5	73.6%
	PlAw	0.0	0.0%	80.4	4.6%	0.0	0.0%	80.4	4.6%
	Sb	0.0	0.0%	16.3	0.9%	0.0	0.0%	16.3	0.9%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	316.4	18.1%	0.0	0.0%	316.4	18.1%
	SwAw	0.0	0.0%	13.7	0.8%	0.0	0.0%	13.7	0.8%
3093 Total		**0.0**	**0.0%**	**1,748.6**	**100.0%**	**0.0**	**100.0%**	**1,748.6**	**100.0%**
3094	Aw	0.0	0.0%	6.1	1.2%	0.0	0.0%	6.1	1.2%
	AwPl	0.0	0.0%	35.3	7.2%	0.0	0.0%	35.3	7.2%
	AwSx	0.0	0.0%	136.5	27.6%	0.0	0.0%	136.5	27.6%
	Pl	0.0	0.0%	97.5	19.7%	0.0	0.0%	97.5	19.7%
	PlAw	0.0	0.0%	27.4	5.5%	0.0	0.0%	27.4	5.5%
	Sb	0.0	0.0%	25.3	5.1%	0.0	0.0%	25.3	5.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	106.4	21.5%	0.0	0.0%	106.4	21.5%
	SwAw	0.0	0.0%	59.8	12.1%	0.0	0.0%	59.8	12.1%
3094 Total		**0.0**	**0.0%**	**494.3**	**100.0%**	**0.0**	**0.0%**	**494.3**	**100.0%**
3095	Aw	0.0	0.0%	28.2	1.8%	0.0	0.0%	28.2	1.8%
	AwPl	0.0	0.0%	55.0	3.6%	0.0	0.0%	55.0	3.6%
	AwSx	0.0	0.0%	108.1	7.0%	0.0	0.0%	108.1	7.0%
	Pl	0.0	0.0%	727.5	47.2%	0.0	0.0%	727.5	47.2%
	PlAw	0.0	0.0%	91.2	5.9%	0.0	0.0%	91.2	5.9%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Sb	0.0	0.0%	35.3	2.3%	0.0	0.0%	35.3	2.3%
	SbAw	0.0	0.0%	11.4	0.7%	0.0	0.0%	11.4	0.7%
	Sw	0.0	0.0%	385.6	25.0%	0.0	0.0%	385.6	25.0%
	SwAw	0.0	0.0%	97.2	6.3%	0.0	0.0%	97.2	6.3%
3095 Total		**0.0**	**0.0%**	**1,539.7**	**100.0%**	**0.0**	**0.0%**	**1,539.7**	**100.0%**
3097	Aw	299.1	26.4%	0.0	0.0%	0.0	0.0%	299.1	26.4%
	AwPl	5.0	0.4%	0.0	0.0%	0.0	0.0%	5.0	0.4%
	AwSx	92.5	8.2%	0.0	0.0%	0.0	0.0%	92.5	8.2%
	Pl	246.7	21.8%	0.0	0.0%	0.0	0.0%	246.7	21.8%
	PlAw	22.9	2.0%	0.0	0.0%	0.0	0.0%	22.9	2.0%
	Sb	103.8	9.2%	0.0	0.0%	0.0	0.0%	103.8	9.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	262.2	23.1%	0.0	0.0%	0.0	0.0%	262.2	23.1%
	SwAw	101.1	8.9%	0.0	0.0%	0.0	0.0%	101.1	8.9%
3097 Total		**1,133.3**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,133.3**	**100.0%**
3098	Aw	664.0	54.6%	0.0	0.0%	0.0	0.0%	664.0	54.6%
	AwPl	6.3	0.5%	0.0	0.0%	0.0	0.0%	6.3	0.5%
	AwSx	15.1	1.2%	0.0	0.0%	0.0	0.0%	15.1	1.2%
	Pl	7.4	0.6%	0.0	0.0%	0.0	0.0%	7.4	0.6%
	PlAw	7.0	0.6%	0.0	0.0%	0.0	0.0%	7.0	0.6%
	Sb	9.2	0.8%	0.0	0.0%	0.0	0.0%	9.2	0.8%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	441.7	36.3%	0.0	0.0%	0.0	0.0%	441.7	36.3%
	SwAw	65.0	5.3%	0.0	0.0%	0.0	0.0%	65.0	5.3%
3098 Total		**1,215.7**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,215.7**	**100.0%**
3099	Aw	582.4	32.5%	0.0	0.0%	0.0	0.0%	582.4	32.5%
	AwPl	38.8	2.2%	0.0	0.0%	0.0	0.0%	38.8	2.2%
	AwSx	198.5	11.1%	0.0	0.0%	0.0	0.0%	198.5	11.1%
	Pl	95.9	5.3%	0.0	0.0%	0.0	0.0%	95.9	5.3%
	PlAw	32.9	1.8%	0.0	0.0%	0.0	0.0%	32.9	1.8%
	Sb	22.2	1.2%	0.0	0.0%	0.0	0.0%	22.2	1.2%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	534.2	29.8%	0.0	0.0%	0.0	0.0%	534.2	29.8%
	SwAw	289.7	16.1%	0.0	0.0%	0.0	0.0%	289.7	16.1%
3099 Total		**1,794.6**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,794.6**	**100.0%**
3100	Aw	186.4	11.4%	0.0	0.0%	0.0	0.0%	186.4	11.4%
	AwPl	49.1	3.0%	0.0	0.0%	0.0	0.0%	49.1	3.0%
	AwSx	28.9	1.8%	0.0	0.0%	0.0	0.0%	28.9	1.8%
	Pl	453.0	27.8%	0.0	0.0%	0.0	0.0%	453.0	27.8%
	PlAw	66.7	4.1%	0.0	0.0%	0.0	0.0%	66.7	4.1%
	Sb	31.3	1.9%	0.0	0.0%	0.0	0.0%	31.3	1.9%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	678.1	41.6%	0.0	0.0%	0.0	0.0%	678.1	41.6%
	SwAw	134.7	8.3%	0.0	0.0%	0.0	0.0%	134.7	8.3%
3100 Total		**1,628.2**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,628.2**	**100.0%**
3101	Aw	393.2	43.8%	0.0	0.0%	0.0	0.0%	393.2	43.8%
	AwPl	22.3	2.5%	0.0	0.0%	0.0	0.0%	22.3	2.5%
	AwSx	28.6	3.2%	0.0	0.0%	0.0	0.0%	28.6	3.2%
	Pl	140.2	15.6%	0.0	0.0%	0.0	0.0%	140.2	15.6%
	PlAw	72.7	8.1%	0.0	0.0%	0.0	0.0%	72.7	8.1%
	Sb	4.3	0.5%	0.0	0.0%	0.0	0.0%	4.3	0.5%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	201.6	22.4%	0.0	0.0%	0.0	0.0%	201.6	22.4%
	SwAw	35.4	3.9%	0.0	0.0%	0.0	0.0%	35.4	3.9%
3101 Total		**898.2**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**898.2**	**100.0%**
3102	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	3.0	0.3%	0.0	0.0%	3.0	0.3%
	AwSx	0.0	0.0%	8.9	0.8%	0.0	0.0%	8.9	0.8%
	Pl	0.0	0.0%	525.2	49.7%	0.0	0.0%	525.2	49.7%
	PlAw	0.0	0.0%	1.9	0.2%	0.0	0.0%	1.9	0.2%
	Sb	0.0	0.0%	1.6	0.2%	0.0	0.0%	1.6	0.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

Appendix 4: Strata Description Tables

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Sw	0.0	0.0%	466.7	44.2%	0.0	0.0%	466.7	44.2%
	SwAw	0.0	0.0%	49.2	4.7%	0.0	0.0%	49.2	4.7%
3102 Total		**0.0**	**0.0%**	**1,056.5**	**100.0%**	**0.0**	**0.0%**	**1,056.5**	**100.0%**
3104	Aw	175.7	25.5%	0.0	0.0%	0.0	0.0%	175.7	25.5%
	AwPl	37.9	5.5%	0.0	0.0%	0.0	0.0%	37.9	5.5%
	AwSx	11.8	1.7%	0.0	0.0%	0.0	0.0%	11.8	1.7%
	Pl	259.3	37.6%	0.0	0.0%	0.0	0.0%	259.3	37.6%
	PlAw	39.5	5.7%	0.0	0.0%	0.0	0.0%	39.5	5.7%
	Sb	3.4	0.5%	0.0	0.0%	0.0	0.0%	3.4	0.5%
	SbAw	0.7	0.1%	0.0	0.0%	0.0	0.0%	0.7	0.1%
	Sw	137.5	19.9%	0.0	0.0%	0.0	0.0%	137.5	19.9%
	SwAw	23.6	3.4%	0.0	0.0%	0.0	0.0%	23.6	3.4%
3104 Total		**689.4**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**689.4**	**100.0%**
3105	Aw	63.8	11.6%	0.0	0.0%	0.0	0.0%	63.8	11.6%
	AwPl	23.1	4.2%	0.0	0.0%	0.0	0.0%	23.1	4.2%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	351.2	63.9%	0.0	0.0%	0.0	0.0%	351.2	63.9%
	PlAw	26.7	4.9%	0.0	0.0%	0.0	0.0%	26.7	4.9%
	Sb	0.1	0.0%	0.0	0.0%	0.0	0.0%	0.1	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	83.1	15.1%	0.0	0.0%	0.0	0.0%	83.1	15.1%
	SwAw	1.6	0.3%	0.0	0.0%	0.0	0.0%	1.6	0.3%
3105 Total		**549.6**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**549.6**	**100.0%**
3106	Aw	0.0	0.0%	13.9	0.7%	0.0	0.0%	13.9	0.7%
	AwPl	0.0	0.0%	33.5	1.8%	0.0	0.0%	33.5	1.8%
	AwSx	0.0	0.0%	18.8	1.0%	0.0	0.0%	18.8	1.0%
	Pl	0.0	0.0%	1,187.2	63.3%	0.0	0.0%	1,187.2	63.3%
	PlAw	0.0	0.0%	32.0	1.7%	0.0	0.0%	32.0	1.7%
	Sb	0.0	0.0%	100.0	5.3%	0.0	0.0%	100.0	5.3%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	435.9	23.2%	0.0	0.0%	435.9	23.2%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	SwAw	0.0	0.0%	54.2	2.9%	0.0	0.0%	54.2	2.9%
3106 Total		**0.0**	**0.0%**	**1,875.5**	**100.0%**	**0.0**	**0.0%**	**1,875.5**	**100.0%**
3107	Aw	0.0	0.0%	0.0	0.0%	30.5	2.1%	30.5	2.1%
	AwPl	0.0	0.0%	0.0	0.0%	38.0	2.6%	38.0	2.6%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	0.0%	923.4	63.9%	923.4	63.9%
	PlAw	0.0	0.0%	0.0	0.0%	81.2	5.6%	81.2	5.6%
	Sb	0.0	0.0%	0.0	0.0%	140.7	9.7%	140.7	9.7%
	SbAw	0.0	0.0%	0.0	0.0%	6.1	0.4%	6.1	0.4%
	Sw	0.0	0.0%	0.0	0.0%	219.1	15.2%	219.1	15.2%
	SwAw	0.0	0.0%	0.0	0.0%	5.6	0.4%	5.6	0.4%
3107 Total		**0.0**	**0.0%**	**0.0**	**0.0%**	**1,444.7**	**100.0%**	**1,444.7**	**100.0%**
3109	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	1,043.0	63.9%	0.0	0.0%	1,043.0	63.9%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	4.0	0.2%	0.0	0.0%	4.0	0.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	573.1	35.1%	0.0	0.0%	573.1	35.1%
	SwAw	0.0	0.0%	11.7	0.7%	0.0	0.0%	11.7	0.7%
3109 Total		**0.0**	**0.0%**	**1,631.7**	**1.7%**	**0.0**	**0.0%**	**1,631.7**	**100.0%**
3110	Aw	0.0	0.0%	0.0	0.0%	111.2	7.9%	111.2	7.9%
	AwPl	0.0	0.0%	0.0	0.0%	10.5	0.7%	10.5	0.7%
	AwSx	0.0	0.0%	0.0	0.0%	1.0	0.1%	1.0	0.1%
	Pl	0.0	0.0%	0.0	100.0%	1,069.0	75.9%	1,069.0	75.9%
	PlAw	0.0	0.0%	0.0	0.0%	36.5	2.6%	36.5	2.6%
	Sb	0.0	0.0%	0.0	0.0%	57.0	4.0%	57.0	4.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	111.7	7.9%	111.7	7.9%
	SwAw	0.0	0.0%	0.0	0.0%	11.8	0.8%	11.8	0.8%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
3110 Total		**0.0**	**0.0%**	**0.0**	**100.0%**	**1,408.6**	**100.0%**	**1,408.6**	**100.0%**
3111	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.9	96.5%	0.0	0.0%	0.9	96.5%
	Pl	0.0	0.0%	0.0	3.5%	0.0	0.0%	0.0	3.5%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3111 Total		**0.0**	**0.0%**	**0.9**	**100.0%**	**0.0**	**0.0%**	**0.9**	**100.0%**
3113	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	4.4	0.6%	0.0	0.0%	4.4	0.6%
	AwSx	0.0	0.0%	27.5	3.9%	0.0	0.0%	27.5	3.9%
	Pl	0.0	0.0%	266.3	37.7%	0.0	0.0%	266.3	37.7%
	PlAw	0.0	0.0%	16.4	2.3%	0.0	0.0%	16.4	2.3%
	Sb	0.0	0.0%	32.4	4.6%	0.0	0.0%	32.4	4.6%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	318.1	45.1%	0.0	0.0%	318.1	45.1%
	SwAw	0.0	0.0%	40.9	5.8%	0.0	0.0%	40.9	5.8%
3113 Total		**0.0**	**0.0%**	**705.9**	**100.0%**	**0.0**	**0.0%**	**705.9**	**100.0%**
3114	Aw	184.5	13.9%	0.0	0.0%	0.0	0.0%	184.5	13.9%
	AwPl	78.1	5.9%	0.0	0.0%	0.0	0.0%	78.1	5.9%
	AwSx	15.4	1.2%	0.0	0.0%	0.0	0.0%	15.4	1.2%
	Pl	532.8	40.2%	0.0	0.0%	0.0	0.0%	532.8	40.2%
	PlAw	96.9	7.3%	0.0	0.0%	0.0	0.0%	96.9	7.3%
	Sb	160.7	12.1%	0.0	0.0%	0.0	0.0%	160.7	12.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	236.3	17.8%	0.0	0.0%	0.0	0.0%	236.3	17.8%
	SwAw	19.4	1.5%	0.0	0.0%	0.0	0.0%	19.4	1.5%
3114 Total		**1,324.0**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,324.0**	**100.0%**

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
3115	Aw	182.5	13.2%	0.0	0.0%	0.0	0.0%	182.5	13.2%
	AwPl	50.4	3.6%	0.0	0.0%	0.0	0.0%	50.4	3.6%
	AwSx	81.6	5.9%	0.0	0.0%	0.0	0.0%	81.6	5.9%
	Pl	467.0	33.7%	0.0	0.0%	0.0	0.0%	467.0	33.7%
	PlAw	60.0	4.3%	0.0	0.0%	0.0	0.0%	60.0	4.3%
	Sb	9.7	0.7%	0.0	0.0%	0.0	0.0%	9.7	0.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	465.0	33.5%	0.0	0.0%	0.0	0.0%	465.0	33.5%
	SwAw	70.0	5.0%	0.0	0.0%	0.0	0.0%	70.0	5.0%
3115 Total		**1,386.1**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**1,386.1**	**100.0%**
3117	Aw	0.0	0.0%	0.5	0.0%	0.0	0.0%	0.5	0.0%
	AwPl	0.0	0.0%	87.9	4.5%	0.0	0.0%	87.9	4.5%
	AwSx	0.0	0.0%	0.7	0.0%	0.0	0.0%	0.7	0.0%
	Pl	0.0	0.0%	935.3	47.5%	0.0	0.0%	935.3	47.5%
	PlAw	0.0	0.0%	322.9	16.4%	0.0	0.0%	322.9	16.4%
	Sb	0.0	0.0%	0.5	0.0%	0.0	0.0%	0.5	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	581.5	29.6%	0.0	0.0%	581.5	29.6%
	SwAw	0.0	0.0%	37.8	1.9%	0.0	0.0%	37.8	1.9%
3117 Total		**0.0**	**0.0%**	**1,967.0**	**100.0%**	**0.0**	**0.0%**	**1,967.0**	**100.0%**
3121	Aw	0.0	0.0%	0.2	0.0%	4.9	1.0%	5.2	0.5%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.2	0.0%	14.7	2.9%	14.9	1.3%
	Pl	0.0	0.0%	495.5	81.8%	344.8	68.6%	840.4	75.8%
	PlAw	0.0	0.0%	47.9	7.9%	26.9	5.4%	74.8	6.8%
	Sb	0.0	0.0%	19.2	3.2%	0.0	0.0%	19.2	1.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	41.4	6.8%	108.0	21.5%	149.5	13.5%
	SwAw	0.0	0.0%	1.0	0.2%	3.2	0.6%	4.2	0.4%
3121 Total		**0.0**	**0.0%**	**605.5**	**100.0%**	**502.6**	**100.0%**	**1,108.1**	**100.0%**
3122	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

Compartment	Stratum	SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
		(ha)	%	(ha)	%	(ha)	%	(ha)	%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	18.4	100.0%	0.0	0.0%	18.4	100.0%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3122 Total		**0.0**	**0.0%**	**18.4**	**100.0%**	**0.0**	**0.0%**	**18.4**	**100.0%**
3123	Aw	52.3	22.9%	0.0	0.0%	0.0	0.0%	52.3	22.9%
	AwPl	20.7	9.1%	0.0	0.0%	0.0	0.0%	20.7	9.1%
	AwSx	10.0	4.4%	0.0	0.0%	0.0	0.0%	10.0	4.4%
	Pl	17.2	7.5%	0.0	0.0%	0.0	0.0%	17.2	7.5%
	PlAw	5.5	2.4%	0.0	0.0%	0.0	0.0%	5.5	2.4%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	102.4	44.9%	0.0	0.0%	0.0	0.0%	102.4	44.9%
	SwAw	19.9	8.7%	0.0	0.0%	0.0	0.0%	19.9	8.7%
3123 Total		**228.0**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**228.0**	**100.0%**
3124	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	8.2	64.5%	0.0	100.0%	8.2	64.5%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.3	2.4%	0.0	0.0%	0.3	2.4%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	4.2	33.1%	0.0	0.0%	4.2	33.1%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3124 Total		**0.0**	**0.0%**	**12.7**	**100.0%**	**0.0**	**100.0%**	**12.7**	**100.0%**
3126	Aw	49.3	36.5%	0.0	0.0%	0.0	0.0%	49.3	36.5%
	AwPl	12.3	9.1%	0.0	0.0%	0.0	0.0%	12.3	9.1%

Appendix 4: Strata Description Tables

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	67.0	49.7%	0.0	0.0%	0.0	0.0%	67.0	49.7%
	PlAw	6.3	4.7%	0.0	0.0%	0.0	0.0%	6.3	4.7%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
3126 Total		**134.8**	**100.0%**	**0.0**	**0.0%**	**0.0**	**0.0%**	**134.8**	**100.0%**
1800 Timber Berth	Aw	0.0	0.0%	1,928.9	57.4%	2,305.2	56.7%	4,234.1	57.0%
	AwPl	0.0	0.0%	8.9	0.3%	7.3	0.2%	16.2	0.2%
	AwSx	0.0	0.0%	205.1	6.1%	266.5	6.6%	471.6	6.4%
	Pl	0.0	0.0%	7.5	0.2%	0.0	0.0%	7.6	0.1%
	PlAw	0.0	0.0%	5.7	0.2%	0.0	0.0%	5.7	0.1%
	Sb	0.0	0.0%	14.0	0.4%	3.6	0.1%	17.6	0.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	710.4	21.1%	1,106.1	27.2%	1,816.4	24.5%
	SwAw	0.0	0.0%	478.7	14.3%	373.9	9.2%	852.6	11.5%
1800 Timber Berth Total		**0.0**	**0.0%**	**3,359.3**	**100.0%**	**4,062.6**	**100.0%**	**7,421.8**	**100.0%**
Bull Creek	Aw	0.0	0.0%	828.0	27.2%	850.5	28.5%	1,678.6	27.8%
	AwPl	0.0	0.0%	140.4	4.6%	129.5	4.3%	269.8	4.5%
	AwSx	0.0	0.0%	106.7	3.5%	93.1	3.1%	199.8	3.3%
	Pl	0.0	0.0%	813.8	26.7%	802.9	26.9%	1,616.8	26.8%
	PlAw	0.0	0.0%	161.3	5.3%	154.5	5.2%	315.7	5.2%
	Sb	0.0	0.0%	245.5	8.1%	156.2	5.2%	401.8	6.7%
	SbAw	0.0	0.0%	2.7	0.1%	0.0	0.0%	2.7	0.0%
	Sw	0.0	0.0%	682.4	22.4%	687.1	23.0%	1,369.5	22.7%
	SwAw	0.0	0.0%	68.3	2.2%	112.6	3.8%	180.9	3.0%
Bull Creek Total		**0.0**	**0.0%**	**3,049.1**	**100.0%**	**2,986.5**	**100.0%**	**6,035.6**	**100.0%**
Calahoo	Aw	0.0	0.0%	493.5	28.1%	666.4	43.7%	1,159.9	35.3%
	AwPl	0.0	0.0%	32.3	1.8%	13.3	0.9%	45.6	1.4%
	AwSx	0.0	0.0%	113.0	6.4%	140.5	9.2%	253.5	7.7%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Pl	0.0	0.0%	271.9	15.5%	182.1	11.9%	453.9	13.8%
	PlAw	0.0	0.0%	55.8	3.2%	33.2	2.2%	89.0	2.7%
	Sb	0.0	0.0%	82.5	4.7%	42.8	2.8%	125.4	3.8%
	SbAw	0.0	0.0%	0.0	0.0%	1.5	0.1%	1.5	0.0%
	Sw	0.0	0.0%	500.4	28.5%	335.2	22.0%	835.6	25.5%
	SwAw	0.0	0.0%	208.1	11.8%	109.9	7.2%	317.9	9.7%
Calahoo Total		**0.0**	**0.0%**	**1,757.5**	**100.0%**	**1,524.9**	**100.0%**	**3,282.4**	**100.0%**
Hammer Head	Aw	0.0	0.0%	266.0	12.3%	455.4	18.5%	721.4	15.6%
	AwPl	0.0	0.0%	46.3	2.1%	39.5	1.6%	85.8	1.9%
	AwSx	0.0	0.0%	210.7	9.7%	253.2	10.3%	463.9	10.0%
	Pl	0.0	0.0%	173.7	8.0%	104.0	4.2%	277.7	6.0%
	PlAw	0.0	0.0%	58.2	2.7%	23.1	0.9%	81.3	1.8%
	Sb	0.0	0.0%	353.0	16.3%	96.7	3.9%	449.8	9.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	847.4	39.1%	1,098.7	44.7%	1,946.1	42.0%
	SwAw	0.0	0.0%	214.5	9.9%	388.5	15.8%	603.0	13.0%
Hammer Head Total		**0.0**	**0.0%**	**2,169.8**	**100.0%**	**2,459.2**	**100.0%**	**4,629.0**	**100.0%**
Kakwa Tower	Aw	0.0	0.0%	2,167.3	45.1%	2,193.9	52.0%	4,361.2	48.3%
	AwPl	0.0	0.0%	103.8	2.2%	70.4	1.7%	174.2	1.9%
	AwSx	0.0	0.0%	427.1	8.9%	475.1	11.3%	902.2	10.0%
	Pl	0.0	0.0%	187.8	3.9%	134.9	3.2%	322.7	3.6%
	PlAw	0.0	0.0%	116.4	2.4%	27.9	0.7%	144.3	1.6%
	Sb	0.0	0.0%	197.5	4.1%	27.3	0.6%	224.8	2.5%
	SbAw	0.0	0.0%	3.5	0.1%	0.0	0.0%	3.5	0.0%
	Sw	0.0	0.0%	1,103.3	23.0%	1,051.5	24.9%	2,154.8	23.9%
	SwAw	0.0	0.0%	495.5	10.3%	237.5	5.6%	733.1	8.1%
Kakwa Tower Total		**0.0**	**0.0%**	**4,802.1**	**100.0%**	**4,218.6**	**100.0%**	**9,020.7**	**100.0%**
MA2 GP North	Aw	0.0	0.0%	649.6	24.5%	583.3	30.1%	1,232.9	26.8%
	AwPl	0.0	0.0%	20.9	0.8%	42.2	2.2%	63.1	1.4%
	AwSx	0.0	0.0%	135.5	5.1%	114.0	5.9%	249.5	5.4%
	Pl	0.0	0.0%	453.7	17.1%	123.8	6.4%	577.5	12.6%

Compartment	Stratum	SHS Area: Caribou Range Priority 2 "Reserves" (ha)	%	Decade 1 (ha)	%	Decade 2 (ha)	%	Total (ha)	%
	PlAw	0.0	0.0%	60.4	2.3%	24.7	1.3%	85.1	1.9%
	Sb	0.0	0.0%	59.9	2.3%	8.5	0.4%	68.4	1.5%
	SbAw	0.0	0.0%	0.0	0.0%	3.8	0.2%	3.8	0.1%
	Sw	0.0	0.0%	1,173.3	44.2%	962.3	49.6%	2,135.5	46.5%
	SwAw	0.0	0.0%	103.1	3.9%	77.5	4.0%	180.6	3.9%
MA2 GP North Total		**0.0**	**0.0%**	**2,656.4**	**100.0%**	**1,940.1**	**100.0%**	**4,596.5**	**100.0%**
Musreau	Aw	0.0	0.0%	2,262.0	30.4%	1,326.3	24.2%	3,588.3	27.8%
	AwPl	0.0	0.0%	166.0	2.2%	237.0	4.3%	403.0	3.1%
	AwSx	0.0	0.0%	529.9	7.1%	268.2	4.9%	798.1	6.2%
	Pl	0.0	0.0%	908.2	12.2%	557.9	10.2%	1,466.2	11.3%
	PlAw	0.0	0.0%	223.8	3.0%	128.9	2.3%	352.7	2.7%
	Sb	0.0	0.0%	789.9	10.6%	344.0	6.3%	1,133.9	8.8%
	SbAw	0.0	0.0%	0.0	0.0%	2.6	0.0%	2.6	0.0%
	Sw	0.0	0.0%	1,856.0	25.0%	2,132.3	38.8%	3,988.3	30.9%
	SwAw	0.0	0.0%	698.5	9.4%	492.5	9.0%	1,191.0	9.2%
Musreau Total		**0.0**	**0.0%**	**7,434.3**	**100.0%**	**5,489.7**	**100.0%**	**12,924.0**	**100.0%**
NON_FMA	Aw	0.0	0.0%	625.9	100.0%	625.2	100.0%	1,251.2	100.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SwAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
NON_FMA Total		**0.0**	**0.0%**	**625.9**	**100.0%**	**625.3**	**100.0%**	**1,251.2**	**100.0%**
Nose Mountain	Aw	0.0	0.0%	84.2	3.6%	21.8	1.4%	106.0	2.7%
	AwPl	0.0	0.0%	23.1	1.0%	13.2	0.8%	36.4	0.9%
	AwSx	0.0	0.0%	41.1	1.8%	11.1	0.7%	52.2	1.3%
	Pl	0.0	0.0%	943.5	40.8%	635.8	39.4%	1,579.3	40.2%
	PlAw	0.0	0.0%	34.7	1.5%	26.8	1.7%	61.5	1.6%

Compartment	Stratum	SHS Area							
		Caribou Range Priority 2 “Reserves”		Decade 1		Decade 2		Total	
		(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Sb	0.0	0.0%	37.8	1.6%	30.3	1.9%	68.1	1.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	1,097.6	47.5%	835.9	51.8%	1,933.5	49.2%
	SwAw	0.0	0.0%	50.9	2.2%	39.1	2.4%	90.0	2.3%
Nose Mountain Total		**0.0**	**0.0%**	**2,313.0**	**100.0%**	**1,614.1**	**100.0%**	**3,927.0**	**100.0%**
Pine Rat	Aw	0.0	0.0%	82.1	4.6%	260.2	6.4%	342.2	5.8%
	AwPl	0.0	0.0%	110.5	6.2%	223.2	5.5%	333.7	5.7%
	AwSx	0.0	0.0%	83.5	4.7%	144.7	3.5%	228.2	3.9%
	Pl	0.0	100.0%	533.7	29.7%	1,623.2	39.7%	2,156.8	36.6%
	PlAw	0.0	0.0%	104.6	5.8%	228.9	5.6%	333.5	5.7%
	Sb	0.0	0.0%	246.8	13.7%	505.3	12.3%	752.1	12.8%
	SbAw	0.0	0.0%	0.0	0.0%	3.1	0.1%	3.1	0.1%
	Sw	0.0	0.0%	490.9	27.3%	947.4	23.2%	1,438.3	24.4%
	SwAw	0.0	0.0%	143.4	8.0%	156.4	3.8%	299.9	5.1%
Pine Rat Total		**0.0**	**100.0%**	**1,795.4**	**100.0%**	**4,092.4**	**100.0%**	**5,887.8**	**100.0%**
Pinto	Aw	0.0	0.0%	2,077.5	49.6%	2,259.1	45.9%	4,336.6	47.6%
	AwPl	0.0	0.0%	23.1	0.6%	45.7	0.9%	68.8	0.8%
	AwSx	0.0	0.0%	255.9	6.1%	387.7	7.9%	643.6	7.1%
	Pl	0.0	0.0%	181.6	4.3%	284.5	5.8%	466.0	5.1%
	PlAw	0.0	0.0%	62.9	1.5%	37.0	0.8%	99.9	1.1%
	Sb	0.0	0.0%	76.1	1.8%	27.1	0.6%	103.2	1.1%
	SbAw	0.0	0.0%	12.9	0.3%	5.7	0.1%	18.6	0.2%
	Sw	0.0	0.0%	1,112.2	26.6%	1,473.8	30.0%	2,586.1	28.4%
	SwAw	0.0	0.0%	385.6	9.2%	396.1	8.1%	781.7	8.6%
Pinto Total		**0.0**	**0.0%**	**4,187.8**	**100.0%**	**4,916.6**	**100.0%**	**9,104.5**	**100.0%**
Pinto Cut Across	Aw	0.0	0.0%	3,183.1	60.3%	1,499.2	53.3%	4,682.3	57.8%
	AwPl	0.0	0.0%	13.2	0.2%	0.0	0.0%	13.2	0.2%
	AwSx	0.0	0.0%	364.6	6.9%	313.0	11.1%	677.6	8.4%
	Pl	0.0	0.0%	43.7	0.8%	21.1	0.8%	64.8	0.8%
	PlAw	0.0	0.0%	6.2	0.1%	1.3	0.0%	7.5	0.1%
	Sb	0.0	0.0%	102.1	1.9%	111.3	4.0%	213.4	2.6%

Compartment	Stratum	SHS Area: Caribou Range Priority 2 "Reserves" (ha)	%	Decade 1 (ha)	%	Decade 2 (ha)	%	Total (ha)	%
	SbAw	0.0	0.0%	1.5	0.0%	17.4	0.6%	18.9	0.2%
	Sw	0.0	0.0%	898.4	17.0%	698.7	24.8%	1,597.1	19.7%
	SwAw	0.0	0.0%	666.8	12.6%	152.6	5.4%	819.4	10.1%
Pinto Cut Across Total		**0.0**	**0.0%**	**5,279.6**	**100.0%**	**2,814.5**	**100.0%**	**8,094.0**	**100.0%**
Prairie Creek	Aw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Pl	0.0	0.0%	0.0	0.0%	59.0	66.9%	59.0	66.9%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	0.0	0.0%	25.2	28.5%	25.2	28.5%
	SwAw	0.0	0.0%	0.0	0.0%	4.1	4.6%	4.1	4.6%
Prairie Creek Total		**0.0**	**0.0%**	**0.0**	**0.0%**	**88.3**	**100.0%**	**88.3**	**100.0%**
Saddle Hills East	Aw	0.0	0.0%	5,727.6	83.9%	8,014.1	92.1%	13,741.7	88.5%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	103.8	1.5%	33.1	0.4%	137.0	0.9%
	Pl	0.0	0.0%	37.5	0.5%	74.9	0.9%	112.4	0.7%
	PlAw	0.0	0.0%	0.0	0.0%	5.7	0.1%	5.7	0.0%
	Sb	0.0	0.0%	2.4	0.0%	0.0	0.0%	2.4	0.0%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	773.6	11.3%	525.6	6.0%	1,299.2	8.4%
	SwAw	0.0	0.0%	183.5	2.7%	44.2	0.5%	227.7	1.5%
Saddle Hills East Total		**0.0**	**0.0%**	**6,828.4**	**100.0%**	**8,697.6**	**100.0%**	**15,526.1**	**100.0%**
Saddle Hills North	Aw	0.0	0.0%	4,875.6	72.9%	4,137.9	76.6%	9,013.5	74.6%
	AwPl	0.0	0.0%	0.0	0.0%	3.2	0.1%	3.2	0.0%
	AwSx	0.0	0.0%	348.4	5.2%	357.7	6.6%	706.1	5.8%
	Pl	0.0	0.0%	0.4	0.0%	22.4	0.4%	22.8	0.2%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	71.2	1.1%	77.0	1.4%	148.3	1.2%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

		SHS Area							
		Caribou Range Priority 2 “Reserves”		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	Sw	0.0	0.0%	991.0	14.8%	594.7	11.0%	1,585.8	13.1%
	SwAw	0.0	0.0%	397.7	5.9%	212.5	3.9%	610.2	5.0%
Saddle Hills North Total		**0.0**	**0.0%**	**6,684.5**	**100.0%**	**5,405.4**	**100.0%**	**12,089.9**	**100.0%**
Saddle Hills South	Aw	0.0	0.0%	4,381.2	60.1%	4,765.6	72.2%	9,146.8	65.9%
	AwPl	0.0	0.0%	4.3	0.1%	8.3	0.1%	12.6	0.1%
	AwSx	0.0	0.0%	675.5	9.3%	317.1	4.8%	992.6	7.1%
	Pl	0.0	0.0%	57.9	0.8%	86.8	1.3%	144.7	1.0%
	PlAw	0.0	0.0%	17.9	0.2%	14.0	0.2%	31.9	0.2%
	Sb	0.0	0.0%	124.3	1.7%	17.8	0.3%	142.1	1.0%
	SbAw	0.0	0.0%	0.3	0.0%	6.4	0.1%	6.7	0.0%
	Sw	0.0	0.0%	1,256.2	17.2%	811.1	12.3%	2,067.3	14.9%
	SwAw	0.0	0.0%	772.9	10.6%	569.6	8.6%	1,342.5	9.7%
Saddle Hills South Total		**0.0**	**0.0%**	**7,290.4**	**100.0%**	**6,596.8**	**100.0%**	**13,887.2**	**100.0%**
South East Kakwa	Aw	0.0	0.0%	114.9	4.6%	139.0	5.2%	253.9	4.9%
	AwPl	0.0	0.0%	139.1	5.6%	147.4	5.5%	286.6	5.5%
	AwSx	0.0	0.0%	24.7	1.0%	56.2	2.1%	80.9	1.6%
	Pl	0.0	0.0%	1,235.5	49.5%	1,105.9	41.2%	2,341.4	45.2%
	PlAw	0.0	0.0%	191.9	7.7%	240.7	9.0%	432.6	8.3%
	Sb	0.0	0.0%	35.9	1.4%	0.2	0.0%	36.1	0.7%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	607.9	24.4%	896.4	33.4%	1,504.3	29.0%
	SwAw	0.0	0.0%	146.0	5.8%	101.2	3.8%	247.1	4.8%
South East Kakwa Total		**0.0**	**0.0%**	**2,496.0**	**100.0%**	**2,687.0**	**100.0%**	**5,183.0**	**100.0%**
Wanyandie	Aw	0.0	0.0%	1,468.2	62.4%	828.4	54.0%	2,296.7	59.1%
	AwPl	0.0	0.0%	115.8	4.9%	29.9	1.9%	145.6	3.7%
	AwSx	0.0	0.0%	61.3	2.6%	32.6	2.1%	93.9	2.4%
	Pl	0.0	0.0%	185.5	7.9%	318.4	20.7%	504.0	13.0%
	PlAw	0.0	0.0%	52.6	2.2%	55.6	3.6%	108.2	2.8%
	Sb	0.0	0.0%	2.9	0.1%	0.0	0.0%	2.9	0.1%
	SbAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sw	0.0	0.0%	370.1	15.7%	235.1	15.3%	605.2	15.6%

		SHS Area							
		Caribou Range Priority 2 "Reserves"		Decade 1		Decade 2		Total	
Compartment	Stratum	(ha)	%	(ha)	%	(ha)	%	(ha)	%
	SwAw	0.0	0.0%	97.2	4.1%	34.9	2.3%	132.1	3.4%
Wanyandie Total		**0.0**	**0.0%**	**2,353.6**	**100.0%**	**1,534.9**	**100.0%**	**3,888.5**	**100.0%**
Wapiti	Aw	0.0	0.0%	1,786.3	68.2%	2,047.0	72.4%	3,833.3	70.4%
	AwPl	0.0	0.0%	1.9	0.1%	10.8	0.4%	12.7	0.2%
	AwSx	0.0	0.0%	126.4	4.8%	136.4	4.8%	262.9	4.8%
	Pl	0.0	0.0%	151.7	5.8%	189.0	6.7%	340.7	6.3%
	PlAw	0.0	0.0%	0.0	0.0%	0.3	0.0%	0.3	0.0%
	Sb	0.0	0.0%	22.6	0.9%	0.0	0.0%	22.6	0.4%
	SbAw	0.0	0.0%	4.1	0.2%	0.0	0.0%	4.1	0.1%
	Sw	0.0	0.0%	245.8	9.4%	335.6	11.9%	581.3	10.7%
	SwAw	0.0	0.0%	279.2	10.7%	109.9	3.9%	389.1	7.1%
Wapiti Total		**0.0**	**0.0%**	**2,618.2**	**100.0%**	**2,829.0**	**100.0%**	**5,447.1**	**100.0%**
Wilson Lake	Aw	0.0	0.0%	1,341.7	89.0%	1,037.1	89.1%	2,378.8	89.0%
	AwPl	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	AwSx	0.0	0.0%	41.9	2.8%	24.7	2.1%	66.6	2.5%
	Pl	0.0	0.0%	1.4	0.1%	0.0	0.0%	1.4	0.1%
	PlAw	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Sb	0.0	0.0%	2.4	0.2%	0.0	0.0%	2.4	0.1%
	SbAw	0.0	0.0%	0.3	0.0%	0.0	0.0%	0.3	0.0%
	Sw	0.0	0.0%	106.6	7.1%	79.7	6.8%	186.2	7.0%
	SwAw	0.0	0.0%	14.0	0.9%	22.7	1.9%	36.6	1.4%
Wilson Lake Total		**0.0**	**0.0%**	**1,508.2**	**100.0%**	**1,164.1**	**100.0%**	**2,672.4**	**100.0%**
Grand Total		**14,437.3**	**100.0%**	**95,311.5**	**100.0%**	**74,380.4**	**100.0%**	**184,129.2**	**100.0%**

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End of Chapter 10.

Alberta
Agriculture and Forestry

Courier Box 8, Room 2201
10320-99 Street
Grande Prairie, Alberta T8V 6J4
Telephone: 780-538-8080
Fax: 780-538-1941
www.alberta.ca

June 26, 2017

File #: 06331-F02-D1-04

Traci Carter
Strategic Forest Planning
Weyerhaeuser Company Ltd.
Postal Bag 1020
Grande Prairie, AB T8V 3A9

RE: Weyerhaeuser Grande Prairie FMA6900016 Forest Management Plan – First Nations Consultation - Pre Consultation Assessment – FNC201703622

Dear Traci,

The proposed Weyerhaeuser Grande Prairie FMA6900016 Forest Management Plan with approvals required under the Forests Act requires that in fulfillment of The Government of Alberta's Guidelines on Consultation with First Nations and Metis Settlements on Land and Natural Resource Management, Weyerhaeuser Company Ltd. is required to consult with the following Indigenous groups at Level 3 Extensive Consultation:

- Aseniwuche Winewak Nation
- Duncan's First Nation
- East Prairie Metis Settlement
- Horse Lake First Nation
- Sucker Creek First Nation

Accordingly, Weyerhaeuser Company Ltd. is required to develop a consultation plan that includes the following:

- Project proponent contact information.
- A list of specific First Nations and Metis Settlements to be consulted.
- Plain language project specific information, which needs to include:
    - Contact information for the proponent;
    - A non-technical plain language description of the proposed project;
    - A map of sufficient scale;
    - A glossary of terms;
    - Clear identification of potential short-term and long-term adverse impacts, and;
    - The proposed consultation schedule.
- Delivery methods for providing plain language project specific and direct notices to Indigenous groups. This should identify which methods used, which could include a combination of the following:
    - Advertisements in First Nations or Metis Settlements newspapers;

Community postings;
Face-to-face meetings with, or presentations to elected leaders or their delegated representatives, and;
Any other means that sufficiently informs members of the First Nation or Metis Settlement about the proposed project and their involvement in the consultation process.

- Any available information regarding potential adverse impacts to First Nations Treaty rights and traditional uses and Metis Settlements harvesting rights and traditional uses.
- Timelines and schedules for consultation activities including any significant milestones.
- Procedures for reporting to Alberta Agriculture and Forestry on the progress and results of consultation. This plan should include details on using a bi-monthly report and a Specific Concern and Response Table. (A phased approach with bi-monthly reporting may work well for the FMP)
- Please consult Appendix D in the Proponent Guide for additional requirements: http://indigenous.alberta.ca/documents/Proponent-Guide-June6-2016.pdf?0.5654484560273143

Mark Feser is the Area Forester assigned to the Weyerhaeuser FMA6900016 Forest Management Plan. He can be reached either by phone at 780-538-8089 or via email at mark.feser@gov.ab.ca. Please contact him if you have any questions on the process of completing your Indigenous Consultation Plan.

Upon completion of your plan, Alberta Agriculture and Forestry will issue a letter of approval and will provide further direction on consultation requirements.

Best Regards,

Tim Heemskerk
Senior Forester
Grande Prairie Forest Area

Cc. Tim MacDonald, Consultation Advisor, Aboriginal Consultation Office, Grande Prairie
Gareth Davies, Forest Resource Management Lead, Forest Management Branch
Mark Feser – Area Forester, Grande Prairie

Alberta Agriculture and Forestry

Grand Prairie Forest Area
Provincial Building, Second Floor
10320-99 Street
Grande Prairie, Alberta, Canada
T8V 6J4
Telephone: 780-538-8080
Facsimile: 780-538-1941
www.alberta.ca

September 22, 2017 File: 06331-005-012

Traci Carter
Strategic Forest Planning
Weyerhaeuser Company Ltd.
Postal Bag 1020
Grande Prairie, AB T8V 3A9

RE: Weyerhaeuser Grande Prairie FMA6900016 – 2019-2029 Foest Management Plan - Public Involvement Process (PIP)– September 21, 2017 Submission

Dear Traci,

The Weyerhaeuser Grande Prairie FMA6900016 2019-2029 Forest Management Plan Public Involvement Process, received on September 21, 2017, has been reviewed by Alberta Agriculture and Forestry (AF), Grand Prairie Forest Area. Please consider this letter as acceptance of the Public Involvement Plan for the FMP regulatory process.

Should you have any questions regarding this letter, please contact Mark Feser at 780-538-8089.

Sincerely,

____

Tim Heemskerk
Senior Forester
Designated Director under the *Forests Act*
Grand Prairie Forest Area

Cc. Robert Popowich, Director, Resource Management Section, Forest Management Branch

Alberta Agriculture and Forestry

Grande Prairie Forest Area
Provincial Building, Second Floor
10320 - 99 Street
Grande Prairie, Alberta, Canada
T8V 6J4
Telephone: 780-538-8080
Fax: 780-538-1941
www.alberta.ca

November 20, 2017

File: 06331-F02-D1-04
Weyerhaeuser Forest Management Plan

DELIVERED VIA EMAIL:
(no original to follow)

Traci Carter
Strategic Forest Planning
Weyerhaeuser Company Ltd.
Postal Bag 1020
Grande Prairie, AB T8V 3A9

Dear Traci,

Re: Approval of Aboriginal Consultation Plan – Weyerhaeuser Grande Prairie FMA6900016 - Indigenous Consultation Process – 2019-2029 Forest Management Plan.

The Department has reviewed the revised Aboriginal Consultation Plan submitted on November 15, 2017 for the proposed Weyerhaeuser Grande Prairie FMA6900016 Indigenous Consultation Process for the Weyerhaeuser 2019-2029 Forest Management Plan.

On the basis of our review the revised Aboriginal Consultation Plan is consistent with the requirements outlined in The Government of Alberta Policy (2013) and Guidelines (July 28, 2014) on Consultation with First Nations on Land and Natural Resource Management and the Government of Alberta Policy (2015) and Guidelines (2016) on Consultation with Metis Settlements on Land and Natural Resource Management. The Department may require further consultation based on the receipt of new or additional information at any time during the regulatory approval process.

Alberta's First Nations/Metis Settlements Consultation *Policy* and *Guidelines* require consultation with potentially affected First Nations & Metis Settlements, and do not apply to Métis Locals or other aboriginal communities. The province determines, on a case-by-case basis, whether consultation is necessary with Métis Local communities who may credibly assert constitutionally protected rights. At this time, Alberta does not have information that would support a requirement for consultation with Métis communities concerning the project.

From November 20, 2017, every two months following this date, you are required to provide to the Department with a report that outlines all of your Aboriginal Consultation activities for the proposed

Grande Prairie Forest Area
Provincial Building, Second Floor
10320 - 99 Street
Grande Prairie, Alberta, Canada
T8V 6J4
Telephone: 780-538-8080
Fax: 780-538-1941
www.alberta.ca

project, as well as a Specific Concerns & Response table which documents project specific concerns brought forward by First Nations/Metis Settlements and the proponents plan to address the concern (see attached). The Department also requires that the bi-monthly consultation reports be shared with those First Nations/Metis Settlements identified in the Consultation Plan.

If you have any questions about the Aboriginal Consultation process or requirements, please contact Mark Feser at 780-538-8089 or by email at mark.feser@gov.ab.ca

Best Regards,

COLLEGE OF ALBERTA PROFESSIONAL FORESTERS TIMOTHY HEEMSKERK RPF

____
Tim Heemskerk
Senior Forester
Grande Prairie Forest Area

cc: Timothy McDonald, Consultation Advisor, Upper Peace
Liana Luard, Lead, Forest Planning & Performance Monitoring, Forest Management Branch
Mark Feser, Area Forester, Grande Prairie Forest Area

GOVERNMENT OF THE PROVINCE OF ALBERTA

FORESTS ACT
FOREST MANAGEMENT AGREEMENT

(O.C. 503/2007)

MEMORANDUM OF AGREEMENT

BETWEEN:

HER MAJESTY THE QUEEN in the right of the Province of Alberta, as represented by the Minister of Sustainable Resource Development, (hereinafter referred to as "the Minister"),
OF THE FIRST PART

and

WEYERHAEUSER COMPANY LIMITED, a body corporate, registered under the laws of Alberta, with a business office in Grande Prairie, Alberta, (hereinafter referred to as "the Company"),
OF THE SECOND PART

WHEREAS the Company is engaged in the production of electricity and manufacturing wood pulp, lumber and other forest products at Grande Prairie, Alberta; and

WHEREAS the Minister desires to provide for the fullest possible economic utilization of forest stands and employment in local communities, and to ensure a perpetual supply of benefits and products while maintaining a forest environment of high quality; and

WHEREAS it has been mutually agreed by the parties hereto that it is desirable to enter into this forest management agreement to replace the forest management agreement authorized under O.C. 778/88;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises, terms, conditions, covenants, stipulations, agreements and provisions herein contained, the Minister and the Company hereby agree as follows:

DEFINITIONS

1 (1) In this Agreement

(a) "Agreement" means this forest management agreement including all appendices or schedules attached hereto, and any written amendments made hereto from time to time by agreement of all the parties;

(b) "annual allowable cut" is the amount of timber that may be harvested in any one forest management operating year as stipulated in the pertinent forest management plan approved by the Minister;

(c) "commencement date" has that meaning provided for in paragraph 2(1);

(d) "Crown" means Her Majesty the Queen in right of Alberta;

(e) "cubic metre" shall have the same meaning as that prescribed by the Timber Management Regulation;

(f) "cut control period" means a period of five consecutive forest management operating years or as otherwise mutually agreed by the Minister and the Company;

(g) "Department" means the Department of Sustainable Resource Development;

(h) "Disposition and Fees Regulation" means Alberta Regulation 54/2000;

(i) "dollar" means Canadian currency of the value of one Canadian dollar, or the Canadian equivalent value in any other currency;

(j) "forest management area" refers to the tract of forest land as specifically defined in paragraph 3;

(k) "forest management operating year" shall mean the operating year established pursuant to paragraph 18(1);

(l) "forest planning standards" shall mean those forest planning standards published by the Minister as amended from time to time;

(m) "original net forest management Area" means the net area of the forest management area established as of the commencement date and agreed upon by the Company and the Minister;

(n) "periodic allowable cut" is the total of the annual allowable cuts approved for a five-year cut control period or as otherwise mutually agreed by the Minister and the Company;

(o) "Scaling Regulation" means Alberta Regulation 195/2002;

(p) "Timber Management Regulation" means Alberta Regulation 60/73;

(q) "Timber Regulation" means Alberta Regulation 404/92:

(r) "volume supply area 1" means that area depicted as such on Appendix "C"; and

(s) "volume supply area 2" means that area depicted as such on Appendix "C".

(2) Any reference in this Agreement to an Act or regulation of Alberta shall mean for the purposes of this Agreement, those Alberta Acts and the regulations thereunder as each may from time to time be amended respectively or such Acts or regulations as may from time to time be substituted therefore, and terms defined in the *Forests Act* or the *Public Lands Act*, or the regulations made thereunder shall, for the purposes of this Agreement, have the meaning given to them by those Acts and regulations as each may be amended or substituted from time to time.

2 (1) This Agreement shall commence on the first day of May, 2008 (herein referred to as the "commencement date"), and shall expire on the last day of April, 2028 unless renewed under the provisions of subparagraph (3).

(2) It is the intention of the parties hereto to continue the rights of the Company under paragraph 7 to establish, grow, harvest, and remove timber on the forest management area for additional terms of twenty years if pursuant to subparagraph (3), agreement thereon can be reached by the Minister and the Company and such agreement is approved by the Lieutenant Governor in Council.

(3) Subject to the approval of the Lieutenant Governor in Council and provided that the Company is not in default as to any of the terms, conditions, stipulations, covenants, agreements or provisions of this Agreement, the Company shall be entitled to a renewal of this Agreement whereby its rights under paragraph 7 to establish, grow, harvest, and remove timber are continued, on condition that:

(a) the Company gives notice to the Minister during or after the eighth year following the commencement date of its desire to renew this Agreement; and

(b) mutually acceptable terms, conditions, stipulations, covenants, agreements and provisions (including further renewal provisions or other requirements) can be negotiated at the time of renewal.

(4) Within sixty (60) days of the Company giving a notice under subparagraph (3)(a), the Company and the Minister shall carry out good faith negotiations in an attempt to agree on a renewal of the Agreement with a term of twenty years and have it approved by the Lieutenant Governor in Council.

(5) The Company and the Minister may agree to commence negotiations at times other than that provided for in subparagraph (3).

FOREST MANAGEMENT AREA

3 The Minister and the Company hereby enter into this Agreement in respect of the forest management area comprising, subject to paragraphs 4, 5, and 6, public lands within the boundaries shown outlined on a map registered with the Department, a copy of which is annexed hereto as Appendix "A".

4 Out of the area shown within the boundaries outlined in Appendix "A" the following are excepted:

(a) lands which are the subject of a disposition issued pursuant to the *Public Lands Act*, other than a Forest Grazing Licence, prior to the commencement date or lands in respect of which a disposition under the *Public Lands Act*, other than a Forest Grazing Licence, has been approved but which issuance is pending prior to the commencement date;

(b) lands which have been reserved under section 18(c) of the *Public Lands Act* prior to the commencement date or in respect of which a reservation has been approved but which has not been granted prior to the commencement date;

(c) the beds and shores of all permanent and naturally occurring bodies of water and all naturally occurring rivers, streams, watercourses and lakes; and

(d) lands contained within any Provincial Park, Forest Recreation Area, Provincial Recreation Area, Natural Area or Ecological Reserve prior to the commencement date.

5 Whenever any of the land excepted under paragraph 4 or subsequently withdrawn from the forest management area becomes available for disposition and where such land is intended to be returned to timber production by the Minister, the Minister shall notify the Company when such land becomes available and where the Company requests that such land be returned to timber production by the Minister, the Minister shall return these lands back to the forest management area.

WITHDRAWALS

6 (1) The Minister may, at any time and from time to time in the Minister's discretion, after consultation with the Company with respect to the effect any such withdrawal may have on the forest management area, either permanently or for a specified term, withdraw from the forest management area:

(a) any land which cannot be logged without causing substantial harm to the water table or to lakes, rivers, streams or other bodies of water, to the margins of watercourses or to roads;

(b) any lands required for rights-of-way or water resource development;

(c) any lands required for any other purposes deemed by the Minister to be required for the human or physical resource development of the Province;

(d) any lands required for commercial or industrial purposes; and

(e) any lands that are not capable of producing timber unless those lands are required to support forest management planning objectives in the approved forest management plan.

(2) A withdrawal shall take effect:

(a) on the date that a notice of withdrawal is given by the Minister to the Company, or

(b) where the notice given to the Company states that the withdrawal shall take effect on a future date, on the date stated in the notice.

(3) In the event from time to time, after consultation with the Company, of any withdrawal or withdrawals of land from the forest management area by the Minister under subparagraph (1):

(a) for disposition to users other than the Crown, the Company shall be entitled to reasonable compensation from the users of the area withdrawn for any loss of profit or other damage or loss suffered by the Company, including by way of example, but without limitation, damage to timber, improvements, regeneration, forest growth, or to its operations on the forest management area resulting from such withdrawals;

(b) for use by the Crown wherein the cumulative net aggregate area withdrawn does not exceed 1% of the original net forest management area, the Minister shall determine the compensation and arrange for reimbursement to the Company for the actual loss or damage resulting from such withdrawal to any improvements created by the Company's efforts, but not for any loss of profit, inconvenience nor increased costs reasonably incurred by the Company in harvesting an equivalent volume of timber elsewhere;

(c) for use by the Crown wherein the cumulative net aggregate area withdrawn does exceed 1% of the original net forest management area, the Minister shall determine the compensation in respect of such excess and arrange for reimbursement to the Company for any increased costs reasonably incurred by the Company in replacing the lost volume of timber and for any loss or damage suffered by the Company, including damage to timber, improvements, regeneration, forest growth, or to its operations on the forest management area.

(4) The Minister may, from time to time, designate a withdrawal of lands under subparagraph (1) as exempt from subparagraph (3)(a) and where the Minister has so designated, the compensation with respect to such withdrawal shall be paid by the user requesting the withdrawal as prescribed by the appropriate Alberta timber damage assessment table.

(5) Compensation under subparagraphs (3)(b) and (c) may be monetary or by the addition of available public land to the forest management area or a combination of both.

(6) If the administration and control of any of the lands comprising the forest management area is transferred to the Crown in right of Canada, the Company shall be entitled to compensation under subparagraph (3) as if the lands were withdrawn for use by the Crown.

(7) For the purposes of applying subparagraphs (3)(b) and (c),

(a) the original net forest management area means the area of the forest management area established as of the commencement date and agreed upon by the Company and the Minister; and

(b) the cumulative net aggregate area withdrawn shall be calculated taking into consideration all exceptions and additions to the original net forest management area under subparagraph (5) and paragraphs 4 and 5 and all withdrawals under subparagraph (1) for use by the Crown.

(8) Monetary compensation received by the Company under subparagraph (3)(a) and paragraph 8(1)(b) shall only be used to replace loss of property, to repair damage to improvements, to replace lost timber resource, to compensate for lost annual allowable cut, to integrate land management activities on the forest management area and to reforest public lands returned to the forest management area.

(9) The Company shall maintain complete and accurate records of the receipt and use of all compensation funds received under subparagraph (3)(a) and paragraph 8(1)(b).

(10) The Minister may from time to time at the Minister's discretion request verifiable documentation of the use of compensation funds received under subparagraph (3)(a) and paragraph 8(1)(b) and the Company shall comply with any such request.

RIGHTS OVER THE LAND

7 (1) Subject to all the terms and conditions of this Agreement, the Minister grants to the Company the right, during the term of this Agreement, to enter upon the forest management area to:

(a) establish, grow, harvest, and remove coniferous timber thereon on a perpetual sustained yield basis as provided for in the approved forest management plan;

(b) establish, grow, harvest, and remove up to 148,000 cubic metres per year of deciduous timber thereon a portion of which may be pure deciduous stands sourced from volume supply area 1;

(c) notwithstanding subparagraph 7(1)(b), should the Company fail to utilize, on an ongoing basis, the deciduous timber listed in subparagraph 7(1)(b) by May 1, 2018 in the Company's own facilities, the Company shall forfeit all rights to this timber. The Company may submit, for the Minister's consideration, a plan for harvesting and utilizing this deciduous timber in another facility on or before January 1, 2018. In the event the Company's plan is accepted by the Minister, the Company shall not forfeit its rights to this deciduous timber;

(d) carry out silviculture and other programs that are approved by the Minister in accordance with this Agreement; and

(e) construct, operate and maintain roads, bridges, camps, timber processing operations, wood concentration yards, and other installations necessary and incidental to the Company's harvesting and silvicultural operations on the forest management area.

(2) For the purpose of interpreting the *Surface Rights Act*, the Company is an occupant of the public lands comprising the forest management area.

(3) The Company may obtain sand and gravel needed for its operations under this Agreement from any vacant public land on the forest management area pursuant to the Disposition and Fees Regulation, subject to the payment by the Company of all required fees and royalties. In no case, however, shall the Company be required to pay fees or royalties for *in situ* right-of-way material located and used where it is found within the right-of-way.

(4) It is recognized by the Minister that the use of the forest management area by the Company to establish, grow, harvest and remove timber, following the principles of sustainable forest management and within the context of integrated resource planning, is to be the primary but not exclusive use thereof.

8 (1) The Minister reserves all rights on the forest management area not specifically given hereby to the Company in this Agreement, including by way of example, but without limiting the generality of the foregoing:

(a) the right of others to travel, hunt, fish and otherwise use the said lands for recreational purposes, subject to any necessary restrictions approved by the Minister for the purpose of prevention of accidents, fire control, protection of wildlife, and seasonal protection of roads;

(b) the right to authorize any person to conduct any work in connection with or incidental to geological or geophysical exploration pursuant to the *Mines and Minerals Act*, or the Exploration Regulation; provided that the Company shall be entitled to reasonable compensation, from the person or company which holds the authorization to conduct the exploration, for any loss or damage suffered by the Company and resulting from such exploration including by way of example but without limitation, for any damage to timber, forest growth, regeneration, improvements or to any of its operations on the forest management area; and provided further that the Company shall not be entitled to compensation for damage to timber or forest growth caused by any such geological or geophysical exploration where the right to such timber has been granted to a third party under a timber disposition;

(c) the right to maintain and enhance forest resources, including fish and wildlife resources, provided the Company's right to establish, grow, harvest, and remove timber is not significantly impaired; and

(d) the right to authorize trapping and, after consultation with the Company, to authorize domestic stock grazing provided that the domestic stock grazing will not damage regeneration of managed species to the point where growth performance and the overall stocking are reduced below the reforestation standards provided for in or agreed to pursuant to the Timber Management Regulation and provided that the Company's right to establish, grow, harvest, and remove timber is not significantly impaired.

(2) The Minister also reserves the following rights to the timber on the forest management area:

(a) the right, after consulting with the Company, to issue timber dispositions to provide timber for local use in construction and maintenance of public works by any local authority, municipality, county, the Crown in the right of Alberta or Canada, and for local residents for their own use or sale provided the total volume of timber cut under authority of such timber dispositions on the forest management area in any forest management operating year does not exceed:

(i) 8,634 cubic metres of the Company's approved coniferous annual allowable cut; and

(ii) 10,000 cubic metres of the Company's approved deciduous annual allowable cut to be sourced from secondary deciduous harvest and provided that the Company is not utilizing deciduous timber in the Company's own facilities.

Should the volume of timber available under this subparagraph 8(2)(a) remain unused on a periodic basis, the Company may request to harvest and utilize this volume;

(b) the right, after consulting with the Company, to issue timber dispositions on the forest management area to those disposition holders listed in Appendix "B", but shall not issue any new or additional quota certificates except in the case where the Minister intends to convert Community Timber Program permits to quota certificates;

(c) the right, after consulting with the Company, to manage and reforest tree species on those lands which are subject to the allocations and timber dispositions referred to in subparagraph (2)(a) which may be required to maintain the annual allowable cut as set out in the approved forest management plan; and

(d) notwithstanding subparagraph (2)(b), the right, after consulting with the Company, to issue long term deciduous timber allocations and related deciduous timber licences for the deciduous timber in volume supply area 2.

(3) The Minister and the Company agree to provide, each to the other, in confidence, such available information as the Minister and the Company may reasonably request concerning the operations on the forest management area that are authorized under timber dispositions. The Minister shall consult with the Company on an ongoing basis as may be required to minimize any conflict on the forest management area between the operations authorized under the timber dispositions issued pursuant to subparagraph (2) and the operations of the Company.

FOREST MANAGEMENT

A. GENERAL PROVISIONS

9 On the forest management area, the Company shall, in accordance with the approved forest management plan, follow sound forest management practices designed to provide a perpetual sustained yield of timber from the productive forest land, while not reducing the productivity of the land.

10 (1) The Company shall submit a forest management plan in accordance with the forest planning standards for the Minister's approval on or before April 1, 2011 and a new forest management plan on or before April 1, 2021.

(2) Each forest management plan developed under subparagraph (1), when approved, shall replace the previously approved forest management plan.

(3) Before the Company submits a forest management plan referred to in subparagraph (1) to the Minister for review and approval, the Company shall make the necessary arrangements required for and shall conduct presentations and reviews of their proposed forest management plans with the public and timber disposition holders in accordance with the forest planning standards as well as with potentially affected First Nations, including but not limited to First Nations having Reserve land located within or in close proximity to the forest management area and such other potentially affected First Nations as may be identified by the Minister to the Company in writing from time to time.

(4) After such presentations and reviews referred to in subparagraph (3), the Company shall incorporate in the forest management plan its response to the public, First Nations, and timber disposition holders respecting the proposed forest management plan.

(5) The Minister may require the Company, after consulting with the Company, to alter any of the methods described in its forest management plans before approving such plans provided, however, that the changes required by the Minister are consistent with the forest planning standards.

(6) The Minister agrees that so long as a plan required under this paragraph has been submitted by the Company within the time periods herein specified and provided such plan complies with the requirements of this Agreement, unless the Minister has sent a notice under paragraph 12, the Company is hereby authorized to continue to carry on its operations pursuant to the existing approved plan, pending approval being granted by the Minister to the newly submitted plan.

(7) Should the company fail to submit a forest management plan by the dates identified in subparagraph (1) or the submitted plan is not satisfactory to the Minister, without in any way limiting the Minister's other rights or remedies hereunder, the Minister may set new dates by reasonable notice in writing for revised forest management plan submissions.

(8) The Company shall co-operate with the development and implementation of integrated land management initiatives to the satisfaction of the Minister.

11 (1) The Company shall not digress from the approved plans without the Minister's consent in writing, with the understanding that the Minister shall provide a full explanation whenever consent is withheld.

(2) Notwithstanding subparagraph (1), the Company may continue operations under approved plans submitted pursuant to the forest management agreement authorized by O.C. 796/85 until such time as those plans are either replaced by plans approved under this Agreement or the Minister deems the existing plans obsolete or inadequate pursuant to paragraph 12.

12 (1) When, in the opinion of the Minister, any approved plan becomes obsolete or inadequate, the Minister may, by reasonable notice in writing, require the Company to submit a revised plan for approval within a specified time, or within any extended time the Minister may subsequently allow.

(2) In the event the Minister's dates for forest management plan submission under paragraph 10(1) or revised dates under paragraph 10(8) are not met or the Minister requires the Company to submit a revised plan under subparagraph (1), the Minister may, after consulting with the Company, impose remedies until such time as a new revised plan is approved. The remedies may include but are not limited to:

(a) imposition of an annual allowable cut;

(b) modification of the approved harvest sequence;

(c) adjustment of the yield curves used in the approved forest management plan; and/or

(d) the requirement to develop cooperative landscape objectives.

(3) If the Minister adjusts the dates for forest management plan submission under paragraph 10(7), the Company may continue to carry out operations in accordance with the approved forest management plan as modified by any remedies imposed by the Minister under subparagraph (2).

13 (1) The Company shall recommend, in its forest management plans, areas available for harvesting by other timber disposition holders on the forest management area.

(2) The Minister shall consult with the Company concerning proposed areas and methods of harvesting by holders of timber dispositions on the forest management area before designating the areas in which their operation may be carried on.

(3) The Company shall, through sustainable forest management planning, make reasonable efforts to integrate and coordinate the management of the forest resources with all timber disposition holders operating on the forest management area.

(4) The Minister shall require third party timber disposition holders operating within the forest management area to conduct all harvesting operations in accordance with the Company's approved plans and to refrain from hindering or obstructing the lawful operations of the Company.

14 (1) The Company shall conduct such forest inventories of the forest management area as are necessary to prepare the plans required by this Agreement.

(2) The Company shall maintain a reasonably complete and accurate forest inventory in accordance with forest planning standards.

(3) Unless otherwise agreed to by the parties, the Company shall maintain or participate in a deciduous and coniferous growth and yield program consistent with prevailing standards and policies and acceptable to the Minister on lands within the forest management area.

15 All information and data related to the forest management area that has been collected or generated by the Company or the Minister relating to forest management planning including forest inventory, other resource uses, growth and yield data, reforestation results, and operational and detailed planning maps shall be made available to the Minister, or the Company, whichever is the case, free of charge upon request and on a timely and confidential basis.

16(1) The Company shall conduct its timber harvesting and reforestation operations in accordance with the approved ground rules jointly developed by the Company and the Minister until such time as they are replaced by the new set of ground rules developed in accordance with subparagraphs (2) or (3).

(2) Concurrently with the development of the forest management plans developed under paragraph 10(1), or at such time as may be agreed to by the Minister and the Company, the Minister and the Company shall jointly develop a new set of ground rules consistent with the forest management plans.

(3) If a set of ground rules, or a revision to a set of ground rules, cannot be established by mutual agreement, the Minister may establish or revise a set of ground rules that are consistent with the approved forest management plans and the "Timber Harvest Planning and Operating Ground Rules" published by the Minister, as amended from time to time.

(4) At the initiative of either party, the Minister and the Company shall jointly review the ground rules. These ground rules may be altered by mutual agreement of the Minister and the Company.

17 (1) The term of this Agreement shall be divided into four cut control periods each with a duration of five years or as otherwise agreed by the Minister and the Company.

(2) If the Company over cuts the periodic allowable cut, the Minister may, after consulting with the Company, reduce the periodic allowable cut during the subsequent cut control period by any amount up to the entire over cut volume at the Minister's sole discretion.

(3) Where production is lower than the periodic allowable cut, the Company may submit a program satisfactory to the Minister making up the under cut volume in the subsequent cut control period, or such other period as may be approved by the Minister.

18 (1) The Company shall forthwith following the commencement date establish a forest management operating year that shall commence and end on dates approved by the Minister.

(2) The Company shall submit to the Minister annual operating plans in accordance with the ground rules referred to in paragraph 16.

(3) Each annual operating plan shall be prepared in accordance with the approved forest management plan and include operating projections showing the proposed harvesting operation intended by the Company. Such operating projections shall be in accordance with the forest planning standards and shall cover the period of time specified in the ground rules referred to in paragraph 16.

(4) The Minister may approve such plans as are submitted, or may require the Company, after discussing any proposed changes with the Company, to alter any harvesting operations described in the plans, provided that the Minister shall not thereby alter the ground rules and acts promptly so as to avoid delay in the Company's operations.

(5) When the annual operating plan does not provide for the salvage of dead, damaged, diseased, or decadent timber, the Minister may give notice to the Company that the Minister requires provision for its salvage in such a plan. The Company shall amend the plan, or justify the exclusion of such timber from its plan within the notice period specified below. If the Company fails or elects not to do either within such period, the Company shall not be deemed to be in default and the Minister may dispose of such timber to any person by a timber disposition without compensating the Company and the volume of timber so disposed may be charged by the Minister as production under this Agreement. For the purposes of this subparagraph, "notice period" shall mean thirty (30) days, unless the timber disposition exceeds two years, in which case "notice period" shall mean one year.

(6) When the annual operating plan does not provide for the utilization of all fibre generated as a result of the Company's harvesting operations, the Minister may give notice to the Company that the Minister requires provision for its utilization in such a plan. The Company shall amend its plan, or justify the exclusion of such fibre from its plan within the notice period specified below. If the Company fails or elects not to do either within such period, the Company shall not be deemed to be in default and the Minister may dispose of such unutilized fibre to any person by a disposition without compensating the Company. For the purposes of this subparagraph, "notice period" shall mean thirty (30) days, unless the disposition exceeds two years, in which case "notice period" shall mean one year. No such disposition shall authorize any activities that might reasonably be expected to hinder or obstruct the lawful timber operations of the Company.

19 The Company shall utilize all the merchantable timber cut in road construction and other incidental operations of the Company unless otherwise permitted in writing by the Minister.

20 (1) The Company shall not hinder or obstruct the lawful timber operations of other timber disposition holders.

(2) It is recognized that during their operations, other timber disposition holders may cause some incidental damage to timber on the forest management area. No claim shall be made by the Company against any timber disposition holder, or the Minister, for reasonably unavoidable incidental damage to timber.

(3) The Minister shall ensure that all timber dispositions issued on the forest management area after the commencement date shall include a provision preventing a claim against the Company for reasonably unavoidable incidental damage to timber.

(4) The Minister shall require other timber disposition holders operating within the forest management area to conduct all harvesting operations in accordance with the Company's approved ground rules and to refrain from hindering or obstructing the lawful operations of the Company.

B. REFORESTATION

21 (1) The Company shall reforest at its own expense all lands cut over by the Company under this Agreement and under the Forest Management Agreement authorized by O.C. 778/88 to the required reforestation standard and shall describe its reforestation program in its forest management plans and annual operating plans.

(2) In this Agreement the required reforestation standard means the reforestation standards provided for in or agreed to pursuant to the Timber Management Regulation.

22 (1) As part of its operations under this Agreement, the Company shall, at its sole expense, furnish all of the seedling trees and propagules required for it's reforestation needs.

(2) Seed, seedling trees and propagules used for reforestation programs under this Agreement shall be produced in accordance with the rules established by the Minister governing the source and type of tree seed and species used to reforest public land.

23 (1) The Company shall be solely responsible for reforesting to the required reforestation standard all productive forested lands burned by fire within the forest management area, when the fire has been caused by or arises out of any operations or activities conducted on the forest management area by the Company, its employees, agents or contractors.

(2) The Company shall not be required to reforest lands cut over or burned after the commencement date unless such cutting or burning was caused by or arises out of any of the operations or activities conducted on the forest management area by the Company, its employees, agents or contractors.

24 The Minister shall be responsible for ensuring that forest lands on the forest management area cut over after the commencement date by persons other than the Company are reforested to the required reforestation standard.

25 The Company may devise and implement enhanced forest management programs. The Company and the Minister may enter into an agreement which will define the programs and conditions that, in the Minister's opinion, will establish a sustainable increase in the annual allowable cut approved by the Minister in the Company's forest management plans submitted under paragraph 10.

C. FOREST PROTECTION

26 (1) The Minister agrees to provide and maintain an organization of people and equipment necessary for the protection of the forest from and suppression of forest fires on the forest management area and, except as herein otherwise provided, to pay the cost of fighting any forest fire that originates on the forest management area on the understanding that the Minister shall not be liable for damages to the Company resulting from a failure to prevent, control or suppress any fire.

(2) Notwithstanding subparagraph (1), the Company shall pay the cost of suppressing any forest fire that originates on the forest management area if the fire is caused by or arises out of any of the operations or activities conducted on the forest management area by the Company, its employees, agents or contractors; provided, however, that in no event shall the liability of the Company exceed the liability provided for in a separate Fire Control Agreement which has been negotiated and entered into by the Minister and the Company. If the cause of any fire is disputed by the Company, the dispute shall be resolved by means of civil suit in the Courts of Alberta.

(3) If a Fire Control Agreement between the Minister and the Company is more than five years old at the commencement date, then notwithstanding any provision in that Fire Control Agreement, that Fire Control Agreement will terminate on the first anniversary of the commencement date unless it has been replaced by a new Fire Control Agreement or the Minister has directed otherwise.

(4) Where there is no Fire Control Agreement in effect, the Company agrees to have on hand in good working order such fire fighting equipment as specified in the Forest and Prairie Protection Regulations and shall train its employees in fire suppression as reasonably specified by the Minister.

(5) Notwithstanding anything contained in this Agreement, the Company shall not be liable for loss of or damage to Crown timber by fire that is caused by or arises out of any of the operations or activities conducted on the forest management area by the Company, its employees, agents or contractors.

(6) In the event of an occurrence of insect damage of epidemic nature to forest growth or a disease epidemic affecting forest growth on the forest management area the parties hereto will cooperate in suppressing the epidemic.

RECORDS AND SCALING

27 (1) All scaling and measuring of timber weights and volumes by or on behalf of the Company shall be conducted in accordance with the Timber Regulation, the Scaling Regulation and the published instructions of the Department.

(2) Consistent with subparagraph (1), the Company shall maintain, in the form and in the manner approved by the Minister, complete and accurate records of its operations conducted on the forest management area.

(3) The Minister, or any person authorized by the Minister, may inspect the records maintained by the Company pursuant to subparagraph (2).

28 (1) Unless otherwise prescribed in the Timber Management Regulation, within thirty days of the termination of every calendar quarter, the Company shall submit to the Minister in writing, on a form prescribed by the Minister, a return reporting:

(a) the volume of timber cut by and for the Company;

(b) the volume of timber cut or destroyed by others for which the Company is entitled to compensation under this Agreement;

(c) at the request of the Minister, the volumes of primary timber products manufactured and sold by and for the Company from its operations in Alberta;

(d) at the request of the Minister and on a confidential basis, the volumes of timber and primary timber products purchased for use in its facilities, the names of all persons from whom timber and primary timber products were purchased, and the land from which the timber was cut; and

(e) at the request of the Minister and on a confidential basis, the geographic destination of timber and primary timber products sold by the Company from its operations in Alberta.

(2) The Company shall remit to the Minister with each timber return the amount of all dues payable by the Company for the volume of timber shown on such returns.

CHARGES AND DUES

29 (1) Once a year during the term of this Agreement, the Company shall pay to the Minister on or before a date specified by the Minister, a holding and forest protection charge.

(2) (a) Initially, the charge in subparagraph (1) will be $413,746.79.

(b) The holding and forest protection charge established in subparagraph (2)(a) shall be adjusted upon approval of a new forest management plan submitted in accordance with paragraph 10.

(3) Subsequent holding and forest protection charges shall be adjusted annually on the anniversary of the commencement date using the Annual Implicit Price Index for government current expenditure in goods and service, as published by Statistics Canada, in the following formula:

$$\text{Charge for Year of Payment} = \text{Charge for Previous Year} \times \frac{\text{Index for Year Prior to Year of Payment}}{\text{Index for Second Year Prior to Year of Payment}}$$

Example:

$$\text{2009 Holding and Forest Protection charge} = \$413{,}746.79 \times \frac{\text{2008 Index}}{\text{2007 Index}}$$

In the event that the Annual Implicit Price Index is no longer published or in the event of a change in the method used to calculate the Index, the Minister and the Company shall mutually and reasonably agree on a comparable published index to be used in the above formula.

(4) Notwithstanding subparagraphs (1), (2), and (3), the Lieutenant Governor in Council may by regulation establish the amounts of annual holding and forest protection charges to be paid by the Company. After five years following the commencement date, if the holding and forest protection charges are established by regulation then the holding and forest protection charges established by regulation shall replace those charges established under this paragraph provided those regulations are of general application (subject only to limitations imposed by contract).

30 (1) For all timber on the forest management area cut by or for the Company or for which the Company is entitled to compensation, the Company shall pay to the Minister timber dues at the rates established under the Timber Management Regulation.

(2) The Company shall co-operate with the reconciliation of timber production and dues associated with the timber production on an annual basis or as mutually agreed upon in accordance with the methods prescribed by and to the satisfaction of the Minister.

31 (1) The Company shall maintain a program or programs to enhance its ability to establish, grow, harvest, and remove timber and the level of understanding of forest resources and forest products within Alberta. The minimum annual expenditure by the Company in respect of such a program or programs shall equal or exceed, on average, during each five (5) year term of this Agreement, $0.25 per cubic metre per year based on all timber cut by or for the Company from the forest management area. The annual funding shall be comprised of direct funding of Canadian research or academic institutes, cooperatives, consultants, in-Company innovations in manufacturing and harvesting technology, silviculture, tree improvement and costs associated with the hiring of scientific personnel in the Company.

(2) The Company shall annually or as otherwise requested by the Minister provide a report that details the activities of the program referred to in subparagraph (1).

FACILITY OPERATION

32 The Company shall notify the Minister, in writing, of any intended major reduction in production levels of its manufacturing facilities, and such notification shall be submitted to the Minister at least six weeks prior to the intended reduction taking effect.

33 (1) If, at any time, the Company's manufacturing facilities in Grande Prairie, Alberta cease to be in production and operation for a period of twelve consecutive months the Minister shall have the right to issue short-term timber dispositions to third parties on the forest management area for up to 100% of the approved annual allowable cut until such time as the Company advises the Minister in writing of its intentions to resume production and operation of the manufacturing facilities. The volume of timber harvested under timber dispositions issued to third parties under this paragraph shall be charged as production under this Agreement.

(2) Notwithstanding subparagraph (1), if the Company submits a proposal prior to the end of the twelve consecutive month period referred to in subparagraph (1) that is acceptable to the Minister for the utilization of timber harvested from the forest management area in another facility, the

Company shall retain all of its rights under this Agreement and the Minister shall not issue timber dispositions to third parties on the forest management area.

(3) If the facilities referred to in subparagraph (1) ceases to be in production and operation for a cumulative, but not necessarily consecutive, period of thirty-six months, the Minister shall have the right to cancel this Agreement.

(4) At the Minister's request, on a confidential basis, the Company shall report on value added initiatives in relation to commercialization of products, new product development, strategic partnerships, and forest management and fibre utilization.

(5) The Company shall make a minimum of five percent of its primary solid wood products available for sale to secondary manufacturers, subject to terms and conditions acceptable to the Company. The Company shall submit a report annually, or as otherwise requested by the Minister, regarding the activities designated by this subparagraph.

GENERAL PROVISIONS

34 (1) If the Company at any time makes default under any of the covenants, terms, conditions, provisions, agreements or stipulations in this Agreement, the Minister may give notice to the Company setting out the default complained of and requiring the Company to remedy the default within six months of the giving of notice.

(2) The Minister may from time to time extend the period during which the Company is required to remedy any default complained of in a notice given pursuant to subparagraph (1).

35 The Minister shall have the right to have the Company perform all of its covenants, terms, conditions, stipulations, provisions, agreements and obligations as contained in this Agreement or to sue the Company for damages for any breach or breaches thereof and the Minister shall also have the right to cancel this Agreement as set forth in paragraph 37 provided the remedies available to the Minister under paragraph 33 shall be limited to those set out in paragraph 33.

36 When any default or delay by the Company in the performance or observance of any of the terms, conditions, provisions, agreements, covenants or stipulations of this Agreement is occasioned in whole or in part through:

(a) industrial disputes;

(b) governmental review or judicial proceedings respecting the possible environmental impact of the forest products manufacturing facilities or woodlands operations; or

(c) interruption which is not the result of any wilful or negligent act or omission by the Company, such as power failure, fire, sabotage, tempest, war or acts of God

and not avoidable by reasonable effort or foresight, the Company shall not be deemed in default under this Agreement and the time for performance or observance of such term, condition, provision, agreement, covenant or stipulation shall be extended by such reasonable period of time as the Minister may specify in writing to the Company.

37 (1) Except as otherwise provided in paragraph 33, the Minister may, by giving to the Company ninety days notice in writing, cancel this Agreement when:

(a) any goods or chattels of the Company, located at the pulp mill or sawmill facilities located in Grande Prairie, Alberta, and which constitute a material part of the Company's assets located thereat, are lawfully seized or taken in execution by a creditor of the Company, and the Company has failed to take any legal action to contest the same within ninety days after such seizure or taking, or

(b) the Company makes any general assignment for the benefit of its creditors or an assignment in bankruptcy or takes the benefit of any Act in force for bankrupt or insolvent debtors, or

(c) the Company fails from time to time to observe or perform any of the covenants, stipulations, terms, conditions, provisions or agreements required to be observed or performed by the Company under this Agreement, and having been given notice of such failure under paragraph 34 of this Agreement, fails to remedy such failure within the time allowed by the said paragraph for so doing, or any extension thereof given by the Minister.

(2) Subparagraphs (1)(a) and (b) do not apply if a trustee for the holders or receiver managers or the holders themselves of bonds, debentures, or other securities of the Company exercises any rights or remedies contained in any deed of trust or mortgage or other agreement under which such bonds, debentures or other securities are issued or secured, including but without restricting the generality of the foregoing, the taking of possession by the trustee, receiver managers or the holders themselves of the Company's properties and assets and the operation or disposition thereof for the benefit of the holders of the Company's bonds, debentures or other securities.

38 The Minister does not guarantee any quality or quantity of timber on the forest management area.

39 No implied contract of any kind by or on behalf of the Minister shall arise or be construed from anything contained in this Agreement and the only rights, powers and privileges granted to the Company are those contained in this Agreement.

40 The Minister and the Company agree that the lines on the map shown in Appendix "A" hereunto annexed are intended, where those lines outline areas that are not surveyed, to be the survey lines of the townships, sections, or half sections, as the case may be, that would exist if such areas were surveyed under the system of township surveys prescribed by the *Surveys Act*.

41 The Company shall comply with and observe all the provisions and requirements of all Acts of the Province of Alberta and the regulations thereunder in force from time to time that apply to the Company or to this Agreement either specially or generally by express wording or by implication.

42 The Company shall, during the term of this Agreement, maintain an office in the Province of Alberta and maintain a registration under the *Business Corporations Act* and its regulations.

43 (1) Except for a dispute as to the cause of any fire referred to in paragraph 26(2), where any dispute arises between the parties to this Agreement concerning the application or interpretation of this Agreement, the dispute may be referred to arbitration pursuant to the *Arbitration Act* but only upon the mutual agreement of both parties.

(2) Where both parties do not agree to refer a dispute concerning this Agreement to arbitration as provided in subparagraph (1) the dispute shall be resolved by means of civil action before the Courts of the Province of Alberta.

44 (1) The Company shall not assign this Agreement or any of the rights granted to it by this Agreement without the consent of the Minister in writing and such consent may, in the Minister's sole discretion, be withheld. Where the Minister refuses consent to an assignment, the Minister shall advise the Company in writing of the reasons for so refusing.

(2) Subparagraph (1) does not apply to:

(a) the employment of one or more contractors in the normal conduct of its operations;

(b) an assignment or transfer of this Agreement by way of mortgage or charge or the grant of a security interest in this Agreement to lenders to or trustees for lenders to the Company; or

(c) an assignment or transfer to a person, firm or corporation upon the sale or other disposition by or on behalf of lenders to or trustees for lenders referred to in subparagraph (2)(b) in the course of realization or enforcement of security against the manufacturing facilities, provided that such assignment, transfer, or other disposition shall not be made without the consent of the Minister in writing. Where the Minister refuses to consent to an assignment, the Minister shall advise the lenders or trustees for lenders, as the case may be, in writing of the reasons for so refusing.

45 Any waiver by the Minister of the strict performance by the Company of its covenants or of any term, condition, stipulation, agreement or provision under this Agreement is not binding upon the Minister

unless such waiver is expressed in writing under the authority of the Minister and any such waiver or any extension of time granted by the Minister hereunder shall not abrogate such or any covenant, term, condition, stipulation, agreement or provision herein or constitute a waiver or extension of time as to any subsequent breach of the same or any other covenant, term, condition, stipulation, agreement or provision herein.

46 The Company covenants and agrees to observe, perform and keep all covenants, terms, conditions, stipulations, agreements and provisions herein on its part to be observed, performed and kept and time shall be and remain of the essence thereof and notwithstanding any binding waiver given by the Minister as referred to in paragraph 45 or any extensions of time given by the Minister under this Agreement that thereby may affect the time for performing any particular act, covenant, term, condition, stipulation, agreement, or provision of this Agreement herein, time shall remain of the essence pertaining to all subsequent performance by the Company of any and all acts, covenants, terms, conditions, stipulations, agreements and provisions herein contained and to this entire Agreement.

47 (1) The Company assumes liability for and shall pay all claims of the Minister for all damages to any real or personal property (other than timber) of the Crown that was caused by, or arising out of, any of the operations or activities conducted on the forest management area by the Company, its employees, agents, or contractors, whether or not the damage so caused is due to the negligence of the Company, its employees, agents, or contractors, as the case may be, provided that such liability under this subparagraph shall not include economic loss or incidental and consequential loss and damage.

(2) Subparagraph (1) shall not restrict, in any manner, the ability of the Minister to pursue the Company under the common law (as opposed to pursuant to this Agreement) for economic loss or incidental and consequential loss and damage, which liability may be resolved by means of arbitration pursuant to the *Arbitration Act* with the mutual agreement of both parties, or failing such agreement, by civil action before the Courts of the Province of Alberta.

48 (1) The Company agrees to hold the Minister harmless against any and all third party claims, demands, or actions for which the Company is legally responsible, including those arising out of negligence, wilful harm, or crimes by the Company or its employees or agents.

(2) Subparagraph (1) does not apply to any claim alleging interference with an aboriginal right or title by the Company, its employees, agents or contractors provided the claim does not relate to a breach by the Company, its employees agents or contractors of this Agreement or the approved forest management plan or annual operating plans during the period of the alleged interference.

49 (1) The Company shall submit, in confidence, to the Minister, when required, any information, data, or documents the Minister may reasonably request in respect of matters relating to this Agreement for the purpose of verifying the Company's continued compliance with the terms of this Agreement.

(2) Where any information, data or documents are provided to the Minister in confidence under this Agreement, that confidentiality is subject to any restriction on disclosure or obligation to disclose imposed on the Minister by law including, without limitation, the *Freedom of Information and Protection of Privacy Act* (Alberta).

50 Any notice required to be given under this Agreement shall be deemed to be well and sufficiently given if delivered to the addresses set out below or if mailed at any post office in Canada by prepaid registered mail addressed as follows:

(1) to the Company:

Weyerhaeuser Company Limited.
Postal Bag 1020
Grande Prairie, Alberta
T8V 3A9

(2) to the Minister:

Minister of Sustainable Resource Development
Legislature Building
Edmonton, Alberta
T5K 2B6

or to such other address either party may from time to time inform the other party in writing, and any such notice shall be deemed to have been received on the fourth business day after the mailing thereof, or if delivered, when delivered; provided that if mailed should there be between the time of mailing and the actual receipt of the notice a mail strike, slow down or other labour dispute which might affect the delivery of such notice then such notice shall only be effective if and when actually delivered.

51 This Agreement is made subject to its approval by the Lieutenant Governor in Council.

52 This Agreement inures to the benefit of and is binding upon the Crown and Her assigns, and the Company and its successors and assigns if approved by the Minister in accordance with the provisions of this Agreement.

53 This Agreement shall be construed as having been made in the Province of Alberta and the laws of the Province of Alberta shall be applied in the event of any action or arbitration mutually agreed to, respecting any dispute arising from this Agreement, its formulation, interpretation, and each and every other aspect pertaining to or resulting from its entire contents.

IN WITNESS WHEREOF the party of the first part executes this Agreement under the hand of the Minister subscribed hereunder and the party of the second part executes this Agreement by subscribing hereunder the signatures of its duly authorized corporate officers at EDMONTON, Alberta this 5 day of FEBRUARY, 2008.

Her Majesty the Queen in Right of Alberta

Witness

Minister of Sustainable Resource Development

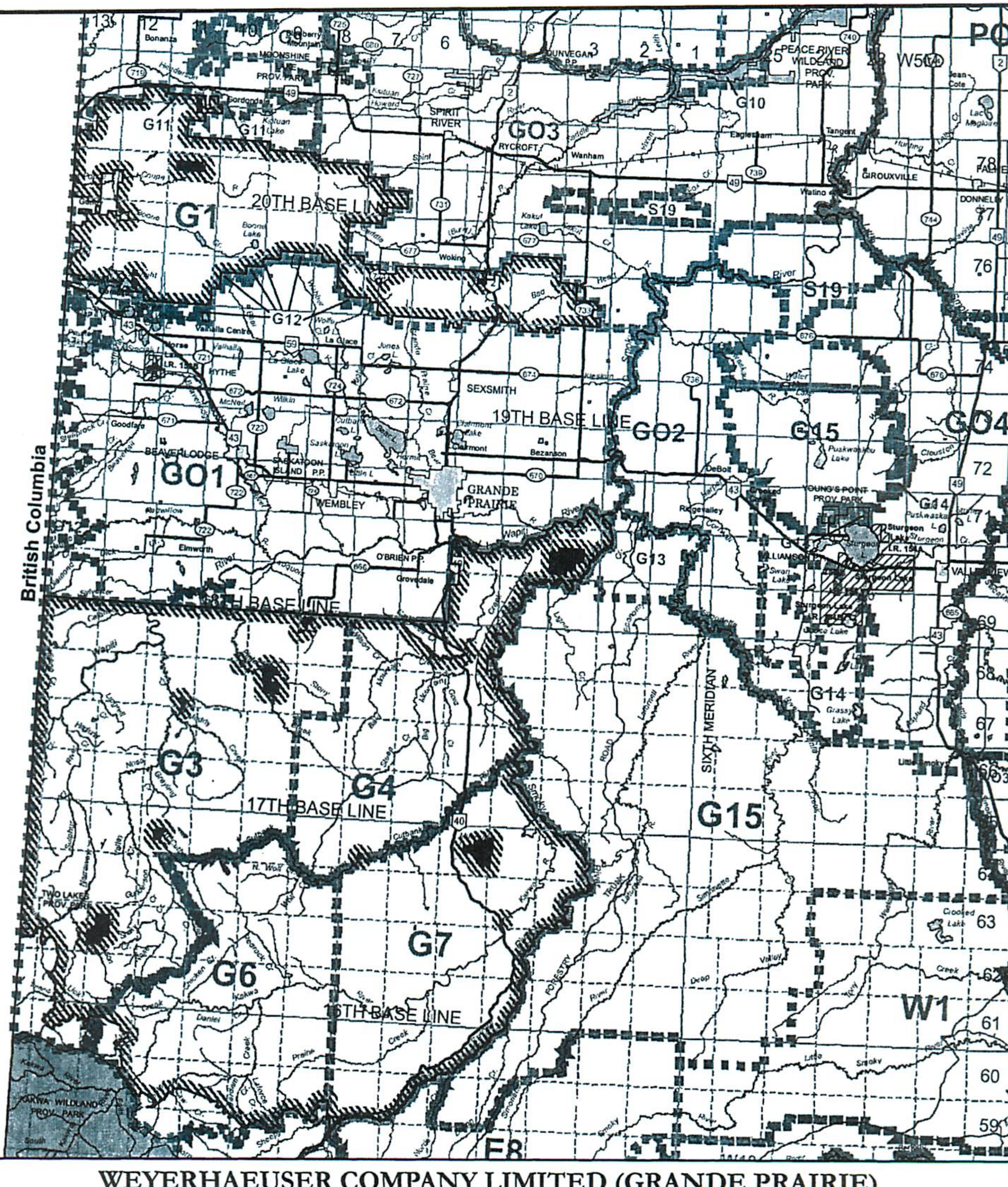
Weyerhaeuser Company Limited

Witness

Per:

Per:

Witness



WEYERHAEUSER COMPANY LIMITED (GRANDE PRAIRIE)
FOREST MANAGEMENT AREA
APPENDIX "A"

This is Appendix "A" to the memorandum of agreement dated February 5, 2008 between HER MAJESTY, THE QUEEN, in right of the Province of Alberta and WEYERHAEUSER COMPANY LIMIITED (GRANDE PRAIRIE)

Forest Management Area

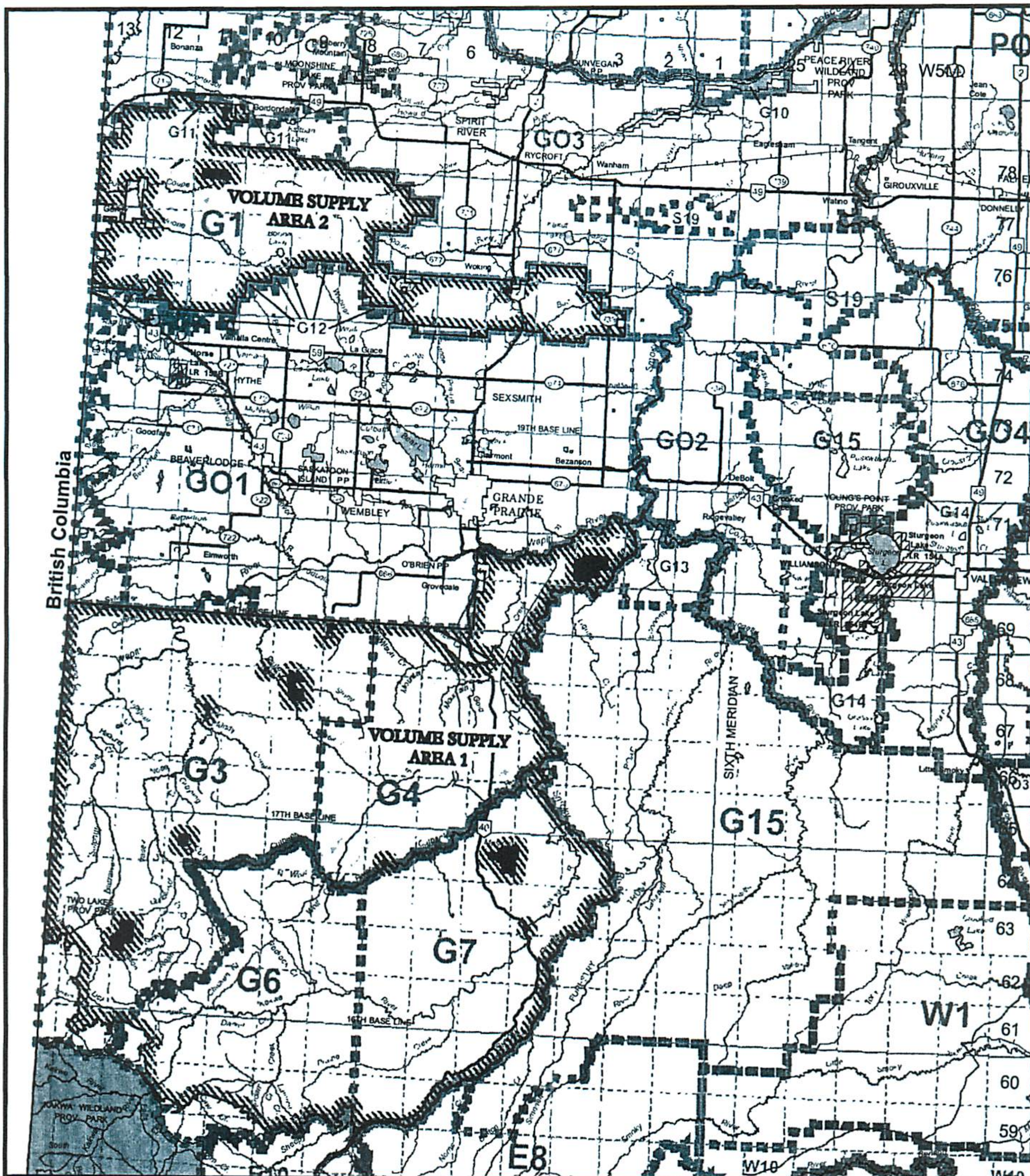
G6 Forest Management Unit

Area Deleted from FMA

APPENDIX B

LIST OF THE HOLDERS OF DECIDUOUS TIMBER ALLOCATIONS ISSUED WITHIN THE FOREST MANAGEMENT AREA

1.	Ainsworth Lumber Co. Ltd.	DTAG910001
2.	Tolko Industries Ltd.	DTAG010001



WEYERHAEUSER COMPANY LIMITED (GRANDE PRAIRIE)
FOREST MANAGEMENT AREA
APPENDIX "C"

This is Appendix "C" to the memorandum of agreement dated February 5, 2008 between HER MAJESTY, THE QUEEN, in right of the Province of Alberta and WEYERHAEUSER COMPANY LIMIITED (GRANDE PRAIRIE)

Forest Management Area

Area Deleted from FMA

G6 Forest Management Unit

Volume Supply Area

Weyerhaeuser

Terms of Reference

2019-2029
Forest Management Plan

Weyerhaeuser Company Limited
Grande Prairie Alberta Timberlands
FMA#6900016

Submitted: July 19, 2017
Approved: August 1, 2017

Grande Prairie Timberlands; Postal Bag 1020; Grande Prairie, Alberta; T8V3A9

Executive Summary

This Terms of Reference (ToR) describes the processes and timelines for development of a new Forest Management Plan (FMP or Plan) for FMA #6900016. The FMP will provide a Timber Supply Analysis (TSA) in conformance with the Alberta Forest Management Planning Standard (AFMPS) version 4.1.[1]

This ToR is intended to ensure a timely submission of the Forest Management Plan that is acceptable to Weyerhaeuser Company Limited, has engaged key stakeholders appropriately in its development, and is suitable for approval by Alberta Agriculture and Forestry.

The preferred management strategy for this FMP will be selected using forest modelling tools and numerous sensitivity analyses as well as input gathered through PDT communications and consultation. Weyerhaeuser will use updated inputs, models and assumptions to build on the management strategies used in previous plans.

Work began on this plan in the spring of 2012 when Weyerhaeuser initiated a renewal of the inventory (AVI). In 2015, Weyerhaeuser transitioned our modelling tool from Woodstock/ Stanley to Patchworks. Weyerhaeuser plans to complete the FMP in the first half of 2019 and this ToR documents how we will achieve that goal. A Plan Development Team with core representatives from Weyerhaeuser (principle planner), the GoA and the imbedded quota holders (Norbord and Tolko) has been created for this purpose.

A Public Advisory Group (PAG) will be created in order to capture input from other stakeholders and the public. Indigenous input will be garnered via processes that are in conformance with The Government of Alberta's Indigenous Consultation Polices and Guidelines (http://www.indigenous.alberta.ca/policy-guidelines.cfm)

[1] In the event that a new AFMPS is published in the interim, some elements of the new standard may be implemented if agreed to by all parties.

Weyerhaeuser

Table of Contents

1.0 Purpose and Scope

The primary goal of this Terms of Reference (ToR) is to provide a framework that details the process for development of the next (2019–2029) Forest Management Plan (FMP or Plan) for Weyerhaeuser Grande Prairie (WY; Weyerhaeuser) in accordance with the *Alberta Forest Management Planning Standard V4.1 April 2006.*

This plan is being developed for FMA #6900016 and will replace the current approved FMP 2011-2021.

1.1 Submission Requirements

Weyerhaeuser will provide GOA with the following at the date of submission;

- 2 paper and 1digital (.pdf) copies of the report
- 1 digital copy of technical files (with password)
- Three RPF validated checklists describing the extent of compliance with applicable standards included with each submission (1. AFMPS Tracking sheet, 2. Responsible RFP Validation Sheet, 3. Senior Company RFP Validation sheet.)

1.2 Forest Resource Management Issues

Throughout the planning period, the Plan Development Team (PDT) will identify key issues that require resolution before proceeding with the next component of the FMP. The PDT will track discussions regarding each issue through to resolution. A separate document titled 'Issues and Management Direction Summary', will summarize each issue and resolution and become part of the final submission and approval.

1.3 Landbase Data

The FMA is divided into two disjointed spatial locations, the smaller "Saddle Hills" area to the north of Grande Prairie and the larger "main block" portion south of Grande Prairie (see Drawing #1).
The FMA falls entirely within FMU16 (see Drawing #2). The FMA is further divided into administrative compartments (cost zones), used in harvest sequence balancing. The compartment boundaries are currently under review and will be provided to the PDT at a later date.

The FMA serves as the main wood supply for Weyerhaeuser's Grande Prairie Lumber business and International Paper's pulp facility[2]. As well as Weyerhaeuser, there are two deciduous timber operators embedded in the FMA Area as overlapping Quota holders; Norbord Inc. and Tolko Industries Ltd. There is also a Community Timber Permit Program (CTPP) active in the FMA Area.

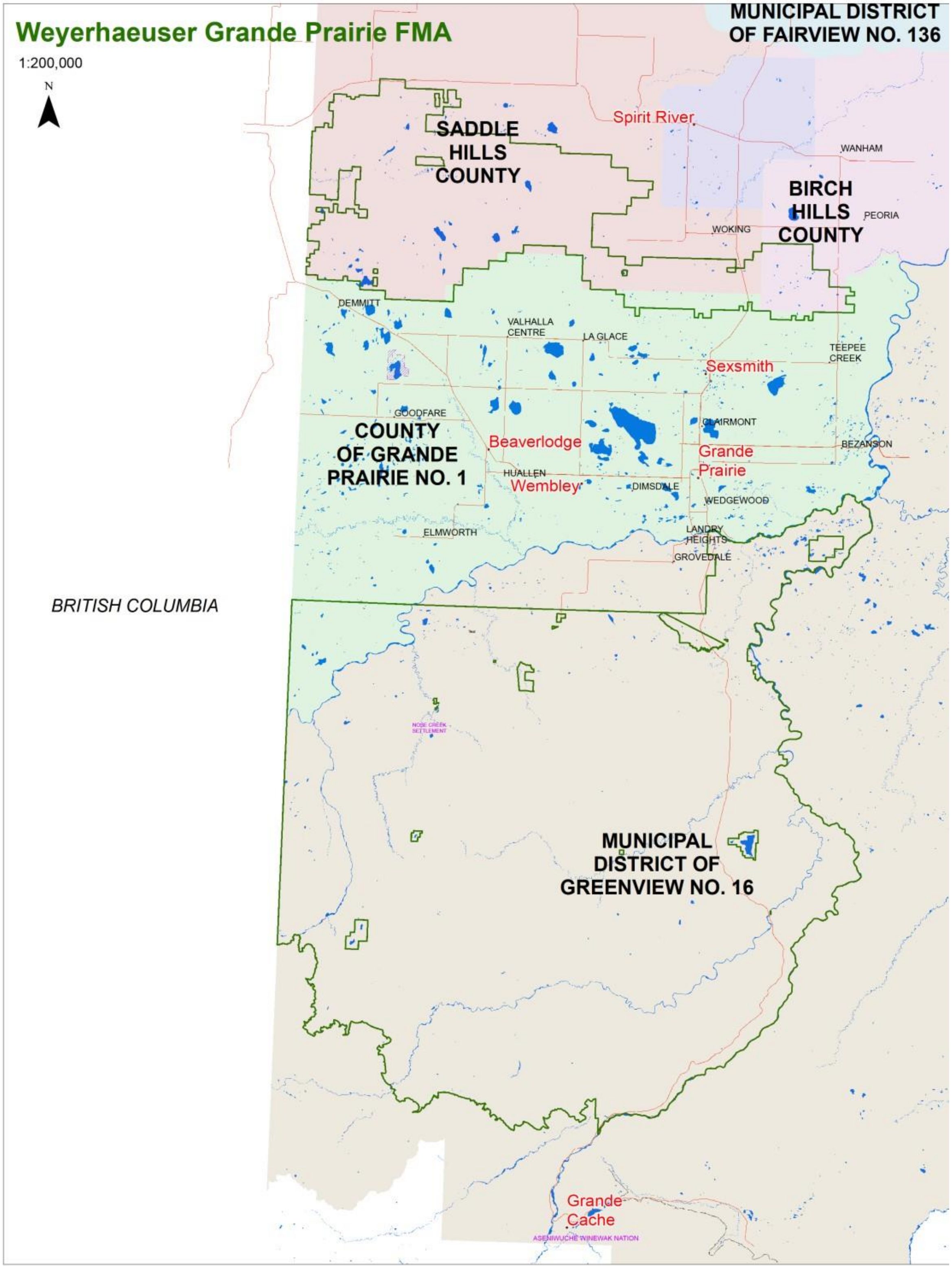
Oilfield developments are extensive across the area, and continue to have a major impact on the land base and forest management. Recreational use is also abundant, including off-roading, hunting, fishing, snowmobiling and camping.

The FMA is biologically diverse covering seven Natural Sub-Regions with two (Upper and Lower Foothills) making up 70% of the area. Subalpine and central mixed wood make up a further 25%.

[2] Weyerhaeuser Company Limited sold the cellulose fibre facility to International paper in December 2016. A long term sale agreement for pulp round wood is in place.

The Defined Forest Area for the 2019 submission will be the boundary of FMU16.

Drawing 1: FMA 6900016 and Municipal Government Boundaries



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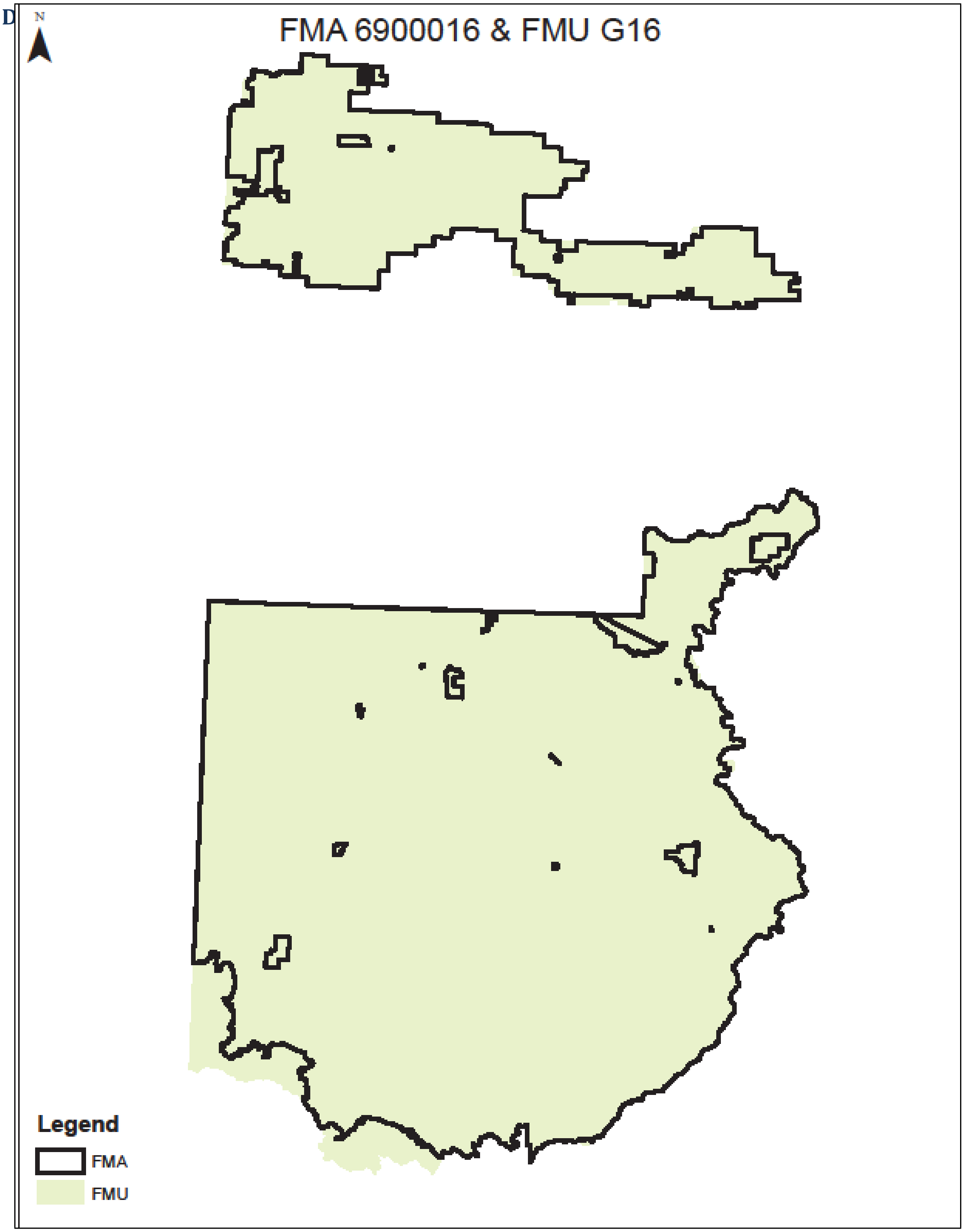

2.0 Timelines

This section of the Terms of Reference outlines a progressive review of all FMP components through to final submission and approval of the entire plan. The process for Plan development is complex and requires a detailed, coordinated schedule to ensure the timelines are met. The Project Plan below provides a brief summary of the timelines for the major components of the FMP. This list is not all inclusive and it should be perceived as a living document, which may be adjusted throughout the planning period to accommodate resources.

Accomplishments by May 1, 2017

- Complete Alberta Vegetation Inventory
- Initiate Plan Development Team (PDT)

Accomplishments by May31, 2017

- Submit Terms of Reference

Accomplishments by August 31, 2017

- Initiate Landbase Determination (Contributing and Non Contributing Landbase)

Accomplishments by October 1, 2017

- Initiate discussions on Values, Objective, Indicators and Targets (VOITs)
- Submit First Nations Consultation Plan
- Submit Public Involvement Plan
- Initiate Landscape Assessment

Accomplishments by December 31, 2017

- Initiate Yield Curve Development

Accomplishments by March 31, 2018

- Finalize and submit Landbase Determination Agreement in Principal Required
- Finalize and submit Yield Curves_______Agreement in Principal Required

Accomplishments by July 1, 2018

- Submit Landscape Assessment

Accomplishments by September 1, 2018

- Finalize Values, Objective, Indicators and Targets (VOITs)
- Initiate Silviculture Strategy discussions
- Initiate Timber Supply Analysis (TSA and PFMS)

Accomplishments by January 31, 2019

- Submit Silviculture strategies
- Submit Preferred Forest Management Strategies- The preferred management strategy will be comprised of compatible resource management strategies that best achieve the identified objectives.
- Initiate FMP document development

Accomplishments by April 30, 2019

- Submit FMP document Final Approval

Operating Ground Rules finalization **by September 1, 2019**

Weyerhaeuser

3.0 Internal and External Communication

3.1 Internal

Communication within the Plan Development Team (PDT) will be through:

- Regular meetings
- Distribution of meeting minutes and related documentation
- Distribution of documents, spatial data sets and any associated materials in support of the planning process

Core members of the PDT will have the responsibility to review all documents, minutes and decision communication with all necessary internal staff as the FMP is developed. GOA will manage input from the CTP groups as they see fit.

3.2 External

Weyerhaeuser will develop a Public Involvement Process (to be submitted as a separate Public Participation Plan) that records and summarizes Weyerhaeuser's efforts to engage the public as well as how public input and concerns will be documented, considered and how they will be implemented into the FMP. This will includes inquiries from the public and local stakeholders outside of a formal process.

Key elements for success in this public consultation process will be:

- Identifying who the key stakeholders are requiring involvement, and distinguishing such stakeholder from otherwise general public interests;
- Establishing supportive relationships with stakeholders and engaging them in a manner which is most convenient and appropriate for them;
- Recruiting those representatives of public interests who can offer capacity for quality input;
- Emphasizing facilitation, listening and feedback processes;
- Ensuring disclosure and ease of understanding of FMP information.

The approved FMP and associated approval documents will be posted on the GOA website, as will the FMA Operating Ground Rules (OGRs) and Stewardship Reports.

Weyerhaeuser will develop an Indigenous Consultation Plan (CP) that records and summarizes input and concerns from applicable Indigenous groups as they occur throughout the development of the FMP. This consultation plan will be consistent with the Government of Alberta's Indigenous Consultation Polices and Guidelines (http://www.indigenous.alberta.ca/policy-guidelines.cfm)

4.0 Resources

In addition to Alberta Agriculture and Forestry (GOA) requirements, Weyerhaeuser's own policy will influence the development of the FMP which includes Weyerhaeuser's Environmental Core Policy, Sustainable Forestry Policy, and Weyerhaeuser's commitment to certification under the Sustainable Forestry Initiative.

Weyerhaeuser will be responsible for financing/resourcing the development of the FMP for the most part. Quota holders and GOA will be responsible for any internal resources they may require as part of this plan's development. Some data sharing agreements may come about during the development of the plan. If extra-ordinary financial burdens are placed upon Weyerhaeuser for scenario development specific to individual operator's desires, then there may be an expectation by Weyerhaeuser for financial contribution to pay for said scenarios, with the idea that additional scenario development will not unduly delay FMP submission timelines.

4.1 Base Assumptions

The goal of the planning exercise is to first establish baseline AAC's (Annual Allowable Cut) using updated AVI and updated net landbase information. Upon completion of the Timber Supply Analysis (TSA) and the establishment of baseline AAC's, a single management plan (FMP with TSA and SHS) will be developed to clearly define management objectives on the FMA.

This will be an "integrated" plan inasmuch that one operator may harvest on both landbases in an area under a pre-identified mixed wood management strategy.

The harvest sequence will be considered as a whole when assessing watershed impacts, habitat, access planning and ecological constraints, and attempts will be made to coordinate the timing of operations in an area.

The FMP will recognize that:

- Tolko's deciduous allocation of 80,000m3 is fixed and is specific to Saddle Hills (VSA2)
- the is 51,000m3 of deciduous that will remain unallocated
- 10,000m3 of deciduous will be allocated for Local Community Use
- 8,634 m3 of coniferous will be allocated for Local Community Use (CTP)
- Weyerhaeuser no longer seeks to maintain FMA-specified rights to pure deciduous stands (33,108 m3 from VSA1).

The Baseline AAC will incorporate the following assumptions in the analysis:

- Conifer landbase will be defined as all conifer (C) and mixed wood (CD & DC) stands (under review)
- Deciduous landbase will be defined as all pure deciduous (D) stands (under review)
- Mixed wood stands where the conifer component currently in the understory is at least 250 stems/ha, will be designated as conifer landbase.
- Mixed wood stand types will be regenerated on a "CD" trajectory.
- Conifer utilization is as per the current Operating Ground Rules.

- Deciduous utilization is as per the current Deciduous Timber Allocation Certificate
- The TSA will be run as per ABFMPS 5.8 A- i) 200 year planning horizon; ii) even flow timber supply up to a maximum 5% deviation on the primary and incidental conifer and deciduous; iii) the amount of operable growing stock will remain stable over the last quarter of the planning horizon iv) both total coniferous and deciduous volumes will be projected.
- Planned blocks will be included as operational constraints and will include previously released CTP blocks.

4.2 Scenarios

In addition, the following new scenarios will be investigated:

- Understand the fibre resource impacts of managing on a single versus a divided landbase. This distinction must be decided on before a Preferred Management Strategy can be selected.
- Understand the long-term fibre resource impacts of establishing minimum conifer and deciduous AACs based on facility needs. This includes the impacts of an accelerated deciduous harvest.
- Weyerhaeuser will be seeking to implement conifer genetic gain yield curves for second generation pine and spruce.
- Strategies and rate of harvest in caribou zones with consideration to MPB mortality and wildfire risks.
- Strategies and rate of harvest in highly susceptible MPB pine stands. TSA constraints to adequately model mortality of stands not harvested within an acceptable period.
- Strategies to understand and minimize impacts from stand transition due to MPB mortality.
- Strategies to understand impacts from mortality and stand transition due deciduous dieback.
- Strategies and rate of harvest in the deciduous landbase to address mortality. TSA constraints to adequately model mortality of stands not harvested in the first 4 periods.
- Understand DC to CD transitions and the feasibility of silviculture options to transition to maintain mixed wood stands.

*** It is important to note that this list of scenarios is not all inclusive and others may be added as agreed by the PDT.*

4.3 Non Timber Assessments

Weyerhaeuser will be responsible for, and GOA will provide input to, the following non-timber assessments:

i. Wildlife

- Woodland Caribou
- Grizzly Bear
- Trumpeter Swan
- Barred Owl
- Canada Warbler
- Bull Trout

ii. Watershed

- Water Quality & Quantity

iii. Wildfire

- Threat Assessment & FireSmart

iv. Natural Range of Variation

- Targets established for gross and contributing landbases
- Opening size targets and distribution
- Age class distribution
- Broad Cover Group distribution

v. Forest Health

- Mountain Pine Beetle
- Spruce Beetle

5.0 Roles, Responsibilities and Obligation of Participants

Weyerhaeuser will ensure that the Forest Management Plan (FMP) will meet the requirements of the Alberta Forest Management Planning standard and comply with all relevant legislation (Provincial and Federal). To ensure these requirements, Weyerhaeuser will consult with experts on an as needed basis and this process will be discussed at the Plan Development Team as required. Alberta, at its discretion, may refer the FMP or parts of it, in draft or final version to outside agencies, e.g. Federal counterparts.

5.1 Plan Development Team

The intent of the Plan Development Team (PDT) is to resolve the technical details of the FMP. Individuals on the team represent Weyerhaeuser, GOA, Norbord and Tolko. The PDT will be in place for the duration of the development of the Forest Management Plan.

Table 2 outlines the core individuals involved in the development of the Plan It will be the responsibility of the PDT to come to a consensus for agreement-in-principle for components of the Plan as it is developed. It will be the responsibility of GOA members to act as the regulatory body that outlines regulations, planning standards and other needs as identified from time to time.

Table 2 Plan Development Core Team Members

TEAM MEMBER	ORGANIZATION	DESIGNATION
Traci Carter	Weyerhaeuser, Grande Prairie	Strategic Forest Planning Lead
Gareth Davies	Alberta Agriculture and Forestry, Edmonton	Forest Resource Management Lead
Mark Feser	Alberta Agriculture and Forestry	Area Planning Forester (GP)
Dave Beck	Consultant for Norbord Inc.	Strategic Forest Planning Lead
Tim Gauthier	Tolko Industries Ltd.	Strategic Forest Planning Lead

Core membership is kept small by design and membership is expected to remain steady throughout the planning process. In the event a core member must be replaced, the appropriate amount of document review for the new member will be determined by the remaining PDT members.

Additional PDT members will include technical advisors from their business as required. Table 3 below identifies some of the advisers expected to participate in the development of the FMP, however this list is not all-inclusive. Experts deemed necessary by the PDT will provide input to help the PDT make decisions.

Table 3 Advisers to the Planning Development Team

ADVISOR	ORGANIZATION	DESIGNATION
Lyle Dechief	Weyerhaeuser, Grande Prairie	Forest Planning Manager
Greg Behuniak	Weyerhaeuser, Grande Prairie	Growth & Yield Forester
Vashti Dunham	Weyerhaeuser, Grande Prairie	Operational Planner/ G&Y
Neil Coates	Weyerhaeuser, Grande Prairie	GIS Specialist
Wendy Crosina	Weyerhaeuser, Canada	Canadian Forest Steward
Jeremy Hachey	Forsite Consultants Ltd.	TSA Analyst
Gyula Guylas	TheXLWiz Consulting	Growth and Yield specialist
Fred Radersma	Norbord Inc.	Woodlands Manager
Janis Braze	Alberta Agriculture and Forestry	Planning Team Section Head
Tim Heemskerk	Alberta Agriculture and Forestry	Grande Prairie Senior Forester
Mike Russell	Alberta Environment and Parks	Senior Wildlife Biologist
Adrian Meinke	Alberta Environment and Parks	Senior Fisheries Biologist
Daniel Martin	Alberta Agriculture and Forestry	Wildfire Management Specialist
Dion Lawrence	Alberta Environment and Parks	Approvals Manager, EAP
Greg Greidanus	Alberta Agriculture and Forestry	Senior Resource Analyst
John Diiwu	Alberta Agriculture and Forestry	Hydrology
Cosmin Tansanu	Alberta Agriculture and Forestry	Growth & Yield Analyst

i. Meeting Frequency and Location

The Plan Development Team will meet as required to keep current on the progress of components of the plan. The initial documented meeting will be held April 5 & 6, 2017 in Grande Prairie. Meetings will continue at least quarterly until final approval, at the discretion of the PDT members. Members may also be asked to comment on draft documents via email outside of the meetings. Unless otherwise determined, all meetings will continue to be held in Grande Prairie, Alberta.

ii. Attendance at Meetings

Identified core PDT members are expected to attend all PDT meetings so that all discussions, decisions and/or disputes can be documented in a timely manner. Attendance via conference call is acceptable (subject matter dependent), providing the majority of Core members deem it appropriate.

iii. Responsibilities & Meeting Documentation

Weyerhaeuser will chair the meetings. Weyerhaeuser will coordinate and provide logistics for all documented meetings. Weyerhaeuser will provide a minute taker for each documented meeting.
A timekeeper and other support roles will be identified at the meeting as the need arises.

The Plan Development Team is to achieve alignment on all components of the Plan prior to its completion.

Meeting proceedings and all decisions made will be recorded utilizing a standard form sheet and distributed to all members.

Expectations for all PDT members:

- Be fully engaged in the planning process
- Be objective and take an open view of issues being discussed
- Be effective communicators
- Read meeting material before attending the meetings to ensure that the committee can have full
- and informed discussion of agenda items

- Participate in consultation events/activities on drafts of the plan
- Provide technical advisors where required to provide clarification and/ or gain alignment.

iv. Meeting Etiquette

The Planning development Team will use the following guidelines when holding documented meetings.

- Notice of at least 30 days will be given when scheduling a documented PDT meeting
- Meeting format will be standard and will include at a minimum: introductions, review and acceptance of previous minutes, acceptance of agenda, completed follow-up, new agenda, new follow-up
- Members will be punctual and fully engaged during the time allotted
- Cell phone and tablet use will be respectful
- There will be a strong agenda and members will gate keep the time
- Thoughtful, prepared and respectful discussions are expected
- Minute keeping is the responsibility of the FMA holders and will be accurate and shared in a timely manner

5.2 Quota Holder and Community Timber Permit Program

Quota Holders covered by the Plan will have the opportunity to review, comment on, and where necessary, provide endorsement through their involvement in the Plan Development Team. It will be the responsibility of GoA to provide input for the CTP Program during the development of the Plan.

There will be two different methods to provide input into the plan:

1. Participating in the Plan Development Team. It is Weyerhaeuser's intent to allow for full involvement in the development of the Plan, and address all issues as they arise.

2. Providing comments directly to Weyerhaeuser upon receipt of direct mail-outs of sections of the Plan, or individual meetings held at the request of either the Quota Holder or Weyerhaeuser.

All documentation shared with or requested from, as well as all responses, outside of the PDT meeting minutes will be tracked by Weyerhaeuser.

5.3 Stakeholders, First Nations and the General Public

The Public Participation Plan will describe the involvement of the main stakeholder groups and the general public for input into development of the Plan, as will the First Nations Consultation Plan. Each of these documents will be approved under separate letter.

6.0 Conflict of Interest

PDT members will represent the interests only of the organization they represent. Persons who may be in a conflict-of-interest must disclose this, and the PDT has the option of excluding such individual(s) from any further discussions on the matter. If it becomes apparent to the PDT that the individual is not representing the interests of their agency, the individual will be approached by the PDT leads and given the opportunity to address the situation. If the potential conflict is not addressed to the satisfaction of the PDT leads, the dispute resolution process as defined in section 11 may be invoked.

7.0 Decision Making Methods

Progressive Review of the Plan Components and Final Approval of the FMP

The PDT will review all decisions regarding the technical details of the FMP during the development of the Plan, taking into account input from Advisers, other stakeholders and the general public. Section 1.7.1 of the Planning Standard (2006) outlines that as plan components are developed and agreement is made by the Plan Development Team, the PDT will recommend those components receive Agreement-in-Principle (AIP) with the understanding that Agreement-in Principle is not final approval, but rather GOA acceptance that the submission is acceptable to that point.

Prior to final submission of the plan, Weyerhaeuser will conduct a meaningful review of the entire FMP with key stakeholder groups including Quota Holders, First Nations, the Public Advisory Group and the general public. Comments may be solicited through One-on-One sessions or in a group session. Weyerhaeuser will submit the stakeholder comments, along with the actions taken to address these comments, with the FMP submission.

The FMP development process may be brought to an end when the GoA believes further discussions will be of limited value in moving the FMP to completion. When this authority is exercised, Weyerhaeuser will be directed to prepare the FMP for review by the PAG and PDT, followed by submission to the GoA for a decision.

Weyerhaeuser will initiate its FMP submission by making a comprehensive presentation of the work and data to the GoA.

Under this approach, when the final Plan is submitted, the 100 business-day review of the Plan by GOA should be sufficient to allow for the timely approval and implementation of the Plan.

8.0 Authority for Decisions

All participants of the Plan Development Team and invited advisers will operate in full authority of their respective organizations. The individuals must have the authority to make decisions that are binding with a view to the final product. GOA has final approval authority on the entire FMP process, including the new AVI, net land base determination, yield curve development and the timber supply analysis.

9.0 Mechanism to Adjust the Process

From time to time it may be necessary to amend the ToR to reflect new information or important changes that have occurred for the following reasons:

- Change in government policy
- Change in company management objectives or direction
- Issues that arise as a result of stakeholder involvement
- First Nation consultation process changes
- Directions from higher level plans, or
- Opportunities to incorporate strategies from other planning initiatives
- Any amendments will be made by consensus within the PDT.

10.0 Access to Information

The flow of information within the PDT will be uninhibited, unless it is deemed by Weyerhaeuser to be proprietary (i.e. financial or business related). The PDT will share information with their respective organizations as necessary. Individual PDT members will own this.

The First Nations Consultation Process and the Public Involvement Process will outline what type of information will be shared among those stakeholders.

11.0 Dispute Resolution Mechanism

Weyerhaeuser, Quota Holders, the GoA and stakeholders are able to express dissenting views during the development of the FMP. It is the intent of the process to allow for meaningful discussions to occur throughout the FMP planning process to resolve all issues before implementing a dispute resolution process.

The following describes the process for dispute resolution:

Step #1: Weyerhaeuser, the GoA, Quota Holders and/or major stakeholder group will attempt to come to some consensus on components of the FMP as they are developed

Step #2: If disputes arise that cannot be solved in step #1, the issue will be brought to the PDT for their review; if the PDT cannot resolve the dispute, or is unwilling to, continue on to step #3.

Step #3: If the issue is specific to a company or organization involved in the input or review of the Plan, that company, group of companies, or organization(s) can bring their issue to the attention of the Director, Forest Resources Management Section and the Forest Area Manager for resolution.

Step #4: If the issue is unresolved after step #3, then the issue will be brought to the attention of the Executive Director of the Forest Management Branch. The decision of the Executive Director will be binding upon all participants.

Weyerhaeuser

12.0 Operating Ground Rules (OGRs)

The ground rules are the standards for operational planning and field practices to ensure consistency with objectives outlined in the FMP. Therefore, it is essential that the ground rules are developed concurrently with the development of the management plan and that approval of the ground rules will be concurrent with approval of the FMP.

Upon approval of the FMP, the current approved set of Operating Ground Rules will be updated to reflect operating procedures that require amendment as a result of the FMP. The GOA Operating Ground Rules coordinator will manage the process, with the opportunity of all Quota Holders being involved in the process if they so desire.

13.0 Vegetation Inventory

Weyerhaeuser initiated a renewal of the Vegetation Inventory (AVI) in May of 2012 using the Alberta Vegetation Inventory Standards Version 2.1.1 (March 2005) and included both an assessment of the overstory and the understory. The AVI has been submitted and approved in phases and the final request for approval will be submitted under a separate process and incorporated into the Timber Supply Analysis.

14.0 Yield Projections

Yield Projections and the Reforestation Strategy Table will be submitted and agreed upon ("Agreement in Principle") in separate documents concurrent to the FMP approval process.

15.0 Stewardship Reporting

The Stewardship Report (SR) will summarize the first five years of performance as per the 'Stewardship Reporting Framework'. All timber operators are expected to contribute relevant information to the Stewardship report. The Stewardship Report will be submitted to GOA no later than December 1st, 2024.

16.0 Approval

This Terms of Reference document was approved as per the Terms of Reference Approval letter issued by the Director, Forest Resources Management on **August 1, 2017**. Revisions may be required and will be documented and approved as necessary.

Weyerhaeuser Company Limited
(Grande Prairie)

Wildfire Threat Assessment

Completed by: Alberta Agriculture and Forestry, Forestry Division, Grande Prairie Forest Area

APRIL 2019

Agriculture and Forestry, Government of Alberta

April 26, 2019

Weyerhaeuser Canada Ltd, FMA Wildfire Threat Assessment

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Introduction

Wildfires are part of a natural disturbance regime in the Canadian landscape. It shaped and formed the landscape we inherited. The aim of wildfire management is to balance the ecological role of fire while protecting human life, communities, watersheds and sensitive soils, natural resources, and infrastructure.

The goal of FireSmart forest management planning is to create a landscape in which catastrophic fire is minimized. This is accomplished through a combination of:

- Reducing the fire behaviour potential,
- Reducing the exposure of resources and assets to the negative impacts of wildfire,
- Targeted timber harvest in locations with problematic forest fuel types,
- The consideration of species conversion and reduce coarse wood debris retention in locations harvested near communities, and
- Ensuring linkages to other Fires Smart strategies such as Community Wildfire Mitigation Strategies

FireSmart landscapes are managed with the recognition of the interaction between the ecological, economic, and social impacts of fire while identifying opportunities for the use of timber harvest and other disturbance strategies build resilient communities and healthy, productive ecosystems.

Natural Sub Regions (NSR)

The Weyerhaeuser Grande Prairie Ltd. Forest Management Agreement (FMA) is located within vast and diverse forest cover types within Alberta. Within its boundaries, the FMA covers seven NSRs. These include the Central Mixedwood, Dry Mixedwood, Lower Foothills, Upper Foothills, Sub-Alpine, Alpine, and Montane NSRs (Figure 1). Both the Lower and Upper Foothills NSR comprise approximately 70% of the area within the FMA. When the Central Mixedwood NSR is added, it jumps to 82 percent while the remaining 4 NSR contribution to the productive / net land base is insignificant.

A good understanding of the fire regime for the NSR is critical in for optima management of wildfires and its impacts (consequences and benefits) to resources and assets on the landscape. Only 16 percent of the FMA is within the Boreal Natural Region for which the Canadian Forest Fire Danger Rating System (CFFDRS) was primarily developed from. Fire size and frequency in the Foothills NR is different than that of the Boreal NR and therefore it is very important to understand the assumptions and applicability of the model(s) being used.

The Lower Foothills NSR occupies approximately **48 percent** of the FMA. In this NSR, human-caused fires peak in May with lightning caused wildfires peaking later in the summer (Tymstra et al. 2005). Overall, the fire regime is considered to be one of frequent medium-sized fires (Tymstra et al. 2005).

The Upper Foothills NSR has a similar wildfire regime to the Lower Foothills NSR and occupies approximately **22 percent** of the FMA. The fire season peaks in July which results in frequent medium sized lightning caused wildfires (Tymstra et al. 2005).

The Central Mixedwood NSR is characterized by white spruce and trembling aspen forest cover types. The wildfire regime in this NSR is predominantly frequent small fires and infrequent large fires (Tymstra et al. 2005). Human caused fire occurrence peaks in May as aspen and mixedwood stands typically do not reach green-up until the end of the month (Tymstra et al. 2005). The central Mixedwood NSR occurs in approximately **12 percent** of the FMA.

The Sub-Alpine NSR occupies approximately **12 percent** of the FMA. This NSR is conifer dominated. The fire regime consists of infrequent small fires and very infrequent large wildfires (Tymstra et al. 2005). The majority of wildfires in the Sub-Alpine NSR occur in summer with a peak area burned in August (Tymstra et al. 2005).

The Dry Mixedwood NSR occupies approximately **4 percent** of the FMA. Provincially, the area burned in this NSR is quite small due to prompt detection and suppression. This NSR is characterized by small and frequent human-caused fires (Tymstra et al. 2005).

The Montane NSR occupies a very small portion of the FMA. This NSR has a regime of frequent and small human-caused fires (Tymstra et al. 2005). Fire occurrence peaks in spring.

The Alpine NSR occupies an area of less than one percent of the FMA. The lack of fuels and rocky terrain in this NSR results in very few wildfires (Tymstra et al. 2005).

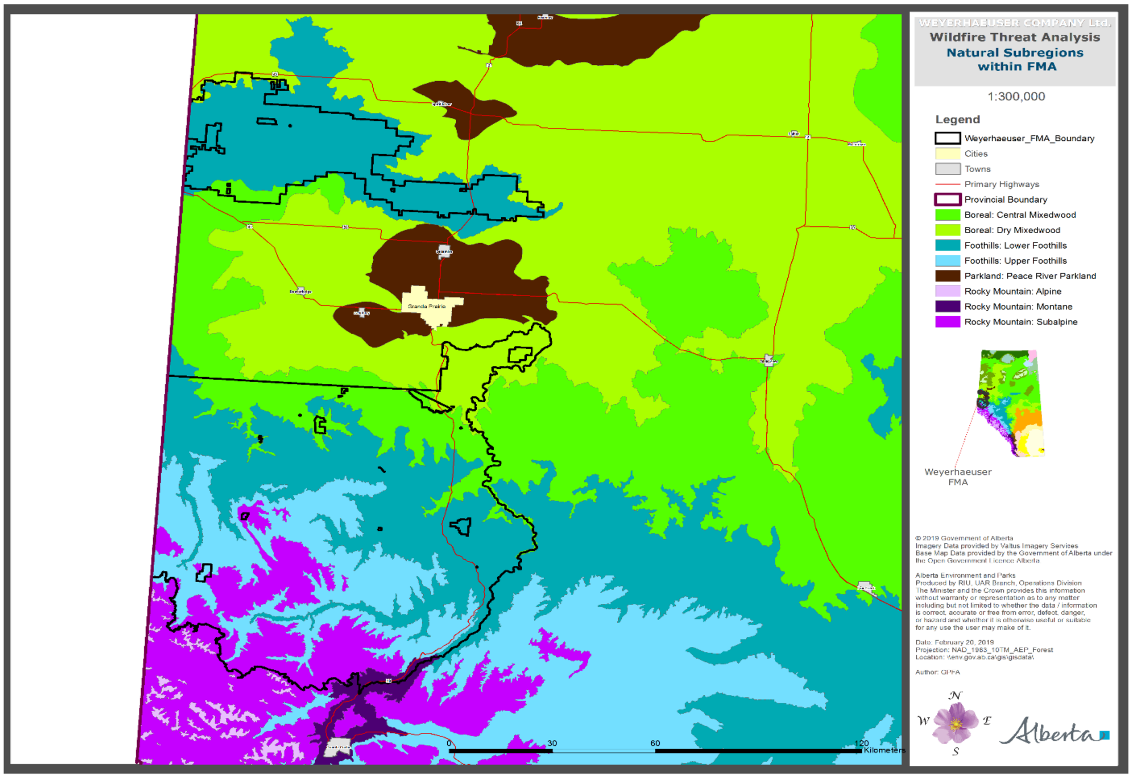

Figure 1. The Natural Sub-regions located within the Weyerhaeuser Company Ltd. FMA (Grande Prairie)

Fire Behaviour Prediction Fuel Types

The combination of the conifer and deciduous fuel types make up 6 mixedwood fuel types (M-1 and M-2) that form the most dominant fuel type in the FMA. The remainder of the area is represented by boreal spruce (C-2) and aspen / poplar (D-1) fuel types. There is also a smaller percentage of mature pine (C-3) and regenerating conifer (C-4/C-6) located throughout the FMA. Dry and Central Mixedwood NSRs have a greater percentage of deciduous content, but as one moves to the south and west into the Foothills NSR, conifer percentage increases. The Central Mixedwood and Lower Foothills NSRs provide a gradual transition from deciduous to conifer dominated fuel types.

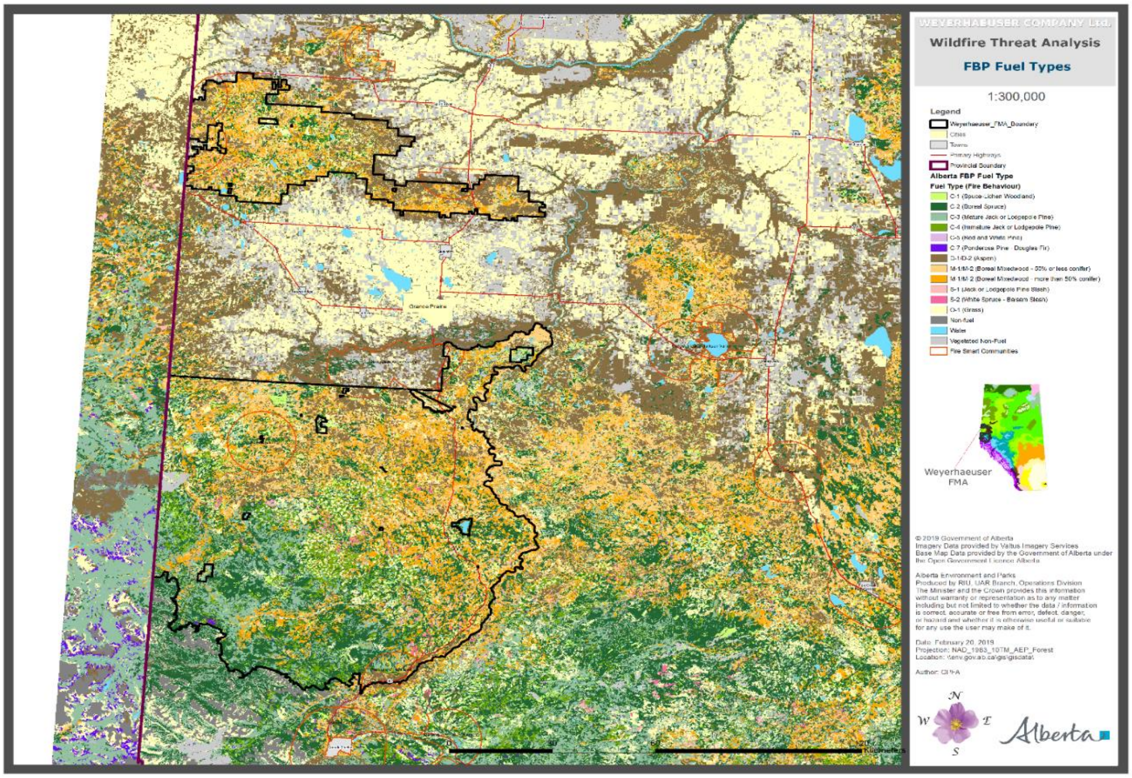

Figure 2. Canadian Forest Fire Behaviour Prediction (FBP) fuel types found on and adjacent to the FMA.

Fire History and Regime

The following provides a general overview of the fire history and fire regime for the FMA. Fire regime data used in the analysis is based on information collected between 1962 and 2002 while fire history is specific to the period of 1990 to 2018. During this time wildfire was managed on the landscape through an aggressive suppression policy which resulted in smaller and fewer fires due to the use of increasingly effective tools and trained personnel.

Fire History within the FMA (1990-2018)

Within the last 28 years, there have been 761 wildfires within the FMA (Figure 3). They range from 0.01 to 4,173.00 hectares in size. The largest being the Red Deer Creek fire in 2014 where the total area of the fire including the portion in B.C. was 33,547.00 hectares. There have only been 3 fires within the FMA that are greater than 200 hectares, and 2 of the 3 were human caused. Fires sizes have been kept lower due to an aggressive operations performance measures. Fires that remained small due to suppression action, initially did not have enough fire behaviour potential to escape and grow beyond suppression capabilities. Left unmanaged, these fires may have had the potential to grow, and under the right weather conditions could have grown substantially larger. Based on our understanding of the fire regime in the Foothills NSR, the average fire size is 66.6 hectares. Very few fires have the potential to grow but 98 percent of them will not grow to a size greater than 200 ha. The potential for large fires to occur is when hazard and risk align.

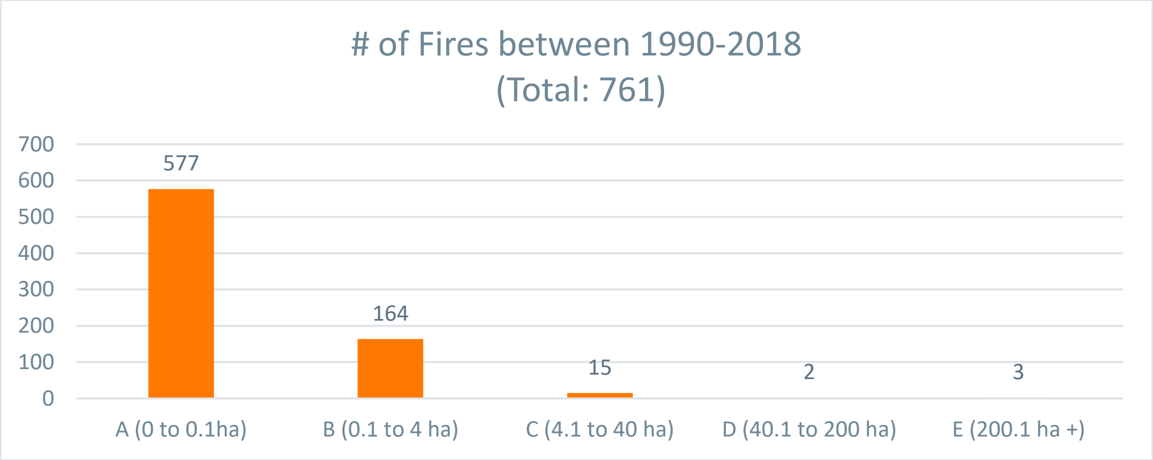

Figure 3. Historic Wildfire size classes of wildfires within the FMA for the last 28 years.

Fire frequency is one metric that provides a rough picture of fire occurrence, however total area burnt also provides a better understanding of impact.

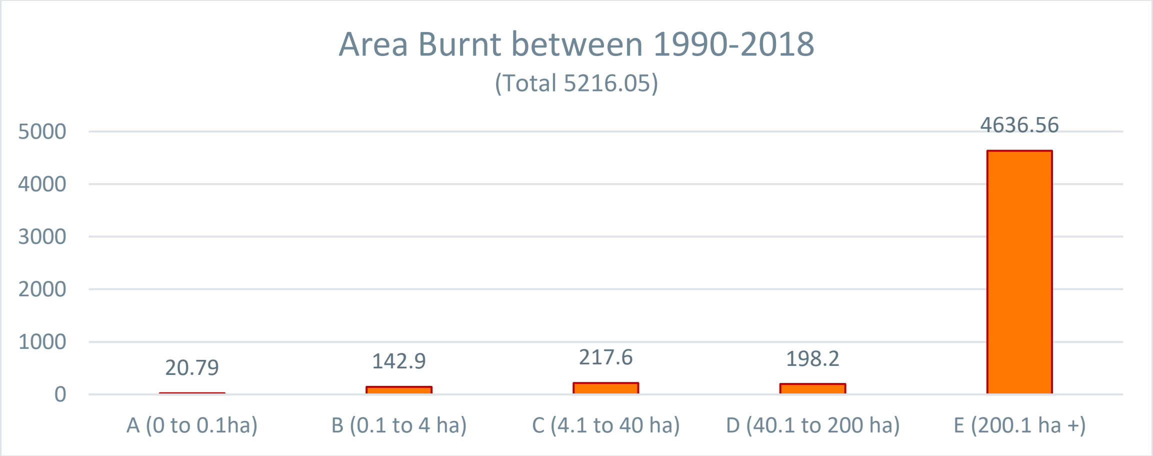

Figure 4. Area burnt by wildfire class sizes within the FMA for the last 28 years.

Efforts to minimize the impacts from the large fires should be one of the objectives of the Forest Management Plan as the plan has the ability to alter the fuels component of the fire behaviour triangle. A very small amount of wildfires (0.39%) burnt 89 percent of the total area within the last

28 years in the FMA (Figure 4). This is close to what occurs provincially. Averages provide a general picture and tend to not show the extremes on both ends of the spectrum.

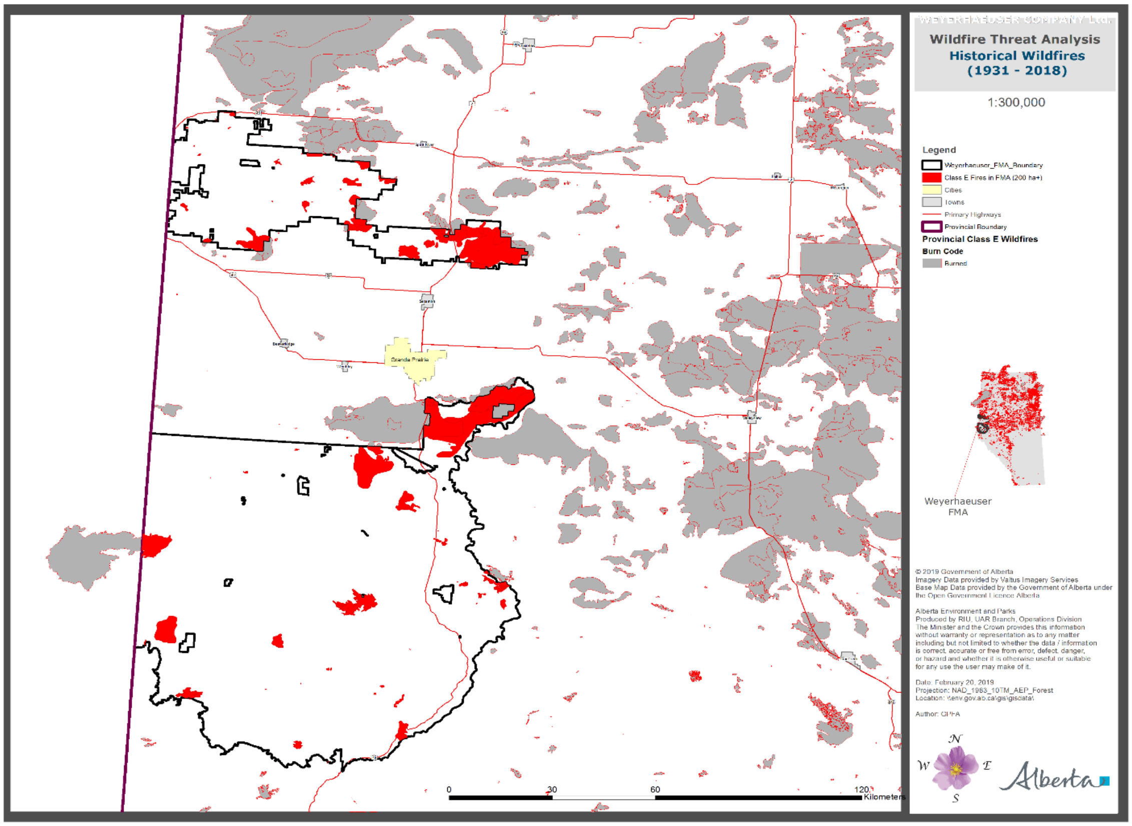

Figure 5. Historic fire locations in and adjacent to the FMA.

Percent Burn / Year by NSR

It is important to recognize that more fires do not equate to more area burnt. One metric used in the understanding of fire regime is Percent Burn per Year (PBY). PBY is simply the percent of area that historically burnt per year by NSR. The data used for the analysis was from 1961 to 2002 (41 yrs.). This is important to recognize that NSRs have varying degrees of burning percent due the difference in the components of the fire behaviour triangle (fuels, weather, topography). The provincial average PBY is 0.37 percent. Foothills NSR has an average of 0.18 percent total area burnt which is approximately half of that of the provincial average or close to the Central Mixedwood NSR. See Chart 1 for summary of percentage of area burn rates per year for each NSR.

Weyerhaeuser FMA (Fire Regime)				
Natural Region	**Natural Sub Region**	**% of Area in FMA**	**% Burned / Yr**	**Avg. Wildfire Size (ha)**
Foothills	Lower Foothills	**48**	0.21	
	Uppper Foothills	**22**	0.16	71
Boreal Forest	Central Mixedwood	**12**	**0.43**	
	Dry Mixedwood	4	0.09	203
Rocky Mountain	Subalpine	**12**	0.02	
	Alpine	1	0.01	
	Montane	1	0.02	10
Provincial Average			**0.37**	**311**

Chart 1. FMA fire regime summary by NSR and fire dynamics.

The Alberta Wildfire Regime Analysis (Tymstra et all, 2005) provides a reasonable snapshot of historic fires on the landscape within the context of historic management policies. With increased fuel loading, population growth, economic development, and climate change, it is recognized that the past may not provide a good lens through which we should forecast the future. It provides a good baseline to understand ecological fire principals, but the future may turn out to be different than what occurred historically for the reasons mentioned. It is with this understanding that recommendations should be framed.

Fire Behaviour Potential – General

The model that tracks fuel moisture throughout the seasons is called the Fire Weather Index (FWI). The Wildfire Threat Assessment model uses the FWI values at the 90 percentile (very dry) based on historical weather to calculate the ratings (Low to extreme) of the average of Crown Fraction Burn (CFB) and Head Fire Intensity (HFI). The estimate of the number of days that the hazard occurs during the each season at the 90 percentile FWI values is 6 days in the spring, 9 days during the summer and 6 days in the fall. The 90 percentile FWI indices are used in the model to show the possible hazard to resource managers over the landscape based from historic weather and current vegetation. Wildfires that occur under these conditions are difficult to manage and pose the greatest threat to resources and assets. It should be noted that the potential of impactful wildfires could occur below the 90 percentile.

Proactive measures and good planning can reduce the hazard to a more acceptable or manageable level. A wildfire hazard that is not paired up with an ignition source is a future opportunity to address the factors that led to the hazard in the beginning. The Detailed Forest Management Plan is a good tool to reduce the overall or specific hazards and potentially reduce the negative impacts of future wildfires.

There are three general seasons of fire throughout the year. There have been large fires during the winter season however they are more the exception. The FBP maps change due to the fuel moisture content of the fuels throughout the seasons which is primarily driven by weather. Multiple consecutive dry years stress vegetation and increase the potential for more and larger fires over the landscape. The lower the fuel moisture content, the greater the potential of fuel availability for consumption and increased fire intensity. Causes of wildfires vary by season and source. Human ignitions occur throughout the three seasons, but lightning is most common during the summer months.

Spring Fire Behaviour Potential (Figure 6)

The spring season is a concern due to the availability of fine fuels (slash and grasses) that contribute to ignition and support fire spread. Fuel moisture content of grasses and conifers are at the lowest point in the year. Weather plays a critical role in shaping the fire environment. Dry spring winds combined with cured / dry fuels is not a good combination when there is an ignition source (generally human).

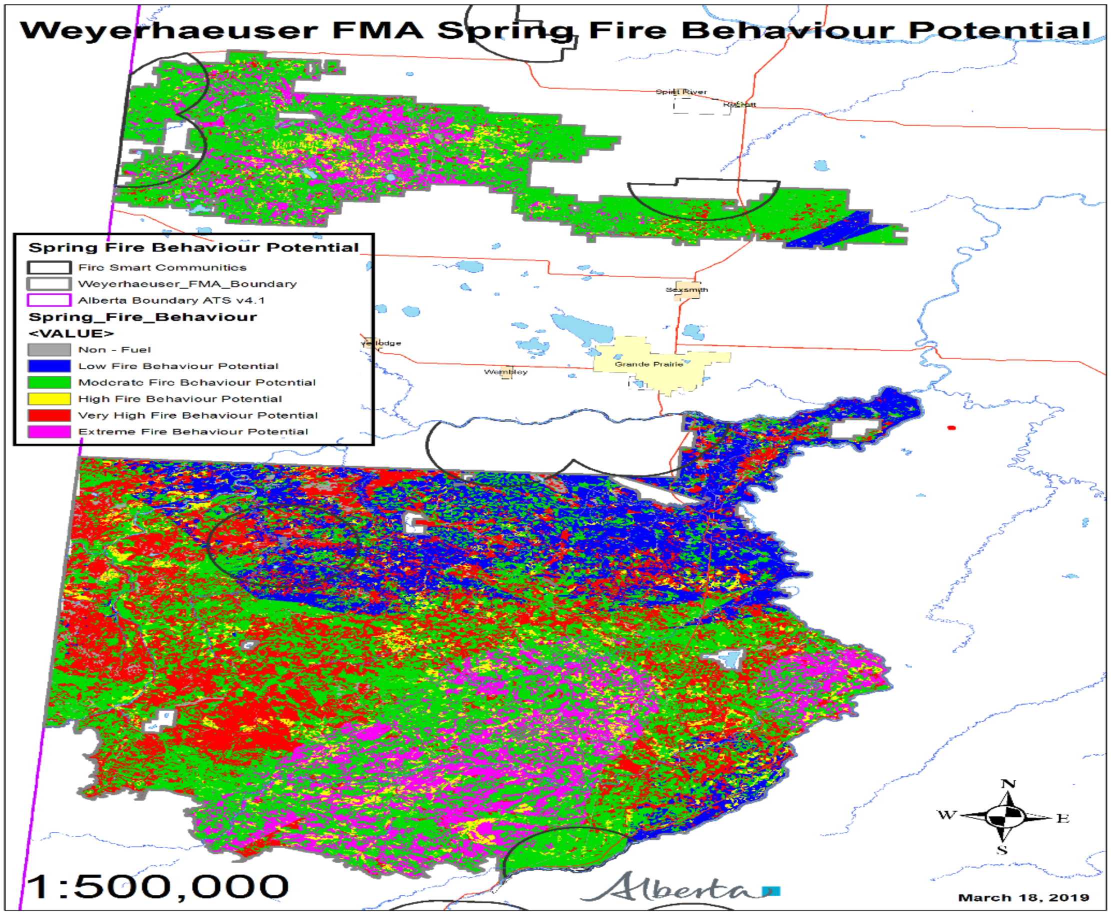

Figure 6. Spring fire behaviour potential.

In the Saddle Hills the extreme fire potential (pink) occurs due to conifer (C-2) or conifer dominated mixedwood (M-1/M-2) fuel types. The central portion of the Saddle Hills has more conifer based fuel types, which is why there is a concentration of higher potential colours. The arrangement of the two fuel types intermixed with cured grassy fuels provide potential for fast and large spreading fires in the spring when pushed by winds. Mixedwood (M-1/M-2) stands with less than 50% conifer may produce lower fire intensity, however would not be considered as a fuel break for fire spread. The mosaic of fuel types historically have restricted the size of wildfires to moderate levels (77 ha). It must be noted that current fuel types do not account for stands that are dead or diseased due to mountain pine beetle or aspen dieback.

The southern portion of the FMA is a mix of Central Mixedwood and Lower / Upper Foothills NSR. The Central Mixedwood portion consists mainly of mixedwood (M-1/M-2) fuel types with some deciduous (D-1) intermixed within. In deciduous dominated stands the spring fire behaviour potential is lower due to the low percent of conifer fuels not contributing to CFB, but due to increased ignition sources, and cured grasses, the fire potential remains low to moderate. Warming spring weather is generally delayed as elevation increases. The extreme conifer fuels (C-2 -pink) are still volatile due to spring dip but due to the higher elevation, cooler temperatures the snow melt is delayed and fine fuels are less available to contribute to fire intensity. The influence of weather collection sites (lookout towers) is very noticeable on the map. Copton and Kakwa towers show increased potential (pink) surrounding them due to the FWI weather inputs. The same fuels to the west are rated slightly lower due to the influence of Torrens and Nose Mtn. Weather stations. The moderate fire behaviour potential (green) is represented by C-3 and C-4. Their lower fire behaviour potential requires higher FWI indices than C-2 (spruce) fuel types to achieve the same intensity. This patchwork of extreme or very high and moderate fire potential creates opportunities to manage wildfires and reduces to potential of large wildfires across the landscape.

Summer Fire Behaviour Potential (Figure 7)

The overall fire behaviour potential is reduced by on category, however conifer dominated fuel types still maintain their very high rating. The transition from spring to summer hazard generally occurs in late May or early June when we get increased precipitation / spring rains. The increase in seasonal temperatures coupled with increased availability of moisture to vegetation for growth is the main driver for the reduction in fire behaviour potential. Previous year's annual precipitation along with current availability of moisture to fuels will drive the hazard for this season.

In the Saddle Hills, the model shows that conifer and conifer dominated mixedwood fuel types maintain their fire behaviour potential. Deciduous dominated stands reduce the fire potential compared to the spring. The arrangement of conifer and deciduous fuel types create a mosaic that supports the fire regime of frequent low severity small fires. Mountain pine beetle and aspen dieback are two insect and disease influences that have not taken in to consideration as to the changes in fire behaviour for the fuel types for which they affect. MPB management strategies were different for the Saddle Hills compared to the south part of the FMA. The exact influence is unknown but literature indicates an increase in fire intensity with an increase in dead or stressed fuel types.

The nature of conifers is that they are quite receptive to burning when fuel moisture content is low. Prolonged absence of rain or surface moistures reduces the moisture content of all fuels but in relation to fire intensity, the impact is greatest to conifer and dead fuels. This is very apparent in the maps where the vegetation gradually changes to a more conifer dominated fuel types the further south and west one goes in the FMA. The boreal fuel type (C-2) is the primary driver for the very high (red) and extreme (pink). The pine (C-3) is moderate due to the requirement of higher winds speeds to generate the surface intensity and support fire growth. Regenerating cutblocks (C-4) and slash (S-1/S-2) fuel types show a reduction because those fuels interact with the surface and there is an exchange of moisture between the ground and surface fuels but also dry out quicker in the absence of precipitation. It is recognized that the slash (S-1/S-2) blocks within the FMA do not have the fuel loading that the FBP model is based off of. This should reduce potential fire intensity but not rate of spread. This means fires will not burn as hot but fire size should be close to the same. Fast spreading fires are difficult to manage, so fuels that spread fast like grasses and slash pose a challenge and a safety concerns to resources and assets.

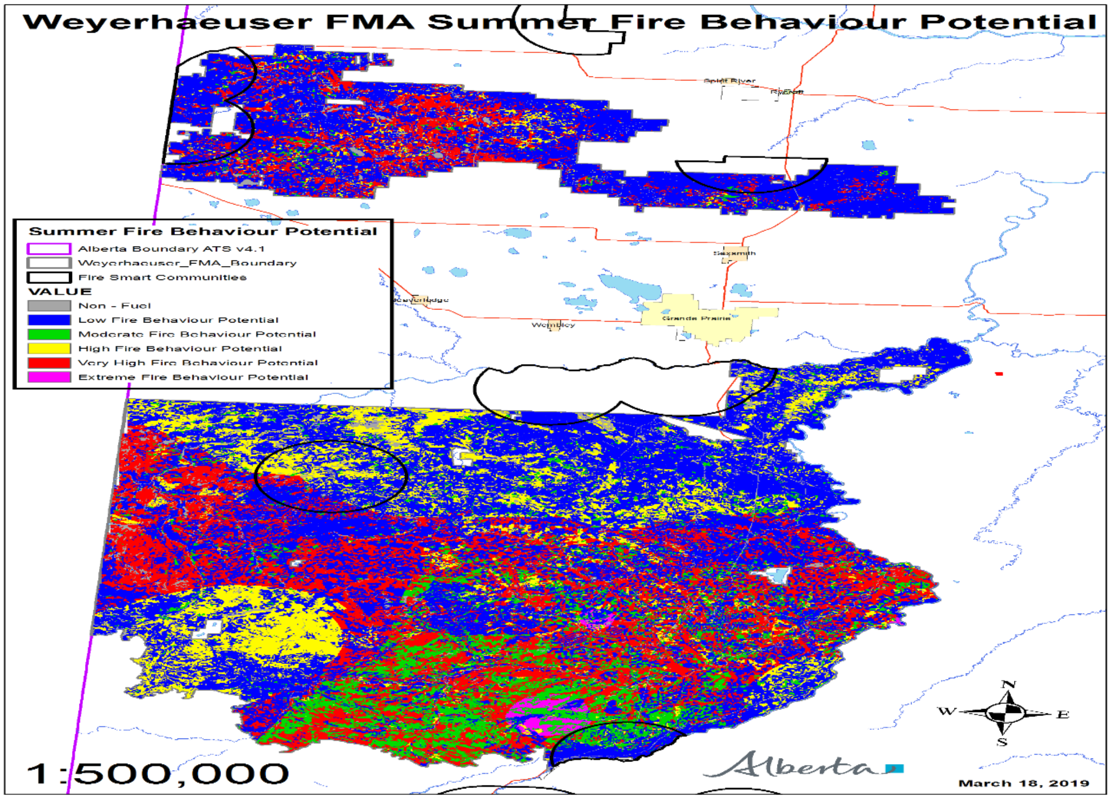

Figure 7 - Summer fire behaviour potential.

Fall Fire Behaviour Potential (Figure 8)

Fall fire potential depends on the amount (duration and quantity) of precipitation received over the spring but more importantly the summer months. C-2 (spruce) or conifer dominated mixedwood stands continue to maintain their very high or extreme fire behaviour potential throughout the FMA. With the colder temperatures at the 90 percentile, dry and or cured slash and grass fuel types cause the fire behaviour potential to increase. This is shown by more moderate fire potential (green) on the southeastern side of the FMA (Lower foothills) compared to the summer. In the Upper Foothills NSR spring weather is delayed and fall weather occurs earlier due to the elevation. An early frost will increase the curing of fine fuels (grasses and slash) and make them more susceptible to ignition and spread. The fire hazard substantially lowers when precipitation or snow arrives to the area and remains. Shorter daylight hours equate to lower peak burning temperatures and better overnight relative humidity recovery.

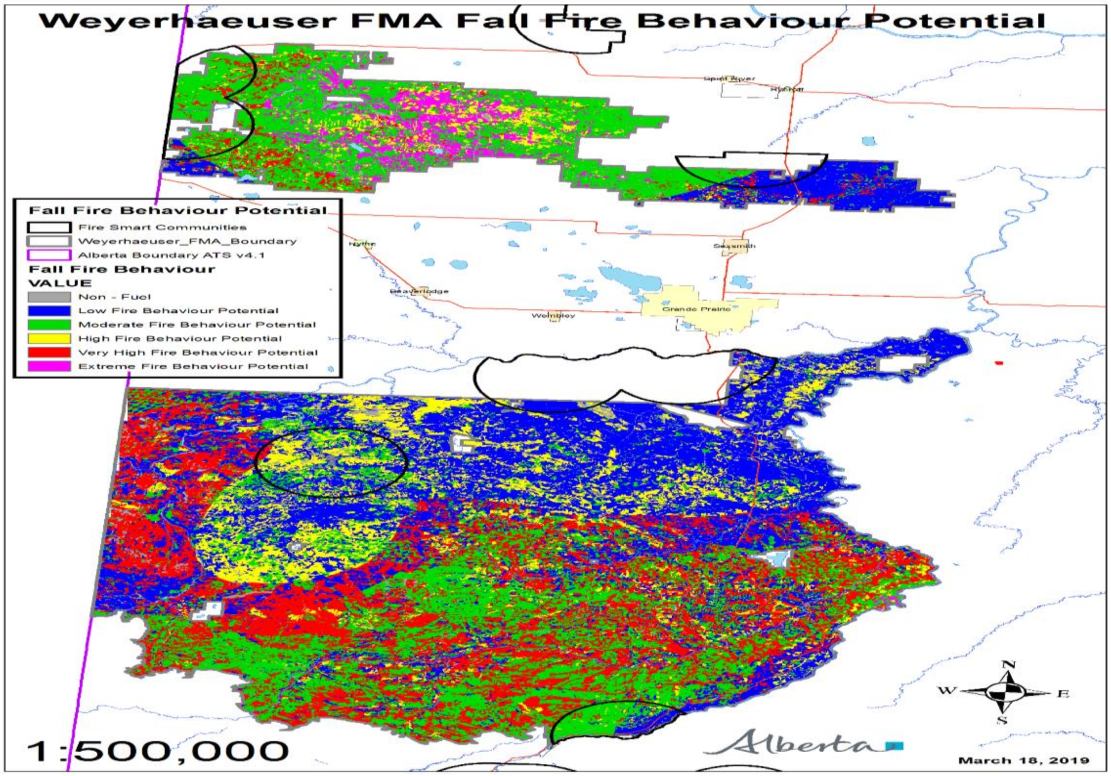

Figure 8 – Fall fire behaviour potential

Fire Regime and Wildfire Behaviour Potential in Forest Management

Land management decisions and actions of today need to consider the future outcomes and their impacts on ecosystem function and health. Wildfire is or can be a significant landscape disturbance that needs to be considered in any policy decision. Even with average fire sizes of between 56-77 hectares in the Foothills NR, this may not adequately represent the potential impacts to timber supply or other natural resources values. Factors like current and future insect and disease outbreaks, changing climate, and land use policies can have an altering impact to intensity and severity of wildfires into the future.

As shown on many figures, fire behaviour potential strongly follows the influence of weather inputs but also aligns well with the changes in NSR boundaries and its associated fire regime. The most variable side of the fire behaviour triangle is the weather which we have little or no ability to influence. The only side of the fire behaviour triangle that we have an influence on is fuels. Conifer dominated fuel types are the dominate fuel type in the Foothills NR and tend to be the most flammable and therefore the biggest contributor to higher intensities and impactful wildfires. Large contiguous conifer fuels a may be beneficial to specific wildlife species but also contribute to an arrangement of fuels that is difficult to be effective at managing when protecting values.

The focus of this plan should be to manage the forest landscape in a manner that reduces the risk of large fires that can impact values (human life, communities, natural resources, critical infrastructure). A historic policy of fire suppression, has had some benefits but as we are starting to realize that it may have also have some unintended consequences. Suppression effectiveness shifted most of the fires to the A class (very small fires). The Foothills NR historically does not produce many large wildfires, although under current land use management practices and a changing fire environment, it would be irresponsible to use the past as a predictor of the future. There is no question about the importance of wildfires and its integral role in ecosystem productivity and health. It is a certainty that wildfires will continue to influence the landscape, but when / where and at what intensities wildfires occur is unknown. Current land use policies and management decisions will have a direct impact on the outcomes of such disturbances. The following recommendations can provide direction as to measures to be taken to reduce catastrophic wildfire and its consequences to provincial priorities.

To best emulate historical disturbance, the following should be considered:

- Where possible, harvest conifer fuel types and prompt removal of debris within the community protection zones and other high value sites to reduce the potential of large fires burning into the communities / camps.
- Harvest and removal of harvest debris or surface fuels to reduce fuels in areas where large contiguous conifer types occur.
- Due to predominate wind patterns, a north / south fuel break could reduce the growth potential of large landscape fires driven by westerly winds.
- Reducing or removing small patches of fuel wicks in conifer and mixedwood fuel types within a harvest plan.

- Manage for low to moderate fires on the landscape under certain conditions to reduce fuel loading in areas where high value assets exist and or to allow for positive ecological benefits to occur.
- The use of prescribed fire in areas to reduce fuel loading or to achieve other objectives identified in the approved Wildfire Management Plan.
- The removal (harvest or burning) of stands that are dead or insect attacked where no plans for utilization exists for the timber resource, considering other values.
- The quick and complete removal of debris piles as per the debris disposal policy.

Grande Prairie Wildfire Management Planning

The Grande Prairie Forest Area is in development of a Wildfire Management Plan. Planning commenced October of 2018 and is forecasted to be completed by October of 2019. The plan will follow the Wildfire Management Planning Standard which will draw from the ISO 31000-18 risk management principles. Once approved the plan will be strategic in nature and will provide direction to Area staff in wildfire management for the following 5 years.

References

Tymstra, W and M.P. Rogeau. Alberta Wildfire Regime Analysis (2005). Alberta Department of Sustainable Resource Development. Forest Protection Division, Wildfire Policy and Business Planning Branch.

Weyerhaeuser Forest Management Plan

Annex IV: Classified Landbase Development

AUTHOR: Jeremy Hachey, RPF

DATE: October 1, 2019

REVISION DATE: August 9, 2019

2019

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

Executive Summary

Weyerhaeuser Grande Prairie's Defined Forest Area (DFA) is located within a single Forest Management Unit (FMU), G16. The total land area of the DFA is 1,178,018 hectares and forest area are allocated to Weyerhaeuser through their Forest Management Agreement (FMA) #6900016.

As part of the 2019-2029 Forest Management Plan (FMP), a landbase netdown was developed to support the Timber Supply Analysis (TSA) and Annual Allowable Cut (AAC) determination for the DFA. This document summarizes the process used to create the classified landbase, which describes the condition of the forest as of May 1, 2017 and was assembled to meet the requirements of the Alberta Forest Management Planning Standard (Version 4.1 – April 2006).

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
Gross Classified Landbase	**1,178,018**	**49,362**	**11,347**	**1,117,309**
Less Non-Forested	94,423	4,746	2,050	87,628
= Net Forested Land base	**1,083,594**	**44,616**	**9,297**	**1,029,681**
Less Administrative Removals	48,269	43,113	18	5,137
= Net Classified Forested Land base	**1,035,326**	**1,503**	**9,278**	**1,024,544**
Less Riparian Buffers	80,518	180	600	79,738
Less Non-Merchantable	104,120	170	1,054	102,896
Less Subjective	16,499	6	213	16,281
less Productive Area within Seismic Lines	8,026	22	138	7,866
= Contributing Net Classified Landbase	**826,163**	**1,126**	**7,273**	**817,764**
Contributing Landbase by Broad Cover Group				
1. Pure Conifer (CX)	432,330	100	651	431,579
2. Conifer Leading (CD)	61,787	35	287	61,465
3. Deciduous Leading (DC)	52,385	104	302	51,979
4. Pure Deciduous (DX)	236,275	705	6,033	229,538
5. 'Switch' Stands (D_US)	43,385	182	0	43,203
less aspatial removals	**33,047**	**45**	**291**	**32,711**
= Effective Contributing Net Classified Landbase	**793,117**	**1,081**	**6,983**	**785,053**

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Document Revision History

Date	Description
October 1, 2018	First submission to Forest Management Branch for review and comment.
January 22, 2019	Second submission submitted to Forest Management Branch for review and comment. Updates to document included: • Addition of Provincial Recreation Areas (PRA) to data inputs (Table 1), Classified Land Base Summary (Table 9), and Section 4.3.4. • Addition of Historical Resource Values (HRV) to data inputs (Table 1), Classified Land Base Summary (Table 9), and Section 4.3.5 • Addition of Dunes to data inputs (Table 1), Classified Land Base Summary (Table 9), and Section 4.3.9. • Addition of Adjusted PSP information to data inputs (Table 1) and corresponding Section 8.1.30. • Editorial revisions and updates to Data Dictionaries (Appendix III and Appendix IV). • Addition of Section 6.4 Mountain Pine Beetle Ranking. • Addition of Section 4.5.6 to describe how MPB impacted stands were identified and removed from the contributing land base. • Editorial revisions to Watercourse documentation (Section 4.4) • All data summary tables updated to reflect updates to Classified Land Base and yield stratification • Editorial revisions throughout
May 30, 2019	Post Agreement-In-Principle revisions including: • Addition of Forest Health Overview - deciduous mortality to data inputs (Table 1) and corresponding Section 8.1.34. • Addition of Annex 3 - Fire Behaviour information to data inputs (Table 1) and corresponding Section 8.1.35. • Updates to Data Dictionaries to reflect changes made to the Classified Landbase Spatial resultant (Appendix III and Appendix IV). • All data summary tables, graphs, and overview maps updated to reflect updates to Classified Land Base and yield stratification. • Updates to data sources and data processing for post-AVI cutblocks (Section 8.1.26) and Planned Block features (Section 8.1.27) in response to GOA ARIS review comments and updated planned cutblock features
August 9, 2019	Updates to reflect the final version of the CLB used for modeling: • Updated summary table in executive summary • Updated Table 2, Table 9, Figure 3, Figure 4, and Figure 5

1. Overview

1.1 Objective

The purpose of the landbase netdown is to identify and classify Weyerhaeuser Grande Prairie's Defined Forest Area (DFA) into areas of active (managed) and passive (non-managed) landbase. The forested stands within the landbase are stratified into similar cover types which form the basis for forecasting growth and yield for the duration of the Forest Management Plan (FMP). Only forested stands on the active landbase will contribute to future timber harvesting activities and AAC determination.

The objective of this document is to describe the datasets used to generate the net landbase (NLB), describe all processing completed on those datasets to prepare them for the netdown process, and describe the business rules applied to the amalgamated landbase to stratify and classify and each polygon for the purposes of FMP development.

The level of detail provided in this document should be sufficient to allow qualified Geographic Information System (GIS) Analysts or GIS/Forestry Analysts to repeat the process, using the prepared input datasets (i.e. ARIS, Cutblocks, etc.), and achieve the same results as reported in Section 4.

1.2 Landbase Effective Date

The datasets are current or were extracted as of May 1, 2017.

1.3 Landbase Products

Two separate land bases are created through this process, each representing the same information in slightly different ways. Each feature is developed for a specific purpose and has the same geographic extent, area deletions, and strata distribution.

1.3.1 Classified Landbase

The classified landbase is used to calculate the area and distribution of all features found on the landbase and carry this into the modelling landbase. This landbase contains the greatest number of polygons and satisfies the requirements of the Alberta Forest Planning Standard Version 4.1 (Alberta, 2006).

1.3.2 Modelling Landbase

The modelling landbase is a subset of the classified landbase that only contains the forested and contributing portions of the DFA.

1.4 Spatial Landbase Process

Developing the classified landbase for Weyerhaeuser Grande Prairie involved five distinct steps:

1. Identify, assemble, and process all input data required to classify the landbase and represent managed assumptions dependant on spatial features (Section 8)
2. Combine input datasets to generate the spatial landbase (Section 6.1)

3. Process attributes to stratify the landbase for growth and yield representation (Section 3)
4. Identify area available for forest management activities to arrive to the classified landbase (Section 4)
5. Prepare the modeling landbase required for timber supply modeling (Section 7)

Figure 1 illustrates the steps used in data processing.

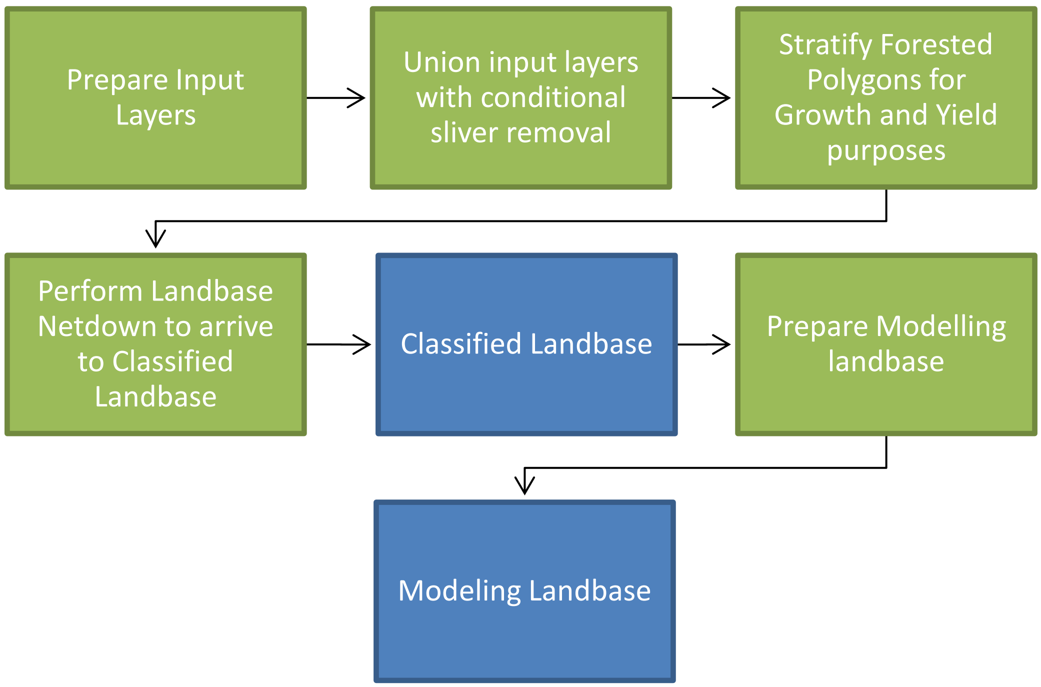


Figure 1 Processing steps and products created through the landbase process in this document

2. Summary of Input Datasets

This section describes the input datasets used to prepare the classified landbase. The source datasets are processed and then combined to create the spatial landbase. Table 1 provides an overview of the input datasets included in the landbase. Further details of how these inputs were processed and combined can be found in Section 8.

Table 1 Input layers used in the creation of the net landbase

Feature	Source	Description	Usage	Reference
Forest Inventory				
Alberta Vegetation Inventory (AVI)	Greenlink	Photo Interpreted Forest polygon boundaries	Absolute	8.1.1
Post AVI Cutblocks	Greenlink	Cutblocks harvested after AVI photo capture	Absolute	8.1.26
Post AVI Fires	GOA	Fires that have occurred after AVI photo capture	Absolute	8.1.14
Reforestation Standard of Alberta (RSA)	Weyerhaeuser and other operators	RSA survey blocks for all operators from both aerial and non-aerial programs	Absolute	8.1.25
Landbase Boundaries				
DFA Boundary	AltaLIS	G16 FMU Boundary	Absolute	8.1.2
FMA Boundary	AltaLIS	Weyerhaeuser (Grande Prairie Timberlands) FMA Boundary	Absolute	8.1.3
Landscape Level Features				
Natural Sub regions	GOA	Provincial Natural Sub Region Boundaries	Absolute	8.1.4
B1 Breeding Zone	GOA	B1 breeding region for pine	Majority	8.1.5
B2 Breeding Zone	GOA	B2 breeding region for pine	Majority	8.1.5
G1 Breeding Zone	GOA	G1 breeding region for white spruce	Majority	8.1.5
Forestry Watersheds	GOA	Forestry Watershed boundaries	Absolute	8.1.6
Hydrology Buffers	Weyerhaeuser, GOA and AltaLIS	Hydrology buffers developed from the AVI and provincial hydrology.	Absolute	8.1.7
Grizzly Bear Habitat Zones	GOA	Primary and Secondary Grizzly Bear Habitat Zones	Majority	8.1.8
Grizzly Bear Watersheds	GOA	Grizzly Bear watersheds	Majority	8.1.9
Trumpeter Swan Buffers	GOA	Buffers around known Trumpeter Swan Lakes	Absolute	8.1.10
Mountain Goat and Sheep Ranges	GOA	Extent of Mountain Goat and Bighorn Sheep Ranges	Majority	8.1.11
Wildfire Management Zones	AltaLIS	Wildfire Management Zones	Majority	8.1.13
FireSmart Community Zones	GOA	FireSmart Community Zones that intersect the DFA	Absolute	8.1.15
Caribou Ranges	GOA	Caribou Ranges that intersect the DFA	Absolute	8.1.12
Eastern Slope Land Use Zones	GOA	Prime protection zones from the Eastern Slope Land Use Plan	Absolute	8.1.23
Cost Zones	Weyerhaeuser	Cost zones that intersect the FMA	Absolute	8.1.28
Access Units	Weyerhaeuser, Forcorp	Access Units that intersect the caribou range of the DFA	Absolute	8.1.29
Dunes	GOA	Sand Dunes	Absolute	8.1.33
Forest Health Overview – Aspen Mortality	GOA	Shows aspen mortality	Majority	8.1.34
Fire Behaviour – Annex 3	GOA	Summer, Spring, and Fall Fire Behaviour	Zonal Stats	8.1.35

Feature	Source	Description	Usage	Reference
Anthropogenic Feature Boundaries				
Digital Integrated Dispositions (DIDs) – Land Use Dispositions	GOA	DIDs dispositions added to the landbase that were not identified in the AVI, not including road dispositions. Source of Non-Forested and Non-Contributing dispositions and Protected Notations	Absolute	8.1.18
Adjusted PSP boundaries	GOA	More accurately mapped PSP boundaries	Absolute	8.1.30
Seismic Lines	Weyerhaeuser	Seismic Lines	Majority	8.1.21
Historic Resources	GOA	Historic Resources	Absolute	8.1.31
Provincial Recreation Areas	GOA	Provincial Recreation Areas	Absolute	8.1.32
Subjective Deletions & Deferrals				
Steep Slopes	Weyerhaeuser	Slopes greater than 55% - identified as being inoperable.	Absolute	8.1.20
Archeological Sites	Weyerhaeuser	Archeological Sites that intersect the DFA	Absolute	8.1.24
Springs	Weyerhaeuser	Springs that intersect the DFA	Absolute	8.1.24
Mineral Licks	Weyerhaeuser	Mineral Licks that intersect the DFA	Absolute	8.1.24
Trapper Cabins	Weyerhaeuser	Trapper Cabins that intersect the DFA	Absolute	8.1.24
Unique Areas	Weyerhaeuser	Unique areas of importance	Absolute	8.1.24

3. Yield Stratification

3.1 Yield Stratification Summary

Stratification of forested stands into similar cover types forms the basis for forecasting growth and yield over the duration of the Forest Management Plan. Information used to stratify forest stands was based on several sources including the Alberta Vegetation Inventory (AVI), Alberta Regeneration Information System (ARIS), harvest stratum assignment or Reforestation Standard of Alberta (RSA) information. All natural stands were stratified based on AVI attributes while cutblock strata were assigned from any one of these four sources, depending on criteria such as the age of the cutblock (pre- or post-91) and whether RSA information existed for a cutblock. Table 2 provides a summary of the contributing landbase by yield strata. Details on the various information sources used to stratify stands into these yield strata are contained in the following sections.

Table 2 Yield Stratification Summary

Yield Type	Yield Strata	Yield Strata Description	DFA (ha)	FMA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)
Natural Stands	D_AB	Pure Deciduous with A or B Density (ESRD 1)	50,974	49,335	169	1,470
	D_CD	Pure Deciduous with C or D Density (ESRD 1)	134,200	129,520	455	4,225
	D_US	Pure Deciduous Overstory managed for Understory	38,051	37,869	182	0
	DC_PL	Hardwood with Pine (ESRD 2)	7,825	7,825	0	0
	DC_SX	Hardwood with Spruce (ESRD 3)	38,901	38,495	104	302
	CD_SX	White Spruce or Black Spruce with Hardwood (ESRD 4,6)	34,868	34,555	30	283
	CD_PL	Pine with Hardwood (ESRD 5)	10,380	10,371	5	4
	C_SW_AB	Pure White Spruce (>= 80%) with A or B Density (ESRD Base 7)	58,501	58,125	25	351
	C_SW_CD	Pure White Spruce (>= 80%) with C or D Density (ESRD Base 8)	17,302	17,247	6	49
	C_SWOC	White Spruce Leading (<=80%) (ESRD Base 8)	35,005	34,857	8	140
	C_PL_AB	Pure Pine (>= 80%) with A or B Density (ESRD Base 8)	33,897	33,894	3	0
	C_PL_CD	Pure Pine (>= 80%) with C or D Density (ESRD Base 8)	56,958	56,954	3	0
	C_PLOC	Pine leading (< 80%) (ESRD Base 8)	68,894	68,885	8	0
	C_SB	Black Spruce pure or leading (ESRD Base 9)	15,291	15,135	46	111
		Sub-Total	**601,049**	**593,068**	**1,046**	**6,936**
Managed Stands Established Prior to March 1, 1991	PL	Pure Pine or pine leading (ESRD 8)	21,742	21,742	0	0
	SW	Pure White Spruce or leading (ESRD 7)	3,705	3,705	0	0
	CD_PL	Mixed Pine (ESRD 5)	4,115	4,115	0	0
	DC_PL	Mixed Pine (ESRD 2)	1,817	1,817	0	0
	CD_SX	Mixed Spruce (ESRD 4 or 6)	1,924	1,924	0	0
	DC_SX	Mixed Spruce (ESRD 3)	1,415	1,415	0	0
	D_AB	Pure Deciduous with A or B Density (ESRD 1)	7,745	7,745	0	0
	D_CD	Pure Deciduous with C or D Density (ESRD 1)	4,836	4,836	0	0
	D_US	Pure Deciduous Overstory managed for Understory	5,334	5,334	0	0
	C_SB	Pure Black Spruce or leading (ESRD 9)	240	240	0	0
		Sub-Total	**52,873**	**52,873**	**0**	**0**
Managed Stands Established After March 1, 1991	Hw	Pure deciduous in RSA SUs	86	86	0	0
	HwPl	ARIS DC declared - HwPl block or HwPl RSA SU	795	795	0	0
	HwSx	ARIS DC declared - HwSx block or HwSx RSA SU	1,632	1,632	0	0
	PlHw	ARIS CD declared - PlHw block or PlHw RSA SU	2,294	2,294	0	0
	SwHw	ARIS CD declared - SwHw block or SwHw RSA SU	8,207	8,207	0	0
	Pl	ARIS C declared - Pl block or Pl RSA SU	74,740	74,740	0	0
	Sw	ARIS C declared - Sw block or Sw RSA SU	19,021	19,021	0	0
	C_SB	ARIS C declared - Sb or ESRD Base 9	1,024	1,024	0	0
	D_CD	ARIS D declared blocks	38,434	38,015	80	338
	PL_G147p1	ARIS C declared - Pl block or Pl RSA SU identified as genetic	21,329	21,329	0	0
	SW_G351p1	ARIS C declared - Sw block or Sw RSA SU identified as genetic	4,679	4,679	0	0
		Sub-Total	**172,241**	**171,823**	**80**	**338**
		Grand Total	**826,163**	**817,764**	**1,126**	**7,273**

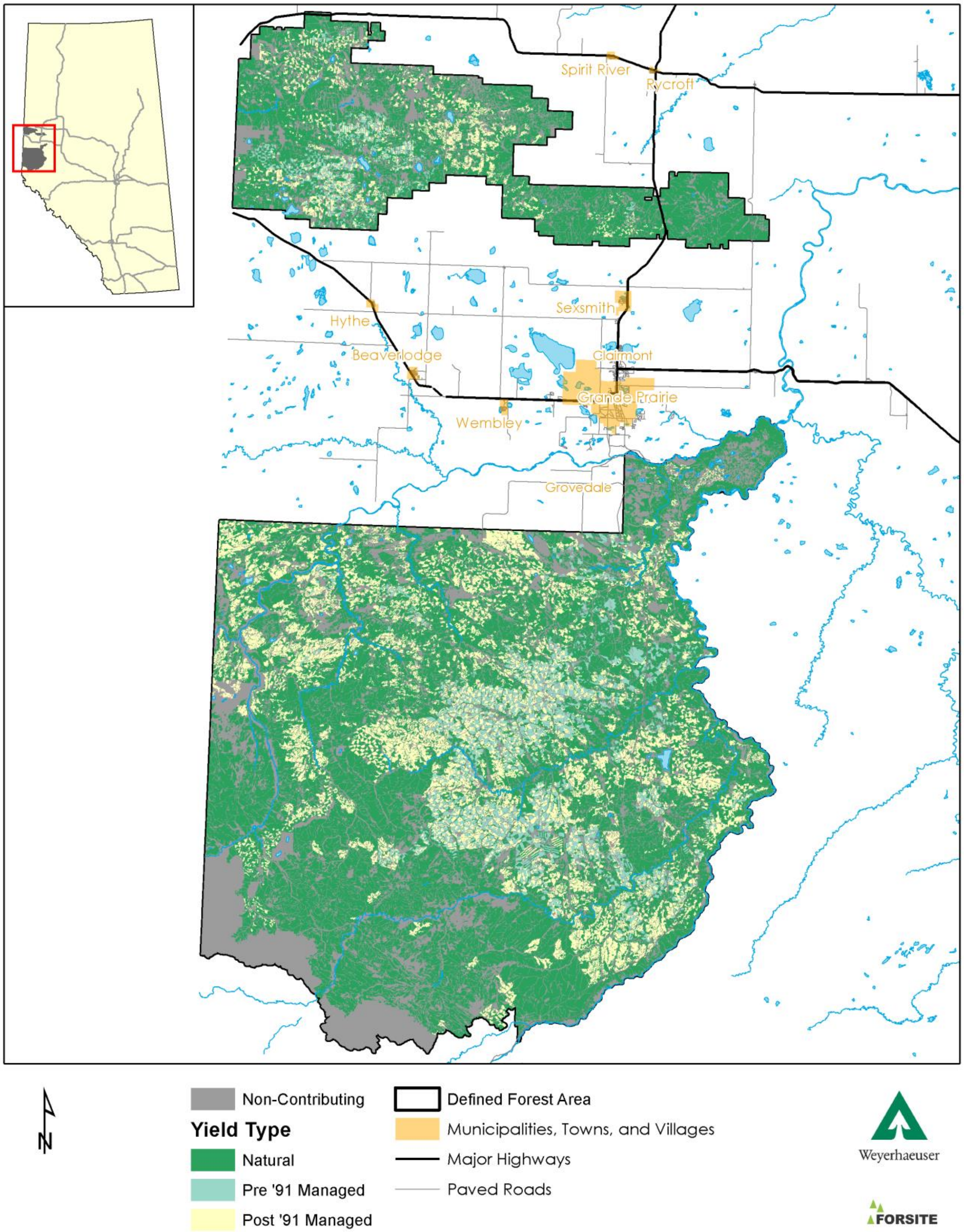


Figure 2 Yield Type Overview

3.2 Natural Stands

The starting point for stratifying natural stands was to first stratify all natural stands (i.e., stands without harvest history) to the base 10 strata using rules outlined in the Planning Standard (Alberta, 2006). These strata were then either left as is or split by density class (i.e., pure deciduous and pure pine), grouped together (i.e., mixed white spruce & mixed black spruce), identified as being managed for the understory layer (see Section 3.2.1, below). Table 2 above describes the yield strata for natural stands and their relationship to ESRD base 10 strata.

3.2.1 Broad Cover Groups

Broad cover group (BCG) attributes were processed and attributed for each forest cover polygon based on tree species percent composition from the AVI for both the overstory and the understory. Table 3 outlines the criteria used to assign BCG. If the leading species group in 50-50 stands is coniferous, stands were assigned a CD BCG; if the leading species group is deciduous, stands were assigned a DC broad cover group.

Table 3 Broad Cover Assignment Rules

Broad Cover Group	Description	Deciduous Crown Closure (%)	Coniferous Crown Closure (%)
CX	Predominately Conifer	0-20	80-100
CD	Conifer dominated mixedwood stands	30-50	50-70
DC	Deciduous dominated mixedwood stands	50-70	30-50
DX	Predominately Deciduous	80-100	0-20

3.2.2 Switch Stands

Forested stands were interpreted in the AVI to include both overstory and understory characteristics. Weyerhaeuser has identified a specific selection of stands where the understory is to be used as the story of primary management, referred to as 'switch' stands (GY-0006- Switch Stand Definition; May 14, 2018). This criterion has changed slightly from the last FMP to adapt to improved technology and increased ability to detect understory conifer densities. Stands that meet the following criteria were assigned as switch stands:

Natural or Pre-'91 stands with a:

- An understory crown closure of B, C, or D; and
- The leading species of the understory is Sw or Se:

And;

- An overstory Broad Cover Group of Pure Deciduous (BCG='DX') with an 'A' density overstory; and
- An understory with greater than 250 stems per hectare (UDEN_CL >= 4);

Or;

- An overstory Broad Cover Group of Pure Deciduous (BCG='DX') with a 'B' density overstory; and
- An understory with greater than 500 stems per hectare (UDEN_CL >= 5); and
- A canopy pattern of greater than 2

Or;

- An overstory Broad Cover Group of Pure Deciduous (BCG='DX') with a 'C' density overstory; and
- An understory with greater than 750 stems per hectare (UDEN_CL >= 6);
- A canopy pattern of greater than 2

Or;

- An overstory Broad Cover Group of Pure Deciduous (BCG='DX') with a 'D' Density overstory; and
- An understory with greater than 1000 stems per hectare (UDEN_CL >= 7);
- A canopy pattern of greater than 2

The criteria above do not apply within Grazing Leases.

Switch stands across the classified landbase are summarized in Table 4 below by overstory crown closure, understory crown closure, and understory density class. The switch population is also summarized in

Table 5 according to understory BCG. Most switch stands are pure Conifer.

Table 4 Net Contributing Area (ha) of 'Switch' Stands by Overstory Crown Closure (DENSITY), Understory Crown Closure (UDENSITY), and Understory Density Class (UDEN_CL; stem/ha)

Overstory Crown Closure (DENSITY) / Understory Crown Closure (UDENSITY)	Understory Conifer Density Class					
	4 (250-500 stem/ha)	5 (501-750 stem/ha)	6 (751-1000 stem/ha)	7 (1001-2000 stem/ha)	8 (2000+ stem/ha)	Grand Total (Net Contributing Area) ha
A (6-30%)	**1,172**	**2,205**	**1,978**	**3,313**	**3,928**	**12,597**
B (31-50%)	1,044	1,204	1,123	1,380	944	5,694
C (51-70%)	129	1,001	846	1,795	2,383	6,154
D (+70%)	0	0	9	138	601	749
B (31-50%)	**0**	**3,637**	**3,494**	**4,023**	**3,639**	**14,793**
B (31-50%)	0	3,421	3,077	2,865	1,995	11,358
C (51-70%)	0	216	417	1,125	1,594	3,352
D (+70%)	0	0	0	33	50	84
C (51-70%)	**0**	**0**	**4,668**	**6,637**	**2,924**	**14,229**
B (31-50%)	0	0	4,435	6,014	2,394	12,843
C (51-70%)	0	0	233	602	524	1,359
D (+70%)	0	0	0	22	5	27
D (+70%)	**0**	**0**	**0**	**1,291**	**475**	**1,766**
B (31-50%)	0	0	0	1,270	385	1,655
C (51-70%)	0	0	0	21	90	111
Grand Total	**1,172**	**5,842**	**10,141**	**15,265**	**10,966**	**43,385**

Table 5 Net Contributing 'Switch' area by Understory Broad Cover Group

Understory Broad Cover Group	Net Contributing Area (ha)
CD	6,145
CX	37,189
DC	51
Total	**43,385**

3.3 Managed Stands Established Prior to March 1st, 1991

All stands with harvest history prior to March 1, 1991 were stratified similar to natural stands by using tree species percent attributes from the AVI. Stands were first assigned base 10 strata and then grouped into the yield strata outlined in Table 2 above. The same approach used to derive BCG and switch stands (section 3.2) was applied to these managed stands.

3.4 Managed Stands Established After March 1st, 1991

Information sources used to stratify stands established after March 1, 1991 included RSA, ARIS, HARV, or AVI, depending on which source was available and when the stand was established (Table 6). The following subsections provide further details on the information and timeframes used to stratify stands into these yield strata.

Table 6 Area summary of information used to stratify managed stands established after March 1, 1991

Yield Type	Information Source	Contributing Area (ha)
Managed Stands Established After March 1, 1991	ARIS	91,451
	AVI	19,548
	HARV	17,470
	RSA	41,210
Grand Total		**169,678**

3.4.1 Stands established between March 1, 1991 and March 1, 1995

Stands established between March 1, 1991 and March 1, 1995 were stratified based on their AVI attributes in the same way as natural and pre 1991 managed stands but were ultimately stratified into the yield strata outlined in Table 2. While this varies from the planning standard (Alberta, 2006), this approach is consistent with the direction provided by GoA in an email dated January 23, 2018. Table 7 shows the relationship between the base 10 strata and the final yield strata used.

Table 7 Relationship between managed yield strata and base 10 strata for stands established between March 1, 1991 and March 1, 1995

Yield Strata	Yield Strata Description	ESRD Base 10 Strata
D_CD	ARIS D declared blocks	1 - Deciduous
HwPl	ARIS DC declared - HwPl block or HwPl RSA SU	2 - Hardwood / Pine
HwSx	ARIS DC declared - HwSx block or HwSx RSA SU	3 - Hardwood / Spruce
SwHw	ARIS CD declared - SwHw block or SwHw RSA SU	4 - White spruce / Hardwood
Pl	ARIS C declared - Pl block or Pl RSA SU	8 - Pure pine or leading
Sw	ARIS C declared - Sw block or Sw RSA SU	7 - Pure white spruce or leading
Sb	ARIS C declared - Sb block or Sb RSA SU	9 - Pure black spruce or leading

3.4.2 Stands established after March 1, 1995

Where available, RSA Information (photo or non-photo) was used to stratify stand established after March 1, 1995 into yield groups. Otherwise, ARIS information was used. ARIS reconciled cutblocks harvested after the AVI photo capture but prior to May 1, 2017 (i.e., source of HARV) were incorporated into the classified landbase file (see Section 8.1.26) and the ARIS-reconciled cutblock strata (A_FinalStrata) was used to classify the yield strata.

3.5 Partially Stocked Openings

3.5.1 Openings with total stocking < 50%

There were 26 openings (approximately 690 ha) established after March 1, 1995 with a stocking of less than 50%. These openings were removed from the contributing landbase (see Section 4.5.9).

3.5.2 Openings with total stocking >= 50% and < 80%

There were 266 openings (approximately 6,451 ha) established after March 1, 1995 with a stocking of between 50-80% that remained in the contributing landbase. For these openings, the stocking % was first reclassified to the nearest 5% class and yield curves for each individual NSR opening was factored down and pro-rated by their respective reclassified stocking percent where 80% is considered fully stocked (i.e., reclassified stocking percent/ 80% = Yield Curve factor), except for those stands that got reclassified to 80, in which case a 97.5% yield factor was applied. Table 8 shows the yield factors applied.

Table 8 Yield Adjustment for applied to Partially Stocked Openings

Reclassified Stocking Percent (%)	Percent Yield Factor Applied (%)
50	62.5
55	68.75
60	75.0
65	81.25
70	87.5
75	93.75
80	97.5

Weyerhaeuser

4. Classified Landbase Determination

4.1 Classified Landbase Summary

Classifying a landbase to derive the contributing landbase is a hierarchical process. For example, there can be steep ground on the landbase that is not forested. Since non-forested removals are considered higher in the summary table, non-forested stands that are also steep get removed under the non-forest criterion but are not counted again under the steep criterion. Table 9 provides an area summary of the classified landbase for each netdown criterion. Areas reported for each category are the net effective removals for that reason. Figure 3 provides a generalized overview map representation of the classified landbase. An overview map of the contributing area by broad cover group is provided in Figure 4. Detailed descriptions of each netdown criterion and how they were applied are provided in the following sections.

Table 9 Classified Landbase Summary

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
Gross Classified Landbase	**1,178,018**	**49,362**	**11,347**	**1,117,309**
Less Non-Forested				
1. Anthropogenic Non-Vegetated	17,651	501	180	16,969
2. Naturally Non-Vegetated	14,167	787	59	13,321
3. Anthropogenic Vegetated	22,851	2,182	924	19,745
4. Non-Forest Vegetated	20,630	557	805	19,268
5. Non-Forested Dispositions	15,602	716	82	14,804
6. Non-Forested Burn	3,523	3	0	3,521
= Net Forested Land base	**1,083,594**	**44,616**	**9,297**	**1,029,681**
Less Administrative Removals				
1. Non-Contributing Dispositions	39,930	35,867	13	4,051
2. Private	2,109	1,842	0	267
3. Provincial Parks	1,563	1,563	0	0
4. Provincial Recreation Areas	1,179	1,169	0	9
5. Historic Resource Values	91	0	0	91
6. MPB Rehab	696	0	0	696
7. Unreconciled ARIS	22	0	0	22
8. No AVI	309	302	6	1
9. Dunes	2,370	2,370	0	0
= Net Classified Forested Land base	**1,035,326**	**1,503**	**9,278**	**1,024,544**

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)	FMA (ha)
Less Riparian Buffers				
1. Large Lake	5,695	10	30	5,655
2. Small Lake	180	0	1	180
3. River	16,724	131	218	16,375
4. Stream	55,385	37	346	55,002
5. Trumpeter Swan Buffers	2,533	2	5	2,526
Less Non-Merchantable				
1. Larch	27,836	32	491	27,313
2. Black Spruce	10,346	52	174	10,120
3. A-Density DX Stands	15,979	84	288	15,607
4. Low Density	4,915	3	78	4,834
5. Subhydric Poor/Very Poor	19,093	0	0	19,093
6. Stands Heavily Impacted by MPB	1,121	0	12	1,109
7. Low Productivity (TPR = U)	14,854	0	10	14,844
8. Low Productivity Within Caribou Range	9,334	0	0	9,334
9. Not Sufficiently Restocked (NSR)	642	0	0	642
Less Subjective				
1. Steep Slopes	10,334	0	2	10,332
2. Archaeology	22	0	0	22
3. Trapper Cabin	394	0	0	394
4. Mineral Lick	224	0	0	224
5. Spring	73	0	0	73
6. Prime Protection (ESLUZ1)	661	0	0	661
7. Unique Areas	884	2	176	706
8. Isolated	3,908	4	34	3,870
less Productive Area within Seismic Lines				
1. Seismic	8,026	22	138	7,866
= Contributing Net Classified Landbase	**826,163**	**1,126**	**7,273**	**817,764**
Contributing Landbase by Broad Cover Group				
1. Pure Conifer (CX)	432,330	100	651	431,579
2. Conifer Leading (CD)	61,787	35	287	61,465
3. Deciduous Leading (DC)	52,385	104	302	51,979
4. Pure Deciduous (DX)	236,275	705	6,033	229,538
5. 'Switch' Stands (D_US)	43,385	182	0	43,203
less aspatial removals				
In-Block Retention (4%)	33,047	45	291	32,711
= Effective Contributing Net Classified Landbase	**793,117**	**1,081**	**6,983**	**785,053**

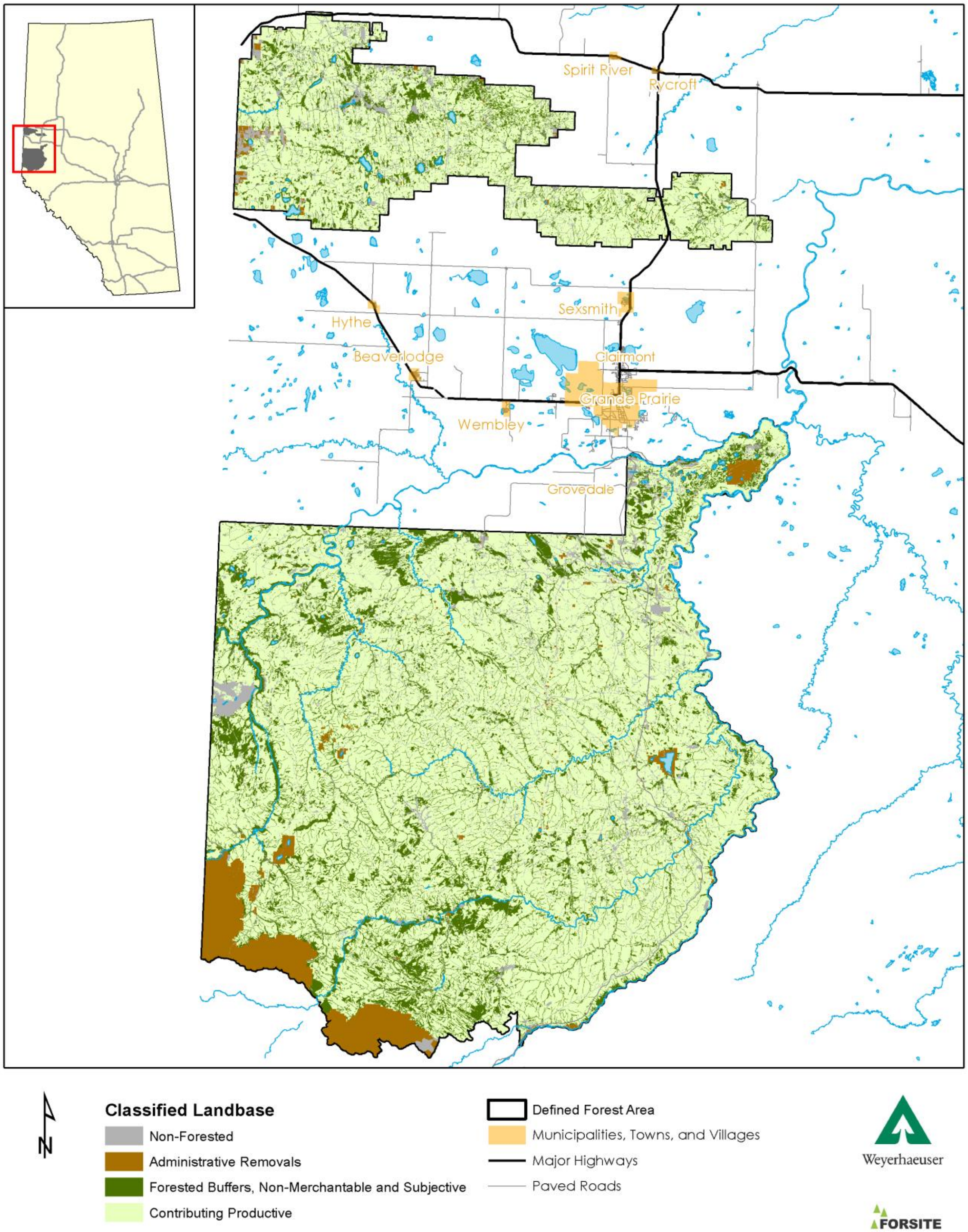


Figure 3 Classified Landbase Overview Map

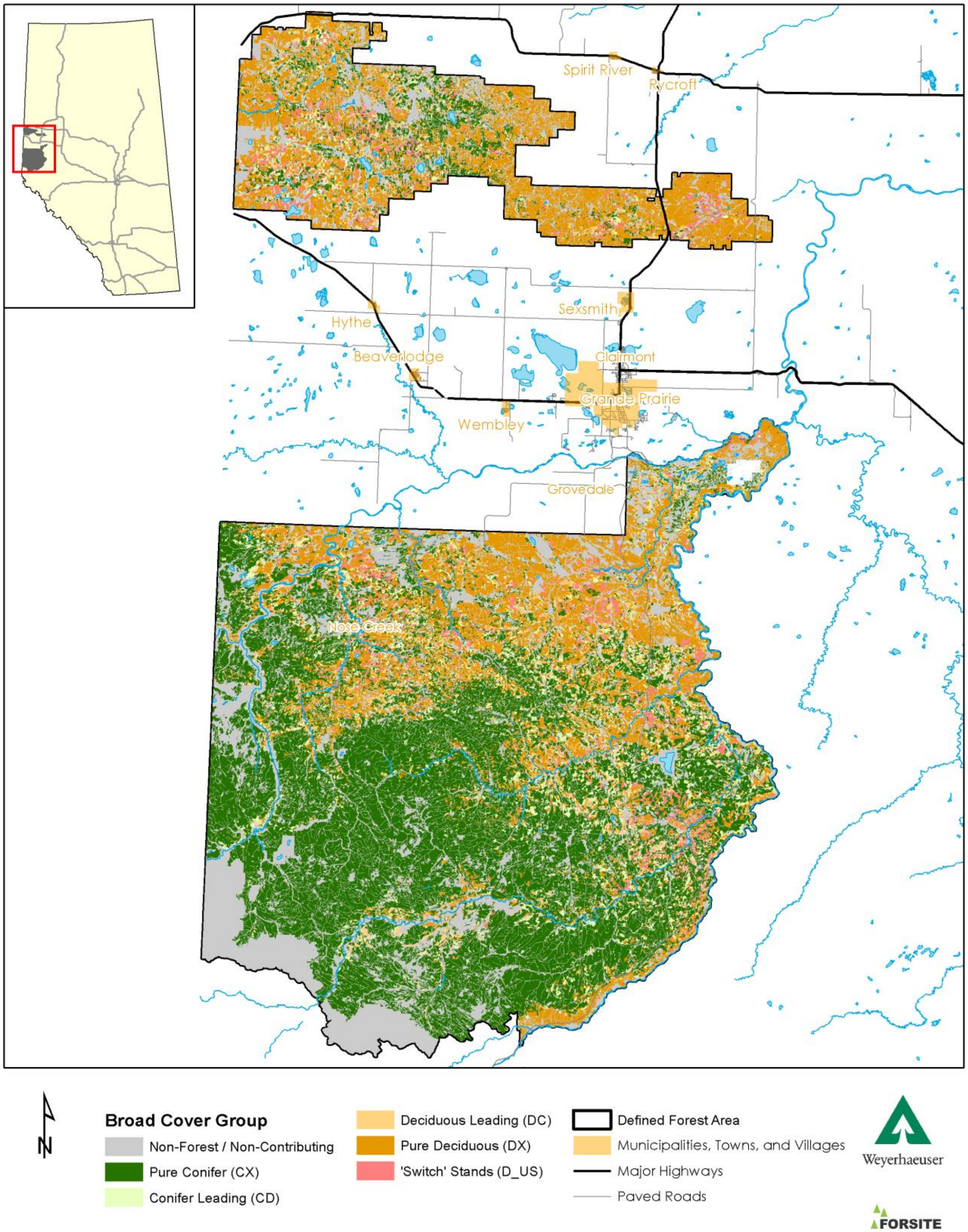


Figure 4 Broad Cover Group Overview Map

4.2 Non-Forested Removals

Lands classified as non-forest were removed from the contributing landbase. These removals were treated differently for existing managed stands (i.e. previously harvested) and existing natural stands (no documented harvest history). The following subsections describe the non-forest categories and how they these areas were identified for removal from contributing to the net classified landbase.

4.2.1 Anthropogenic Non-Vegetated

Anthropogenic non-vegetated are areas that have been left in a non-vegetated state because of human activities. The information source used for these removals was the anthropogenic non-vegetated field (ANTH_NON) in the AVI. Within the DFA, the following anthropogenic non-vegetated designations were removed from contributing to the net landbase: cities, towns, villages, hamlets (ASC), farmyards (AIF), ribbon development / subdivision / acreages (ASR), permanent right-of-way's (AIH), Gravel/borrow pits (AIG), peat extractions (AIE), surface mines (AIM), and industrial sites/sewage lagoons (AII). These were removed whether or not the area had harvesting history.

4.2.2 Naturally Non-Vegetated

Naturally non-vegetated are areas that have no vegetation because of natural processes. The information source used for these removals was the naturally non-vegetated field (NAT_NON) in the AVI. Within the DFA, the following naturally non-vegetated designations were removed from the contributing landbase: cutbanks (NMC), rock/barren (NMR), Sand (NMS), flooded areas (NWF), seasonal thaws / lakes / ponds (NWL), and Rivers (NWR). These areas were removed whether the area had harvest history or not.

4.2.3 Anthropogenic Vegetated

Anthropogenic vegetated removals are areas where humans have influenced the vegetation. The information source used for these removals was the anthropogenic vegetated field (ANTH_VEG). Since cutblocks can sometimes get typed as anthropogenic vegetated, only those areas identified as anthropogenic vegetated that did not have also have harvest history (i.e. ARIS number, MOD1='CC', etc.) were removed.

4.2.4 Non-Forest Vegetated

Non-forest vegetated are areas that have greater than 6% plant cover but less than 6% tree cover. It includes areas covered by closed shrub, open shrub, herbaceous grassland, herbaceous forbs, and moss. As with anthropogenic vegetated removals, previously harvested areas can sometimes be typed as non-forested vegetated, so previously harvested areas were not removed for this reason.

4.2.5 Non-Forested Dispositions

Activities on some dispositions are expected to remove the forest cover resulting in non-forested areas even though they may be currently forested. As per the document entitled "*Best Practices, Classified Landbase Development: Non-Contributing dispositions*", Nov. 1, 2017, these areas must be assigned a non-forest cover type and be removed from the contributing landbase. Table 10 provides the list of disposition types that are considered non-forested.

Table 10 Non-Forested Disposition Types

Disposition Description	Disposition Code(s)
Miscellaneous Lease	MLL, DML, PML
Surface Material Lease	SML, PSM, SMC
Easement	EZE, PEZ
Easement in Special Areas	EAS
License of Occupation	LOC, DLO, PLC
Mineral Surface Lease	DMS, PMS
Pipeline Agreement	PLA, DPL, PPA
Pipeline Installation Lease	PIL, DPI, PPI
Right of way lease	ROW
Right-Of-Entry Agreement	ROE
Rural Electric Association Easement	REA, PRA
Vegetation Control Easement	RVC, VCE
Forestry Road	FRD
Provisional Roadway	RDS
Registered Roadway	RRD, PRD

4.2.6 Non-Forest Burn

Stands affected by fires that occurred since photos were captured for the AVI, and that do not have a subsequent valid strata call assigned were removed from the contributing net landbase. Relatively little area had burned since the AVI capture; the largest fire (Red Deer Creek Fire) occurring in 2014 on the western boundary of DFA.

4.3 Administrative Designations

Administrative designations are legal boundaries that define where licensees have rights to specified resources. The G16 Forest Management Unit (FMU) forms the DFA and covers 1,178,017 ha. Within the DFA, the FMA forms the outer extent of the area for which Weyerhaeuser has harvesting rights to and covers 1,117,309 ha. Deciduous operators have specified rights to harvesting deciduous volume (11,347 ha) within grazing leases within the DFA but outside the FMA. Within each of these designations are areas with no associated harvesting rights or where harvest rights have been transferred to other parties through dispositions. The following subsections describe each administrative designation that exclude timber harvesting rights.

4.3.1 Non-Contributing Dispositions

Several disposition types occur within the DFA. These are areas where no harvesting rights are granted or have been granted to other parties and do not contribute in this analysis. These spatial boundaries were derived from the AltaLIS Digital integrated dispositions (DIDs) spatial feature class, which includes several disposition types. Table 11 outlines the dispositions types that do not include forest harvesting rights and were subsequently removed from the contributing to the net landbase. This is consistent with the approach outlined in the document entitled "*Best Practices, Classified Landbase Development: Non-Contributing dispositions*", Nov. 1, 2017.

Table 11 Non-Contributing Dispositions Types

Disposition Description	Disposition Code(s)
Cultivation Permit	CUP
Disposition Reservation	DRS
Farm Development Lease	FDL
Provincial Grazing Reserve	GRR
Miscellaneous Permit	MLP, PMP
Public Land Sales	PLS
Miscellaneous Townsite Lease	MTS
Recreation Lease	REC, PRL
Parks Reservation Notation	PRS

Boundaries for protective notations (PNT) were also extracted from the AltaLIS DIDs feature. Only protected notations that legally imposed restrictions on harvesting activities were identified as deletions. There are 121 unique protective notations within the DFA. This list was reviewed by Weyerhaeuser staff to ensure only protected notations without harvesting rights were removed from contributing to the net landbase.

4.3.2 Private

Private ownership was removed from the contributing landbase.

4.3.3 Two Lakes Provincial Park

Two Lakes Provincial Park is a remote scenic park that includes two small lakes and offers 86 camping sites with basic facilities. The gross area of the park is approximately 1,580 ha. As timber harvesting rights are not granted within this park, it was removed from the contributing net landbase.

4.3.4 Provincial Recreation Areas

Several Provincial Recreation Areas occur within the DFA. These are Shuttler Flats, Musreau Lake, Kakwa River, Big Mountain Creek, Southview, and Sheep Creek. These parks were removed from the contributing landbase.

4.3.5 Historic Resource Values

Historic resources identify lands that contain or are believed to contain historic resources, including primarily archaeological and palaeontological sites, Aboriginal traditional use sites of a historic resource nature, and historic structures. Historic resources were removed from the contributing landbase if they had a Historic Resource Value (HRV) of 1, 2, or 3.

4.3.6 Mountain Pine Beetle Rehabilitation

Areas that have had rehabilitation treatments using funds from the Forest Resource Improvement Association of Alberta (FRIAA) were considered administrative removals and removed from the contributing net landbase. A list of associated ARIS opening numbers was provided by GOA and this list was used to identify the population of blocks to remove from the landbase.

4.3.7 Unreconciled ARIS

Areas that could not be reconciled with ARIS records were removed from the contributing net landbase.

4.3.8 No AVI

A few areas within the DFA were removed from the contributing net landbase where the vegetation inventory was not collected. This area is primarily in the Southwest portion of the DFA and is largely overlapped by protective notations.

4.3.9 Dunes

In the 2011 plan, an area of dunes was subjectively removed from the productive landbase. Since that plan, this area has been formally removed from the FMA. The gross area of this removal is approximately 2,500 ha.

4.4 Riparian Buffers

Riparian buffers are minimum distances between harvest openings and hydrologic features such as streams, rivers, lakes, and other riparian features (i.e., oxbow lakes, wetlands etc.). These minimum distances are defined in the operating ground rules (Table 12). Special buffers are also established for lakes that trumpeter swans are known to frequent. These buffered elements were removed from contributing to the net landbase. The following subsections describe each riparian class in more detail.

Table 12 Riparian Classes and associated buffer distances

Netdown Description	Buffer Distance (m)
1. Large Lake (> 4 ha)	100
2. Small Lake (<= 4 ha)	30
3. River	60
4. Stream	30
5. Trumpeter Swan Buffers	200

4.4.1 Large Lakes

Large lakes are greater than 4 ha in size. These lakes were identified using AVI and the 'Natural non-vegetated' attribute field (NAT_NON) that indicates seasonal thaws, lakes, ponds (NWL) and flooded areas (NWF) and were buffered by 100 m.

4.4.2 Small Lakes

Small lakes are smaller than or equal to 4ha in size. These lakes were identified using AVI using the Natural non-vegetated attribute field (NAT_NON) that indicates Seasonal, thaws, lakes, ponds (NWL) and flooded areas (NWF) and were buffered by 30 m.

4.4.3 Rivers

Rivers are identified with channels wide enough to discern and delineate as polygons during inventory mapping. The source for rivers was a combination of AVI (NAT_NON = 'NWR') and the AltaLIS hydrology features FEATURE_TY in ('OXBOW-PER', 'RIV-MAJ-LB', 'RIV-MAJ-RB'). These two information sources were combined prior to buffering. Rivers were buffered by 60 m and the portion of the buffers not already considered non-forest (i.e. water) was removed from the contributing land base.

4.4.4 Streams

Streams not wide enough to delineate during inventory mapping were buffered by 30 m and the portion not already considered non-forested was removed from the contributing land base. The source of these streams was the AltaLIS Hydrography single line network (BF_SLNET; all features buffered by 30m).

4.4.5 Trumpeter Swan Lake Buffers

Water bodies identified as habitat used by Trumpeter Swans were buffered by 200 m and removed from the contributing landbase.

4.5 Non-Merchantable Removals

While some stands may currently be forested, the species present can be considered unsuitable as commercial timber or too difficult to reforest due to the physical characteristics of the terrain. The following subsections describe each non-merchantable removal. None of these non-merchantable conditions applied if the areas were previously harvested or are currently planned for harvest.

4.5.1 Larch

Existing natural stands containing greater than 40% larch were removed from the contributing landbase. For stands with any amount of larch (i.e., greater than 10%), stands with a calculated site index of less than 8.0 were also removed from the contributing landbase.

4.5.2 Black Spruce

Existing natural and unproductive stands containing greater than 80% of combined black spruce and larch composition were removed from the contributing landbase.

4.5.3 A-Density pure deciduous

Low density (i.e., Crown closure <30%) stands identified as pure deciduous (>= 80%) were removed from the contributing landbase if:

- there was no understory identified, or
- If an "A" Density understory was detected with a height less than 15m.

4.5.4 Low Density

Low density stands greater than 80 years old with less than 20% crown closure or with less than 250 sph and less than 50% crown closure in the understory were removed from the contributing landbase.

4.5.5 Subhydric Poor and Very Poor

Predictive ecosystem mapping was used to identify poorly drained, unproductive (subhydric very poor and poor) sites that were removed from the contributing landbase.

4.5.6 Stands Heavily Impacted by MPB

Stands heavily impacted by Mountain Pine Beetle (MPB) were removed from the contributing landbase. These were identified using AVI stand modifier (MOD1 or MOD2 in ('BK', 'SN')) where the modifier extent was equal to or greater than 2 with a density of 'A' and an understory density of 'A' or with no understory call and did not was not recently harvested and was not planned for harvest.

4.5.7 Low Productivity (TPR=U)

Areas identified as being unproductive in the AVI (Timber Productivity Rating = 'Unproductive' or simply TPR=U) were removed from the contributing landbase.

4.5.8 Low Productivity within Caribou Range

Stands that have a leading species of pine, black spruce, or white spruce with an origin date of <=1900 and a stand height of <=13 m and area within the caribou range were removed from the contributing landbase.

4.5.9 Not Sufficiently Restocked (NSR) with Stocking < 50%

Previously harvest areas with a stocking percent of less than 50% were removed from the contributing landbase.

4.6 Operability Restrictions and Subjective Removals

4.6.1 Steep Slopes

Areas that are inoperable due to steep slope, position on the slope, and/or slope stability were excluded from the contributing landbase. In general, areas identified with >55% slope with no previous harvest history were removed from the contributing landbase. Steep polygons greater than 0.2 ha were aggregated if they were within 20 m of each other while those less than or equal to 0.2 ha were ignored and not included in the final steep feature. Small areas (< 2ha) surrounded by steep areas were filled and treated as if they were steep (eliminate polygon part). The remaining steep areas were buffered by 5m to smooth out the line work and cinch in areas close together but not touching. Finally, manual edits were made to the buffered steep feature to help facilitate the identification of larger areas isolated by steep topography (details for identifying isolated areas are provided in section 4.6.8).

4.6.2 Archaeology

Areas with known important or sensitive archaeology significance were removed from the contributing landbase.

4.6.3 Trapper Cabins

Current and historic trapper cabins were buffered by 200 m and removed from the contributing landbase.

4.6.4 Mineral Licks

Identified mineral licks were buffered by 100 m and removed from the contributing landbase.

4.6.5 Springs

Identified springs were buffered by 100 m and removed from the contributing landbase.

4.6.6 Eastern Slopes Prime Protection Zone

The Eastern Slopes Management Policy was originally published in 1977 with a revision update published in 1984. Areas identified as Prime Protection Zone were removed from the contributing landbase.

4.6.7 Unique Areas

Areas considered unique were identified by Weyerhaeuser the areas not already removed under a disposition were buffered and removed from the contributing landbase. Table 13 shows the unique areas, their associated gross areas, and the net areas removed from the contributing landbase. A description of all the unique areas is included in section 4.2.3 of the Landscape Assessment.

Table 13 Unique Area Removals from the Contributing Landbase

Unique Areas	Gross Area (ha)	Net Area Removed (ha)
Calliope Nesting Areas and 500 m buffer	1,751	1,081
Lingrell Waterfall	13	3
Saddle Hills Cave and Waterfall	13	9
Saddle Hills Rimrocks and 200 m Buffer	269	196
Total	**2,045**	**1,289**

4.6.8 Isolated

Small areas (<1 ha) greater than 59 m from other harvestable areas or from roads and greater than 1 ha in size where the sum of the small areas within 59 m of each other were identified and removed (approximately 381 ha) from the contributing landbase (ISOLATED=1).

Areas within 300 m of major rivers (Narraway River, Smoky River, Kakwa River, and Wapiti River), less than 50 ha, further than 150 m from a road and further than 5m from the closest contributing area greater than 5 ha were also removed (approximately 3,513 ha) as areas isolated by steep and rivers (ISOLATED=2).

4.7 Seismic Lines

The Alberta Forest Management Planning Standard outlines the requirements surrounding seismic lines in Annex 1, Sec 3.2.i. To account for seismic lines in the classified landbase, an adjustment factor was used. Seismic line features were buffered by 3 m on either side for a total buffer width of 6 m. This buffered seismic area was then used to calculate an adjustment factor for every AVI polygon (NET_FACTOR). This was done by performing a GIS union of the buffered seismic lines and input AVI on the side to determine the proportion of each AVI polygon that was covered by seismic buffers. This approach is consistent with Option B outlined in the document "*Clarification on seismic line integration Feb 24, 2017*".

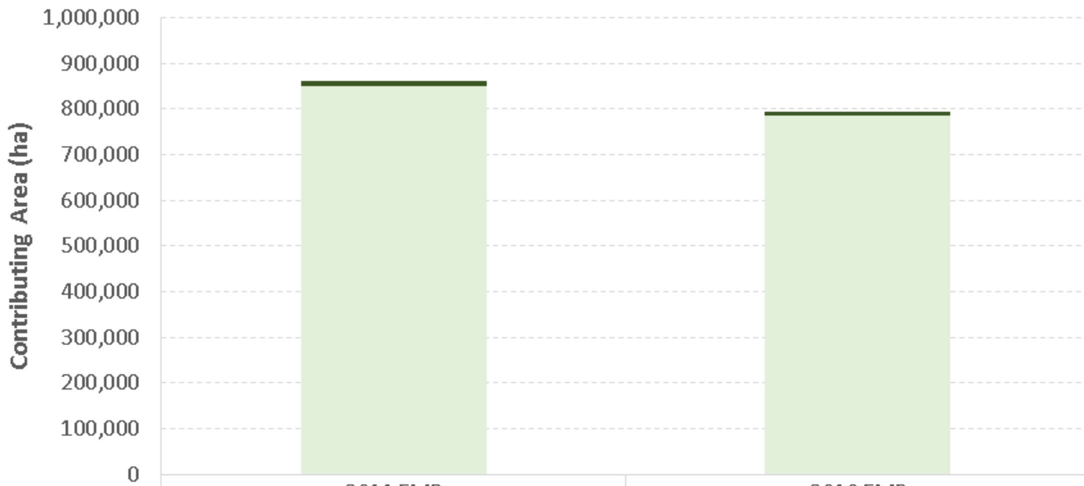
4.8 In-Block Retention

In-block retention is accounted for in the timber supply analysis. Efforts have been made to map existing insular in-block retention from both historic harvest openings and planned harvest (see Section 6.3) and ensure that these retention areas are not sequenced for 60 years after the harvest date of the adjacent opening. However, due to the small polygon sizes, it is not always mapped consistently. For the planned areas being sequenced in the timber supply analysis, an aspatial reduction factor of 4% was applied within the timber supply model consistently across the landbase. This aspatial retention factor is included in Table 9 to illustrate the impact on the net contributing landbase.

5. Key Differences from the Last FMP

Key differences from the 2011 FMP Landbase Netdown are briefly summarized below from the specific information outlined in section 4 of this document.

- The contributing area for the FMA is approximately 7.7% (~69,024 ha) smaller (Figure 5).



	2011 FMP	2019 FMP
Non-FMA	11,487	8,063
FMA	850,654	785,053

Figure 5 Comparison of Contributing Areas between the 2011 FMP and the 2019 FMP

- In the 2011 Plan Weyerhaeuser used the 2004 version of the Alberta Forest Management Planning Standard (AFMPS) as a guide for determining the contributing landbase available for timber harvesting. For this Plan we are using version 2006 of the AFMPS.
- In the 2011 Plan the Defined Forest Area (DFA) included only the Forest Management Agreement Area and the Grazing Leases. In this plan the DFA is all of Forest Management Unit 16.
- The AVI was for the last Plan was completed in 2004 using leaf on photography and was brought up to AVI version 2.1 specifications in 2008. For this Plan, the AVI was redone for the DFA using leaf off photography to better detect understory conifer and to better assess mortality from Mountain Pine Beetle.
- In this Plan a netdown hierarchy was used (PDT-003; September 2017) that considered netdown reasons from non-forested and administrative reasons through to subjective removals. This concept was similar to the 2011 Plan, however there were changes to the classifications that resulted in a shift around of specific (hectares) in the final product.
- Non-Forested includes non-forested dispositions and non-forested burned areas.
- Administrative includes dispositions (as in 2011), as well as, areas designated as private land, provincial parks, unreconciled ARIS, no AVI and areas removed because of FRIAA funded activities.

- DIDS were removed from this landbase as per direction received in November 2017.
- Riparian Buffers included Trumpeter Swan buffers and did not include dispositions and seismic lines in this section. Buffer widths were applied according to the current approved Operating Ground Rules.
- Non-Merchantable areas were removed from the landbase due to their inability to meet current merchantability criteria. These were separated out into their own category from the subjective field because non-merchantable deletions and deferrals were a main contributor to Spatial Harvest Sequence (SHS) variance in the last plan and these removals require more detail to fully describe the reasoning.
- The threshold for removing larch was increased to 40% from 20%, as it was determined that blocks with up to 40% larch content could be feasibly operated through variable retention practices providing the second leading species in the stand met merchantability criteria.
- Subhydric Poor/ Very Poor and Low Productivity Stands were removed based on information gathered during variance tracking in the last plan.
- Heavily Impacted MPB Stands were removed based attributes assigned during the AVI renewal.
- Subjective removals are a result of known operational constraints, previous planned activities or through consultative activities.
    - Slopes considered too steep to operate was determined using Lidar-derived slope classes. The threshold increased from 45% to 55% in this plan.
    - Areas were removed because of archeological, stakeholder, and wildlife values based on information from previous planning and harvesting operations.
    - Prime Protection/ Eastern Slopes areas were removed based on direction from the Province in September 2017.
    - Unique areas were updated based on consultation activities. Many of the identified areas were already removed under a disposition.
    - Isolated stands were identified and removed as being inoperable.
    - Horizontal stands were not removed in this Plan because of the reduced minimum polygon size and an improved method of identifying and removing for non-merchantability.
- Seismic lines were buffered and removed as per direction from the Province in September 2017. The buffered width did not change from the previous Plan.
- In-Block Retention was removed using an aspatial approach during the landbase definition as opposed to a volume (AAC) reduction as was done in the 2011 Plan. The retention targets increased to 4% representative from 2.5% conifer and 3% deciduous.
- Broad Cover Group definition did not change with the exception of “switch stands” as described in 3.2.2. The criteria for determining a switch stand now requires a stronger contribution from the conifer understory.

5.1 Incorporating Variance from the Previous Plan

In the 2011 plan, variance from the approved conifer sequence became an issue as we reached the end of the second cut period. Several factors contributed to this, including working from an older AVI product and having included a wide range of stand types to provide flexibility in harvest planning to address the threat from Mountain Pine Beetle.

An analysis of the SHS variance for cut periods 1 and 2 for both the conifer and the deciduous operators was completed to identify the following operational trends in the deferral and deletion categories. Table 14 below describes the reason for and how each variance has been addressed in the new classified landbase.

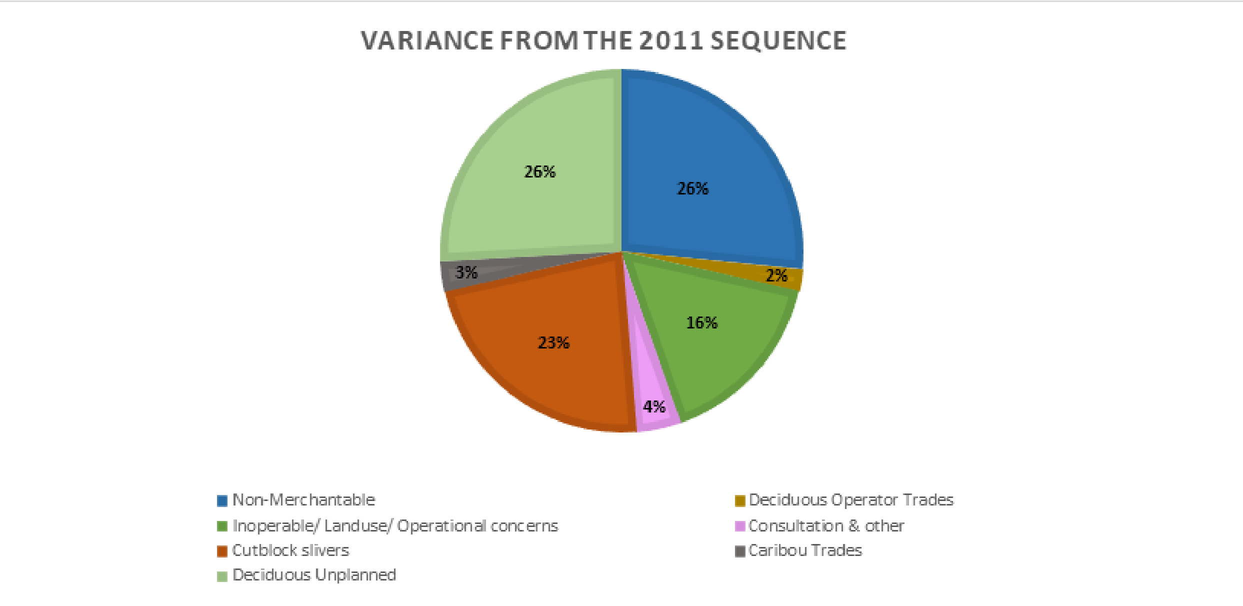


Figure 6 Variance from the 2011 Sequence

Table 14 Variance from 2011 Sequence and how they will be addressed in the 2019 Landbase

Deferral/ Deletion Reason	How it will be addressed in the 2019 Landbase
Non-Merchantable	New AVI; stand removals for low density stands, subhydric/ poor sites, low productivity sites, non-merch species content (Lt & Sb); MPB infestation
Cutblock slivers	Modelling function in Patchworks as described in 6.2.1 of this document; subjective deletion of isolated stands
Inoperable/ Land use/ Operational concerns	Updated layers for steep slopes, DIDS, streams & buffers; watershed model built into the sequence
Caribou Trades	Not a landbase removal; New sequence in the Caribou Zones
Consultation & other	Consultative deletions included in subjective deletions
Deciduous Operator Trades	Not a landbase removal; New sequence in the Dx landbase with operator tagging
Deciduous Unplanned	Not a landbase removal; New sequence in the Dx landbase; reduced AAC

6. Development of the Classified Landbase

This section describes the general methods and procedures used to create the spatial files for the classified landbase. This process combined various datasets into a single flat non-relational feature.

This section also describes how the seismic lines were addressed, as well as, how the AVI and the other spatial data layers were used to stratify and classify the landbase to determine the effective contributing net classified landbase and the yield strata within the landbase that contribute to the AAC.

6.1 Combining Input Spatial Datasets

Section 6.1.1 describes how features listed as absolute in Table 1 were combined to form the classified landbase file while section 6.1.2 describes how proxy features were added to the file.

6.1.1 Absolute

Prior to combining, spatial features were grouped into 4 groups depending on their size and the importance of maintaining spatial integrity (Table 15). A python script was used to first union all layers within each group. After each group of features were unioned together, the results were cleaned using a 'sliver' identification selection and then once identified, were merged with neighboring polygons that had the largest area or longest shared border. Slivers are small narrow polygons that get created when two polygon lines from separate sources create thin small polygons. These were identified using a selection expression employing a 'thinness ratio' (i.e., area-to-circumference ratio) expression in combination with a minimum and maximum polygon size tolerance (Table 15):

- Shape_Area < minimum area or (4*12.56636*(Shape_Area / (Shape_Length*Shape_Length)) < Thinness Ratio and Shape_Area < Maximum Area
- Once each group of features were combined (arcpy.Identity_analysis) and cleaned (arcpy.Eliminate_management), group1 was combined with group2 (combo1), Combo1 was combined with Group 3 (Combo2), and finally Combo2 was combined with Group4 (combo3). The sliver removal processes were applied after each combination of groups (combo).

Table 15 Input Feature Eliminate Tolerances and Groupings

Group	Input Feature Class Name	Thinness Ratio	Minimum Area (m^2)	Maximum Area (m^2)
1	AccessUnits	0.175	1000	10000
	Caribou_Range	0.175	1000	10000
	CostZones_2019	0.175	1000	10000
	EasternSlopesLUZ	0.175	1000	10000
	FireSmart	0.175	1000	10000
	FMA_6900016	0.175	1000	10000
	FMU_G16	0.175	1000	10000
	Forestry_Watersheds	0.175	1000	10000
	Natural_Regions_Subregions_of_Alberta	0.175	1000	10000
	ProvincialPark	0.175	1000	10000
	Dunes	0.175	1000	10000
	ProvincialRecreationArea	0.175	1000	10000

Group	Input Feature Class Name	Thinness Ratio	Minimum Area (m²)	Maximum Area (m²)
2	DIDs_GL_t	0.175	500	5000
	DIDs_NCON	0.175	500	5000
	PostAviFires	0.175	500	5000
	Subhydric	0.175	500	5000
	UniqueBuffers	0.175	500	5000
	G16_AFS_SDS_MPB	0.175	500	5000
	HistoricResources	0.175	500	5000
3	Archaeology	0.175	500	5000
	MineralLick	0.175	500	5000
	Private	0.175	500	5000
	Spring	0.175	500	5000
	STEEP_edit	0.175	500	5000
	TrapperCabin	0.175	500	5000
	TrumpeterSwanBuffers	0.175	500	5000
4	DIDs_NFOR	0.1	10	500
	Hydrology_Buffer	0.1	10	500
	PLANNED_BLOCKS	0.1	10	500
	WEYGP_FMA_G16_AVI_ARIS	0.1	10	500
	Cutblocks_V9_missingWeycoFRIAATOLKMerge	0.1	500	500
	AVI_RECONCILED_RSA_NP	0.1	10	500
	AVI_RECONCILED_RSA	0.1	10	500
Combo1	All features in Group 1 combined with Group2	0.175	1000	5000
Combo2	Combo1 combined with Group 3	0.175	1000	5000
Combo3	Combo2 combined with Group 4	0.01	10	100

6.1.2 Majority / Proxy

Some spatial features were incorporated into the final classified landbase without introducing their respective spatial line-work using a majority operation (Table 16). This was achieved by performing a union with each majority feature with the classified landbase created from the combining the absolute features (6.1.1) and then attributing the source feature attributes to the original classified landbase using the attributes from the polygon with the most overlap from the majority input feature. Once used for updates purposes, unioned features created on the side were deleted. The 'Threshold' column indicates how much overlap had to be achieved to receive the majority feature attributes.

Table 16 Input Features Applied as Majority/Proxy

Input Feature Description	Input Feature Class Name	Field Name	Threshold
Wildfire Management Zones	WildfireManagementZones	FA_NAME	0.5
Mountain Goat and Sheep Area	MountainGoatSheep	MountainGoatSheep	0.5
Grizzly Bear Watersheds	GB_Watersheds	GBWU	0.5
B1 deployable areas	B1_BREED	B1_BREED	0.5
B2 deployable areas	B2_BREED	B2_BREED	0.5

G1 deployable areas	G1_BREED	G1_BREED	0.5
Hard linear disturbed (for songbirds)	HLIN	HLIN_RATIO_GT_1pct	0.41
Aspen Mortality	AspenMortality	SYMPTOM	0.5

6.2 Yield Stratification

Once all input features were combined and majority features incorporated, stands were stratified into final yield groups to drive the development of the growth curves used in the timber supply analysis. This script added many fields that were either calculated with linked datasets (i.e., ARIS reconciliation spreadsheet, EFM Block List spreadsheet) or with existing fields. This script primarily uses ARIS reconciled AVI and cutblock information for stratification but also uses RSA photo and RSA non-photo information, where available. Further details of the yield stratification process and results can be found in Section 3.

6.3 Landbase Classification

The landbase classification hierarchical logic was applied to the CLB resultant to classify each polygon within the G16 FMU landbase file according to the logic and hierarchy presented in Section 4. Isolated areas were identified and flagged (details of which can be found in Section 4.6.8). Existing Insular Retention (< 5ha) was identified and tagged with the associated opening ID to determine the harvest year of the surrounding opening to determine how long timing constraints needed to be applied to prevent the model from sequencing areas intentionally set aside from harvest. In this case, stands were prevented from being harvested for a period of 60 years from the skid clearance date of the associated harvest opening. Productive insular retention within planned harvest was deferred for a period of 60 years from 2017.

Site index was calculated by first determining stand age at photo capture (PHOTO_YR - ORIGIN), then adjusting for Breast Height Age (Table 3-10. of *Alberta Vegetation Inventory Interpretation Standards Version 2.1.1*), and then using site index equations found in APPENDIX VIII of *Alberta Vegetation Inventory Interpretation Standards Version 2.1.1.* Site index values were only used to identify low productivity stands that contained larch for the larch removal (see Section 4.5.1)

6.4 Mountain Pine Beetle Ranking

6.4.1 Alberta Stand Susceptibility Ranking (ASSI)

The Canadian Forest Service (CFS) Shore/Safranyik Stand Susceptibility Index (SSI) model determines the susceptibility for a given stand based on four variables: relative abundance of susceptible pine basal area in the stand, age of dominant and co-dominant live pine, density of the stand, and the climatic suitability of the stand. This model has been adapted by Forest Management Branch (FMB) for use with Alberta Vegetation Inventory (AVI) data, and by removing the climate factor as this modifier was not suitable to Alberta's MPB situation. The ASSI is calculated using stand age, density, and percentage of susceptible pine basal area (derived from per cent pine, tree height and growth and yield data). All stands are rated between 1 and 100 where stands rated as 100 have the highest amount of suitable host trees. It is a relative measure of the attributes of the stand and its suitability as MPB habitat without considering the location of the stand or the climate the stand experiences. Updated ASSI was provided by GOA in September of 2017.

6.4.2 Compartment Risk

Compartment risk is an assessment by the Province of the probability that a compartment will be attacked based on existing MPB populations. Updated compartment risk was provided by GOA on 13 October 2017. All compartments were ranked 'Very High'.

6.4.3 Stand Level Predicted r-value

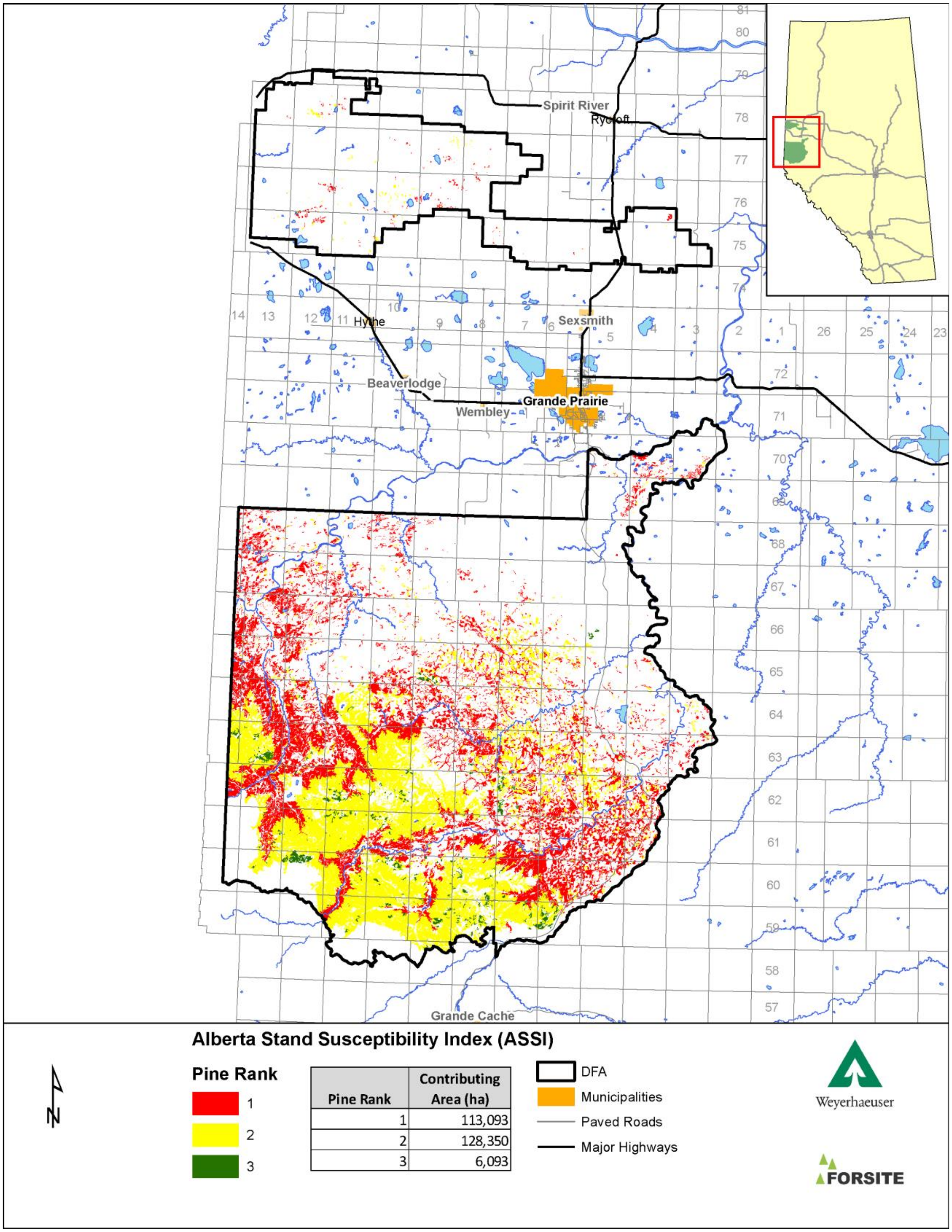
Predicted r-value is an estimate of female MPB productivity as determined by tree size, stand location and weather. This is a relative measure of female productivity and does not translate into per cent population increases. Updated predicted r-values were provided by GOA on 11 October 2017 (effective 14 September 2017).

6.4.4 Final Pine Stand Ranking

Combining the ASSI, compartment risk and r-value forms a stand ranking system for pine strategy FMP planning and implementation (Table 17). An overview of the final pine ranking is shown in Figure 7.

Table 17 Pine Stand Ranking System for Pine Strategy Forest Management Planning and Implementation

Stand Level Predicted r-value				Compartment Risk
Low	Rank 3	Rank 3	Rank 3	Low
	Rank 3	Rank 3	Rank 3	Moderate
	Rank 3	Rank 3	Rank 2	High
	Rank 3	Rank 2	Rank 2	Very High
Moderate	Rank 3	Rank 3	Rank 3	Low
	Rank 3	Rank 3	Rank 2	Moderate
	Rank 3	Rank 2	Rank 2	High
	Rank 3	Rank 2	Rank 2	Very High
High	Rank 3	Rank 3	Rank 3	Low
	Rank 3	Rank 2	Rank 2	Moderate
	Rank 3	Rank 2	Rank 1	High
	Rank 2	Rank 1	Rank 1	Very High
Very High	Rank 3	Rank 2	Rank 2	Low
	Rank 3	Rank 2	Rank 1	Moderate
	Rank 2	Rank 1	Rank 1	High
	Rank 2	Rank 1	Rank 1	Very High
	1 to 22	23 to 63	64 to 100	
	Alberta Stand Susceptibility Index			



Pine Rank	Contributing Area (ha)
1	113,093
2	128,350
3	6,093

Figure 7 Final Pine Strategy Stand Ranking within the DFA

7. Development of the Modeling Landbase

After all input features were combined into a single classified landbase file and yield stratification and landbase classification applied, the forested subset of the classified landbase was exported to the required timber supply modeling input file format (i.e., Shapefile) as fragments[date].shp. This file also only contained the fields and attributes necessary to inform and conduct the timber supply analysis (TSA). These forested polygons were then grouped using the 'Group Fragment' Patchwork tool. This is form of simplifying the landbase where adjacent and/or close polygons were grouped into discrete blocks with a target block size. In this case, 25 ha was the specified target block size. Polygons could belong to the same 'block' if they shared the same yield unit and were within 10 years in age of each other. Specific fields and attributes (i.e., administrative line-work) were also specified to indicate what polygons were not allowed to be grouped together to attain the target block size. The fields for which blocks were stratified on include:

- FMA_NAME,
- NSRNAME
- WS_KEY
- SUBUNIT
- CARIBOU
- GRAZING
- PLAN_KEY
- UNIT
- YLD_STRATA
- CONTCLAS
- RETENTION
- G1_BREED
- B1_BREEDand
- B2_BREED
- RETENTION
- NSR_FACTOR

It is important to note here that the target block size specified here is not synonymous with target harvest opening size. The patchworks model can schedule one or more adjacent blocks together to achieve specified harvest opening sizes. Further details relating to the blocking criteria are shown in Table 18. The data dictionary for the both the fragments and blocks file can be found in Appendix IV.

Table 18 Model Blocking Criteria

Criteria	Factor Applied
Blocking	Polygons were grouped into blocks using the built-in patchworks blocking tool (group fragments). Multi-part blocks were created with a target block size of 25 ha. A 20 m distance threshold was used meaning that polygons up to 20 m apart could be considered part of the same block. Fragment polygons were not allowed to be grouped together if they had more than a 10-year age gap.
Target Block Size	A target block size of 25 ha was used. The blocking tool will attempt to group polygons into 25 ha blocks if they meet the specified stratification criteria.

8. Processing of Input Datasets

The input datasets listed in Section 2 are described in this section. For each layer, a brief description of the data is provided, along with the steps taken to process the data to create the submission dataset.

8.1 Processing of Landbase Spatial Input Datasets

The management and processing of the input datasets were completed using ArcGIS software including ArcMap and ArcCatalog (Version 10.5.1). Processes were managed using a combination of Python scripting and manual processing in a limited capacity.

Datasets are described with regards to:

- Source(s): Where the datasets were sourced from;
- Creation Date/Effective Date: Either the date the file was created, downloaded, or the effective date of the dataset
- Source Filename(s): The names of the datasets used in the creation of the output file;
- Description of Source File: A description of the datasets listed in the Source Filename(s) section;
- Projection/Datum: The projection and datum of the source datasets;
- Important Attributes: The attributes in the source datasets that are to be used to create the output dataset;
- Required Processing: The processing methods used to create the output dataset;
- Assumptions/Processing Issues: Identified issues and assumptions that had to be resolved to create the output dataset;
- Programs: A list of the processing programs/tools used to create the output dataset;
- Output Filename: The name of the output dataset;
- Output Description: A description of the output dataset;
- Output Attributes: A summary of the attributes in the output dataset; and
- Polygon Area/Line Length: The total polygon area or line length of the dataset

8.1.1 Alberta Vegetation Inventory

Leaf-off imagery was acquired for most of the DFA between 2012 and 2015. This imagery was interpreted to the AVI standard 2.1.1 (Alberta, 2005) by Greenlink Forestry Inc. and final approval of the AVI for use in forest management and operational planning was obtained from the GOA on December 13, 2016 (Appendix I). Weyerhaeuser then hired Forcorp Solutions Inc. to perform the ARIS reconciliation. Figure 8.1 shows the final ARIS reconciled AVI by imagery photo year.

Item	Description
Source(s)	Greenlink Forestry Inc., FORCORP Solutions Inc.
Source Filename(s)	G16_2017AVI_ARISRevisions_20180315, G16_FMA_HOLES_AVI.shp
Creation Date/Effective Date	Created: 2018-12-12, Effective: 2017-05-01
Description of Source File	Alberta Vegetation Inventory data for the Weyerhaeuser DFA
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	All attributes were used
Required Processing	1. Copy both features into a file geodatabase called AVI.gdb 2. Erase G16_2017AVI_ARISRevisions_20180315 with G16_FMA_HOLES_AVI and name the result G16_2017AVI_ARISRevisions_20180315_erase 3. Merge G16_2017AVI_ARISRevisions_20180315_erase and G16_FMA_HOLES_AVI and name the result WEYGP_FMA_G16_AVI 4. Repair geometry 5. Add a Key field called KEY_ARIS_AVI and update it with the OBJECTID
Assumptions/Processing Issues	
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1000_Prep_Input_0001_AVI.py 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	WEYGP_FMA_G16_AVI_ARIS
Output Description	File geodatabase feature class consisting of ARIS-reconciled AVI coverage.
Output Attributes	All input attributes are maintained. Output attributes are listed in Appendix V: Data Dictionary.
Polygon Area/Line Length	Total Area - 1,142,747 ha

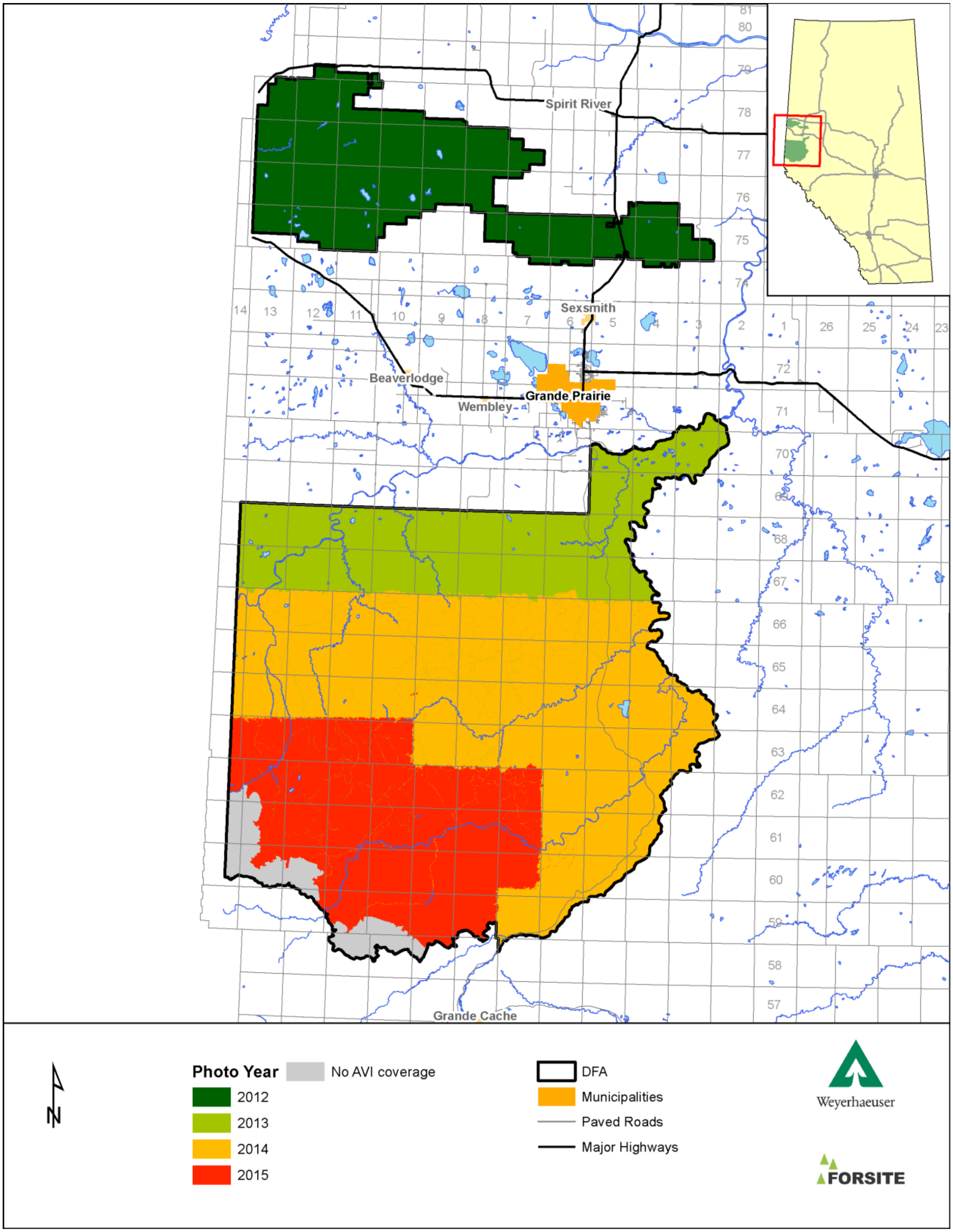


Figure 8.1 AVI photo year for AVI coverage in the DFA

8.1.2 Defined Forest Area Boundary

Item	Description
Source	AltaLIS
Source Filename	**BF_FMU_POLYGON.shp**
Creation Date/Effective Date	Download Date: 2017-08-23
Description of Source File	Boundary of FMU G16
Projection/Datum	Projected, NAD 1983, 10TM-AEP Forest
Important Attributes	FMU_NAME, FMU_CODE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Dissolve on field FMU_NAME with single part option 3. Repair geometry 4. Check and repair topology 5. Export result as FMU_G16 to a file geodatabase feature class
Assumptions/ Processing Issues	Extents of FMU G16 as specified by GoA.
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	FMU_G16
Output Description	Single part file geodatabase feature class showing the boundaries of the G16 Forest Management Unit.
Output Attributes	FMU_NAME
Polygon Area/Line Length	Total Area - 1,178,017 ha

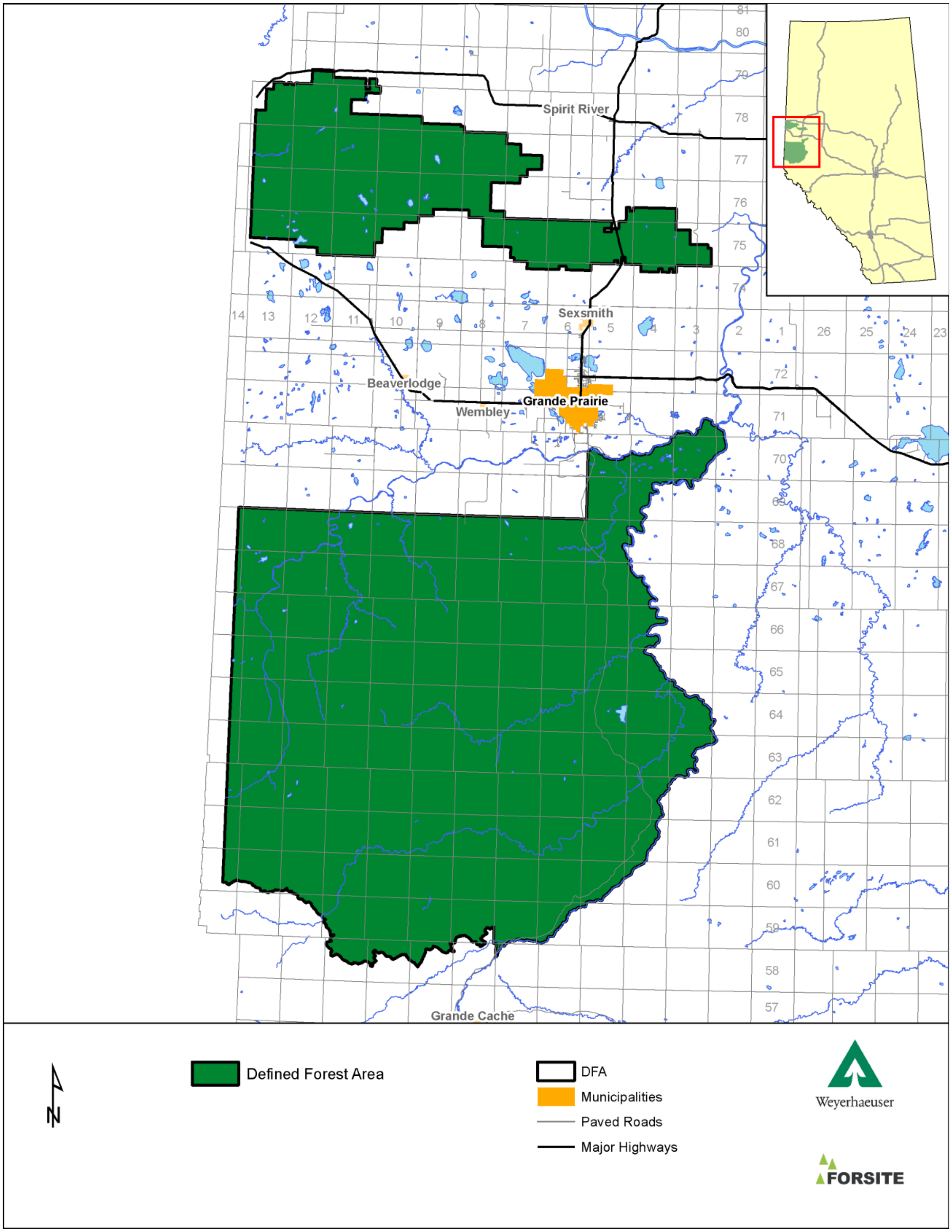


Figure 8.2 Boundary of the DFA.

8.1.3 Forest Management Agreement Area Boundary

Item	Description
Source	AltaLIS
Source Filename	**BF_FMA_POLYGON.shp** (Calendar Date: 2016/08/24)
Creation Date/Effective Date	
Description of Source File	Alberta Forest Management Agreement Areas
Projection/Datum	Geographic, NAD 1983, Decimal Degrees
Important Attributes	FMA_NAME, FMA_NUM
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Dissolve on FMA_NAME, FMA_NUM 3. Repair geometry 4. Check and repair topology 5. Export result as FMA_6900016 to a file geodatabase feature class
Assumptions/Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	FMA_6900016
Output Description	Single part file geodatabase feature class showing the boundaries of the Forest Management Agreement Area (FMA) belonging to Weyerhaeuser (Grande Prairie).
Output Attributes	FMA_NAME
Polygon Area/Line Length	1,117,307 ha

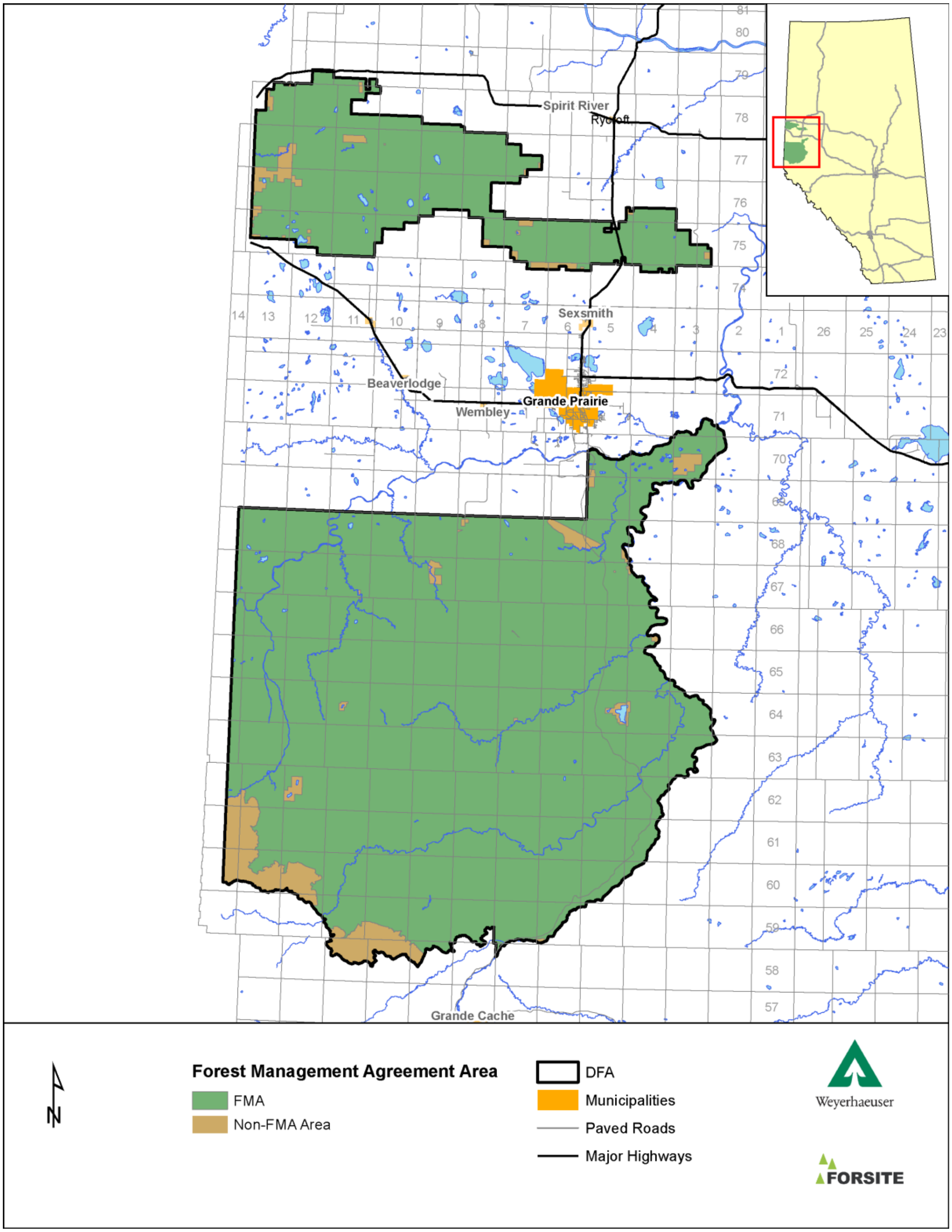


Figure 8.3 Weyerhaeuser Grande Prairie's FMA Area

8.1.4 Natural Sub regions

Item	Description
Source	GOA – Environment and Parks
Source Filename	Natural_Regions_Subregions_of_Alberta.shp
Creation Date/Effective Date	Publication Date: 2005-06-02
Description of Source File	Alberta Natural Sub regions
Projection/Datum	Geographic, NAD 1983, Decimal Degrees projected to NAD 1983 10TM AEP Forest
Important Attributes	NRNAME, NSRCODE, NSRNAME
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip to DFA boundary 3. Dissolve on fields NRNAME, NSRCODE, NSRNAME 4. Repair geometry 5. Check and repair topology
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1006_NaturalSubregions.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	Natural_Regions_Subregions_of_Alberta
Output Description	File geodatabase feature class showing the Natural Sub regions found within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	NRNAME, NSRCODE, NSRNAME
Polygon Area/Line Length	Total Area – 1,178,630 ha Alpine – 3,854 ha Central Mixedwood – 135,753 ha Dry Mixedwood – 55,807 ha Lower Foothills – 548,327 ha Montane – 7,319 ha Subalpine – 175,315 ha Upper Foothills – 252,257 ha

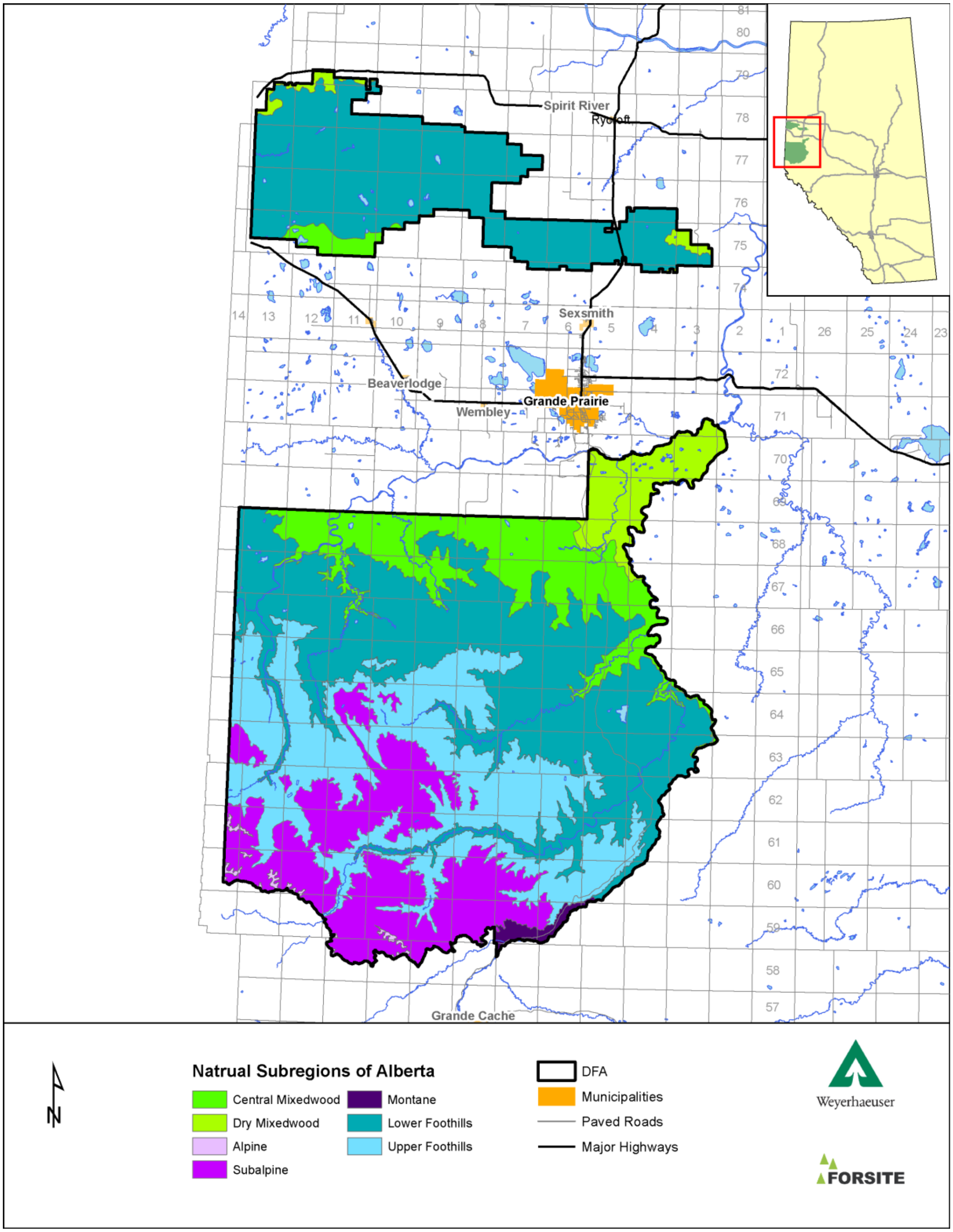


Figure 8.4 Alberta Natural Sub regions found within the DFA.

8.1.5 Tree Breeding Regions

Item	Description
Source	Weyerhaeuser
Source Filename	B1_Breeding_Regions.shp, B2_Breeding_Regions.shp, G1_Breeding_Regions.shp
Creation Date/Effective Date	Download date: 2017-08-11
Description of Source File	White spruce (G1) and Pine (B1, B2)
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	B1_BREED, B2_BREED, G1_BREED
Required Processing	1. Clip to DFA boundary and save result as a file geodatabase feature class and name the outputs, B1_BREED, B2_BREED, and G1_BREED 2. Add short integer fields B1_BREED, G1_BREED, and B2_BREED to the respective feature classes and update the fields to 1 3. Repair geometry 4. Check and repair topology (if required)
Assumptions/Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1012_BreedingZones.py 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	B1_BREED, B2_BREED, G1_BREED
Output Description	Single part file geodatabase feature class showing the tree improvement zones for white spruce (G1) and Pine (B1, B2) within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	B1_BREED, G1_BREED
Polygon Area/Line Length	B1 – 488,572 ha B2 – 248,620 ha G1 – 708,910 ha

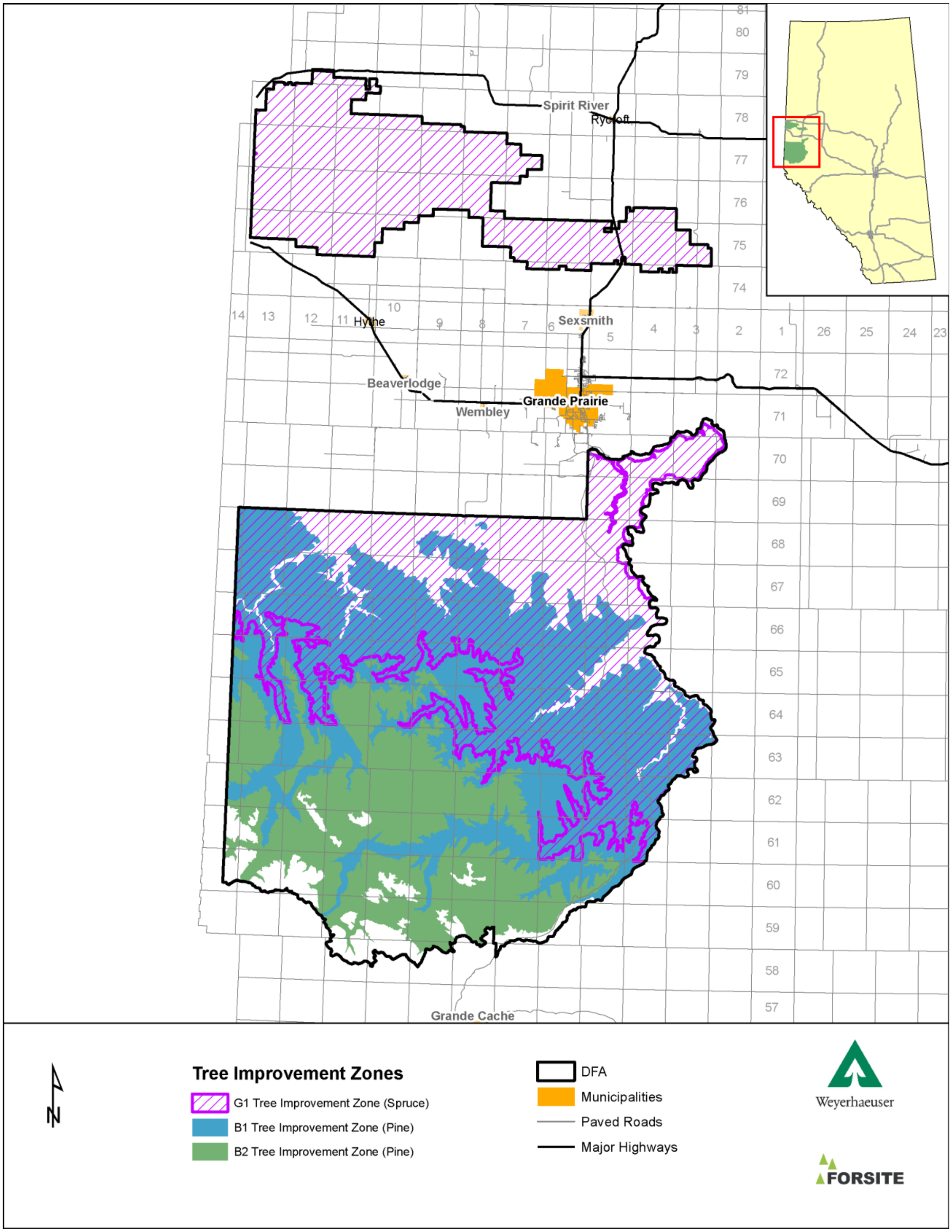


Figure 8.5 Tree Breeding Regions within the DFA

8.1.6 Watersheds

Item	Description
Source	GOA – Agriculture and Forestry
Source Filename	**WEYERGP** (Delivered 2016-11-30) **G16_watershedJan3.shp** (Delivered on 2017-01-03)
Creation Date/Effective Date	See dates above
Description of Source File	Watersheds within the Weyerhaeuser Grande Prairie DFA
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	Watersheds
Required Processing	1. Project both input sources to UTM, NAD 1983 UTM Zone 11N into file geodatabase feature datasets 2. Check for and repair topology (gaps and overlaps) 3. Clip features to the DFA (G16 FMU) Boundary 4. Merge repaired feature classes together and name the result Forestry_Watersheds 5. Add a field called WS_KEY and update with OBJECTID value. 6. Add a field called WS_SIZE_CAT and categorize each watershed as either 0-500 ha or 500ha+
Assumptions/ Processing Issues	All watersheds are to remain as distinct units regardless of size. However, watersheds smaller than 500 ha will not have an assessment completed on them because the entire watershed is not being assessed. No watershed amalgamation will occur.
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1007_Watersheds.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	Forestry_Watersheds
Output Description	File geodatabase feature class showing the watersheds found within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	WS_KEY, WS_SIZE_CAT
Polygon Area/Line Length	Total number of watersheds – 206 Number of watersheds < 500 ha – 21 Mean watershed area (ha) within the DFA (<500 ha) – 157 ha Number of watersheds > 500 ha – 185 Mean watershed area (ha) within the DFA (>500 ha) – 6349 ha

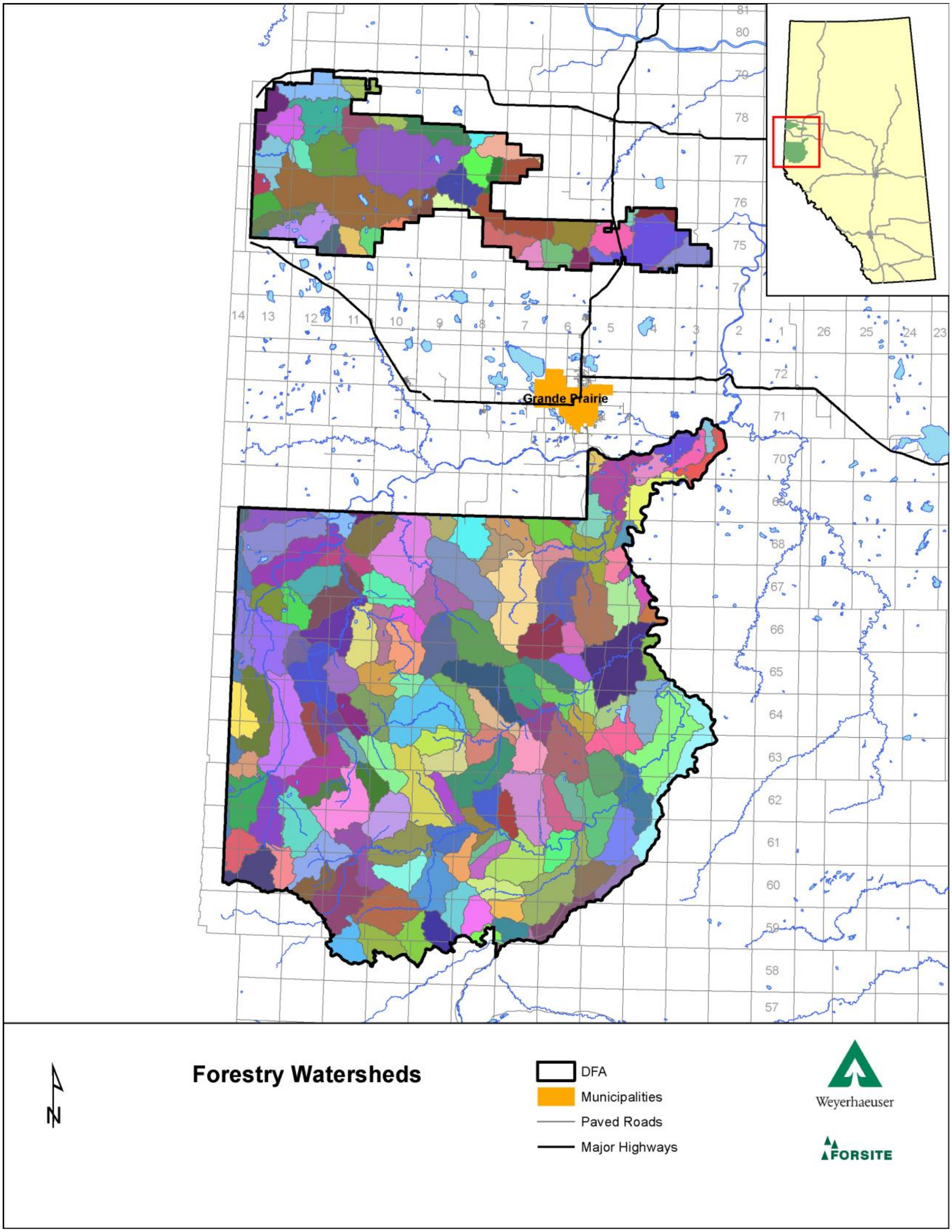


Figure 8.6 Forestry watersheds within the DFA

8.1.7 Hydrology Buffers

Item	Description
Sources	AltaLIS for hydrology polygons and single line network; Weyerhaeuser for AVI
Source Filenames	**BF_HYDRO_POLYGON.shp** (last modified: 2004/10/25) **BF_SLNET_ARC.shp** (creation date: 2000/09/05) AVI (creation date: 2017-05-01)
Creation Date/Effective Date	See dates above
Description of Sources Files	Hydrology layers
Projection/Datum	Geographic, NAD 1983, Decimal Degrees
Important Attributes	FEATURE_TY, NAT_NON, FINAL_RIP_CD
Required Processing	1. Make a feature layer called Rivers using AVI with a new selection where NAT_NON = ‘NWR’ 2. Make a feature layer called LgLake using AVI with a new selection where NAT_NON in (‘NWL’, ‘NWF’) and Shape_Area > 40000 3. Make a feature layer called SmLake using AVI where NAT_NON = ‘NWL’ and Shape_Area <= 40000 4. Make a feature layer called Hydro using BF_HYDRO_POLYGON with a new selection where FEATURE_TY in (‘OXBOW-PER’, ‘RIV-MAJ’) 5. Buffer DFA boundary by 200m and name the result AOI 6. Clip BF_SLNET with AOI and name the result Streams_clip 7. Buffer Hydro by 100m and name the result HydroBuffer100m 8. Buffer Rivers by 100m and name the result RiverBuff100m 9. Buffer LgLake by 100m and name the result LgLakes100m 10. Buffer SmLakes by 60m and name the result SmLakes60m 11. Buffer Streams_clip by 30m and name the result Streams30m 12. Add a field called RIVER_HYDRO (Short) to HydroBuffer100m and update it to 1 13. Add a field called RIVER_AVI (Short) to RiverBuff100m and update it to 1 14. Add a short Integer field called LgLakes to LgLakes100m and update it to 1 15. Add a short Integer field called SmLake to SmLakes60m and update it to 1 16. Add a short Integer field called STREAMS to Streams30m and update it to 1 17. Run repair geometry on HydroBuffer100m, RiverBuff100m, LgLakes100m, SmLakes60m (‘DELELTE_NULL’)

Item	Description
	18. Clip HydroBuffer100m with AOI HydroBuffer100m_clip 19. Clip RiverBuff100m with AOI RiverBuff100m_clip 20. Clip LgLakes100m with AOI LgLakes100m_clip 21. Clip SmLakes60m with AOI SmLakes60m_clip 22. Clip Streams30m with AOI Streams30m_clip 23. Union buffered, repaired, and clipped riparian features (HydroBuffer100m_clip, RiverBuff100m_clip, LgLakes100m_clip, SmLakes60m_clip, Streams30m_clip) and name the result WC_BUFFER_TMP 24. Add a text (10) field called FINAL_RIP_CD to WC_BUFFER_TMP 25. Add a short integer field called BUFFER_DIST to WC_BUFFER_TMP 26. Update FINAL_RIP_CD and BUFFER_DIST to “Stream” and 30, respectively where the field STREAM = 1 27. Update FINAL_RIP_CD and BUFFER_DIST to “River” and 100, respectively where the field RIVER_HYDRO = 1 28. Update FINAL_RIP_CD and BUFFER_DIST to “SmLake” and 60, respectively where the field SmLake = 1 29. Update FINAL_RIP_CD and BUFFER_DIST to “LgLake” and 100, respectively where the field LgLake = 1 30. Update FINAL_RIP_CD and BUFFER_DIST to “River” and 100, respectively where the field RIVER_AVI = 1 31. Dissolve WC_BUFFER_TMP on the fields FINAL_RIP_CD and BUFFER_DIST and name the result Hydrology_Buffer_tmp 32. Clip Hydrology_Buffer_tmp with the DFA boundary and name the result Hydrology_Buffer
Assumptions / Processing Issues	None
Programs / Scripts	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1005_WaterCourseBuffers.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	Hydrology_Buffer
Output Description	Single part file geodatabase feature class showing hydrology buffers within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	FINAL_RIP_CD, BUFFER_DIST
Polygon Area/Line Length	Total Area – 113,126 ha Large Lakes – 11,095 ha Small Lakes – 664 ha Rivers– 39,649 ha Small Streams – 61,719 ha

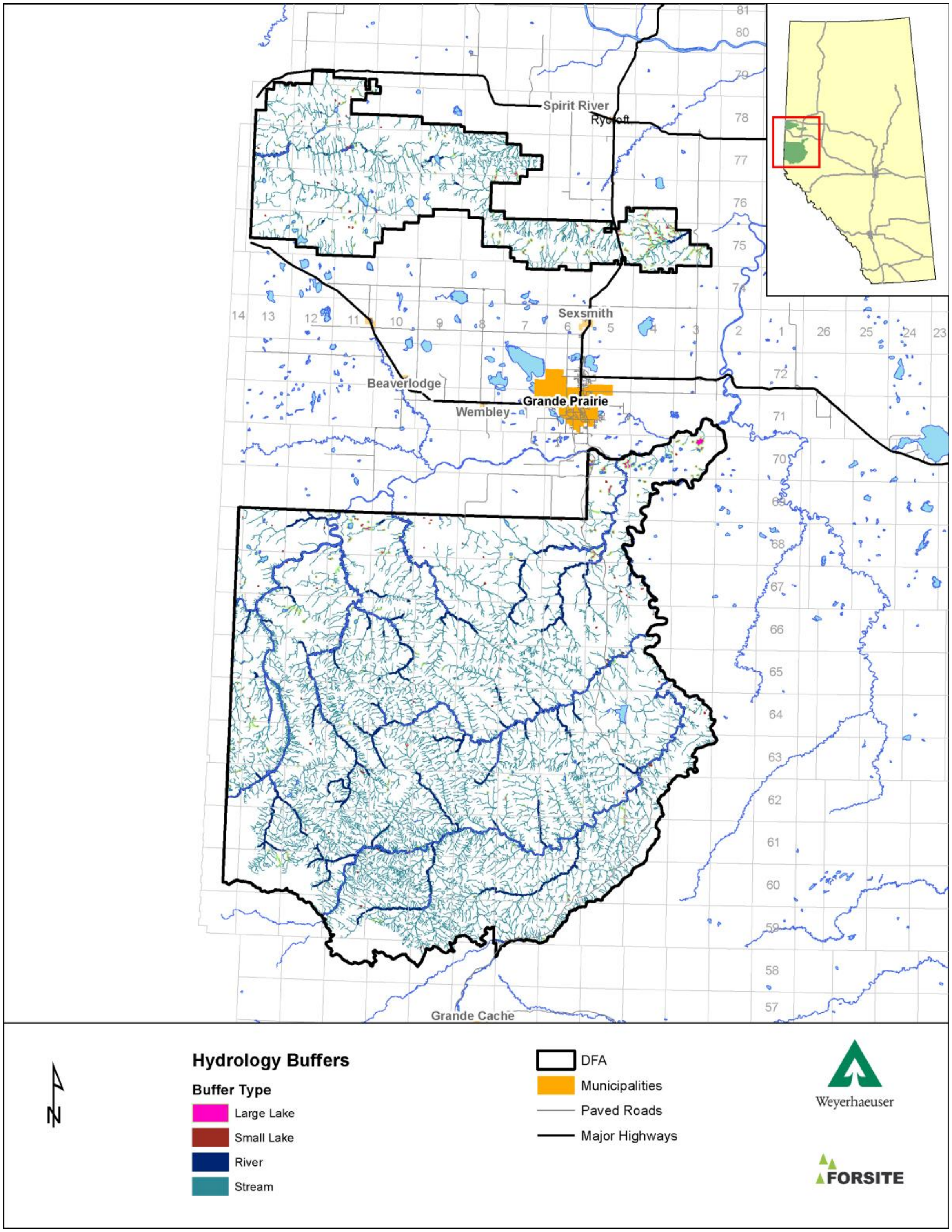


Figure 8.7 Hydrology buffers within the DFA.

8.1.8 Grizzly Bear Habitat Zones

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	Grizzly_Bear_Zone.shp
Description of Source File	Provincial grizzly bear zones
Creation Date/Effective Date	Publication Date: 2016-04-28
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	GB_POPUNIT, GB_POPTYPE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 boundary 3. Add field named “GB_TYPE” and calculate with the field “TYPE” 4. Dissolve on fields GB_POPUNIT and GB_TYPE 5. Check for and repair topology (overlaps)
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	Grizzly_Bear_Zones
Output Description	File geodatabase feature class showing the grizzly bear zones that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	GB_POPUNIT, GB_TYPE
Polygon Area/Line Length	Total Area – 738,294 ha Core – 445,841 ha Secondary – 292,453 ha

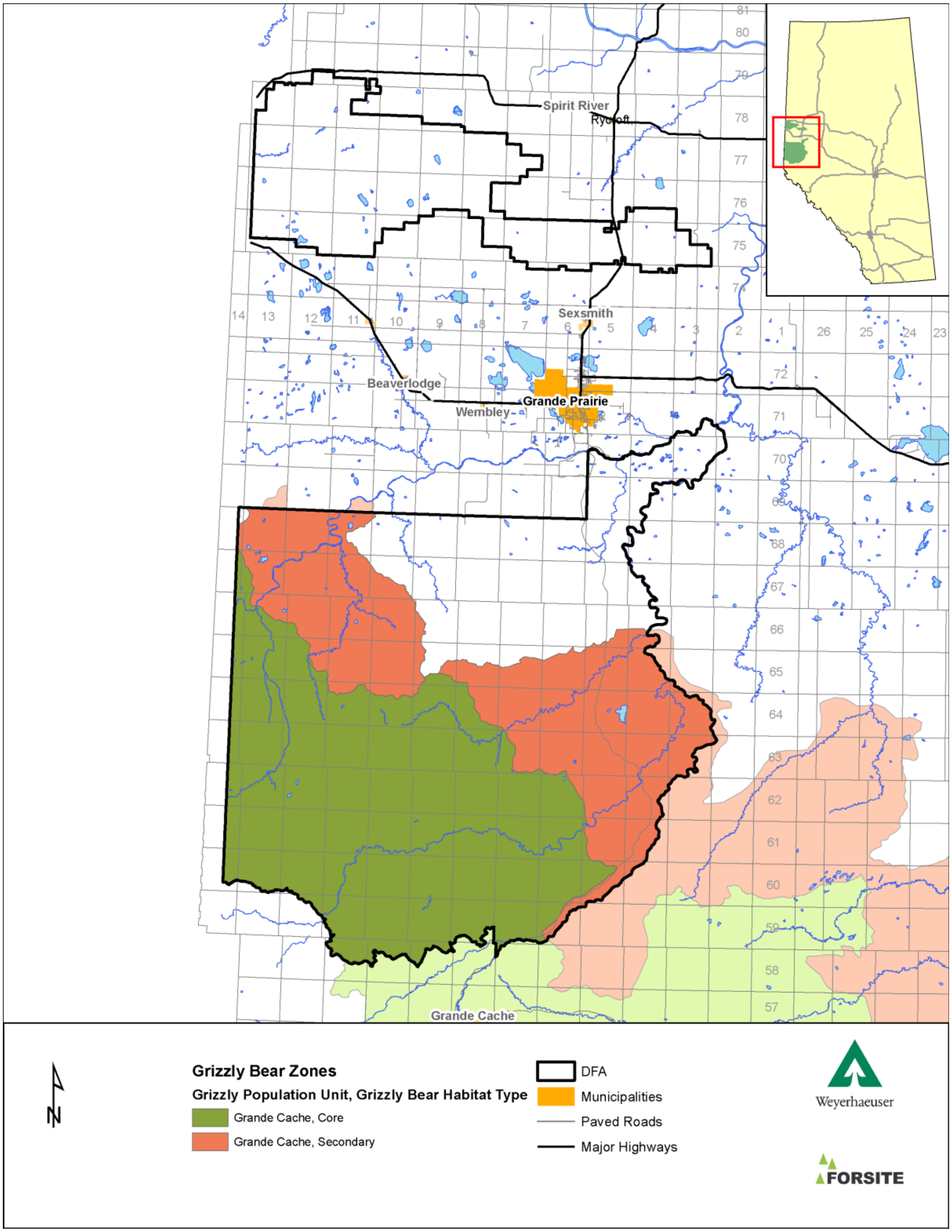


Figure 8.8 Grizzly Bear Zones found within and around the DFA

8.1.9 Grizzly Bear Watersheds

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	gb_csa_080924.shp
Description of Source File	Provincial grizzly bear watersheds
Creation Date/Effective Date	Modified Date: 2008-09-24, Download Date: 2017-08-08
Projection/Datum	Projected, UTM, NAD 1983 UTM Zone 11N
Important Attributes	GBWU
Required Processing	1. Clip result to the G16 boundary 2. Add field named "GB_TYPE" and calculate with the field "TYPE" 3. Dissolve on fields GBWU 4. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1013_GrizzlyBearWatersheds.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	GB_Watersheds
Output Description	File geodatabase feature class showing the grizzly bear watersheds that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	GBWU
Polygon Area/Line Length	GBWU / AREA (ha): G6 45,161.4 G9 104,446.3 G10 73,251.6 G14 77,850.2 G15 23,072.0 G16 50,699.7 G17 68,139.2 G19 73,117.6 G23 77,748.5 G24 53,773.3 G25 46,295.3 G29 37,940.9 G34 4,682.3 G35 2,115.7 Total 738,294.0

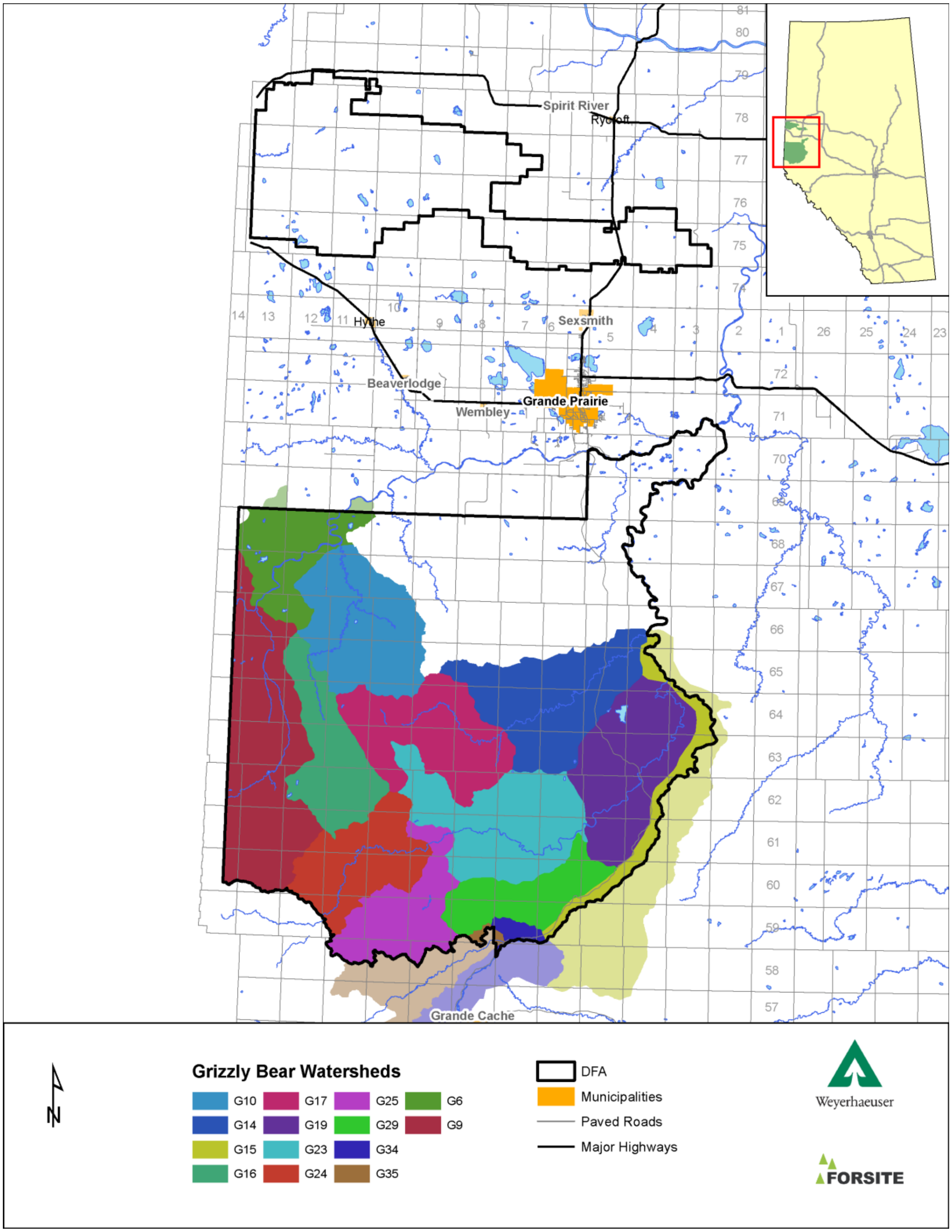


Figure 8.9 Grizzly Bear Watersheds found within and around the DFA

8.1.10 Trumpeter Swan Buffers

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	TrumpeterSwanBuffers.shp
Description of Source File	Provincial Trumpeter Swan Buffers
Creation Date/Effective Date	Download Date: 2017-10-4
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	GB_POPUNIT, GB_POPTYPE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 boundary 3. Add field named "TrumpSwanBuffer" and calculate with the field "BUFF_DIST" 4. Dissolve on field TrumpSwanBuffer 5. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1014_TrumpeterSwanBuffers.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	TrumpSwanBuffer
Output Description	File geodatabase feature class showing the trumpeter swan buffers that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	TrumpSwanBuffer
Polygon Area/Line Length	Total Area – 8,353 ha 200 m – 8,353 ha

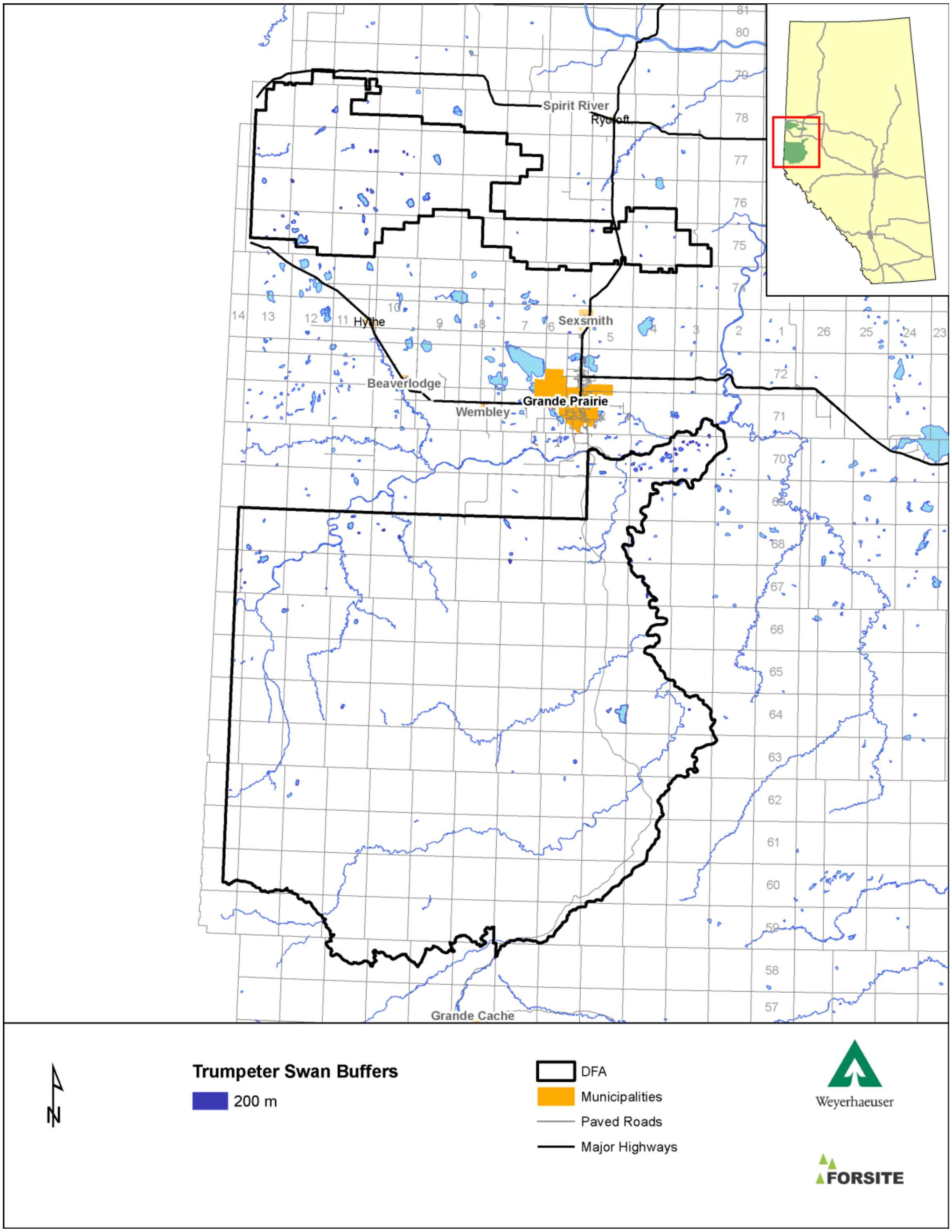


Figure 8.10 Trumpeter Swan Buffers found within and around the DFA

8.1.11 Mountain Goat and Sheep

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	Mountain_Goat_And_Sheep_Areas.shp
Creation Date/Effective Date	Download Date: 2017-08-30
Description of Source File	Provincial Mountain Goat and Sheep Areas
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	MountainGoatSheep
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 boundary 3. Add field named “MountainGoatSheep” and calculate to 1 4. Dissolve on field MountainGoatSheep 5. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1015_MountainGoatandSheep.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	MountainGoatSheep
Output Description	File geodatabase feature class showing the mountain goat and sheep areas that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	MountainGoatSheep
Polygon Area/Line Length	Total Area – 53,794 ha

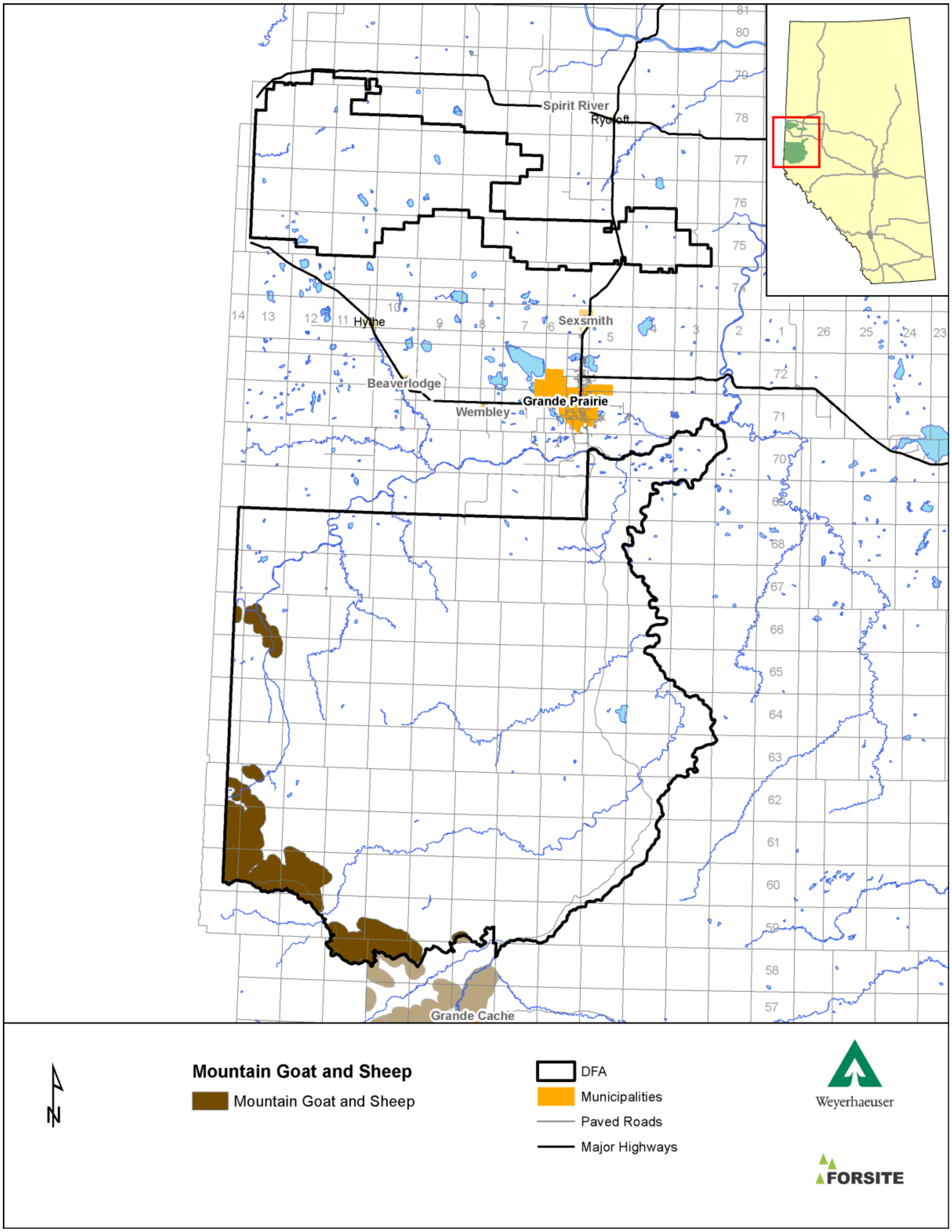


Figure 8.11 Mountain Goat and Sheep Ranges found within and around the DFA

8.1.12 Caribou Range

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	Caribou_Range.shp
Creation Date/Effective Date	Download Date: 2017-02-28
Description of Source File	Provincial Caribou Range
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	GB_POPUNIT, GB_POPTYPE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 FMU boundary 3. Add field named "CARIBOU" and calculate to 1 4. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1022_Caribou.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	Caribou_Range
Output Description	File geodatabase feature class showing the extent of the Caribou Range that intersects the Weyerhaeuser Grande Prairie DFA.
Output Attributes	CARIBOU, SUBUNIT
Polygon Area/Line Length	Total Area – 410,577 ha Narraway – 103,966 ha Redrock – Prairie Creek – 306,611 ha

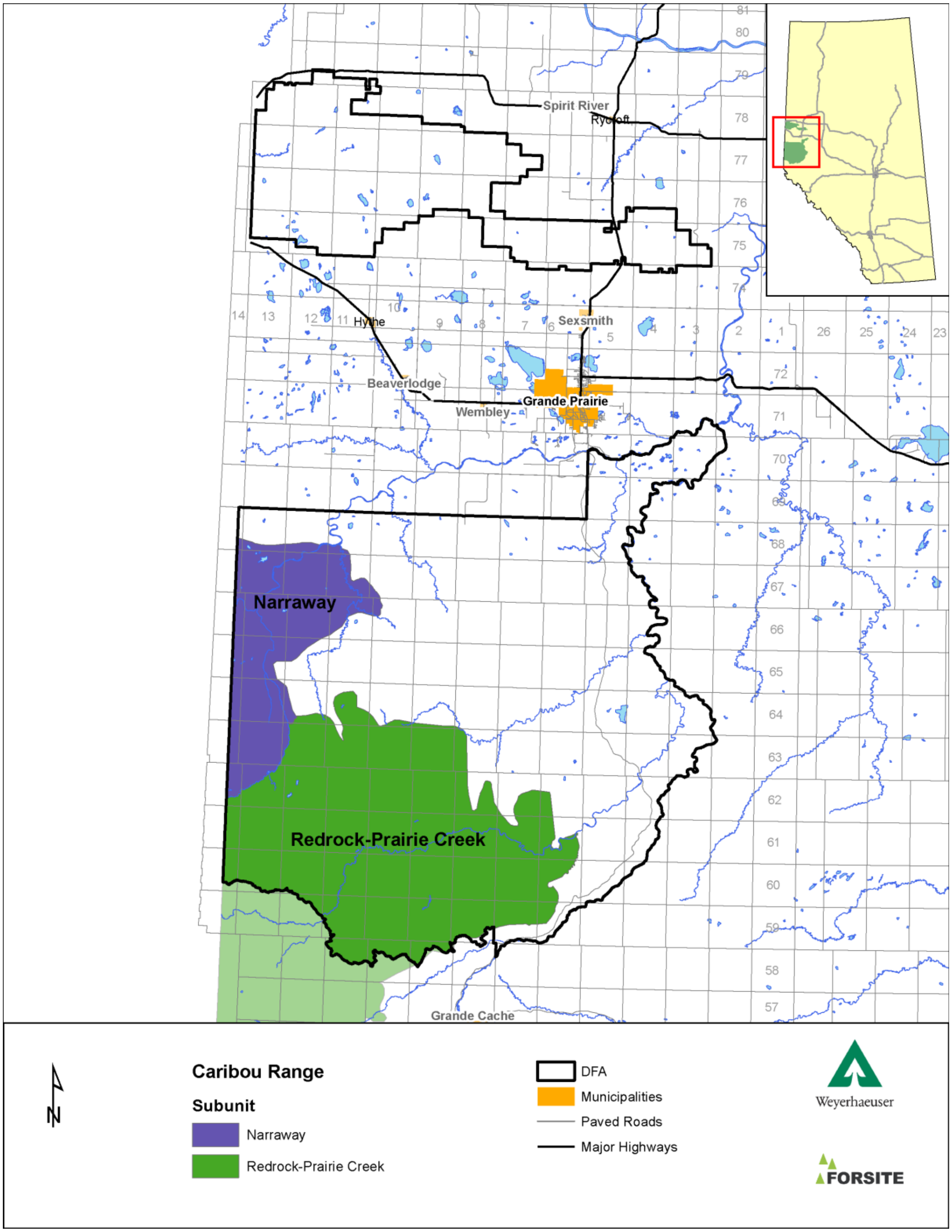


Figure 8.12 Caribou Range found within and around the DFA

8.1.13 Wildfire Management Zones

Item	Description
Source	GOA
Source Filename	AF_Forest_Area_Boundaries.shp
Creation Date/Effective Date	Download Date: 2017-08-11
Description of Source File	Provincial wildfire management areas
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	GB_POPUNIT, GB_POPTYPE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 boundary 3. Dissolve on field FA_NAME 4. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1016_WildfireManagementZones.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	WildfireManagementZones
Output Description	File geodatabase feature class showing the boundaries of Alberta Wildfire management zones that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	WildfireManagementZones
Polygon Area/Line Length	Total Area – 1,178,017 ha Edson Forest Area – 1,191 ha Grande Prairie Forest Area – 1,176,825 ha

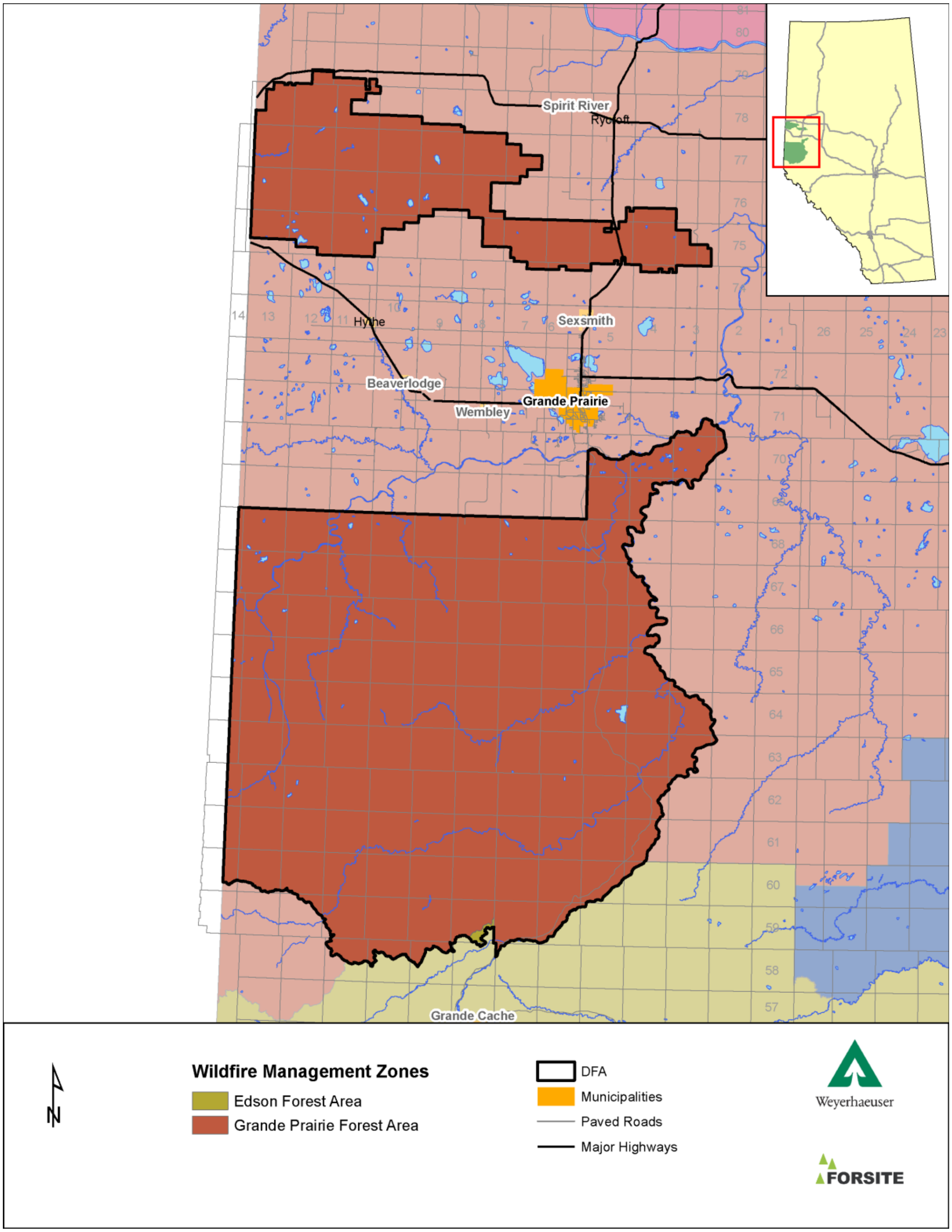


Figure 8.13 Wildfire Management Zones found within and around the DFA

Weyerhaeuser

8.1.14 Post-AVI Wildfires

Item	Description
Source	GOA
Source Filename	WeyCo_Fires_May_2012_2017.shp,
Creation Date/Effective Date	Download Date: 2017-08-11
Description of Source File	Fires that occurred after AVI photo capture
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	BURN_CLASS, FIRE_YEAR
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 FMU boundary as FIRES_MAY_2012_2017 3. Add field called FIRE_YEAR and update it with the YEAR field 4. Update FIRE_YEAR, FIRE_CLASS, and BURN_CLASS 5. Copy FIRES_MAY_2012_2017 and save as PostAviFires 6. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1021_Fires.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	PostAviFires
Output Description	File geodatabase feature class showing the boundaries of fires with the Grande Prairie DFA that have occurred since AVI photo capture.
Output Attributes	BURN_CLASS, FIRE_YEAR
Polygon Area/Line Length	(see below)

BURN_CLASS	FIRE_YEAR	Area (ha)
0	2016	3
1	2016	4
2	2016	1
4	2014	2
4	2016	1
5	2012	3
5	2014	4198
5	2015	99
5	2016	83
Total		4393

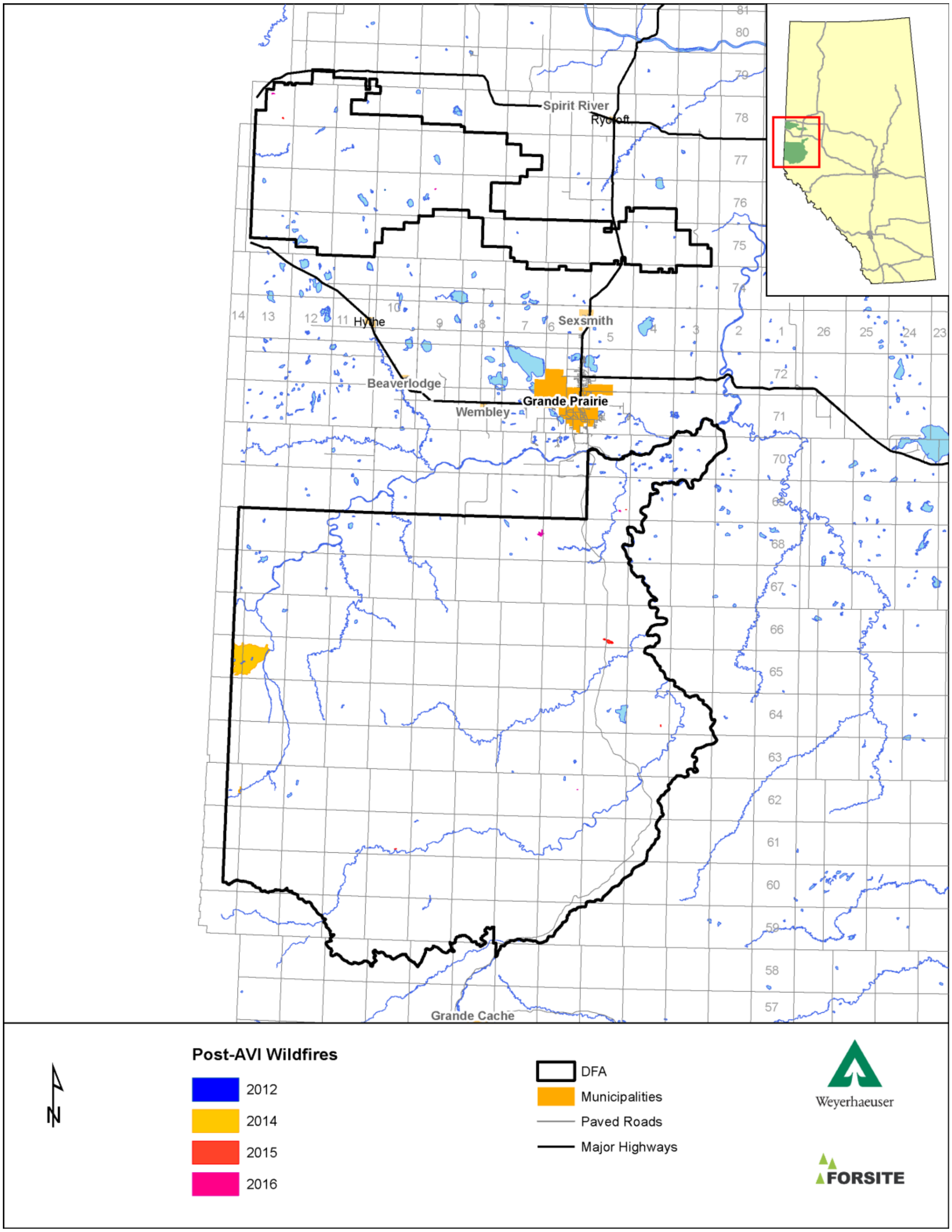


Figure 8.14 Wildfires that have occurred since AVI photo capture

8.1.15 FireSmart Community Zone

Item	Description
Source	GOA
Source Filename	GP_FireSmart_Community_Zones.shp
Creation Date/Effective Date	2017-08-11
Description of Source File	Provincial FireSmart Community Zones
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	GB_POPUNIT, GB_POPTYPE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 boundary and name the result FireSmart 3. Dissolve on field FA_NAME 4. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1017_FireSmartCommunityZones.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	FireSmart
Output Description	File geodatabase feature class showing the boundaries of Alberta Wildfire management zones that intersect the Weyerhaeuser Grande Prairie DFA.
Output Attributes	FireSmart
Polygon Area/Line Length	see table below

FireSmart Community Zones	Area (ha)
Grovedale Aspen Grove	8,975
Gundy Saddle Oak	27,737
Nose Creek	31,391
Wanyandie Flats East	13,287
Woking	6,445
Total Area	87,835

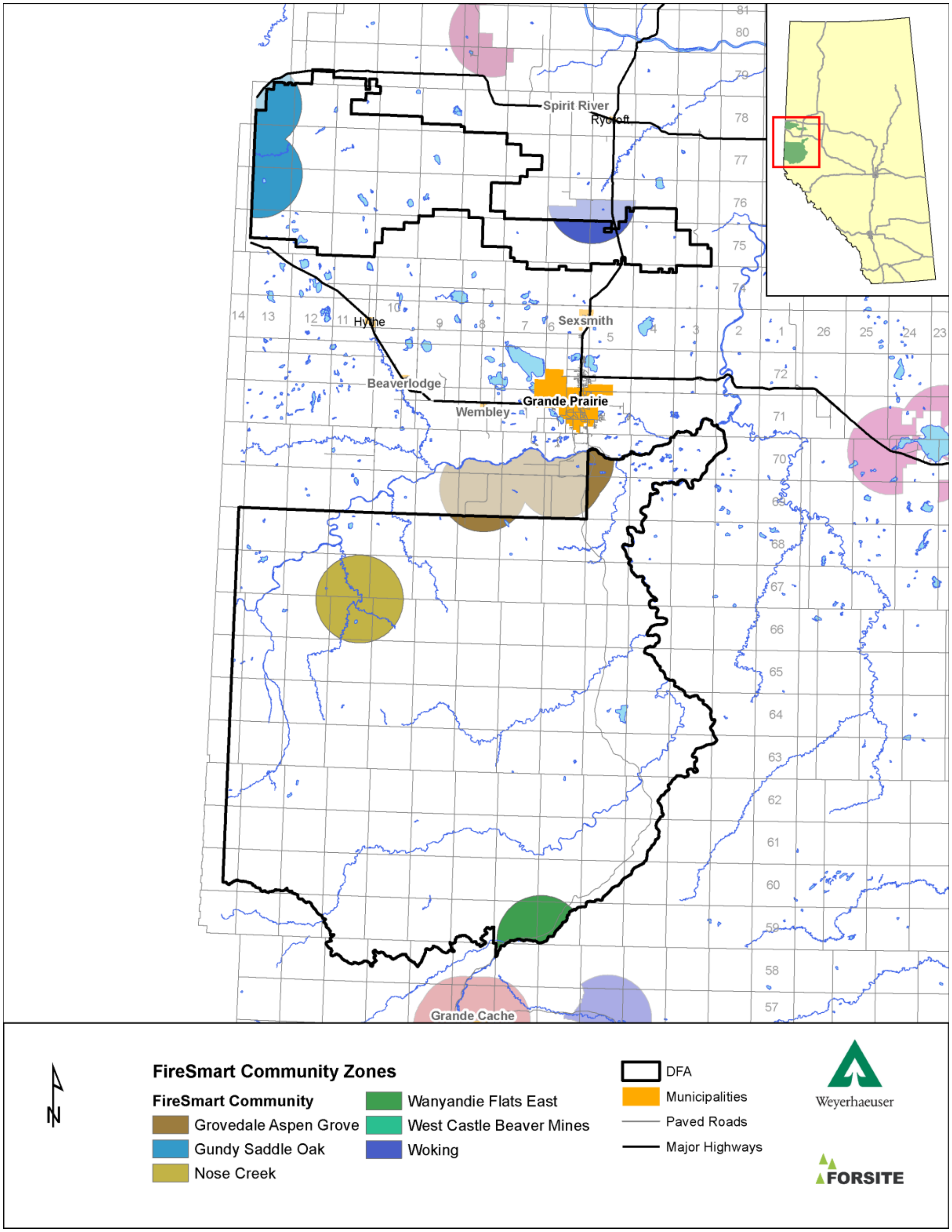


Figure 8.15 FireSmart Community Zones found within and around the DFA

8.1.16 Grazing Dispositions

Item	Description
Source	GOA – Environment and Parks: Digital Integrated Dispositions (DIDs)
Source Filename	D83lAPPL.shp, D83mAPPL.shp (DIDs Layer, Download Date 2017/04/30)
Creation Date/Effective Date	Download Date: 2017-04-30
Description of Source file	Shapefiles showing Lands dispositions found in mapsheets D83L and D83M.
Projection/Datum	Geographic, NAD 1983, Decimal Degrees
Important Attributes	DISP_TYPE, DISP_NUM
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N, save the result as D83lAPPL and D83mAPPL feature classes in in a file geodatabase called DIDs.gdb 2. Create list of uniq_num in D83lAPPL 3. Make a feature layer with D83mAPPL 4. Select uniq_num from the D83mAPPL feature layer where they exist in D83lAPPL 5. Switch the selection 6. Merge D83lAPPL and D83mAPPL features together, save the result as DIDs_raw 7. Clip to DFA boundary, save the result as DIDs 8. Select the grazing lease Dispositions by selecting DISP_TYPE in (‘GRL’, ‘FGL’) 9. Dissolve selected layer on the field DISP_TYPE and save the result as DIDs_GL 10. Add a text field called GRAZING and update with DISP_TYPE 11. Delete the field DISP_TYPE
Assumptions / Processing Issues	When conducting the landbase netdown, the following rules apply: Forest Grazing Licenses (FGLs) are included in the FMA and are in the active landbase. Grazing Leases (GRLs) are not included in the FMA but are part of the active landbase.
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1000_DIDs_Preprocessing.py, 1001_Prep_Input_1003_GrazingLeases.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	DIDS_GL
Output Description	File geodatabase feature class showing the different grazing dispositions found in the Weyerhaeuser Grande Prairie DFA
Output Attributes	GRAZING
Polygon Area/Line Length	Total Area – 29,154 ha Forestry Grazing Licenses (FGLs) – 17,84.86 ha Grazing Leases (GRLs) – 11,347.4 ha

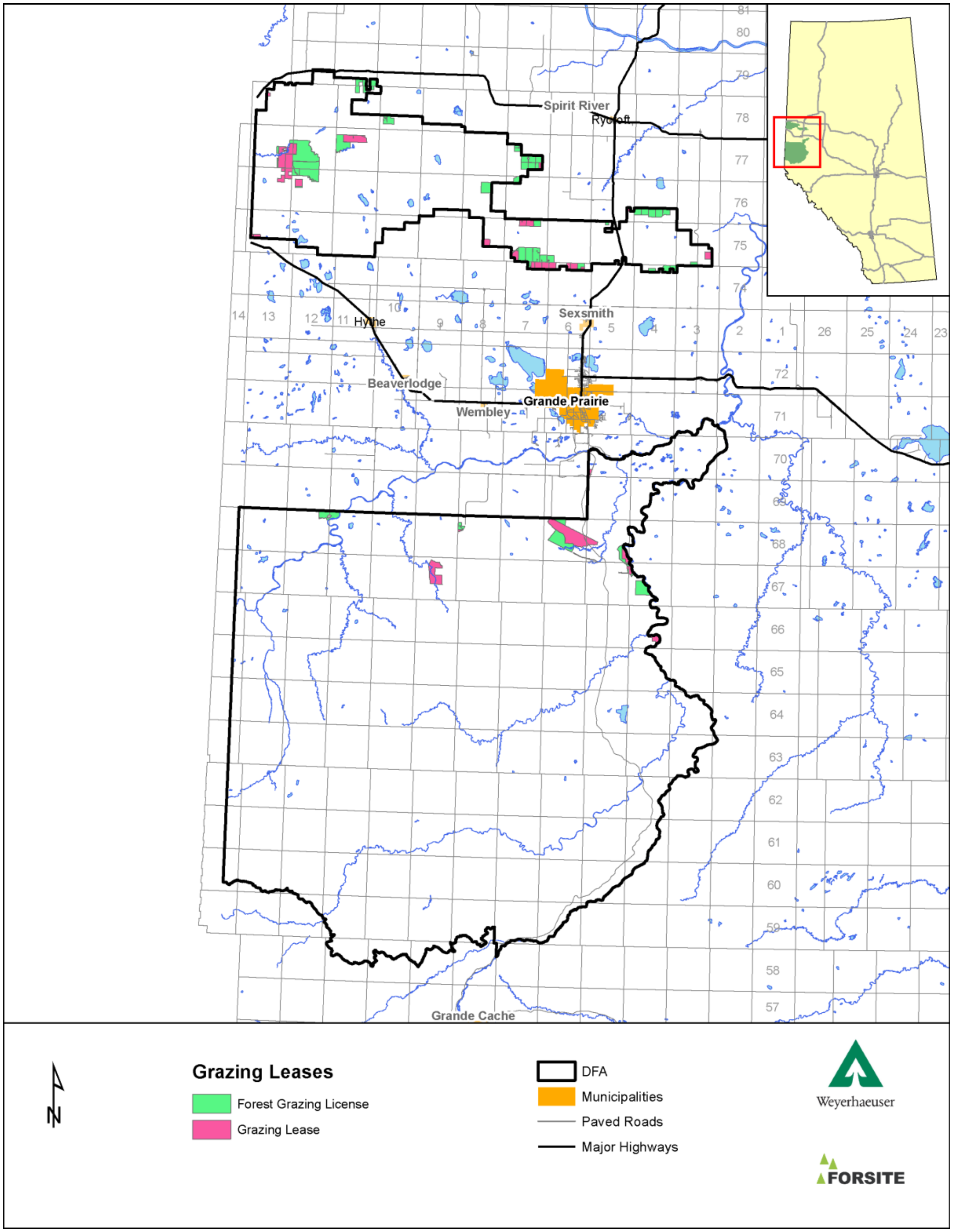


Figure 8.16 Grazing dispositions found within the DFA

8.1.17 Non-Forested Dispositions

Item	Description
Source	GOA – Environment and Parks
Source Filename	D83lAPPL.shp, D83mAPPL.shp (DIDs Layer, Download Date 2017/04/30)
Creation Date/Effective Date	Download Date: 2017-04-30
Description of Source file	Shapefiles showing Lands dispositions found in mapsheets D83L and D83M.
Projection/Datum	Geographic, NAD 1983, Decimal Degrees
Important Attributes	DIDs_NFOR
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N, save the result as D83lAPPL and D83mAPPL feature classes in in a file geodatabase called DIDs.gdb 2. Create list of uniq_num in D83lAPPL 3. Make a feature layer with D83mAPPL 4. Select uniq_num from the D83mAPPL feature layer where they exist in D83lAPPL 5. Switch the selection 6. Merge D83lAPPL and D83mAPPL features together, save the result as DIDs_raw 7. Clip to DFA boundary, save the result as DIDs 8. Select the protective notations dispositions by selecting DISP_TYPE In ('MLL', 'DML', 'PML', 'SML', 'SMC', 'EZE', 'PEZ', 'LOC', 'DLO', 'MSL', 'DMS', 'PLA', 'DPL', 'PIL', 'DPI', 'ROE', 'REA', 'RVC', 'VCE', 'FRD', 'RRD', 'FRD', 'RRD', 'RDS') 9. Dissolve selected layer on the field DISP_TYPE and save the result as DIDs_NFOR_DISP_TYPE 10. Add a Short integer field called DIDs_NFOR and update to 1 11. Dissolve DIDs_NFOR_DISP_TYPE on field DIDs_NFOR and name the result DIDs_NFOR
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1000_DIDs_Preprocessing.py, 1001_Prep_Input_1001_NonForestedDispositions.py 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	DIDs_NFOR
Output Description	Non-Forested Dispositions within the DFA
Output Attributes	DIDs_NFOR
Polygon Area/Line Length	Total DIDs NFOR Area – 45,916.5 ha

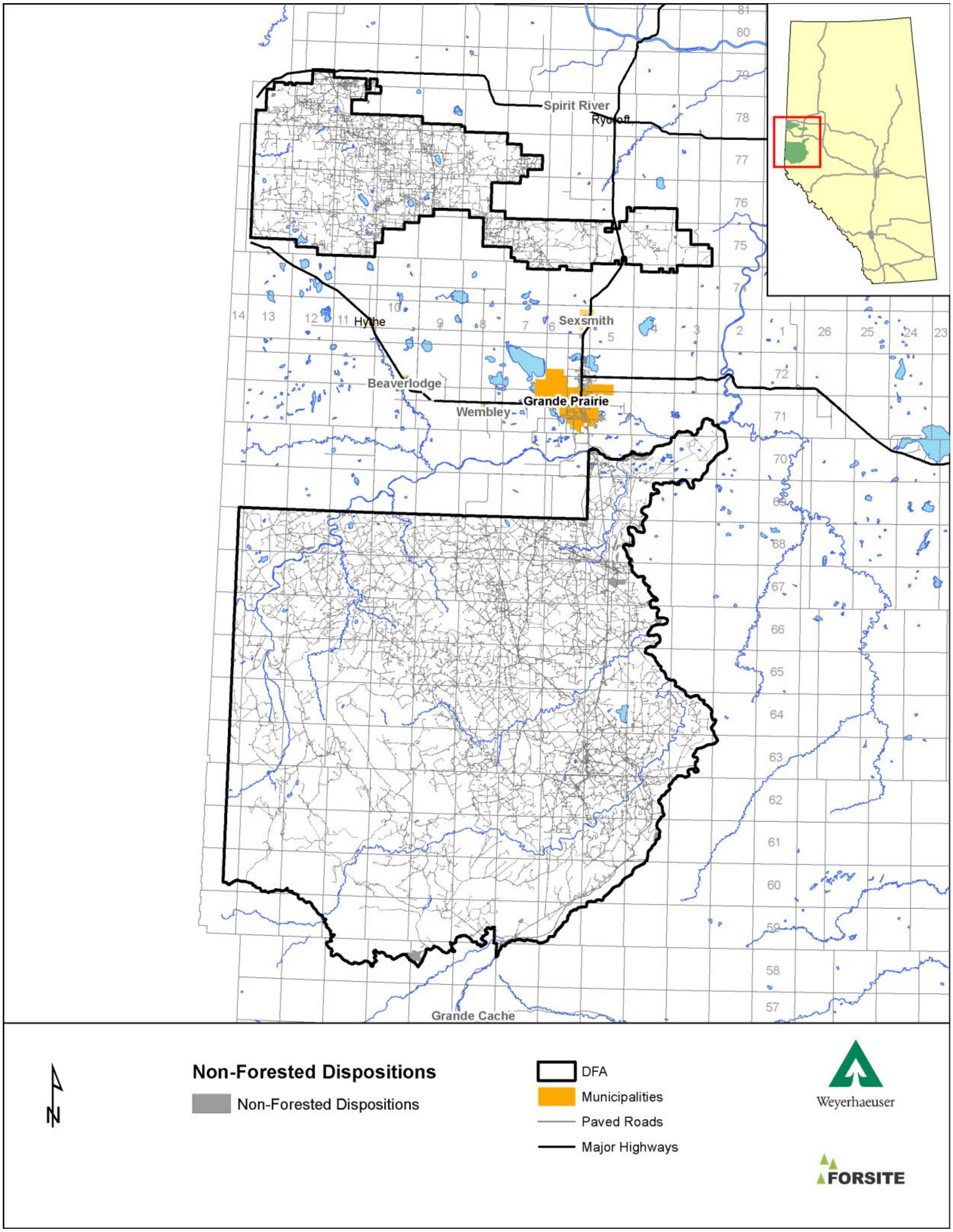


Figure 8.17 Non-Forested Dispositions within the DFA

8.1.18 Non-Contributing Dispositions

Item	Description
Source	GOA – Environment and Parks
Source Filename	D83lAPPL.shp, D83mAPPL.shp (DIDs Layer, Download Date 2017/04/30)
Creation Date/Effective Date	Download Date: 2017-04-30
Description of Source File	Shapefiles showing Lands dispositions found in mapsheets D83L and D83M.
Projection/Datum	Geographic, NAD 1983, Decimal Degrees
Important Attributes	DISP_TYPE, DIDs_NCON
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N, save the result as D83lAPPL and D83mAPPL feature classes in in a file geodatabase called DIDs.gdb 2. Create list of uniq_num in D83lAPPL 3. Make a feature layer with D83mAPPL 4. Select uniq_num from the D83mAPPL feature layer where they exist in D83lAPPL 5. Switch the selection 6. Merge D83lAPPL and D83mAPPL features together, save the result as DIDs_raw 7. Clip to DFA boundary, save the result as DIDs 8. Make a layer of the DIDs feature and select specific Protective Notations (PNTs) to be removed 9. Add to the Selected polygons within the layer that intersect the Weyerhaeuser Grande Prairie DFA where DISP_TYPE in ('CUP','FDL','PLS','FDS','GRR','MLP','PMP','PMP','MTS','REC','PRL','DRS','PRS ') 10. Dissolve on DISP_TYPE (to keep as an interim product) and name the result DIDS_NCON_DISP_TYPE 11. Add a field called DIDs_NCON and populate all records to 1. 12. Dissolve on field DIDs_NCON and name the result DIDs_NCON
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1000_DIDs_Preprocessing.py, 1001_Prep_Input_1002_NonContributingDispositions.py 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	DIDS_NCON
Output Description	Single part file geodatabase feature class showing the non-contributing dispositions deletions that intersect the Weyerhaeuser DFA
Output Attributes	DIDS
Polygon Area/Line Length	40,976.7 ha

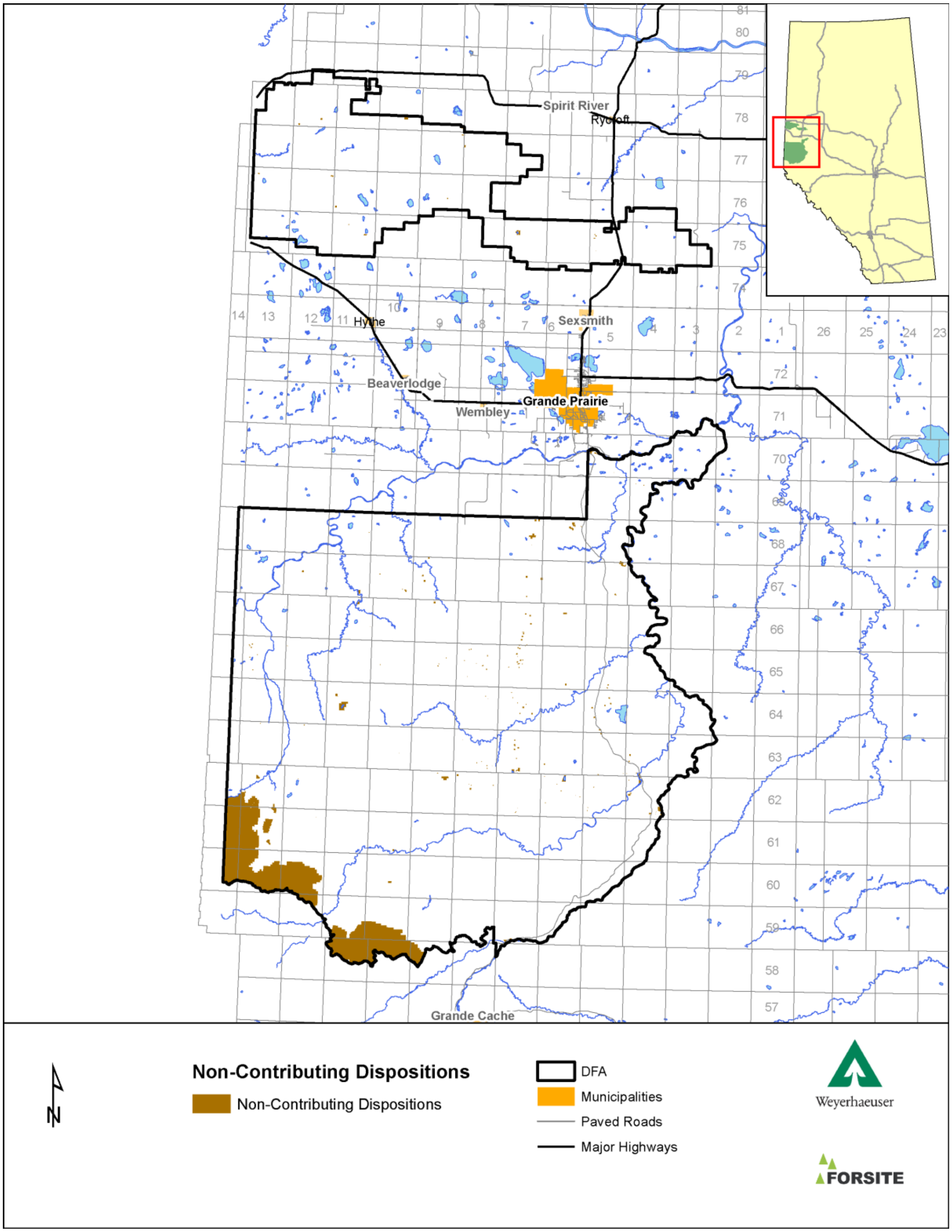


Figure 8.18 Digital Integrated Dispositions within and overlapping the DFA.

8.1.19 Subhydric Poor / Very Poor

Item	Description
Source	Weyerhaeuser
Source Filename	DEP_subhydric_poor_vpoor.shp
Creation Date/Effective Date	Download Date: 2017-10-16
Description of Source File	Subhydric poor and very poor areas
Projection/Datum	NAD_1983_UTM_Zone_11N
Important Attributes	Subhydric
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Multipart to single part 3. Make a layer and select polygons that are less than 0.01 ha in size and delete those features 4. Add a field called Subhydric and update with NUTR_ES field
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1019_SubjectiveUnique.py
Output Filename	Subhydric
Output Description	File geodatabase feature class showing areas identified as Subhydric Poor and Very Poor
Output Attributes	Subhydric
Polygon Area/Line Length	Total Area – 44,136 ha Very Poor – 43,739.3 ha Poor – 396.9 ha

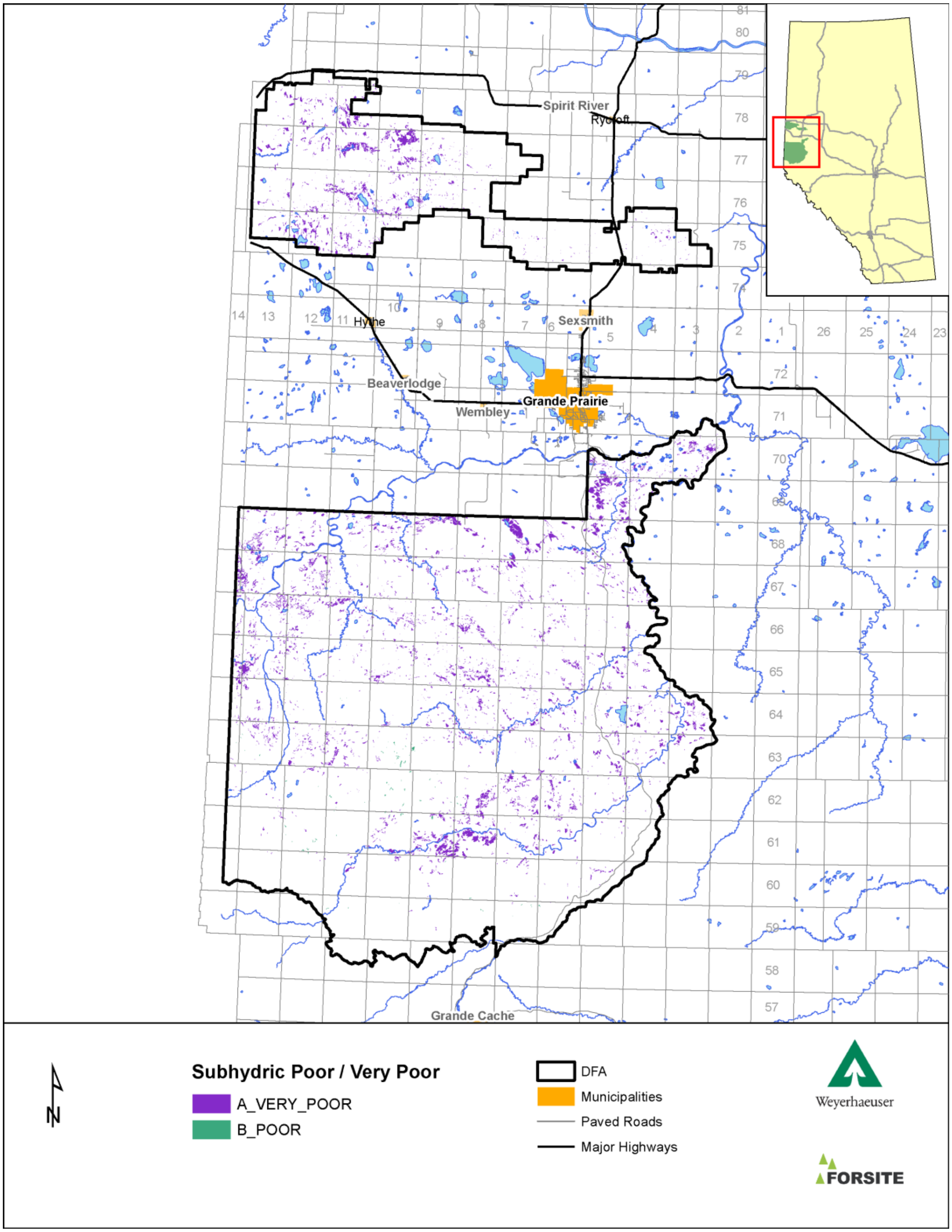


Figure 8.19 Subhydric Poor and Very Poor within the DFA.

8.1.20 Steep Slopes

Item	Description
Source	Weyerhaeuser
Source Filename	Slope_Class
Creation Date/Effective Date	Download Date: 2016-11-18
Description of Source File	Slope classes within the DFA
Projection/Datum	NAD_1983_UTM_Zone_11N
Important Attributes	SLOPE_CLAS
Required Processing	1. Select and copy slope classes '55-65 %' and '65+ %' from Slope_Class and name the result Steep_temp1 2. Add a short integer field named STEEP and update to 1 3. Dissolve Steep_temp1 on the STEEP field and name the result Steep_temp2 4. Aggregate Polygons > 0.2ha if they are within 20 meters of each other and name the result Steep_temp3 5. Buffer Steep_temp3 by 5 meters and name the result Steep_temp4 6. Eliminate polygon parts (remove holes) from Steep_temp4 up to 2 ha in size and name the result Steep_temp5 7. Erase Steep_temp5 with the AVI filtered to where R_OPENING <> ‘’ or MOD1 = ‘CC’ Steep_temp6 8. Erase Steep_temp6 with hydrology buffers and save result as STEEP 9. Manually edit SteepSlopes to enable better identification of areas isolated by steep slopes and name the result STEEP_edit
Assumptions/ Processing Issues	Steep slopes provided by Weyerhaeuser include all slopes greater than 55% based on digital elevation models.
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1009_SteepSlopes.py
Output Filename	STEEP_edit
Output Description	File geodatabase feature class showing steep slopes deletions.
Output Attributes	SLOPE
Polygon Area/Line Length	Total Area – 12,470 ha

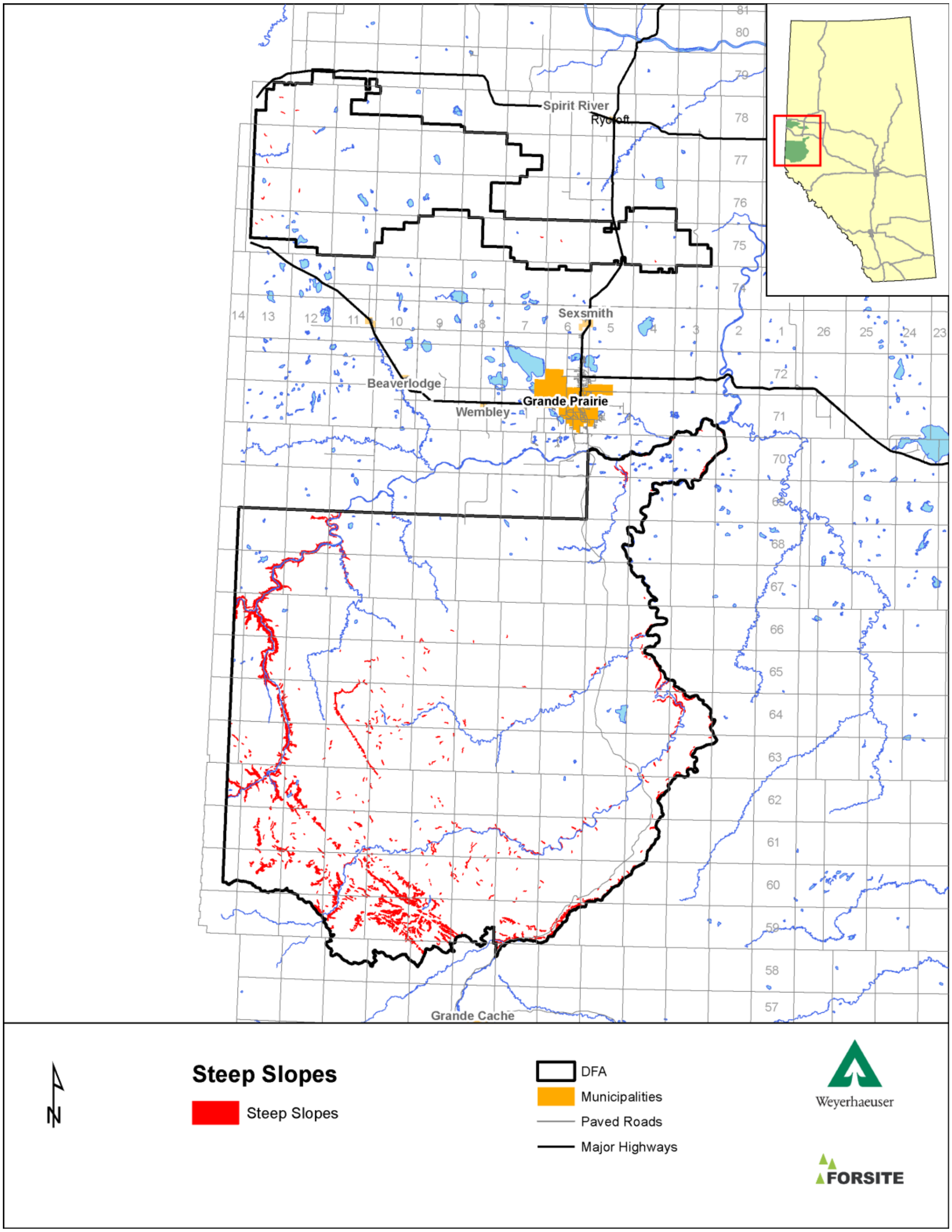


Figure 8.20 Steep Slopes identified on within the DFA.

8.1.21 Seismic Lines

Item	Description
Source	Weyerhaeuser
Source Filename	Cutlines.shp (Delivered on 2017/08/09)
Creation Date/Effective Date	Download Date: 2017-08-09
Description of Source Files	Line features showing the seismic lines found within the Weyerhaeuser DFA
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	None, spatial information is needed but not specific attributes. New field will be generated for output
Required Processing	1. Project to NAD 1983 UTM Zone 11N 2. Save result as seismic in a file geodatabase called Cutlines.gdb 3. Buffer the merged line layer using a 3-meter buffer, full side type, round line ends and dissolve all intersections 4. Save result as seismic_Buffer
Assumptions/ Processing Issues	Seismic lines are assumed to have an average width of 6 meters across the DFA.
Programs	ESRI ArcGIS 10.5.1
Output Filenames	seismic_Buffer
Output Description	File geodatabase feature class showing the seismic lines found in the DFA as polygons.
Output Attributes	seismic
Polygon Area/Line Length	Total Length – 18,787.7 km Total Buffered Area – 11,250.2 ha

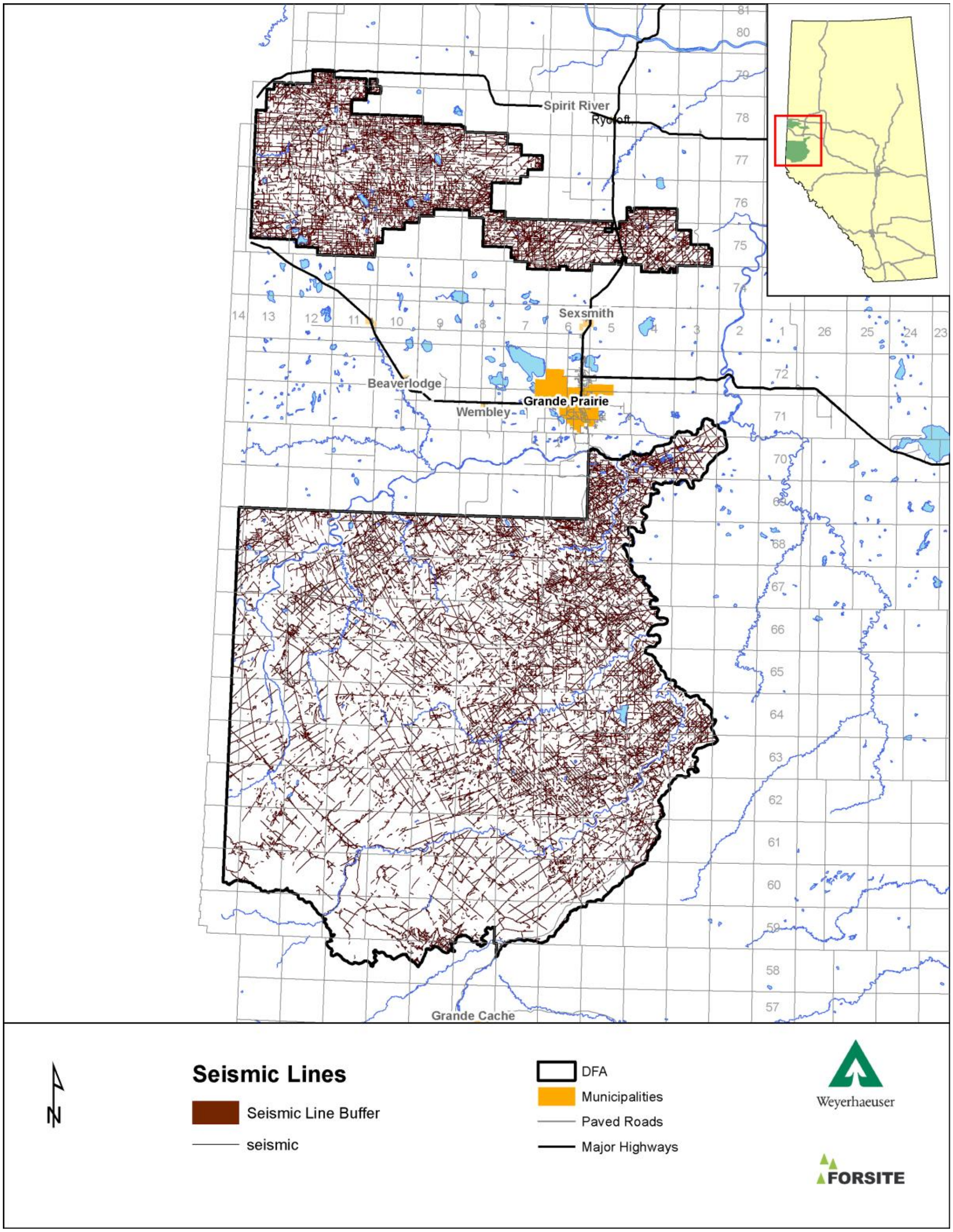


Figure 8.21 Seismic lines within the DFA.

8.1.22 Two Lakes Provincial Park

Item	Description
Source	Altalis Geo Admin
Source Filename	BF_PROVINCIAL_PARK_POLYGON.shp
Creation Date/Effective Date	Download Date: 2017-08-23
Description of Source File	Provincial Parks
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	PARK_NAME
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Clip result to the G16 FMU boundary 3. Check for and repair topology (overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1026_ProvincialPark.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	ProvincialPark
Output Description	File geodatabase feature class showing the provincial park boundaries within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	ProvincialPark
Polygon Area/Line Length	Total Area – 1,566.7 ha

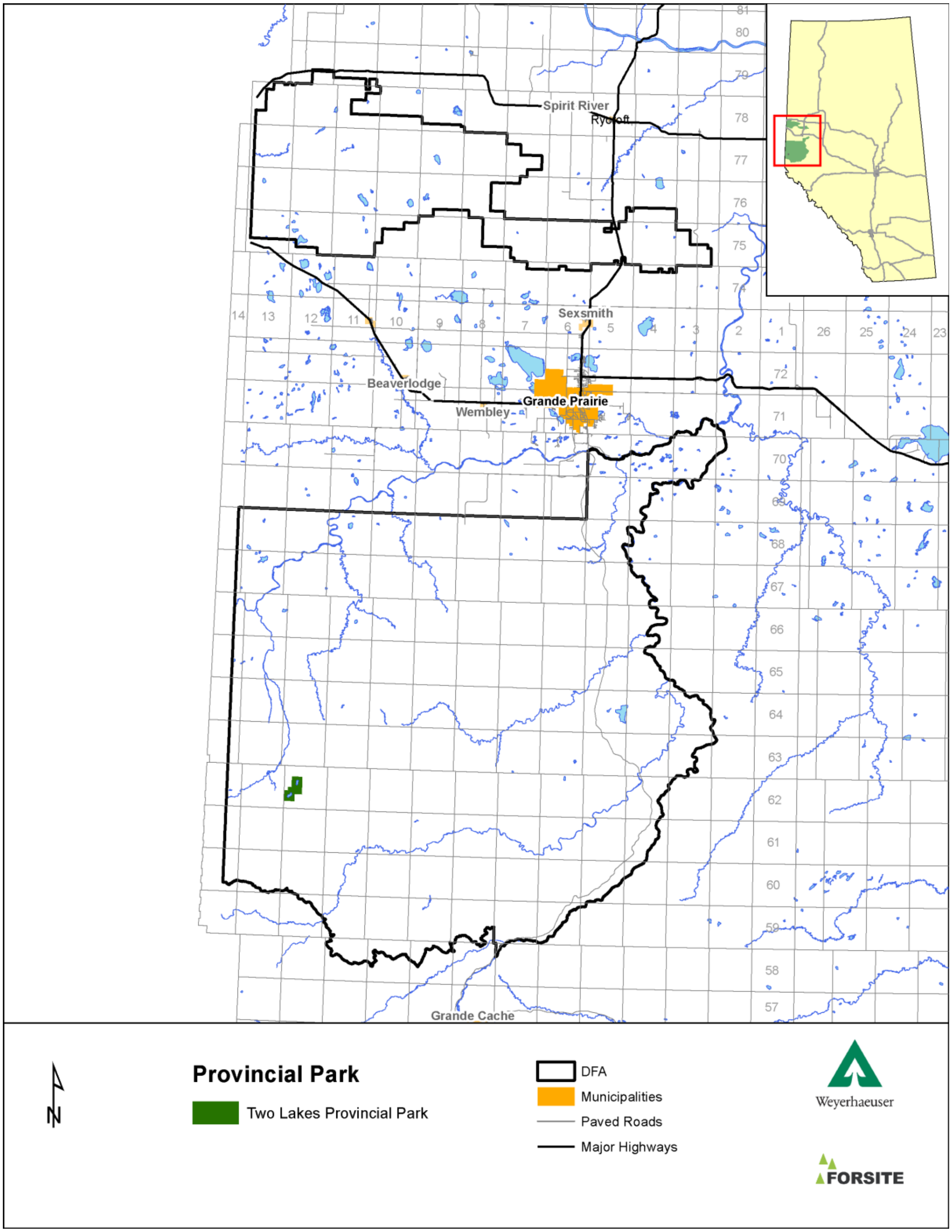


Figure 8.22 Provincial Parks Found within the DFA.

8.1.23 Eastern Slopes Land Use Zones (Prime Protection)

Item	Description
Source	GOA – Alberta Environment and Parks
Source Filename	BF_EASTRN_SLPS_LUZ_POLYGON.shp
Creation Date/Effective Date	Download Date: 2017-11-09
Description of Source File	Eastern Slopes Land Use Zones
Projection/Datum	Projected, NAD 1983, 10TM AEP Forest
Important Attributes	ESLUZ_CODE
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N 2. Created a layer from the result and select where ESLUZ_CODE = 'ZONE1' 3. Clip result to the G16 FMU boundary and name it EasternSlopesLUZ
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1025_EasternSlopes.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filename	EasternSlopesLUZ
Output Description	File geodatabase feature class showing the prime protection zone from the Eastern Slopes Land Plan within the Weyerhaeuser Grande Prairie DFA.
Output Attributes	EasternSlopesLUZ
Polygon Area/Line Length	Total Area – 1,566.7 ha

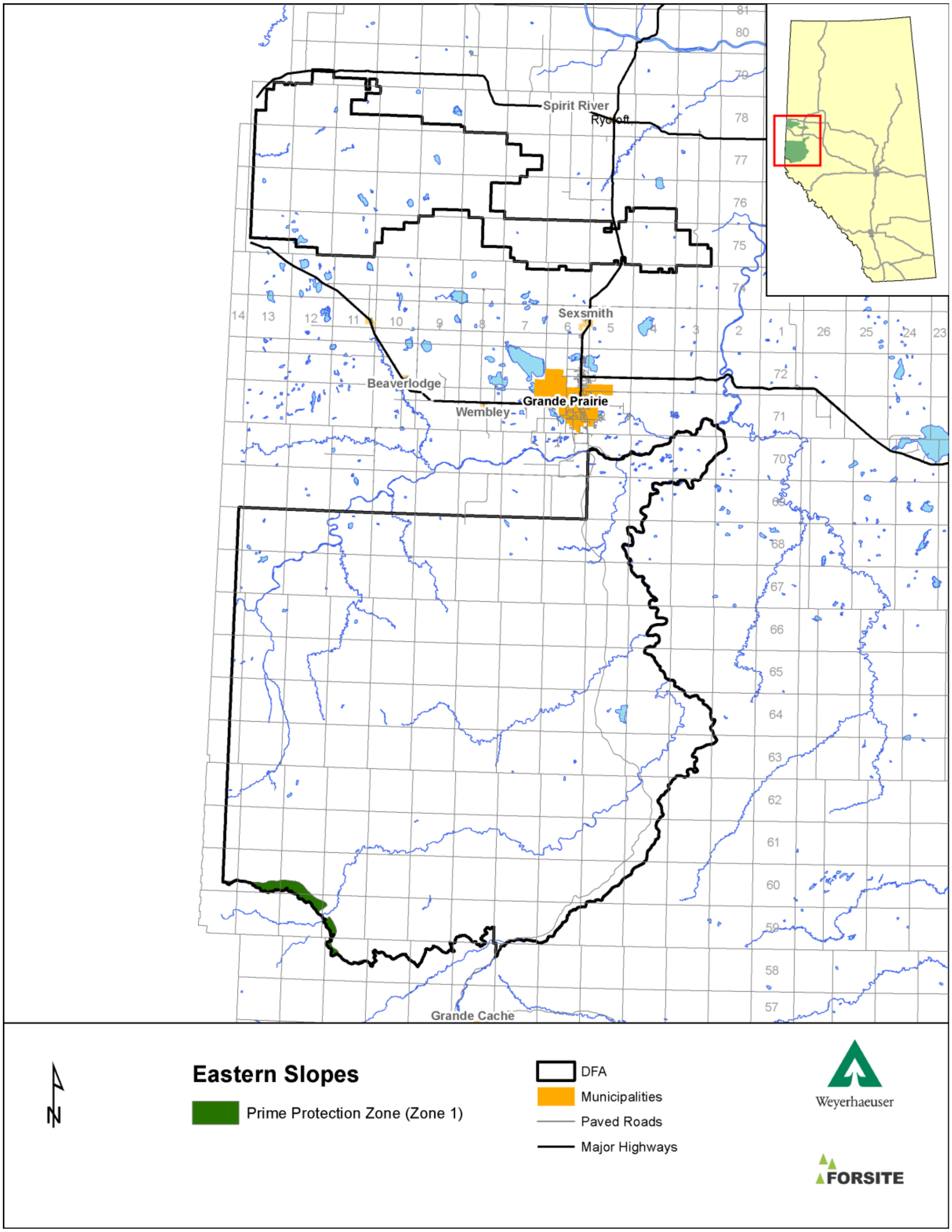


Figure 8.23 Trumpeter Swan Buffers found within and around the DFA

8.1.24 Subjective Deletions

Item	Description
Source	Weyerhaeuser
Source Filename	Archeology_Site_Buffers.shp, mineral_lick_100m.shp, spring_20m.shp, trapper_cabin_200m.shp, Unique_Areas_2019_Buffer.shp
Creation Date/Effective Date	2017-08-03
Description of Source Files	Polygon features showing subjective deletions for Archaeology, mineral licks, natural springs, trapper cabins, and unique areas
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	Archaeology, MineralLick, Spring, TrapperCabin, and UniqueName
Required Processing	1. Convert trapper_cabin_200m.shp to multipart and save the result as TrapperCabin in a file geodatabase feature class called Subjective.gdb 2. Add a short integer field called TrapperCabin and calculate the field with 1 3. Convert spring_20m.shp to multipart and save the result as Spring in a file geodatabase feature class called Subjective.gdb 4. Add a short integer field called Spring and calculate the field with 1 5. Convert mineral_lick_100m.shp to multipart and save the result as MineralLick in a file geodatabase feature class called Subjective.gdb 6. Add a short integer field called MineralLick and calculate the field with 1 7. Convert Archeology_Site_Buffers.shp to multipart and save the result as Archaeology in a file geodatabase feature class called Subjective.gdb 8. Add a short integer field called Archaeology and calculate the field with 1 9. Dissolve Archaeology, MineralLick, Spring, and TrapperCabin on the respective fields added. 10. Convert Unique_Areas_2019_Buffer.shp to single part and name the result UniqueBuffers 11. Add a field to UniqueBuffers named UniqueName and calculate it with the Description field 12. Repair geometry and check topology (for overlaps)
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1019_SubjectiveUnique.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filenames	Archaeology, TrapperCabin, Spring, MineralLick, and UniqueBuffers
Output Description	File geodatabase feature classes showing archaeology, mineral licks, springs, Trapper Cabins, and unique areas found within the DFA as polygons.
Output Attributes	Archaeology, MineralLick, Spring, TrapperCabin, and UniqueBuffers
Polygon Area/Line Length	Total Area – 2682 ha; Spring – 104 ha; Trapper Cabin – 835 ha; Mineral Lick – 325 ha; Archaeology – 55 ha; Unique Areas – 2197 ha

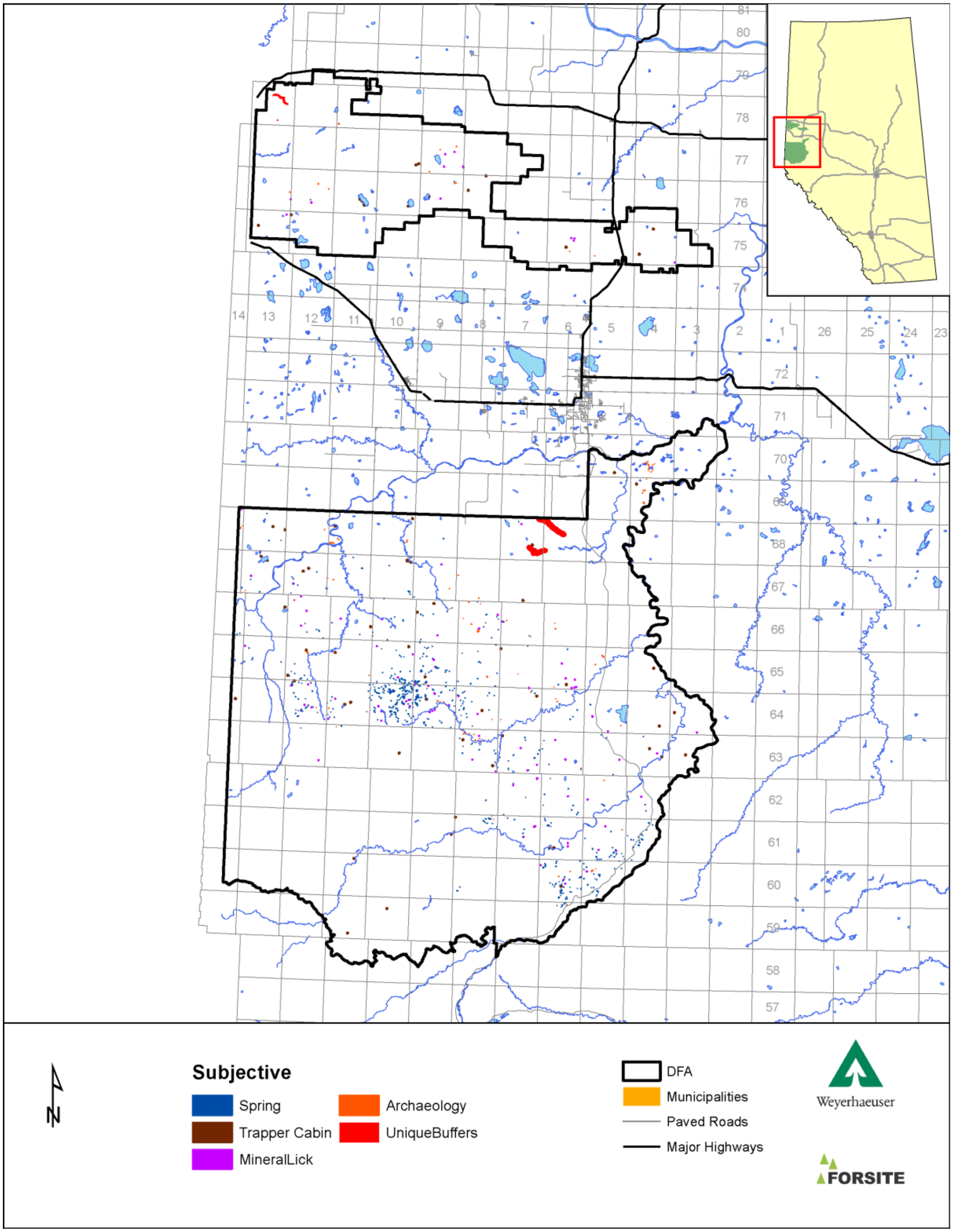


Figure 8.24 Subjective Deletions (Springs, Trapper Cabins, Mineral Licks, Archaeology, and Unique Areas) found within the DFA.

8.1.25 Reforestation Standard of Alberta (RSA)

Item	Description
Source	Weyerhaeuser
Source Filename	RSA_NON_PHOTO_PULLED_FROM_AVI_v2.shp, WeyGP_NP_RSA_GroundLabel_Stratum.xlsx, RSA_PHOTO_2009_2016.shp
Creation Date/Effective Date	Download Date: 2017-08-18
Description of Source Files	RSA survey polygons from both aerial and non-aerial programs
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	NAA, SP_CL, N_NAA, N_SP_CL
Required Processing	RSA Photo: 1. Copy both features into a file geodatabase called RSA.gdb 2. Make a unique list of openings (R_OPENING) in the RSA_PHOTO feature 3. Select ARIS reconciled openings from AVI that match 4. Copy Selections from ARIS-reconciled openings 5. Dissolve copied features on R_OPENING 6. Dissolve RSA_PHOTO on 'ARIS_OPEN', 'ARIS_OPEN_UNIQUE', 'SP_CL' 7. Identity dissolved RSA Photo into dissolved ARIS-reconciled AVI openings 8. Eliminate small areas within ARIS reconciled openings with no RSA coverage (<20000 m²) 9. Eliminate very small portions of openings (<1000m²) 10. Multipart to singlepart 11. Dissolve on RSA_P, SP_CL and save the result as AVI_RECONCILED_RSA RSA Non-Photo: 1. Make a unique list of openings in the RSA_NON_PHOTO feature 2. Select ARIS reconciled openings (R_OPENING) from AVI that match 3. Copy Selections from ARIS-reconciled openings 4. Dissolve copied features on R_OPENING 5. Dissolve RSA_NON_PHOTO on 'OPENING', 'UNIQUE_ID_NP' 6. Add a filed called N_SP_CL and update it using RSA_layer\WeyGP_NP_RSA_GroundLabel_Stratum.xlsx on UNIQUE_ID_NP 7. Identity dissolved RSA_NON_PHOTO into dissolved ARIS-reconciled AVI openings 8. Eliminate small areas within ARIS reconciled openings with no RSA coverage (<20000 m²) 9. Eliminate very small portions of openings (<1000m²) 10. Multipart to singlepart 11. Dissolve on RSA_NP, N_SP_CL and save the result as

	AVI_RECONCILED_RSA_NP
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, Python 2.7.10, 1001_Prep_Input_1023_RSAv2.py, 1001_Prep_Input_1030_PrepInputLayers.py
Output Filenames	AVI_RECONCILED_RSA, AVI_RECONCILED_RSA_NP
Output Description	RSA survey polygons from both aerial and non-aerial programs
Polygon Areas/Line Lengths	

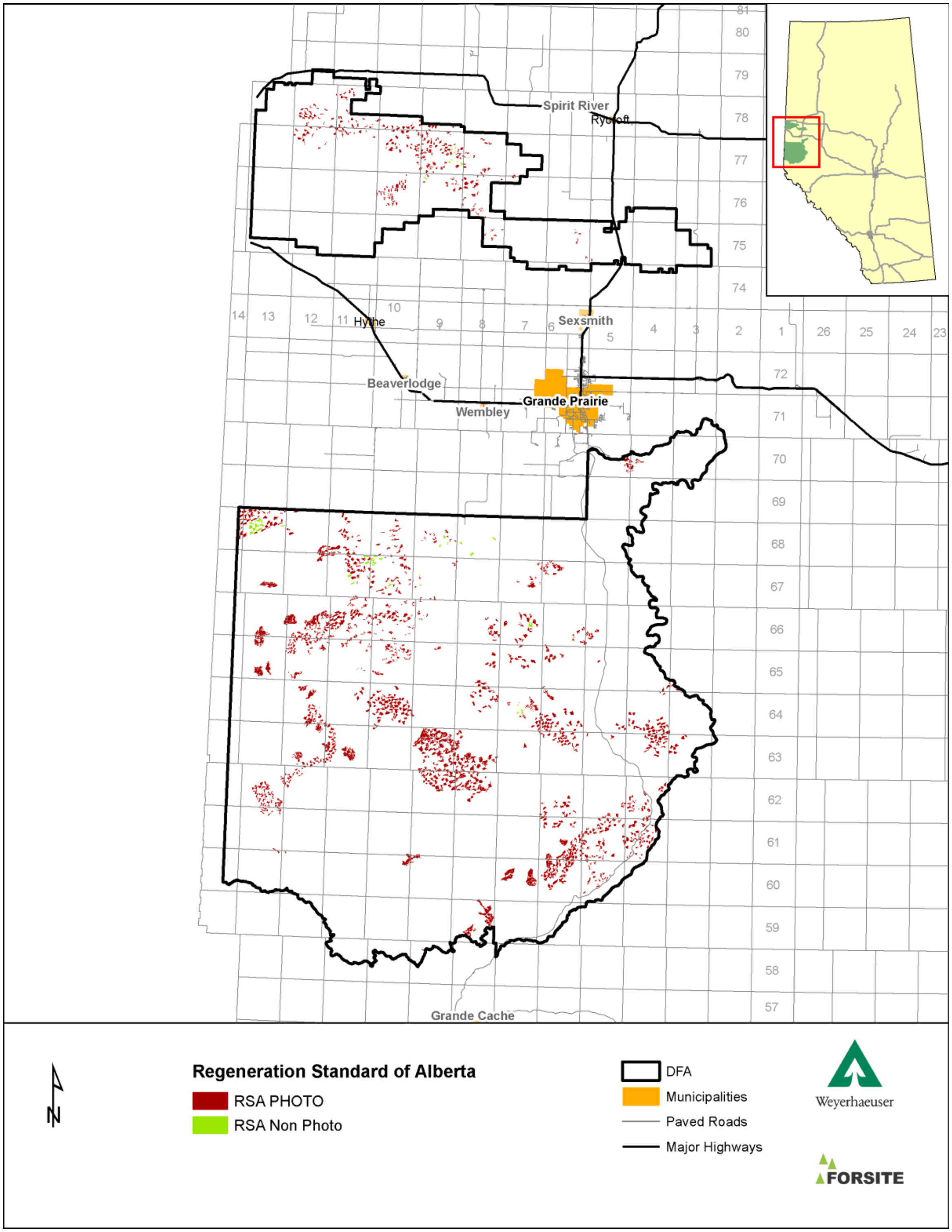


Figure 8.25 RSA polygons within the DFA

8.1.26 Cutblocks

Item	Description
Source	Forcorp
Source Filename	Cutblocks_V8_20181228, missingWeyGPblocks, OPENING_6110763282, OPENING_6130871087
Creation Date/Effective Date	Created: 2018-12-12, Effective: 2017-05-01
Description of Source Files	Cutblocks added to the landbase after the AVI photo cut-off date.
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	CC_OPENING, CC_FIELD, CC_OWNER, CC_BLKYEAR, CC_STRATA, CC_Status
Required Processing	1. 1. Copy Cutblocks_V8_20181228 as features classes in a file geodatabase called Cutblocks.gdb 2. Merge with MissingWeyGPblocks and name the result Cutblocks_V9_missingWeycoMerge 3. Create and digitize opening OPENING_6110763282 4. Merge with OPENING_6110763282 with Cutblocks_V9_missingWeycoMerge and name the result Cutblocks_V9_missingWeycoFRIAAMerge 5. Create and digitize OPENING_6130871087 6. Merge OPENING_6130871087 with Cutblocks_V9_missingWeycoFRIAAMerge and name the result Cutblocks_V9_missingWeycoFRIAATOLKMerge
Assumptions / Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1020_Cutblocks.py
Output Filenames	Cutblocks_V9_missingWeycoFRIAATOLKMerge
Output Description	Post-AVI photo capture harvest openings.
Output Attributes	CC_OPENING, CC_FIELD, CC_OWNER, CC_BLKYEAR, CC_STRATA, CC_Status, DISP_HOLD, DISP_NUM, OPENING_NU, HARV_CODE, SKID_CLEAR
Polygon Areas/Line Lengths	**CC_OWNER** / **Area (ha)** CFPL 49 FRIA 138 NORI 10,535 SPEC 177 TOLK 220 WEYG 16,895 **Total** **28,014**

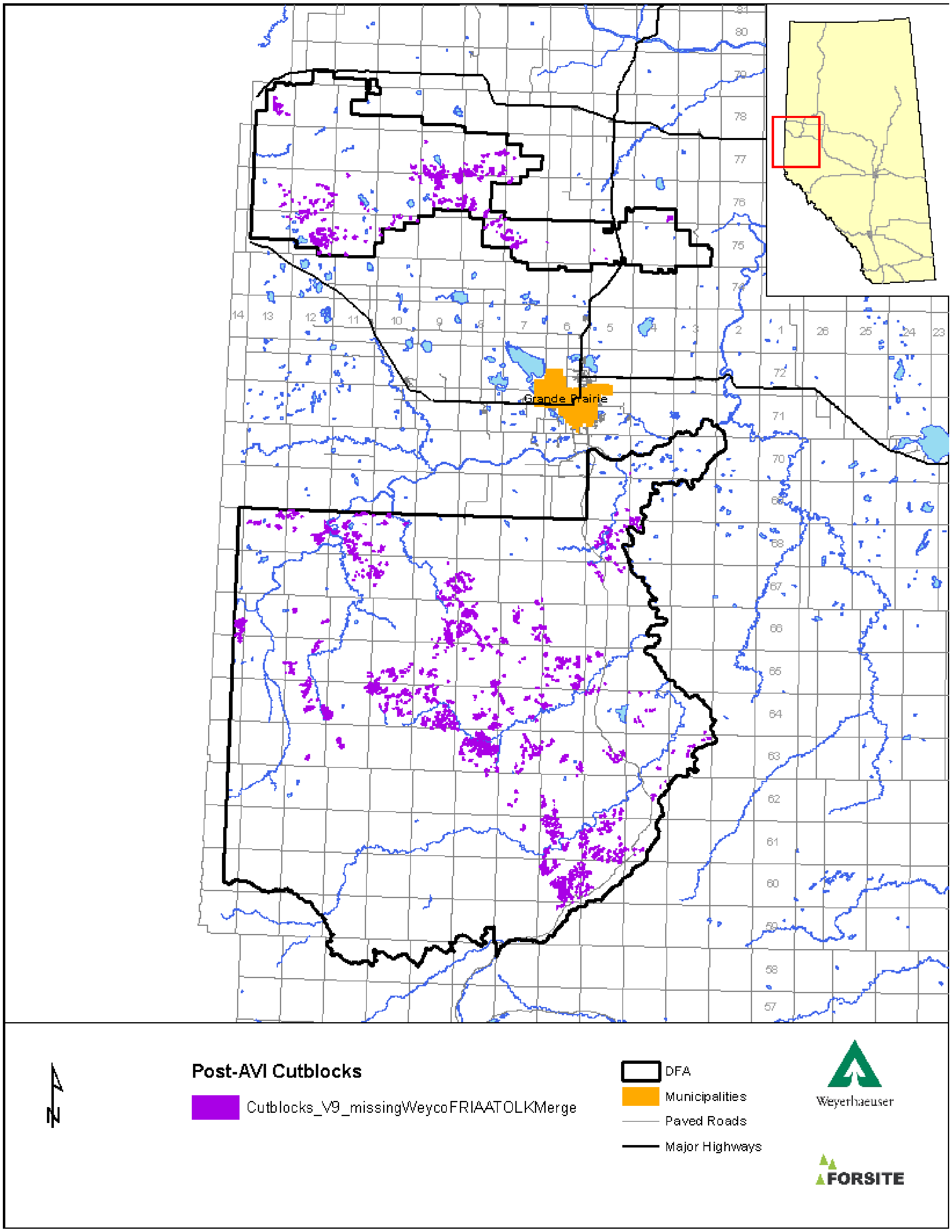


Figure 8.26 Cutblocks harvested within the DFA after AVI air-photo capture

8.1.27 Planned Cutblocks

Item	Description
Source	Weyerhaeuser and Quota holders
Source Filename	WeyGP_2017_18blocks.shp, WeyGP_2018_19blocks.shp, 21090411_FinalApproval.shp, 21090411_LayoutComplete.shp, Nor_Harvested_May_1_2017_to_April_30_2019.shp, Nor_Preblock_MArch_28_2019.shp, Proposed_CTP_blocks_nov20_17.shp, Tolko_Kistuan_Laidout_Blocks.shp
Creation Date/Effective Date	Created: 2019-01-07
Description of Source Files	Planned Cutblocks that are expected to be harvested after the effective date of the planning inventory
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	Opening Numbers, Block Operators, Harvest Status (each source file had unique field names for the same data)
Required Processing	1. Ensure projections of all files is UTM, NAD 1983 UTM Zone 11N 2. Copy all planned block sources into a file geodatabase feature dataset to check for overlaps and address overlaps 3. Union all planned block inputs with FID only together (named PlannedBlocksTemp1), add SOURCE field and update with source depending on FID 4. Dissolve on SOURCE field and name the result Planned_Blocks_Temp2 5. Union Planned_Blocks_Temp2 with DFA boundary, name the result Planned_Blocks_Temp3 6. Convert Planned_Blocks_Temp3 to single part and name the result Planned_Blocks_Temp4 7. Select Planned_Blocks_Temp4 where Shape_Area <= 1000 or (12.56636*(Shape_Area/(Shape_Length*Shape_Length)) < 0.175 and Shape_Area < 5000) 8. Eliminate selected features of Planned_Blocks_Temp4 to get rid of small slivers 9. From ARIS-reconciled AVI, select all harvest openings and dissolve 10. Merge dissolved AVI openings with Post-AVI cutblocks 11. Erase Planned_Blocks_Temp_4 with merged AVI and Post-AVI cutblocks to get rid of planned block overlaps with historic harvest openings. 12. Union historic blocks with planned blocks and FMU background

Item	Description
	feature 13. Convert to result from above to singlepart (multipartToSinglepart) 14. Add PLANNED and HARVESTED flag field and update with for harvested and planned attributes 15. Get rid of small unintended gaps between historic harvest areas and planned harvest areas by using arcpy. GeneratNearTable_analysis, updating a flag field to ID small gaps between planned and historically harvested. This was done essentially so that planned blocks were 'expanded' to fill in small gaps between historic and planned openings.
Assumptions/ Processing Issues	Once planned blocks were consolidated, they first erased with historic cutblocks to ensure they did not overlap previously harvested areas. After that planned blocks were 'expanded' to fill in small unintended gaps between historic and planned openings.
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1024_PlannedCutblocks.py
Output Filenames	PLANNED_BLOCKS
Output Description	Planned cutblocks that are expected to be harvested after 2017
Output Attributes	SOURCE, PLAN_KEY
Polygon Areas/Line Lengths	**SOURCE** / **Area (ha)** CTP 139 NorbordHarvested 4,304 NorbordPlanned 6,164 TOLKO 539 WeycoFinalApproval 6,521 WeycoHarvested 15,684 WeycoLayoutComplete 7,642 **Total** **40,995**

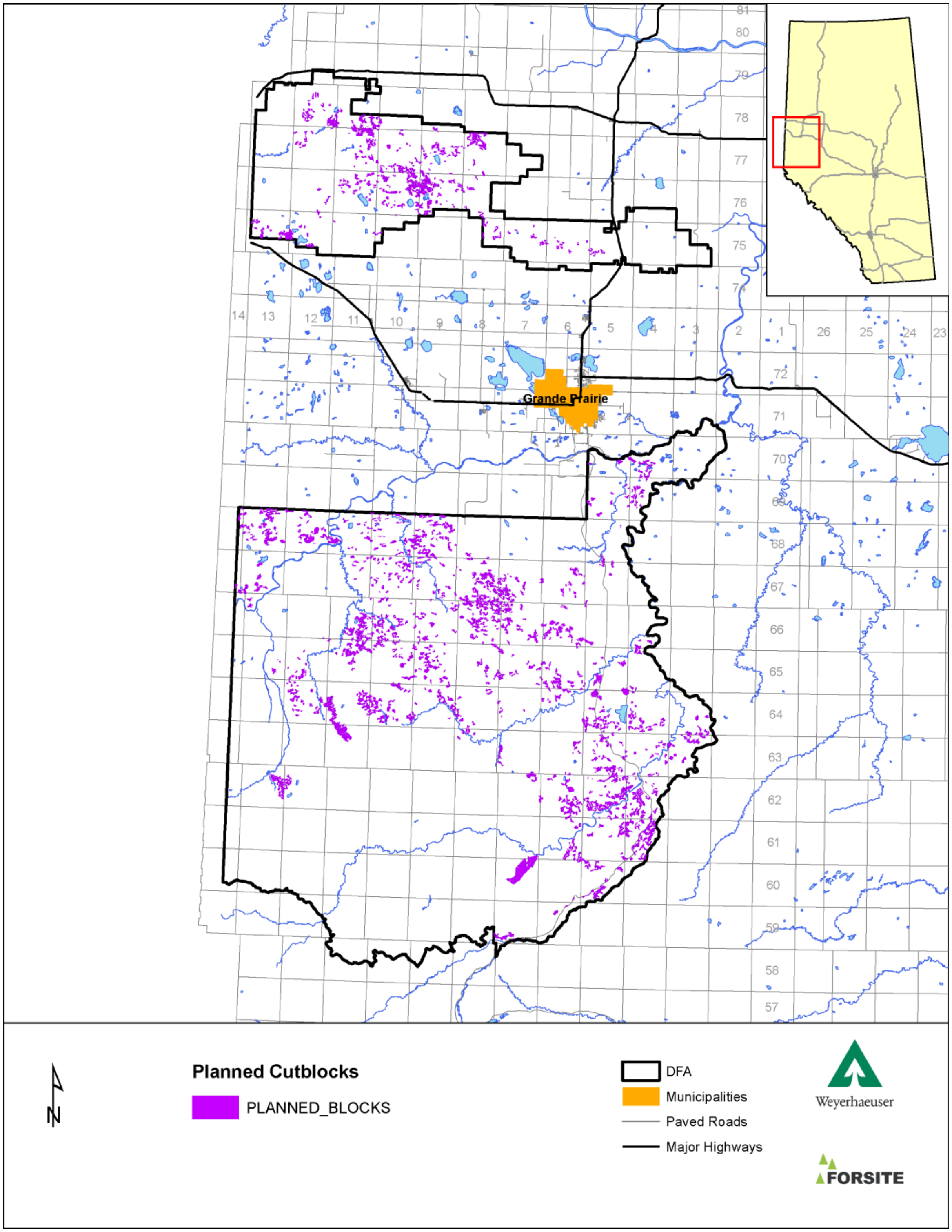


Figure 8.27 Planned Cutblocks that are expected to be harvested after May 1, 2017.

8.1.28 Cost Zones

Item	Description
Source	Weyerhaeuser
Source Filename	Cost_Zones_2019DFMP.shp
Creation Date/Effective Date	Download Date: 2018-07-24
Description of Source Files	Cost zones that overlap the DFA
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	COST_ZONE
Required Processing	1. Ensure projections of all files is UTM, NAD 1983 UTM Zone 11N 2. Check and address overlapping topology
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1028_CostZones.py
Output Filenames	CostZones_2019
Output Description	Cost zones that overlap the DFA
Output Attributes	COST_ZONE
Polygon Areas/Line Lengths	

COST_ZONE	AREA
1800 Timber Berth	38,133
Bull Creek	54,839
Calahoo	17,466
Calahoo Zone 3	15,144
Hammer Head	19,311
Kakwa Tower	57,258
Lingrell Zone 3	47,687
MA2 GP North	21,358
Musreau	61,884
Narraway Zone 1	33,599
Narraway Zone 2	7,482
Nose Mountain	19,639
Pine Rat	42,246
Pinto	62,412
Pinto Cut Across	42,751
Prairie Creek	483
Prairie Creek Zone3	31,597
Redrock Prairie Zone 1	107,169
Redrock Zone 2	47,582
Redrock Zone 3	42,077
Saddle Hills East	59,955
Saddle Hills North	62,111
Saddle Hills South	95,602
South East Kakwa	27,401
Stetson Zone 2	17,990
Two Lakes Zone 3	21,900
Wanyandie	15,966
Wapiti	33,890
Wilson Lake	24,396
Total	1,129,330

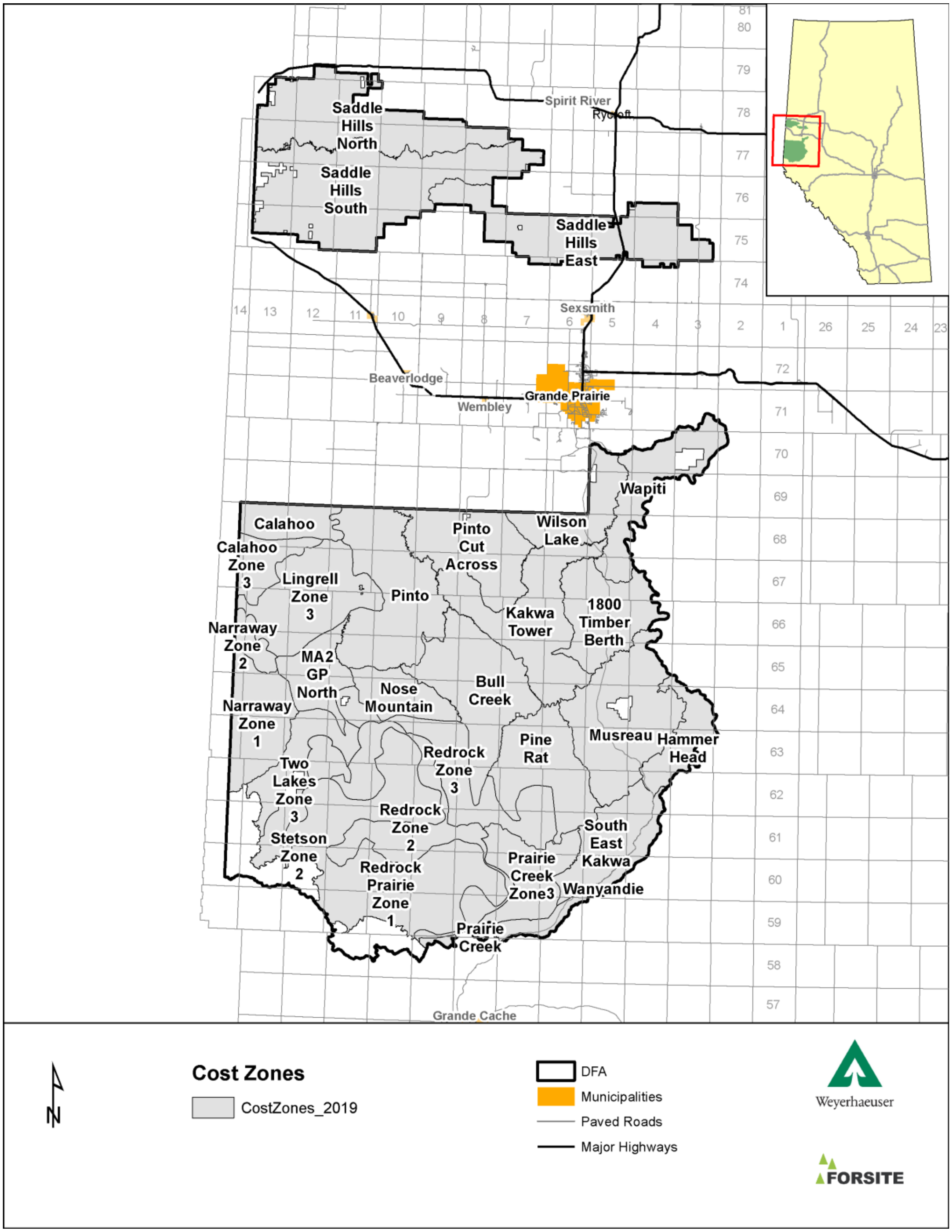


Figure 8.28 Cost Zones

8.1.29 Access Units

Item	Description
Source	Forcorp (via Weyerhaeuser)
Source Filename	Decade_One_and_Two_June_25.shp
Creation Date/Effective Date	Download Date: 2018-06-26
Description of Source Files	Access Units within the Caribou Range
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	
Required Processing	1. Ensure projections of all files is UTM, NAD 1983 UTM Zone 11N 2. Copy Decade_One_and_Two_June_25.shp into a file geodatabase feature class and name the copy AccessUnits 3. Change 'Compartment' field to 'ACCESS_UNT' (AlterField_management)
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1028_CostZones.py
Output Filenames	AccessUnits,
Output Description	Access units that overlap the caribou range within the DFA
Output Attributes	ACCESS_UNIT
Polygon Areas/Line Lengths	Total Area – 372,198 ha

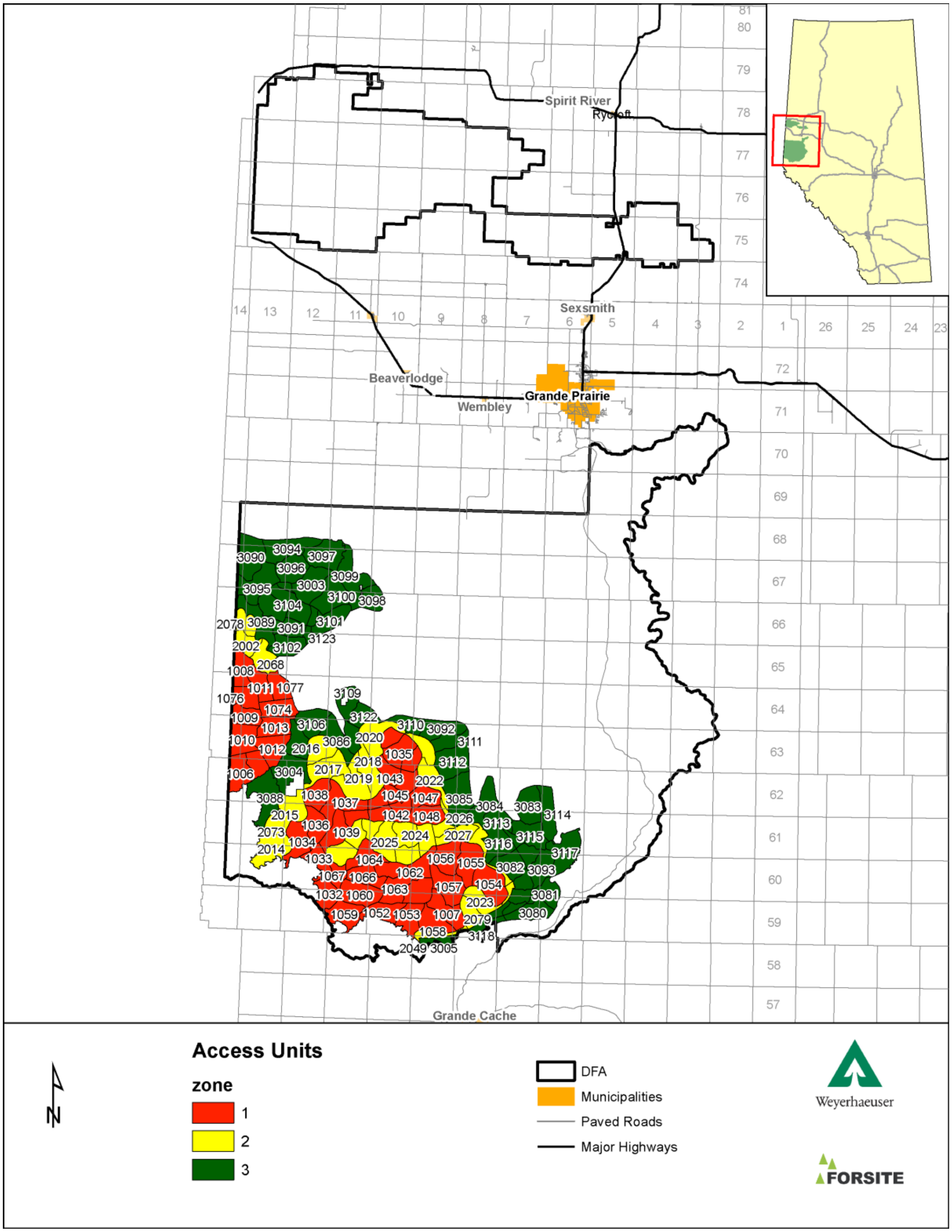


Figure 8.29 Access Units

8.1.30 Adjusted PSPs

Item	Description
Source	GOA
Source Filename	G16_AFS_SDS_MPB.shp
Creation Date/Effective Date	Download Date: 2018-12-17
Description of Source Files	Adjusted PSP boundaries
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	PSP_NUMBER
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N and name result PSP_Adjustments.gdb\G16_AFS_SDS_MPB
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1030_PSP_Adjustments.py
Output Filenames	G16_AFS_SDS_MPB
Output Description	Adjusted PSP boundaries
Output Attributes	PSP_NUMBER
Polygon Areas/Line Lengths	Total Area – 461 ha

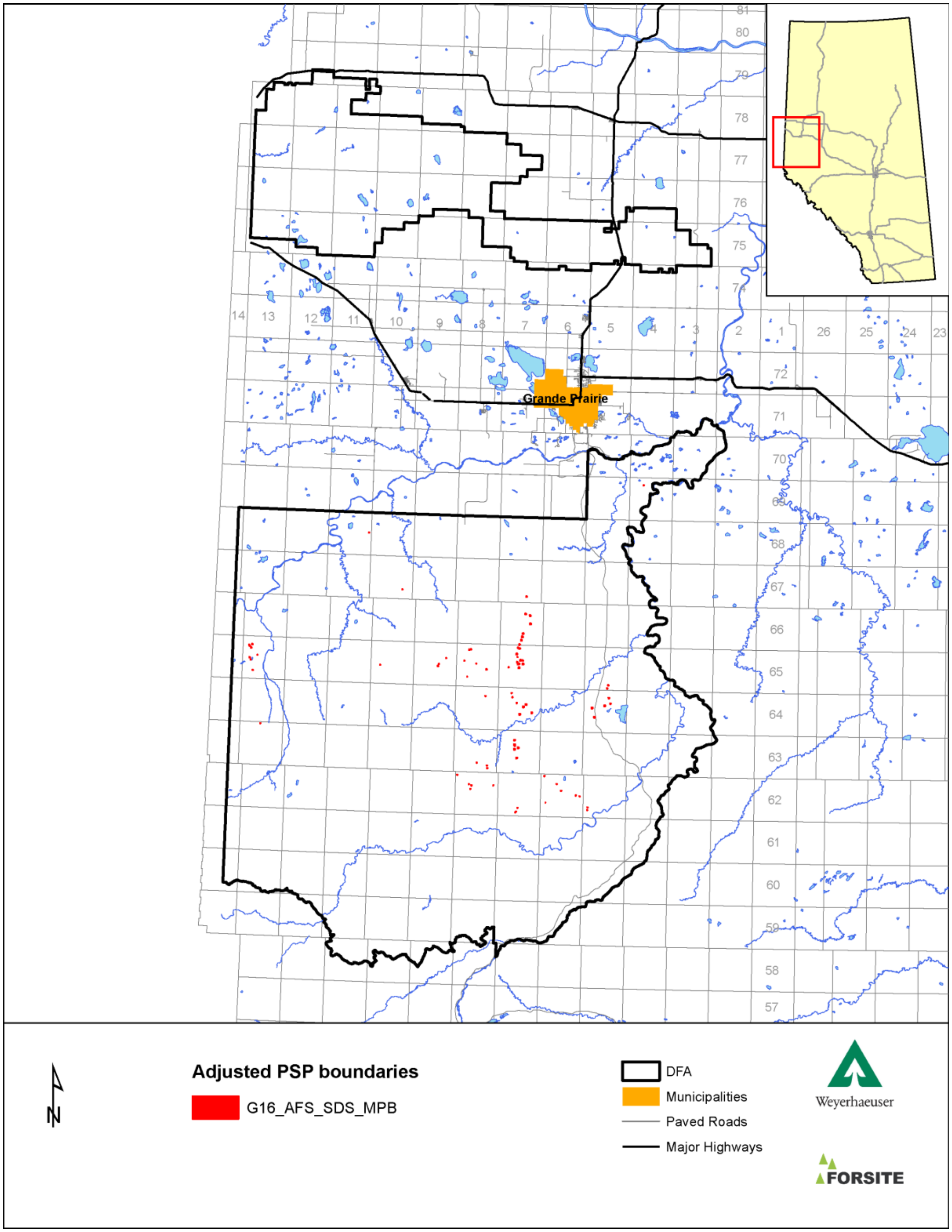


Figure 8.30 Adjusted PSP boundaries

8.1.31 Historic Resources

Item	Description
Source	GOA
Source Filename	Listing_of_Historic_Resources_Apr2017_Public.shp
Creation Date/Effective Date	Download Date: 2017-09-28
Description of Source Files	Historic Resources within the G16 FMU
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	HRV
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N and save the result as HistoricResources_project 2. Make a feature layer and select where 'HRV in (1,2,3)' 3. Copy selected layer features as HistoricResources
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1026_ProvincialPark.py
Output Filenames	HistoricResources
Output Description	Historic Resources within the G16 FMU
Output Attributes	HRV
Polygon Areas/Line Lengths	**HRV** / **Area** 1 / 47 3 / 192 **Total** / **238**

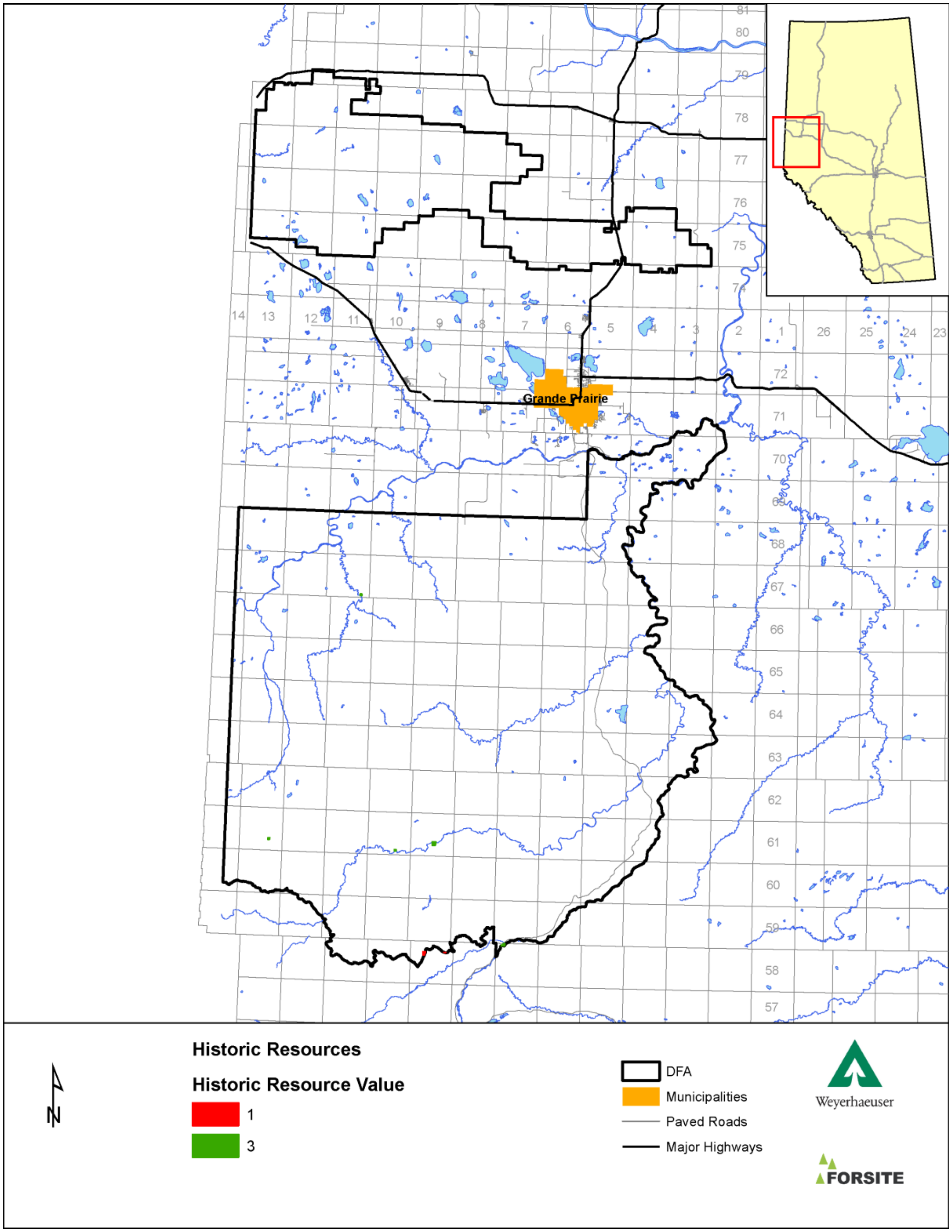


Figure 8.31 Historic Resources

8.1.32 Provincial Recreation Areas

Item	Description
Source	Altalis
Source Filename	BF_PRA_POLYGON.shp
Creation Date/Effective Date	2017-08-23
Description of Source Files	Provincial Recreation Areas
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	PRA_NAME
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N and save the result as pra_project 2. Clip with FMU Boundary and save as ProvincialRecreationArea
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_Prep_Input_1026_ProvincialPark.py
Output Filenames	ProvincialRecreationArea
Output Description	Provincial Recreation Areas within the G16 FMU
Output Attributes	PRA_NAME
Polygon Areas/Line Lengths	**PRA_NAME** / **Area** Big Mountain Creek 13 Kakwa River 8 Musreau Lake 1,801 Sheep Creek 11 Shuttler Flats 15 Southview 5 **Total** **1,852**

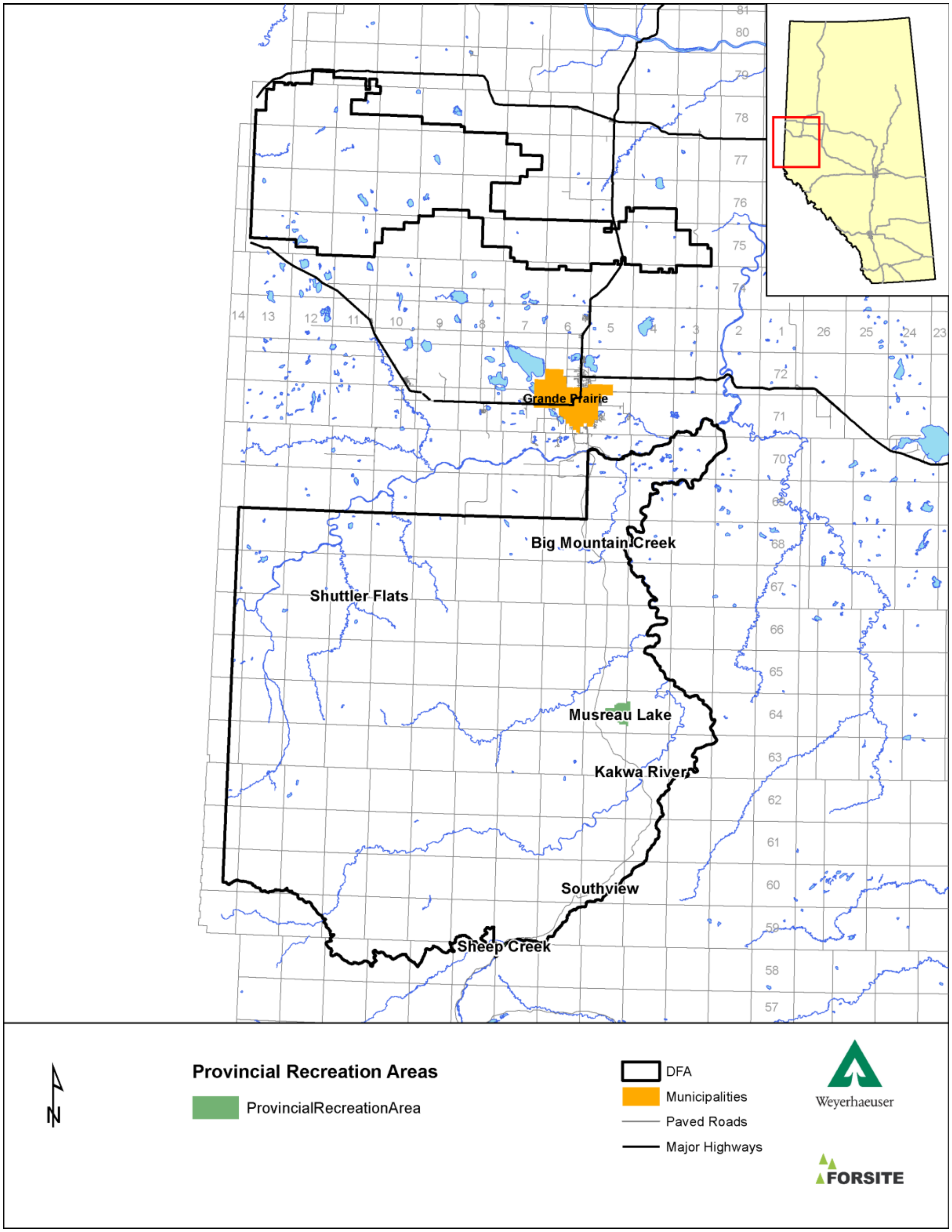


Figure 8.32 Provincial Recreation Areas

8.1.33 Dunes

Item	Description
Source	Altalis
Source Filename	**BF_FMA_POLYGON.shp** (Calendar Date: 2016/08/24)
Creation Date/Effective Date	2017-08-23
Description of Source Files	FMA Boundaries
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	DUNES
Required Processing	1. Run Eliminate Polygon part against FMA (EliminatePolygonPart_management) 2. Clip with FMA Boundary and save as Dunes 3. Add column “Dunes” (short integer) and populate with 1
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1
Output Filenames	Dunes
Output Description	Dunes area within the G16 FMU
Output Attributes	DUNES
Polygon Areas/Line Lengths	**Dunes** — **Area** 1 — 2,498 **Total** — **2,498**

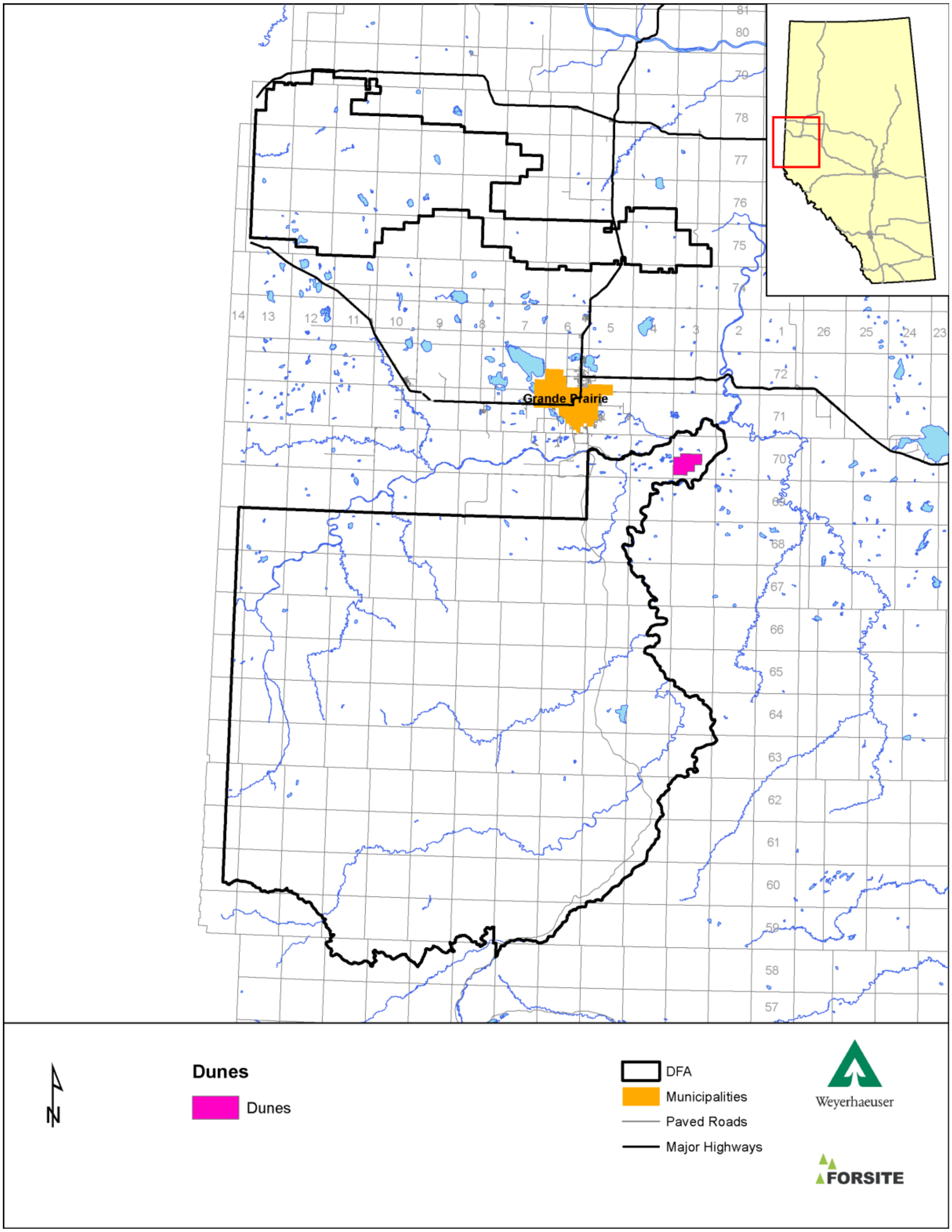


Figure 8.33 Dunes

8.1.34 Forest Health Overview – Aspen Mortality

Item	Description
Source	GOA
Source Filename	Aspen_Mortality_2018_v2
Creation Date/Effective Date	2018-11-15
Description of Source Files	Aspen_Mortality_2018_v2
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	SYMPTOM
Required Processing	1. Project to UTM, NAD 1983 UTM Zone 11N and save the result as AspenMort_project 2. Clip with FMU Boundary and save as AspenMortality
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 1001_PREP_Input_1029_ForestHealth.py
Output Filenames	AspenMortality
Output Description	Aspen Mortality Identified in Forest Health Overview within the G16 FMU
Output Attributes	AspenMortality
Polygon Areas/Line Lengths	**SYMPTOM** / **Area** Mortality / 71,050 **Total** / **71,050**

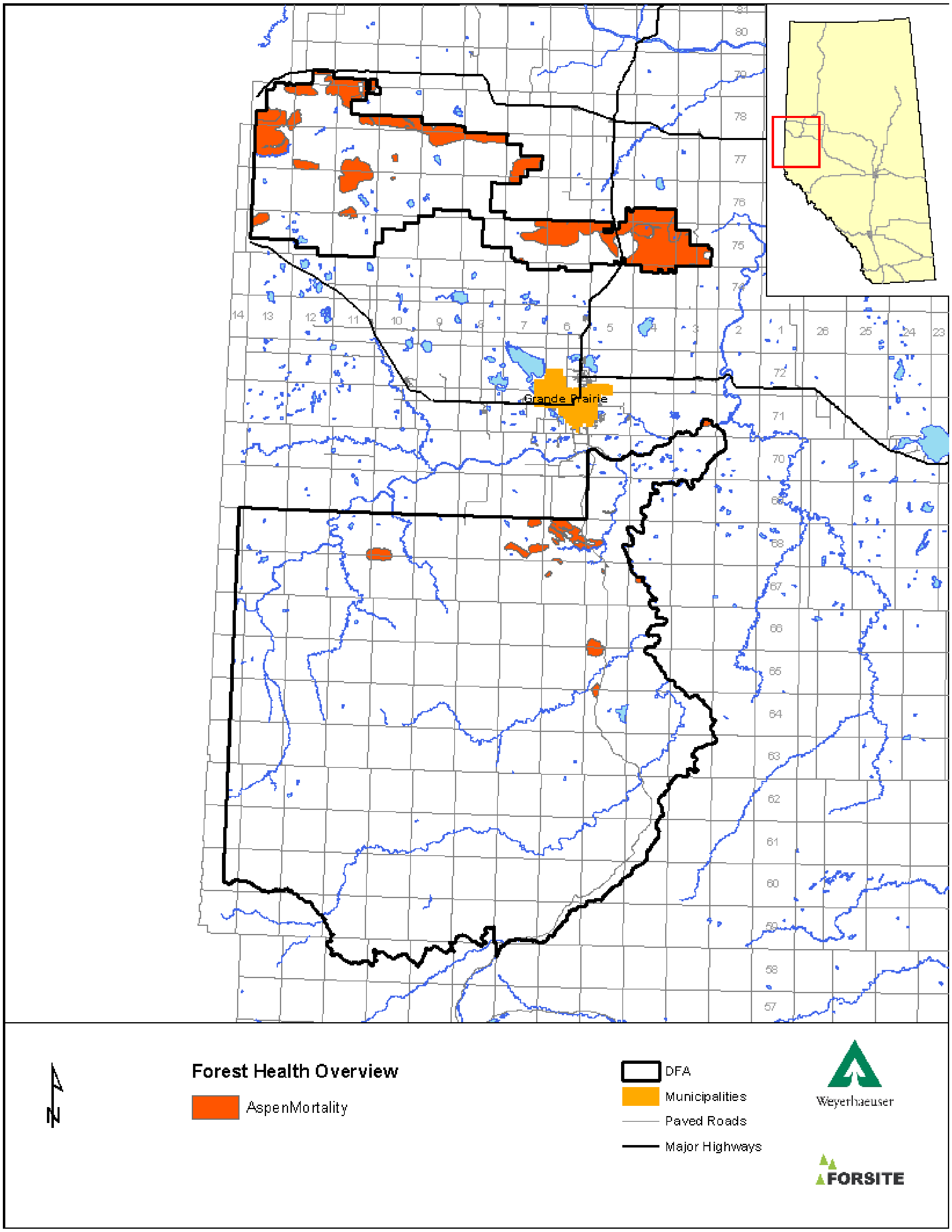


Figure 8.34 Forest Health Overview – Aspen Mortality

8.1.35 Annex 3 – Spring, Summer, and Fall Fire Behaviour

Item	Description
Source	GOA
Source Filename	Annex_3_WeyCo.gdb\Summer_Fire_Behaviour Annex_3_WeyCo.gdb\Spring_Fire_Behaviour Annex_3_WeyCo.gdb\Fall_Fire_Behaviour
Creation Date/Effective Date	2017-08-23
Description of Source Files	Spring, Summer, and Fall Fire Behaviour Potential – Annex 3
Projection/Datum	UTM, NAD 1983 UTM Zone 11N
Important Attributes	SPRING_FIRE_BEHAVIOUR, SUMMER_FIRE_BEHAVIOUR, FALL_FIRE_BEHAVIOUR
Required Processing	1. Used as is to perform zonal statistics in Final CLB resultant
Assumptions/ Processing Issues	None
Programs	ESRI ArcGIS 10.5.1, 4000_Netdown_007_AssignFireRisk_Annex3.py
Output Filenames	N/A
Output Description	Spring, Summer, and Fall Fire Behaviour Potential – Annex 3
Output Attributes	SPRING_FIRE_BEHAVIOUR, SUMMER_FIRE_BEHAVIOUR, FALL_FIRE_BEHAVIOUR
Polygon Areas/Line Lengths	N/A

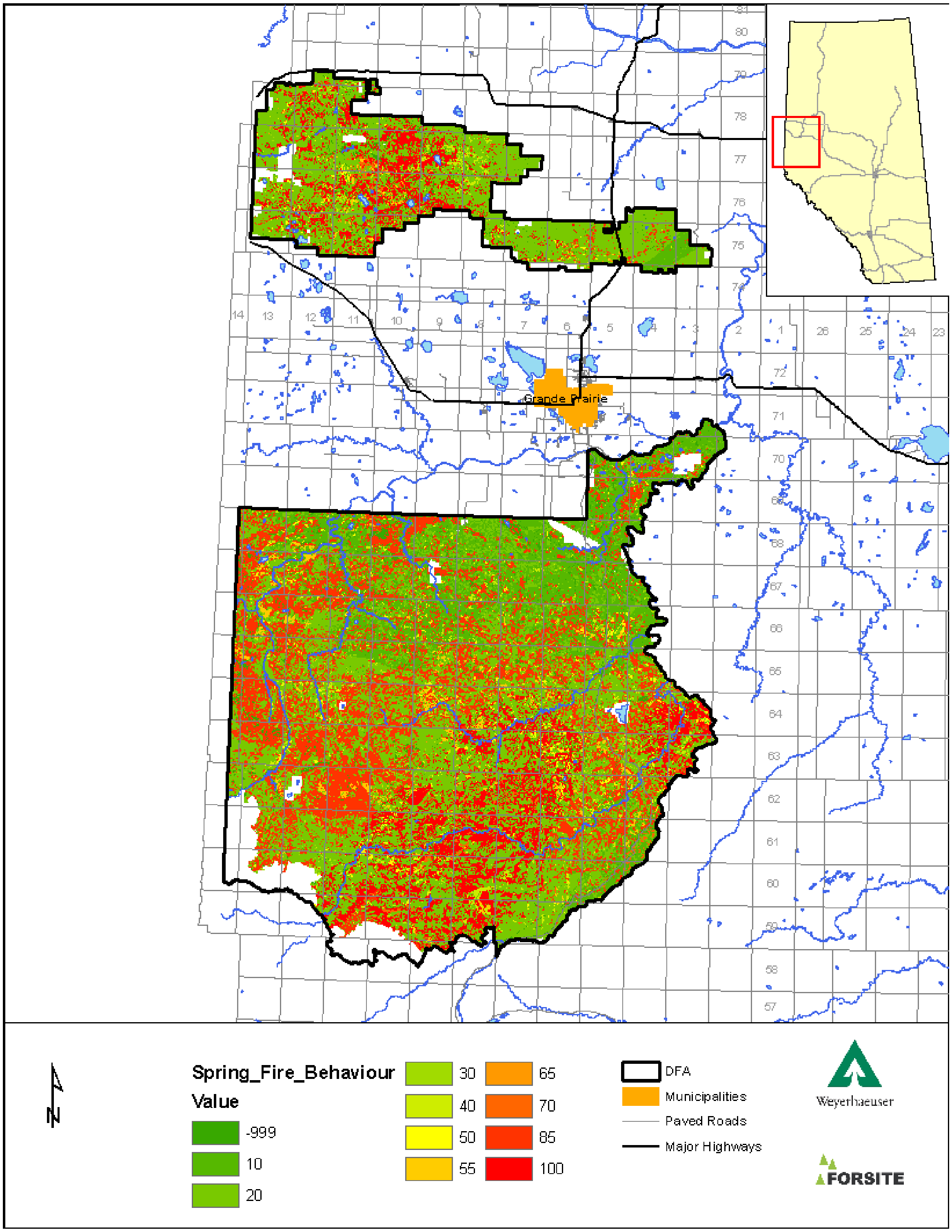


Figure 8.35 Annex 3 – Spring Fire Behaviour

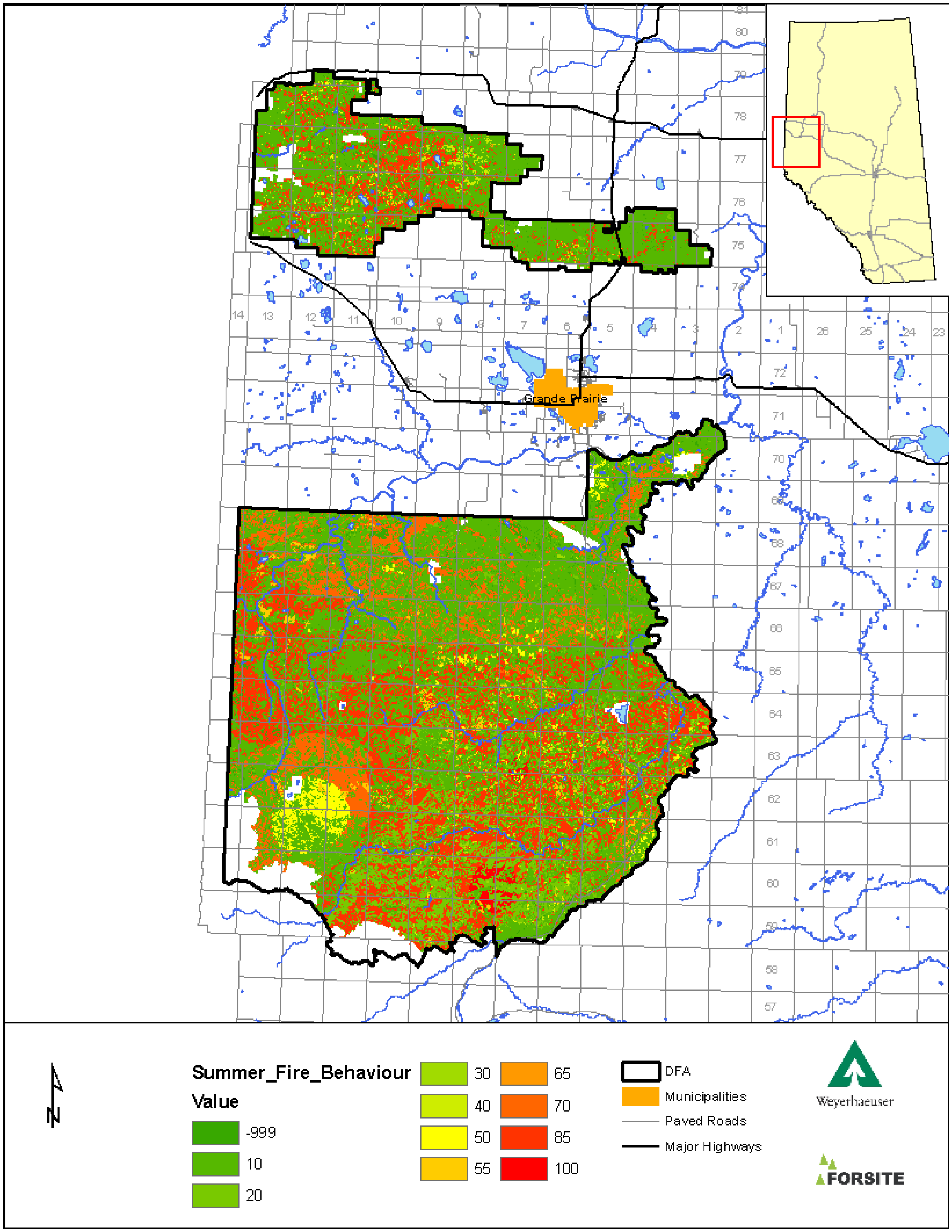


Figure 8.36 Annex 3 – Summer Fire Behaviour

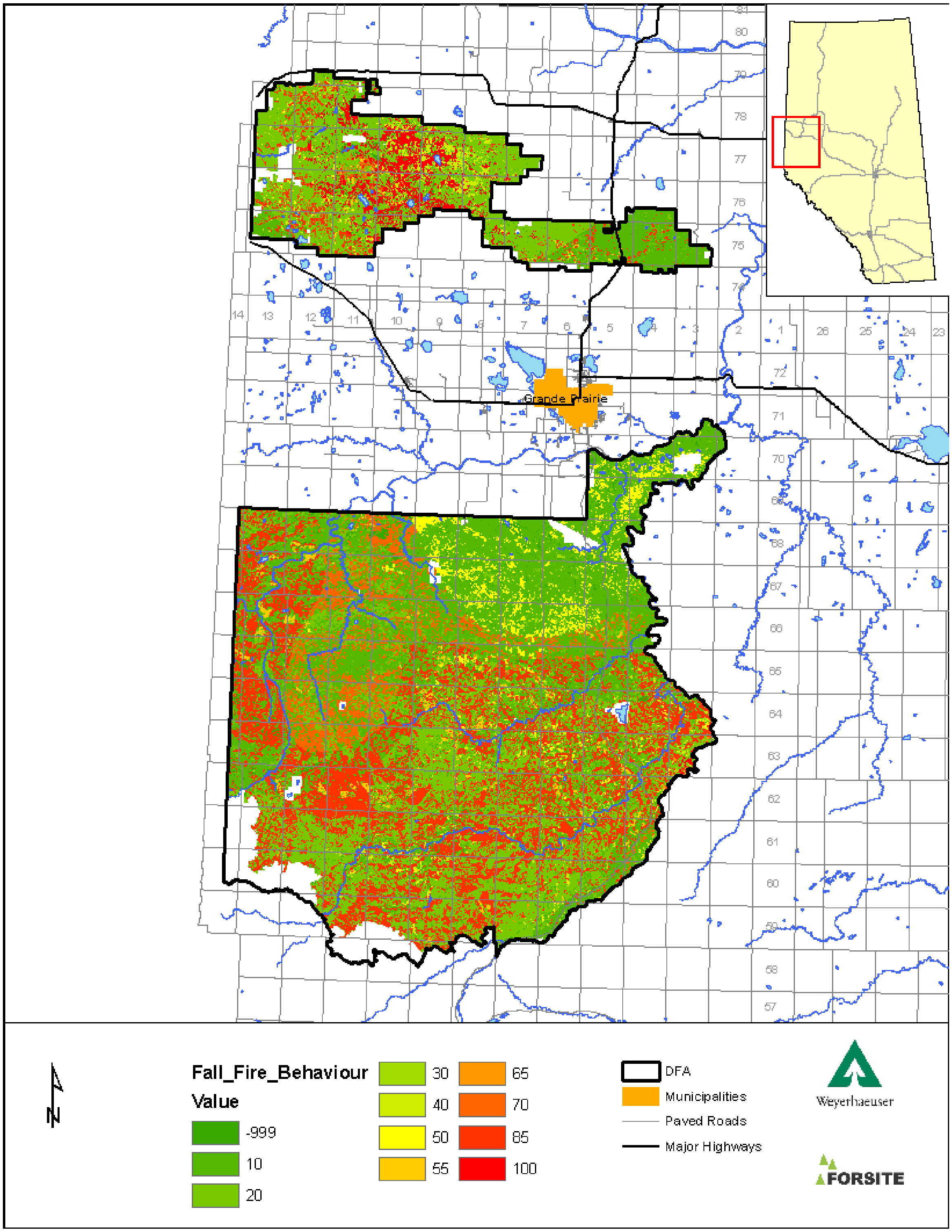


Figure 8.37 Annex 3 – Fall Fire Behaviour

8.2 Enhancements to the Forest Inventory (AVI)

The CLB is essentially a copy of the approved AVI file where modifications have been applied. All existing AVI attributes were carried forward and remain unchanged, however, the CLB dataset underwent many changes. These changes included splitting of features to reconstruct cutblock boundaries, integration of RSA internal line work, updating of AVI attributes (using new field names so that the original attributes are preserved) following close inspection of the data, and reconciliation of opening numbers with ARIS.

8.2.1 ARIS Reconciliation

Alberta Regeneration Information System (ARIS) is a database that includes information on forest activities submitted by forestry companies as a provincial reporting requirement.

The Alberta Forest Management Planning Standard, Section 3.11 Annex 1 (Alberta, 2006), requires that areas harvested after March 1, 1991 be assigned to a yield stratum as defined in ARIS. It is the responsibility of each operator with harvested areas that will be contributing to the regenerating landbase to ensure that their ARIS records are consistent with the landbase information for each harvested area. Where inconsistencies are found, operators are individually responsible to resolve these to the satisfaction of the GOA (Alberta, 2017[1]). Sign off sheets can be found in Appendix II

8.2.1.1 Processing ARIS Data

An ARIS data extract was obtained from the GOA dated June 27, 2017. This extract included all the CSV files for the G16 FMU and was the entire list of cutblocks that required reconciliation as it was downloaded after the landbase effective date.

FORCORP's Excel based ARIS processing tool was used to 1) consolidate and 2) process the data to determine the final strata assignments, ages, and area for each opening number. The process to determine strata and block year is described in the Appendix

8.2.1.2 One-to-One Matching

One to one matching is the process for assigning a spatial match for each ARIS record. In summary this process was completed as follows:

- Opening numbers from the AVI and ARIS data were compared to determine which opening numbers matched or did not match between the two tables. For cutblocks that were cut after the AVI photo date, cutblock boundaries were provided by the operators and reconciled in a separate cutblock layer.
- All openings that did not match were investigated further:
  - Lists of openings were provided to each operator to investigate;
  - Opening numbers were investigated for errors in the number, for example a missing character;
  - The grid, township and range numbers were checked by parsing out the opening numbers to ensure they fell within the DFA boundary.
- Where errors were found in opening numbers regarding alpha characters, the opening numbers were updated in the AVI or cutblock layer to create one-to-one matches of opening numbers from ARIS to the cutblock data. When updates were required in the AVI, a supplementary ARIS field (R_ARIS) was used to make the changes so that the ARIS field from the original interpretation remained unchanged.

[1] Alberta 2017. Reference guide for ARIS auditing and application. January 17, 2017.

- Opening numbers in the ARIS table that did not have a match in the AVI were investigated to identify the spatial location. This was also done for cutblocks in the AVI that did not have a matching opening number in the ARIS dataset. Comments were added to the data detailing why there was a discrepancy. As part of correcting these errors supplementary data fields were added to the AVI attributes with an "R_" prefix. These fields corrected any errors in the AVI while ensuring that the fields from the original interpretation remained unchanged.

8.2.1.3 Area Variance

The second phase of ARIS reconciliation was to compare the cutblock area in the AVI or cutblock layer for each opening to the area reported in ARIS to determine whether they met the compliance standard. For openings greater than or equal to 10 hectares in size, the landbase area must be within 5% of the reported ARIS area; for openings less than 10 hectares in size, the landbase area must be within 0.5 hectares of the reported ARIS area (Alberta, 2017[2]).

There were several steps to complete this phase:

1. Area differences were calculated for each matching AVI/cutblock layer boundary and ARIS opening. The area differences were then converted to a percentage (with the ARIS area as denominator), and those that had a variance of more than 5% or 0.5 ha, depending on opening size, were flagged;
2. The flagged openings were then individually inspected by the block owner to assess why the areas were outside the allowable variance – comments were made in the dataset to reflect why there was a difference;
3. Where necessary, polygons within the AVI/cutblock layer were edited based on information received from each operator to create an area match between the data layers and ARIS. Typical edits included:
   - Splitting cutblocks in the AVI/cutblock layer into multiple cutblocks and assigning the correct number to each cutblock;
   - Modifying opening boundaries to match the best available information provided by each operator;
   - Splitting a polygon that had been harvested prior to a disturbance event. In these cases, the disturbance boundary crossed the cutblock boundary, making it difficult to identify the original cutblock boundaries. Cutblock boundaries were redrawn to create an area match contributing to the block area, *i.e*. "reconstruction" of the original block;
4. Where AVI/cutblock layer boundaries and ARIS areas could not be brought within the compliance standard, a rationale was included in the ARIS table identifying why an area match was not possible. The following rationales were used to identify the reason for the differences:
   - Openings not within the reconciliation population
     - **Pre91 – Reconciliation Not Required**- openings harvested on or before March 1, 1991 are not required to be reconciled;
     - **Outside Not in FMA** – openings outside the DFA are not required to be reconciled.
     - **Polygon in Grazing Reserve** – The polygon was within a grazing reserve. It did not require reconciliation as it was either outside the DFA or the area had not been interpreted.

[2] Alberta 2017. Reference guide for ARIS auditing and application. January 17, 2017.

- Openings within the reconciliation population
  - Openings requiring an area update in ARIS
    - **Update "NHH" - Update Required Due to New AVI** – the cutblock shape is determined to be most accurate representation of the actual cutblock shape and area. The NHH in ARIS should be updated to reflect the current landbase opening area.
    - **Update "NHH" - Update Required Due to Transboundary Issue -** The cutblock is outside tolerance due to a transboundary issue. The NHH area to be updated with the landbase area as it represents what is in the DFA and/or the block number will be adjusted.
    - **Update "Update Area" - Block Liability has changed** – The ownership of the block has changed resulting in a reduced reforestation liability for the company.
    - **Update "Update Area" - Permanent Deletion** – openings which have decreased in size due to a post-harvest anthropogenic disturbance, such as a well site, road, pipeline etc. In these instances, the "Update Area" field in ARIS is to be updated with the landbase area.
    - **Update "Update Area" - Post-fire replanting created a split block** – A fire burned the block after replanting. The subsequent reforestation of that portion of the block and any neighbouring area resulted in a change to the block boundary and the block area.
  - Openings NOT requiring an area update in ARIS
    - **Block hasn't been captured at time of reconciliation** - no ARIS record existed for the opening at the time of the extract. These records will be captured in ARIS by the operator in due course.
    - **Partial Cut - No New Imagery** - The block was only partially interpreted because the harvest occurred during the photo date. Interpretation of the actual block boundary cannot occur until the next photo date.
    - **Block boundaries unavailable from Operator** – Block boundary could not be provided by the operator.
    - **GOA unable to locate the block** – ARIS record exists but location of opening cannot be established.
    - **Polygon Adjustment - DIDs** – A DIDs deletion was incorrectly incorporated into the block area. Removal of this area will bring the cutblock area into compliance.
    - **Polygon Adjustment - Retention Patch** – The retention patches were captured incorrectly. This could either be that the patches were interpreted but not removed from the ARIS area (resulting in an ARIS area overage), or they were not interpreted but were removed from the ARIS area (resulting in a cutblock area overage).
    - **Polygon Adjustment - Incorrect Boundary** – The boundary of the block was adjusted in the AVI to bring the block area into compliance.
    - **In Compliance** – ARIS and landbase areas are in compliance.

Openings whose sizes were within the 5.0% or 0.5 ha compliance standard did not require investigation or "reconstruction" of the cutblock boundaries. In most cases, however, other ARIS attributes were checked regardless of the area tolerance.

The result of this process was an ARIS table having either a matching area between it and its spatial record in the AVI/cutblock layer, ARIS requiring an area update to match the spatial record, or a rationale indicating the reason why the records do not match. The ARIS table is based on an Excel spreadsheet template provided by the GOA and which is included with the net landbase submission.

The purpose of this submission is to ensure that data in the raw ARIS dataset is consistent with the processed ARIS data used in the net landbase and to ensure that the starting information for the yield curves is consistent with ARIS.

Weyerhaeuser is including the ARIS reconciliation with the net landbase submission under RFP validation for both themselves and all embedded operators with post-91 cutblocks on the DFA for the Forest Management Branch (FMB) to review and approve. For openings that required changes in ARIS, sign-off from operators was collected prior to submission. The sign-off demonstrates that each operator agrees with any proposed changes.

8.2.2 RSA Integration

Reforestation Standard of Alberta (RSA) reconciliation was another key component in the data reconciliation process for integration into the final landbase. RSA data plays an important role in yield curve development which is used in the Timber Supply Analysis (TSA) process. Where available, internal RSA photo and non-photo Survey unit line work was incorporated into the CLB file and the declared species class stratification from the RSA information was used to assign the yield strata. In order to preserve the ARIS-reconciled block boundary, this information was only used if the RSA line work fell within the matching ARIS reconciled opening boundary. Section 8.1.25 shows the RSA data sources incorporated into the CLB file and the extent of the RSA line work for both photo and non-photo.

9. References

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Weyerhaeuser. (2014a). LB-002: Seismic Line Width. September 2014. Weyerhaeuser Company Ltd. Grande Prairie 2016-2026 FMP Development, LB Issue Document. 2p.

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Weyerhaeuser. (2016a). LB-017: Landbase Assignments for Protective Notations (PNTs). September 2016. Weyerhaeuser Company Ltd. Grande Prairie 2016-2026 FMP Development, LB Issue Document. 9p.

Weyerhaeuser. (2016b). LB-021: NSR Performance Surveyed Blocks. September 2016. Weyerhaeuser Company Ltd. Grande Prairie 2016-2026 FMP Development, LB Issue Document. 5p.

Appendix I Approvals

Alberta Agriculture and Forestry

Forestry Division
Forest Management Branch
7th floor, Forestry Building
9920 – 108 Street
Edmonton, Alberta T5K 2M4
Canada
Telephone: 780-427-8474
www.agriculture.alberta.ca

File: 06331-F01-04

December 13, 2016

Mr. Greg Behuniak, RPFT
Forest Technologist
Weyerhaeuser Grande Prairie Forestlands Operations
Resources Road Postal Bag 1020
Grande Prairie, AB T8V 3A9

Dear Mr. Behuniak:

Subject: ALBERTA VEGETATION INVENTORY APPROVAL FOR WEYERHAEUSER COMPANY LIMITED (GRANDE PRAIRIE)

Alberta government staff completed a final review within Forest Management Unit (FMU) G16 in the Weyerhaeuser Company Limited (Grande Prairie) Forest Management Agreement area submitted in December 2016. The review indicated that the data are within acceptable ranges of agreement. The final audit summary is attached.

The data for the Defined Forest Area (FMU G16) is approved for use in forest management and operational planning.

If you have any questions regarding this process please contact Daryl Price at (780) 422-0329.

Yours truly,

Darren Tapp, MBA, MF, RPF
Executive Director

cc: Daryl Price, Director, Forest Resource Analysis
Robert Popowich, Director, Forest Resource Management

Alberta Agriculture and Forestry

Forestry Division
Forest Management Branch
Suite 303, J. G. O'Donoghue Building
7000 113 Street
Edmonton, Alberta T6H 5T6
Canada
Telephone: 780-427-8474
www.forestry.alberta.ca

File: 06331-R01-02

April 1, 2019

Ms. Traci Carter, RPFT
Strategic Planning Forester
Weyerhaeuser Company Limited (Grande Prairie)
Postal Bag 1020
Grande Prairie, Alberta T8V 3A9

Dear Ms. Carter:

Subject: AGREEMENT-IN-PRINCIPLE – WEYERHAEUSER COMPANY LIMITED (GRANDE PRAIRIE) 2019 FOREST MANAGEMENT PLAN CLASSIFIED LANDBASE #2

Thank you for the January 22, 2019 re-submission of the Weyerhaeuser Company Limited, Grande Prairie (WeyCo GP) Classified Landbase (CLB).

The department has reviewed the submission and agreement-in-principle is granted subject to the following:

1. WeyCo GB shall work with the department to address any issues arising from the Alberta Regeneration Information System reconciliation portion of the review prior to submission of the forest management plan.

The CLB was audited. WeyCo GP is responsible for identifying and correcting attribute and documentation errors found through further review or through the use of the product.

If you have any questions or require further information, please contact Liana Luard, Lead, Forest Planning and Performance Monitoring at (780) 427-0395.

Yours truly,

Robert J. Popowich, RPF
Director, Forest Resource Management

cc: Owen Spencer, Forest Area Manager, Grande Prairie Forest Area
Mark Feser, Area Forester, Grande Prairie Forest Area
Daryl Price, Director, Forest Resource Analysis
Greg Greidanus, Senior Resource Analyst
Cassandra Roberge, Senior Reforestation Data
Darren Aitkin, Manager, Forest Biometrics
Cosmin Tansanu, Analysis Forester, Forest Biometrics

Alberta Agriculture and Forestry

Forestry Division
Forest Management Branch
Suite 300 J. G. O'Donoghue Building
7000 - 113 Street
Edmonton, Alberta T6H 5T6
Telephone 780-427-8474
www.agriculture.alberta.ca

File: 06331-F02-04

April 24, 2019

Ms. Traci Carter, RPFT
Strategic Planning Forester
Weyerhaeuser Company Limited (Grande Prairie)
Postal Bag 1020
Grande Prairie, Alberta T8V 3A9

Dear Ms. Carter:

Subject: APPROVAL – WEYERHAEUSER COMPANY LIMITED (GRANDE PRAIRIE) 2019 FOREST MANAGEMENT PLAN PLANNING STANDARD DEVIATION

Thank you for your letter dated April 23, 2019 requesting a deviation from Annex 1, Section 2.3 of the Alberta Forest Management Planning Standard (AFMPS).

The request is approved. All other requirements of the AFMPS continue to apply.

The effective date of the classified landbase for the 2019 Forest Management Plan (FMP) to be submitted on or before October 30, 2019 will be May 1, 2017.

We thank you for all the hard work that has gone into the planning process to date. We look forward to working together on the final development stages of the FMP.

If you have any questions or require further information, please contact Liana Luard, Lead, Forest Planning and Performance Monitoring at (780) 427-0395.

Yours truly,

Darren Tapp, MF, MSC, RPF
Executive Director

cc: Owen Spencer, Forest Area Manager, Grande Prairie Forest Area
Tim Heemskerk, Senior Forester, Grande Prairie Forest Area
Daryl Price, Director, Forest Resource Analysis
Robert Popowich, Director, Forest Resource Management
Erica Samis, Director, Forest Health and Adapatation
Glenn Dobransky, (Acting) Director Timber Production, Audit and Enforcement
Barry White, Director, Forest Program Management
Quota holders

Appendix II ARIS SIGN-OFF Letters

Appendix III Classified Land Base Data Dictionary

File: Resultant_20190412.gdb/resultant

Number of Records: 637,320

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
1	OBJECTID	OBJECTID_1	OID	4	<skipped>	N/A	
2	Shape	Shape	Geometry	0	<skipped>	N/A	
3	FMU_NAME	FMU_NAME	String	80	['G16']	FMU_G16	Name of FMU
4	FMA_NAME	FMA_NAME	String	100	['', 'Weyerhaeuser Company Limited (Grande Prairie)']	FMA_6900016	Name of FMA
5	FMA_NUM	FMA_NUM	String	15	['', '6900016']	FMA_6900016	Number of FMA
6	NSRNAME	NSRNAME	String	25	['Subalpine', 'Upper Foothills', 'Alpine', 'Lower Foothills', 'Central Mixedwood', 'Dry Mixedwood', 'Montane']	Natural_Regions_Subregions_of_Alberta	Natural Sub Region
7	NSRCODE	NSRCODE	String	3	['SA', 'UF', 'A', 'LF', 'CM', 'DMW', 'M']	Natural_Regions_Subregions_of_Alberta	Natural Sub Region Code
8	NRNAME	NRNAME	String	20	['Rocky Mountain', 'Foothills', 'Boreal']	Natural_Regions_Subregions_of_Alberta	Natural Region Name
9	WS_KEY	WS_KEY	Integer	4	[0, 206]	Forestry_Watersheds	Watershed Key ID
10	SUBUNIT	SUBUNIT	String	50	['Redrock-Prairie Creek', 'Narraway', '']	Caribou_Range	Caribou SUBUNIT name
11	CARIBOU	CARIBOU	SmallInteger	2	[0, 1]	Caribou_Range	Caribou Range Flag
12	CZ_NAME	CZ_NAME	String	50	['', 'Nose Creek', 'Grovedale Aspen Grove', 'Wanyandie Flats East', 'Gundy Saddle Oak', 'Woking']	FireSmart	Firesmart Community Name
13	ESLUZ_NAME	ESLUZ_NAME	String	80	['', 'Prime Protection']	EasternSlopesLUZ	Eastern Slope LUZ Name
14	ESLUZ_CODE	ESLUZ_CODE	String	5	['', 'ZONE1']	EasternSlopesLUZ	Eastern Slope LUZ Code
15	PARK_NAME	PARK_NAME	String	80	['', 'Two Lakes']	ProvincialPark	Provincial Park Name

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
16	COST_ZONE	COST_ZONE	String	25	['', 'Narraway Zone 1', 'Two Lakes Zone 3', 'Stetson Zone 2', 'Redrock Prairie Zone 1', 'Redrock Zone 2', 'Bull Creek', 'Prairie Creek Zone3', 'Redrock Zone 3', 'Prairie Creek', 'Calahoo', 'Pinto', 'MA2 GP North', 'Lingrell Zone 3', 'Calahoo Zone 3', 'Narraway Zone 2', 'Pinto Cut Across', 'Kakwa Tower', 'Nose Mountain', 'Wilson Lake', 'Wapiti', 'Musreau', '1800 Timber Berth', 'Hammer Head', 'Pine Rat', 'South East Kakwa', 'Wanyandie', 'Saddle Hills South', 'Saddle Hills North', 'Saddle Hills East']	CostZones_2019	Cost Zone Name
17	ACCESS_UNIT	ACCESS_UNIT	Integer	4	[0, 3128]	AccessUnits	Harvest Scheduling Units within Caribou Range
18	PRA_NAME	PRA_NAME	String	80	['', 'Shuttler Flats', 'Musreau Lake', 'Kakwa River', 'Big Mountain Creek', 'Southview', 'Sheep Creek']	Provincial Recreation Areas (PRA)	Provincial Recreation Area Name
19	DUNES	DUNES	SmallInteger	2	[0, 1]	DUNES	Dunes Flag
20	DIDs_NCON	DIDs_NCON	SmallInteger	2	[0, 1]	DIDs_NCON	Non-Contributing DIDs flag
21	GRAZING	GRAZING	String	3	['', 'FGL', 'GRL']	DIDs_GL_t	Grazing Disposition flag
22	Subhydric	Subhydric	String	255	['', 'B_POOR', 'A_VERY_POOR']	Subhydric	Areas identified as being Subhrydric poor and very poor
23	FIRE_CLASS	FIRE_CLASS	String	1	['', 'C', 'E', 'D', 'B']	PostAviFires	Fire Class

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
24	BURN_CLASS	BURN_CLASS	Integer	4	[0, 5]	PostAviFires	Burn Class
25	FIRE_YEAR	FIRE_YEAR	Integer	4	[0, 2016]	PostAviFires	Fire Year
26	UniqueName	UniqueName	String	255	['', 'Nose Creek Settlement', 'Calliope Hummingbird Nesting Habitat (Pine/Decadent Willow/Marsh)', 'Calliope Hummingbird Habitat', 'Saddle Hills Rimrocks']	UniqueBuffers	Unique areas name
27	PSP_NUMBER	PSP_NUMBER	String	254	<skipped>	Adjusted PSP Boundaries (G16_AFS_SDS_MPB)	PSP number of adjusted PSP boundaries
28	HRV	HRV	Integer	4	[0, 3]	HistoricResources	HRV 1=designated under the Act as a Provincial Historic Resource HRV 2=designated under the Act as a Municipal or Registered HRV 3=contains a significant historic resource that will likely require avoidance
29	ARCH_FIELD	ARCH_FIELD	String	15	<skipped>	Archaeology	Archaeology field number
30	Archaeology	Archaeology	SmallInteger	2	[0, 1]	Archaeology	Archaeology flag
31	TrumpSwanBuffer	TrumpSwanBuffer	SmallInteger	2	[0, 200]	TrumpeterSwanBuffers	Trumpeter Swan Buffer flag
32	TrapperCabin	TrapperCabin	SmallInteger	2	[0, 1]	TrapperCabin	Trapper cabin flag
33	Spring	Spring	SmallInteger	2	[0, 1]	Spring	Spring flag
34	MineralLick	MineralLick	SmallInteger	2	[0, 1]	MineralLick	mineral lick flag
35	STEEP	STEEP	SmallInteger	2	[0, 1]	STEEP_edit	Steep areas flag
36	CROWNCLASS	CROWNCLASS	String	10	['', 'Private']	Private	private ownership flag
37	TITLECLASS	TITLECLASS	String	10	['', 'Titled']	Private	private ownership flag
38	FINAL_RIP_CD	FINAL_RIP_CD	String	10	['', 'Stream', 'River', 'LgLake', 'SmLake']	Hydrology_Buffer	Riparian buffer type
39	BUFFER_DIST	BUFFER_DIST	SmallInteger	2	[0, 100]	Hydrology_Buffer	Riparian buffer distance

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
40	DIDs_NFOR	DIDs_NFOR	SmallInteger	2	[0, 1]	DIDs_NFOR	Non-Forested disposition flag
41	CC_OPENING	CC_OPENING	String	15	<skipped>	Cutblocks_V8_20181228	Cutblock opening
42	CC_FIELD	CC_FIELD	String	15	<skipped>	Cutblocks_V8_20181228	Cutblock field ID
43	CC_OWNER	CC_OWNER	String	4	['', 'WEYG', 'NORI', '0', 'FRIA', 'TOLK', 'CFPL', 'SPEC']	Cutblocks_V8_20181228	Cutblock owner
44	CC_BLKYEAR	CC_BLKYEAR	Integer	4	<skipped>	Cutblocks_V8_20181228	Cutblock year
45	CC_STRATA	CC_STRATA	String	25	<skipped>	Cutblocks_V8_20181228	Cutblock strata
46	CC_Status	CC_Status	String	15	['', 'Harvested', '0']	Cutblocks_V8_20181228	Cutblock status
47	OPEN_NUM	OPEN_NUM	String	11	<skipped>	WEYGP_FMA_G16_AVI_ARIS	AVI Opening number (un-reconciled)
48	SKID_CLEAR	SKID_CLEAR	Date	8	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Skid Clear from AVI
49	TIMBER_YR	TIMBER_YR	SmallInteger	2	[0, 2014]	WEYGP_FMA_G16_AVI_ARIS	Timber year from AVI
50	MONTH	MONTH	SmallInteger	2	[0, 12]	WEYGP_FMA_G16_AVI_ARIS	Month from AVI
51	OPERATOR	OPERATOR	String	10	['0', '', ' ', 'WEYR', 'OLDCTP', 'UNKNOWN', 'NORB', 'FRIA', 'OLDCANQ', 'MPBLIC', 'LFS', 'UNK', 'TOLK']	WEYGP_FMA_G16_AVI_ARIS	Operator from AVI
52	POLY_NUM	POLY_NUM	Integer	4	[0, 145493]	WEYGP_FMA_G16_AVI_ARIS	AVI polygon number
53	MOIST_REG	MOIST_REG	String	1	[' ', '', 'm', 'd', 'w', 'a']	WEYGP_FMA_G16_AVI_ARIS	Moisture regime: d = dry m = mesic w = wet a = aquatic
54	DENSITY	DENSITY	String	1	[' ', '', 'C', 'D', 'B', 'A']	WEYGP_FMA_G16_AVI_ARIS	Crown closure (%): A = 6 to 30 % B = 31 to 50 % C = 51 to 70 % D = 70 % +
55	HEIGHT	HEIGHT	SmallInteger	2	[0, 38]	WEYGP_FMA_G16_AVI_ARIS	Average stand height (dominant & codominant trees) in meters.
56	SP1	SP1	String	2	[' ', '', 'PL', 'SW', 'FA', 'SE', 'PB', 'AW', 'SB', 'FB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Declining order of species based on crown closure
57	SP1_PER	SP1_PER	SmallInteger	2	[0, 10]	WEYGP_FMA_G16_AVI_ARIS	Actual % (to nearest 10) of species listed above.

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
58	SP2	SP2	String	2	[' ', '', 'AW', 'SE', 'SW', 'FB', 'PL', 'FA', 'PB', 'SB', 'BW', 'LT']	WEYGP_FMA_G16_AVI_ARIS	Declining order of species based on crown closure
59	SP2_PER	SP2_PER	SmallInteger	2	[0, 5]	WEYGP_FMA_G16_AVI_ARIS	Actual % (to nearest 10) of species listed above.
60	SP3	SP3	String	2	[' ', '', 'SE', 'FB', 'PL', 'FA', 'AW', 'PB', 'SW', 'SB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Declining order of species based on crown closure
61	SP3_PER	SP3_PER	SmallInteger	2	[0, 3]	WEYGP_FMA_G16_AVI_ARIS	Actual % (to nearest 10) of species listed above.
62	SP4	SP4	String	2	[' ', '', 'AW', 'PB', 'FB', 'FA', 'PL', 'SE', 'SB', 'SW', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Declining order of species based on crown closure
63	SP4_PER	SP4_PER	SmallInteger	2	[0, 2]	WEYGP_FMA_G16_AVI_ARIS	Actual % (to nearest 10) of species listed above.
64	SP5	SP5	String	2	[' ', '', 'PL', 'PB', 'SB', 'FB', 'AW', 'BW', 'SW', 'LT']	WEYGP_FMA_G16_AVI_ARIS	Declining order of species based on crown closure
65	SP5_PER	SP5_PER	SmallInteger	2	[0, 2]	WEYGP_FMA_G16_AVI_ARIS	Actual % (to nearest 10) of species listed above.
66	STRUC	STRUC	String	1	[' ', '', 'M', 'H']	WEYGP_FMA_G16_AVI_ARIS	Stand structure: Blank = inferred single storey M = multi-layer canopy (2 storey) C = complex (multiple or uneven stories) H = Horizontal (homogeneous stand with scattered pockets)
67	STRUC_VAL	STRUC_VAL	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Used only with 'H' above (e.g., 80% Pl, 20% Aw pockets would be Pl8 / Aw2 (based on crown closure composition)
68	ORIGIN	ORIGIN	SmallInteger	2	[0, 2012]	WEYGP_FMA_G16_AVI_ARIS	Actual year of origin
69	TPR	TPR	String	1	[' ', '', 'M', 'F', 'U', 'G']	WEYGP_FMA_G16_AVI_ARIS	Tree productivity rating (site index grouping) U = Unproductive F = Fair M = Medium G = Good
70	INITIALS	INITIALS	String	2	['NB', '', 'ST', 'MM', 'CP', 'LL', 'SG', 'BW', 'TP', 'DF', 'AW', 'KN']	WEYGP_FMA_G16_AVI_ARIS	AVI interpreters' initials

Weyerhaeuser

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
71	NFL	NFL	String	2	[' ', '', 'SC', 'HG', 'SO', 'BR']	WEYGP_FMA_G16_AVI_ARIS	Non-forest vegetated land (>6% plant cover and <6% tree cover): SC = closed shrub SO = open shrub HG = herbaceous grassland HF = herbaceous forbs BR = bryophyte (moss)
72	NFL_PER	NFL_PER	SmallInteger	2	[0, 10]	WEYGP_FMA_G16_AVI_ARIS	Nfl % closure, SC or SO only
73	NAT_NON	NAT_NON	String	3	[' ', '', 'NMC', 'NWR', 'NMS', 'NWL', 'NMR', 'NWF']	WEYGP_FMA_G16_AVI_ARIS	Naturally non-vegetated (<6% plant cover): NWI = Permanent ice/snow NWL = Seasonal thaws, lakes, ponds NWR = River NWF = Flooded NMB = Recent burn NMC = Cutbank NMR = Rock/barren NMS = Sand
74	ANTH_VEG	ANTH_VEG	String	3	[' ', '', 'CIP', 'CIW', 'CP', 'CPR', 'CA']	WEYGP_FMA_G16_AVI_ARIS	Human-induced vegetation: CA = Annual crops (farmland) CP = Perennial forage crops CPR = Rough pasture (>10% woody cover) CIP = Pipelines, powerlines etc. seeded to grass CIW = Geophysical and wellsites seeded to grass
75	ANTH_NON	ANTH_NON	String	3	[' ', '', 'AIH', 'AII', 'AIG', 'AIF', 'ASR', 'AIM']	WEYGP_FMA_G16_AVI_ARIS	Anthropogenic non-vegetated land: ASC = Cities, towns, villages, hamlets ASR = Ribbon development, subdivisions, acreages AIH = Permanent right-of-way AIE = Peat extractions AIG = Gravel/borrow pits AIF = Farmyards AIM = Surface mines AII = Industrial sites, sewage lagoons

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
76	PATTERN	PATTERN	SmallInteger	2	[0, 8]	WEYGP_FMA_G16_AVI_ARIS	Overstory canopy pattern Code 1-6
77	MOD1	MOD1	String	2	[' ', '', 'BK', 'BU', 'CC', 'CL', 'WF', 'SN', 'UK', 'TH', 'SI', 'IK', 'GR', 'MO', 'PL']	WEYGP_FMA_G16_AVI_ARIS	Stand modifier 1 (or 2) condition/treatment: CC = Clearcut, partial cut BU = Burn WF = Windfall CL = Clearing DI = Disease IK = Insect kill BK = Beetle Kill MO = MOF (Maintaining Our Forest) Blocks UK = Unknown kill WE = Weather (e.g.,. redbelt) DT = Discolored/dead tops BT = Broken tops SN = snags ST = Scattered timber SI = Site improvement (fertilization, draining) SC = Seedbed prepared PL = Planted/seeded TH = Thinned GR = Grazing development (domestic) IR = Irrigated
78	MOD1_EXT	MOD1_EXT	SmallInteger	2	[0, 5]	WEYGP_FMA_G16_AVI_ARIS	Modifier extent: Blank = nil 1 = 1 to 25% loss of crown closure or area affected 2 = 26 to 50% 3 = 51 to 75% 4 = 76 to 94% 5 = Entire
79	MOD1_YR	MOD1_YR	SmallInteger	2	[0, 2015]	WEYGP_FMA_G16_AVI_ARIS	Year of the stand modifying occurrence
80	MOD2	MOD2	String	2	[' ', '', 'SN', 'WF', 'BK', 'SC', 'CL', 'PL', 'BU', 'BT', 'CC', 'IK', 'SI', 'UK']	WEYGP_FMA_G16_AVI_ARIS	see Mod1
81	MOD2_EXT	MOD2_EXT	SmallInteger	2	[0, 5]	WEYGP_FMA_G16_AVI_ARIS	Year of the stand modifying occurrence
82	MOD2_YR	MOD2_YR	SmallInteger	2	[0, 2009]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier 1

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
83	DATA	DATA	String	1	[' ', '', 'I', 'F', 'A']	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier extent 1
84	DATA_YR	DATA_YR	SmallInteger	2	[0, 2016]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modification year 1
85	UMOD1	UMOD1	String	2	[' ', '']	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier 1
86	UMOD1_EXT	UMOD1_EXT	SmallInteger	2	[0, 0]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier extent 1
87	UMOD1_YR	UMOD1_YR	SmallInteger	2	[0, 0]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modification year 1
88	UMOD2	UMOD2	String	2	[' ', '']	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier 2
89	UMOD2_EXT	UMOD2_EXT	SmallInteger	2	[0, 0]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modifier extent 2
90	UMOD2_YR	UMOD2_YR	SmallInteger	2	[0, 0]	WEYGP_FMA_G16_AVI_ARIS	Understory stand modification year 2
91	PHOTO_YR	PHOTO_YR	SmallInteger	2	[0, 2015]	WEYGP_FMA_G16_AVI_ARIS	Year of photo capture
92	ARIS	ARIS	String	11	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Cut Block identification
93	TSP1	TSP1	String	2	[' ', '', 'PB', 'SW', 'FB', 'AW', 'FA', 'SB', 'PL', 'SE', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Thirdrstory Species Percent 1
94	TSP1_PER	TSP1_PER	SmallInteger	2	[0, 10]	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species 1
95	TSP2	TSP2	String	2	[' ', '', 'SW', 'AW', 'PB', 'SE', 'SB', 'PL', 'FA', 'FB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species 2
96	TSP2_PER	TSP2_PER	SmallInteger	2	[0, 5]	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species Percent 2
97	TSP3	TSP3	String	2	[' ', '', 'PL', 'SW', 'SB', 'FB', 'AW', 'FA', 'SE', 'PB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species 3
98	TSP3_PER	TSP3_PER	SmallInteger	2	[0, 3]	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species Percent 3
99	TSP4	TSP4	String	2	[' ', '', 'AW', 'PL', 'FB', 'SE', 'SB', 'LT', 'PB', 'BW', 'SW']	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species 4
100	TSP4_PER	TSP4_PER	SmallInteger	2	[0, 2]	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species Percent 4
101	TSP5	TSP5	String	2	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species 5
102	TSP5_PER	TSP5_PER	SmallInteger	2	[0, 1]	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey Species Percent 5
103	R_OPENING	R_OPENING	String	50	<skipped>	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled cut block identification

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
104	R_OPERATOR	R_OPERATOR	String	50	['0', '', ' ', 'WEYG', 'LFS', 'NORI', 'ESRD', 'FRIA', 'UNKNOWN', 'FRIAA', 'CFPL', 'TOLK']	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled operator
105	R_SKID	R_SKID	Date	8	0	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Skid Clearance Date
106	R_MOD1	R_MOD1	String	50	['0', '', ' ', 'BK', 'BU', 'CC', 'CL', 'WF', 'SN', 'UK', '<Null>', 'TH', 'SI', '2/22/1993', 'GR', 'MO', 'PL']	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled stand modifier 1
107	R_MOD1YR	R_MOD1YR	SmallInteger	2	[0, 2015]	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Stand Modifier Year 1
108	R_MOD2	R_MOD2	String	50	['0', '', ' ', 'SN', 'WF', 'BK', 'CC', 'SC', 'CL', 'PL', 'BU', 'BT', 'SI', 'UK']	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Stand Modifier 2
109	R_MOD2YR	R_MOD2YR	SmallInteger	2	[0, 2012]	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Stand Modifier Year 2
110	AREA_HA	AREA_HA	Double	8	[0.0, 2871.2298363364671]	WEYGP_FMA_G16_AVI_ARIS	Area of ARIS reconciled AVI - No longer valid - ignore
111	R_DATA	R_DATA	String	1	['0', '', ' ', 'S']	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Data Source
112	R_DATA_YR	R_DATA_YR	SmallInteger	2	[0, 2017]	WEYGP_FMA_G16_AVI_ARIS	ARIS reconciled Data Source Year
113	UMOIST_REG	UMOIST_REG	String	1	[' ', '', 'm', 'd', 'w']	WEYGP_FMA_G16_AVI_ARIS	Understory moisture regime
114	UDENSITY	UDENSITY	String	1	[' ', '', 'A', 'B', 'C', 'D']	WEYGP_FMA_G16_AVI_ARIS	Understory crown closure
115	UHEIGHT	UHEIGHT	SmallInteger	2	[0, 27]	WEYGP_FMA_G16_AVI_ARIS	Average understory stand height (dominant & codominant trees) in meters.
116	USP1	USP1	String	2	[' ', '', 'SE', 'PL', 'FB', 'FA', 'SW', 'PB', 'AW', 'SB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Understory Species 1
117	USP1_PER	USP1_PER	SmallInteger	2	[0, 10]	WEYGP_FMA_G16_AVI_ARIS	Understory Species Percent 1
118	USP2	USP2	String	2	[' ', '', 'FA', 'SE', 'SW', 'PL', 'PB', 'AW', 'FB', 'SB', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Understory Species 2
119	USP2_PER	USP2_PER	SmallInteger	2	[0, 5]	WEYGP_FMA_G16_AVI_ARIS	Understory Species Percent 2

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
120	USP3	USP3	String	2	[' ', '', 'PL', 'FA', 'AW', 'FB', 'SW', 'PB', 'SB', 'SE', 'LT', 'BW']	WEYGP_FMA_G16_AVI_ARIS	Understory Species 3
121	USP3_PER	USP3_PER	SmallInteger	2	[0, 3]	WEYGP_FMA_G16_AVI_ARIS	Understory Species Percent 3
122	USP4	USP4	String	2	[' ', '', 'SB', 'FB', 'AW', 'PL', 'SE', 'SW', 'FA', 'PB', 'BW', 'LT']	WEYGP_FMA_G16_AVI_ARIS	Understory Species 4
123	USP4_PER	USP4_PER	SmallInteger	2	[0, 2]	WEYGP_FMA_G16_AVI_ARIS	Understory Species Percent 4
124	USP5	USP5	String	2	[' ', '', 'AW', 'SB', 'FB', 'PL', 'PB', 'BW', 'LT', 'SW']	WEYGP_FMA_G16_AVI_ARIS	Understory Species 5
125	USP5_PER	USP5_PER	SmallInteger	2	[0, 1]	WEYGP_FMA_G16_AVI_ARIS	Understory Species Percent 5
126	USTRUC	USTRUC	String	1	[' ', '', 'M', 'H']	WEYGP_FMA_G16_AVI_ARIS	Understory Stand structure: Blank = inferred single storey M = multi-layer canopy (2 storey) C = complex (multiple or uneven stories) H = Horizontal (homogeneous stand with scattered pockets)
127	USTRUC_VAL	USTRUC_VAL	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Used only with 'H' above (e.g., 80% Pl, 20% Aw pockets would be Pl8 / Aw2 (based on crown closure composition)
128	UORIGIN	UORIGIN	SmallInteger	2	[0, 2009]	WEYGP_FMA_G16_AVI_ARIS	Understory year of origin
129	UTPR	UTPR	String	1	[' ', '', 'M', 'F', 'U', 'G']	WEYGP_FMA_G16_AVI_ARIS	Understory Timber Productivity Rating
130	UINITIALS	UINITIALS	String	2	[' ', '', 'NB', 'ST', 'LL', 'CP', 'SG', 'MM', 'TP', 'DF', 'AW', 'KN']	WEYGP_FMA_G16_AVI_ARIS	Understory interpreter’s initials
131	UNFL	UNFL	String	2	[' ', '', 'HG', 'SO', 'SC', 'BR', 'HF']	WEYGP_FMA_G16_AVI_ARIS	Understory non-forest vegetated land
132	UNFL_PER	UNFL_PER	SmallInteger	2	[0, 10]	WEYGP_FMA_G16_AVI_ARIS	Understory non-forest vegetated land percent
133	UNAT_NON	UNAT_NON	String	3	[' ', '', 'NWR', 'NWF', 'NWL', 'NMR', 'NMC']	WEYGP_FMA_G16_AVI_ARIS	Understory naturally non-vegetated land
134	UANTH_VEG	UANTH_VEG	String	3	[' ', '', 'CP', 'CPR']	WEYGP_FMA_G16_AVI_ARIS	Understory human induced vegetation
135	UANTH_NON	UANTH_NON	String	3	[' ', '', 'AIG', 'ASR']	WEYGP_FMA_G16_AVI_ARIS	Understory anthropogenic non-vegetated

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
136	UDATA	UDATA	String	1	[' ', '', 'F', 'I', 'A']	WEYGP_FMA_G16_AVI_ARIS	Understory data source
137	UDATA_YR	UDATA_YR	SmallInteger	2	[0, 2016]	WEYGP_FMA_G16_AVI_ARIS	Understory data source year of collection
138	DIST_PTRN	DIST_PTRN	SmallInteger	2	[0, 8]	WEYGP_FMA_G16_AVI_ARIS	Overstory canopy pattern Code 1-6
139	UPATTERN	UPATTERN	SmallInteger	2	[0, 8]	WEYGP_FMA_G16_AVI_ARIS	Understory canopy pattern Code 1-6
140	UDEN_CL	UDEN_CL	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Understory density class code Code - 1 = density 0 - 2 = density 1-100 -3 = density 101-250 -4 = density 251-500 -5 = density 501-750 -6 = density 751-1000 -7 = density 1001-2000 -8 = density 2001+
141	TMOIST_REG	TMOIST_REG	String	1	[' ', '', 'm', 'w', 'd']	WEYGP_FMA_G16_AVI_ARIS	Thirdrstorey moisture regime
142	TDENSITY	TDENSITY	String	1	[' ', '', 'A', 'B', 'C']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey density
143	THEIGHT	THEIGHT	SmallInteger	2	[0, 20]	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey height
144	TSTRUC	TSTRUC	String	1	[' ', '', 'M']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey stand structure
145	TSTRUC_VAL	TSTRUC_VAL	SmallInteger	2	[0, 0]	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey stand structure value
146	TORIGIN	TORIGIN	SmallInteger	2	[0, 2006]	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey origin
147	TTPR	TTPR	String	1	[' ', '', 'M', 'G', 'F', 'U']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey TPR
148	TINITIALS	TINITIALS	String	2	[' ', '', 'NB', 'ST', 'LL', 'CP', 'SG', 'MM', 'TP', 'AW']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey interpreter's initials
149	TNFL	TNFL	String	2	[' ', '', 'SC', 'SO', 'HG', 'BR']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey non-forest vegetated land
150	TNFL_PER	TNFL_PER	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey non-forest vegetated land percent
151	TNAT_NON	TNAT_NON	String	3	[' ', '']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey naturally non-vegetated land
152	TANTH_VEG	TANTH_VEG	String	3	[' ', '']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey human induced vegetation
153	TANTH_NON	TANTH_NON	String	3	[' ', '']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey human induced non-vegetated

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
154	TDATA	TDATA	String	1	[' ', '', 'F', 'A']	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey data source
155	TDATA_YR	TDATA_YR	SmallInteger	2	[0, 2016]	WEYGP_FMA_G16_AVI_ARIS	Thirdstorey data source year
156	TPATTERN	TPATTERN	SmallInteger	2	[0, 6]	WEYGP_FMA_G16_AVI_ARIS	Tertiary canopy pattern Code 1-6
157	TDEN_CL	TDEN_CL	SmallInteger	2	[0, 8]	WEYGP_FMA_G16_AVI_ARIS	Thridstory density class
158	STEMSHA	STEMSHA	Integer	4	[0, 105300]	WEYGP_FMA_G16_AVI_ARIS	Overstory Stems per hectare
159	MOISTURE1	MOISTURE1	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Moisture Regime 1 - Very Xeric = class 1 -Xeric = class 2 -Subxeric = class 3 -Submesic = class 4 -Mesic = class 5 -Subhygric = class 6 -Hygric = class 7 -Subhydric = class 8 -Hydric = class 9
160	NUTRIENT1	NUTRIENT1	String	1	[' ', '', 'C', 'B', 'D', '7', '3', 'E', '5']	WEYGP_FMA_G16_AVI_ARIS	Nutrient Regime 1 – Very Poor = code A - Poor = code B - Medium = code C - Rich = code D - Very Rich = code E
161	MAPCODE1	MAPCODE1	String	2	[' ', '', '5C', '5B', '3C', '5D', '7D', '7C', '2B', '7B', '9B', '3B', '9C', '6E', '9D', '10', '9E', '0', '7E']	WEYGP_FMA_G16_AVI_ARIS	AVI mapcode 1
162	EXTENT1	EXTENT1	SmallInteger	2	[0, 50]	WEYGP_FMA_G16_AVI_ARIS	AVI mapcode 1 extent
163	MOISTURE2	MOISTURE2	SmallInteger	2	[0, 9]	WEYGP_FMA_G16_AVI_ARIS	Moisture Regime 2
164	NUTRIENT2	NUTRIENT2	String	1	[' ', '', 'C', 'D', 'B', 'E']	WEYGP_FMA_G16_AVI_ARIS	Nutrient Regime 2
165	MAPCODE2	MAPCODE2	String	2	[' ', '', '5C', '5D', '3C', '2B', '5B', '7C', '7D', '7B', '3B', '9C', '9B',	WEYGP_FMA_G16_AVI_ARIS	AVI mapcode 2

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
					'9D', '4C', '6E', '9E', '6D', '5', '7E', '8B']		
166	EXTENT2	EXTENT2	SmallInteger	2	[0, 8]	WEYGP_FMA_G16_AVI_ARIS	AVI mapcode 2 extent
167	DEN_INT	DEN_INT	SmallInteger	2	[0, 90]	WEYGP_FMA_G16_AVI_ARIS	Overstory Density as an integer value Density code 6 = Crown Closure 6-10% Char (A) 10 = Crown Closure 11-20% Char (A) 20 = Crown Closure 21-30% Char (A) 30 = Crown Closure 31-40% Char (B) 40 = Crown Closure 41-50% Char (B) 50 = Crown Closure 51-60% Char (C) 60 = Crown Closure 61-70% Char (C) 70 = Crown Closure 71-80% Char (D) 80 = Crown Closure 81-90% Char (D) 90 = Crown Closure 91-100% Char (D)
168	UDEN_INT	UDEN_INT	SmallInteger	2	[0, 90]	WEYGP_FMA_G16_AVI_ARIS	Conifer Understory Density as an integer value Density code 6 = Crown Closure 6-10% Char (A) 10 = Crown Closure 11-20% Char (A) 20 = Crown Closure 21-30% Char (A) 30 = Crown Closure 31-40% Char (B) 40 = Crown Closure 41-50% Char (B) 50 = Crown Closure 51-60% Char (C) 60 = Crown Closure 61-70% Char (C) 70 = Crown Closure 71-80% Char (D) 80 = Crown Closure

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
							81-90% Char (D) 90 = Crown Closure 91-100% Char (D)
169	TDEN_INT	TDEN_INT	SmallInteger	2	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Thirdstory Conifer Density as an integer value Density code 6 = Crown Closure 6-10% Char (A) 10 = Crown Closure 11-20% Char (A) 20 = Crown Closure 21-30% Char (A) 30 = Crown Closure 31-40% Char (B) 40 = Crown Closure 41-50% Char (B) 50 = Crown Closure 51-60% Char (C) 60 = Crown Closure 61-70% Char (C) 70 = Crown Closure 71-80% Char (D) 80 = Crown Closure 81-90% Char (D) 90 = Crown Closure 91-100% Char (D)
170	FMA_CODE	FMA_CODE	String	5	<skipped>	WEYGP_FMA_G16_AVI_ARIS	FMA Code
171	SO	SO	String	42	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Calculated field for labeling
172	SU	SU	String	42	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Calculated field for labeling
173	ST	ST	String	42	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Calculated field for labeling
174	MDS	MDS	String	14	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Calculated field for labeling
175	ECO	ECO	String	12	<skipped>	WEYGP_FMA_G16_AVI_ARIS	Calculated field for labeling

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Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
176	R_UKEY	R_UKEY	Integer	4	[0, 147249]	Calculated from WEYGP_FMA_G16_AVI_ARIS OID	ARIS reconciled AVI Unique key
177	R_NFL	R_NFL	String	2	<skipped>	RSA_PHOTO_2009_2016	ARIS reconciled Non-forest vegetated land
178	KEY_ARIS_AVI	KEY_ARIS_AVI	Integer	4	<skipped>	RSA_PHOTO_2009_2016	Unique ARIS-reconciled consolidated unique key
179	NET_FACTOR	NET_FACTOR	Double	8	<skipped>	SEISMIC	Factor to account for seismic area
180	SP_CL	SP_CL	String	4	['', 'Pl', 'N/A', 'Sw', 'HwPl', 'PlHw', 'Sb', 'HwSx', 'SwHw', 'Hw']	AVI_RECONCILED_RSA	RSA Photo Species class
181	N_SP_CL	N_SP_CL	String	4	['', 'Pl', 'N/A', 'Sw', 'SwHw', 'HwSx', 'PlHw']	AVI_RECONCILED_RSA	RSA Non-Photo Species class
182	SOURCE	SOURCE	String	25	['', 'WeycoLayoutComplete', 'NorbordHarvested', 'WeycoHarvested', 'WeycoFinalApproval', 'NorbordPlanned', 'CTP', 'TOLKO']	PLANNED_BLOCKS	Source of planned block information
183	PLAN_KEY	PLAN_KEY	Integer	4	[0, 2903]	PLANNED_BLOCKS	Unique key of planned block
184	Shape_Length	Shape_Length	Double	8	[5.1054089913194822, 216230.7970640928]	Shape Length; Polygon perimeter in meters	Shape Length; Polygon perimeter in meters
185	Shape_Area	Shape_Area	Double	8	[1.0558187847530807, 12887330.117955316]	Shape Area; Polygon area in square meters	Shape Area; Polygon area in square meters
186	UNIT	UNIT	String	15	['MainBlock', 'SaddleHills']	Calculated	Calculated field to distinguish two main blocks of the FMA
187	RES_KEY	RES_KEY	Integer	4	[1, 637320]	Calculated field; Copy of CLB OID	Calculated field; Copy of CLB OID
188	GRL	GRL	SmallInteger	2	[0, 1]	Calculated field based on GRAZING field	Calculated field based on GRAZING field
189	FMA	FMA	SmallInteger	2	<skipped>	Calculated field based on FMA_NAME	Calculated field based on FMA_NAME

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
190	FRIAA	FRIAA	SmallInteger	2	[0, 1]	FRIAA Flag	FRIAA FLAG, calculated by linking to Opening Summary Oct 29, 2018 PC and MR.xls and updating to 1 where common openings occur
191	NET_AREA	NET_AREA	Double	8	[0.0, 378.23659796564715]	2000_BuildResultant_002_PostResultantBuildUpdates.py	Factored area to account for seismic areas ([Shape_Area] / 10000 * [NET_FACTOR])
192	PSP_SURVNUM	PSP_SURVNUM	String	20	<skipped>	Calculated via spatial join of psp point feature (2000_BuildResultant_002_PostResultantBuildUpdates.py)	Unique PSP_SURVNUM
193	FA_NAME	FA_NAME	String	80	['Grande Prairie Forest Area', 'Edson Forest Area', '']	Majority Calculated from AF_Forest_Area_Boundaries	Fire protection zone
194	G1_BREED	G1_BREED	SmallInteger	2	[0, 1]	Majority Calculated from G1_BREED	G1 breeding area
195	GBWU	GBWU	String	5	['G9', 'G16', 'G24', 'G25', 'G35', 'G17', 'G23', '', 'G29', 'G6', 'G10', 'G14', 'G15', 'G19', 'G34']	Majority Calculated based on GB_Watersheds	Grizzly bear watershed
196	B1_BREED	B1_BREED	SmallInteger	2	[0, 1]	Majority Calculated from B1_BREED	B1 breeding area
197	B2_BREED	B2_BREED	SmallInteger	2	[0, 1]	Majority Calculated from B2_BREED	B2 breeding area
198	MountainGoatSheep	MountainGoatSheep	SmallInteger	2	[0, 1]	Majority Calculated from MountainGoatSheep	Mountain goat and Sheep area
199	HLIN_RATIO_GT_1pct	HLIN_RATIO_GT_1pct	SmallInteger	2	[0, 1]	Majority Calculated from HLIN_RATIO_GT_1pct	Hard Linear ratio gt 1; used for Songbirds
200	BCG	BCG	String	4	['0', 'CD', 'CX', 'DX', 'DC']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Broad cover group of overstory CX=conifer dominant, CD=Conifer leading mixed, DC=Deciduous leading mixed, DX=Deciduous dominant
201	UBCG	UBCG	String	4	['0', 'CX', 'DX', 'CD', 'DC']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Broad cover group of understory
202	SWITCH	SWITCH	String	4	['N', 'Y']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Switch stand flag
203	STORY_USED	STORY_USED	String	4	['OS', 'US', 'RSA', 'HARV']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Story used for yield stratification

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
204	CUTBLK	CUTBLK	String	4	['N', 'Y']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes	Previously harvested flag
205	YLD_TYPE	YLD_TYPE	String	4	['NAT', 'MGD', 'M91']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Yield type
206	STD_BCG	STD_BCG	String	4	['0', 'CD', 'CX', 'DX', 'DC']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned broad cover group
207	STD_DENSITY	STD_DENSITY	String	4	[' ', '0', 'C', 'D', 'B', 'A']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned Density
208	STD_TPR	STD_TPR	String	4	[' ', '0', 'M', 'F', 'U', 'G']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned timber productivity rating
209	STD_SP1	STD_SP1	String	4	[' ', '0', 'PL', 'SW', 'FA', 'SE', 'PB', 'AW', 'SB', 'FB', 'LT', 'BW']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned leading species
210	STD_SP2	STD_SP2	String	4	[' ', '0', 'AW', 'SE', 'SW', 'FB', 'PL', 'FA', 'PB', 'SB', '', 'BW', 'LT']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned secondary species
211	SPEC_SOURCE	SPEC_SOURCE	String	4	['AVI', 'RSAP', 'ARIS', 'HARV', 'RSAN']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Indication of information source used for yield assignment
212	A_FieldNumber	A_FieldNumber	String	20	<skipped>	Calculated based on ARIS submission spreadsheet	ARIS field number -consolidation of AVI and cutblock reconciled information
213	A_Operator	A_Operator	String	20	['0', 'WEYG', 'NORI', 'ESRD', 'FRIA', 'LFS', 'TOLK', 'CFPL', 'SPEC']	Calculated based on ARIS submission spreadsheet	ARIS operator - consolidation of AVI and cutblock reconciled information
214	A_StratumDeclaration	A_StratumDeclaration	String	20	['0', 'C-2000', 'CD-2000', 'PR91', 'D-2000', 'DC-2000', 'DECD', 'CONF', '']	Calculated based on ARIS submission spreadsheet	ARIS stratum declaration - consolidation of AVI and cutblock reconciled
215	A_FinalStrata	A_FinalStrata	String	20	['0', 'Pl', 'Sw', 'PlAw', 'SwAw', 'Aw', 'Sb', 'AwSw', 'SWAw', '']	Calculated based on ARIS submission spreadsheet	ARIS final strata -consolidation of AVI and cutblock reconciled
216	A_LastSurveyType	A_LastSurveyType	String	20	['0', 'Per Survey', 'Est Survey', '']	Calculated based on ARIS submission spreadsheet	ARIS last survey type - consolidation of AVI and cutblock reconciled
217	A_StockStatus	A_StockStatus	String	20	['0', 'PSC', 'SR', '', 'FTG', 'NSR']	Calculated based on ARIS, AVI, Post-AVI Cutblock information	AVI stock status -consolidation ARIS, AVI, of AVI and cutblock reconciled

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
218	A_LandbaseDesignation	A_LandbaseDesignation	String	20	['0', 'SS', 'WEYG1107', 'WEYG1113', 'CC', 'SC', 'WEYG1108', 'WEYG1106', 'WEYG1105', 'WEYG0702', 'WEYG1101', 'WEYG0704', 'WEYG0701', 'HH', 'WEYG0703', 'HC', 'WEYG0705', 'CH', 'WEYG1103', 'WEYG1102', 'WEYG1110', 'CS', 'DC', 'WEYG1112', 'SH', 'WEYG1104', 'HS', 'WEYG1109', 'HD', 'MS', 'DS', 'DH']	Calculated based on ARIS, AVI, Post-AVI Cutblock information	Aris reconciled Landbase Designation
219	AGE_2017	AGE_2017	SmallInteger	2	[0, 286]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Stand age as of 2017
220	ESRD10	ESRD10	SmallInteger	2	[0, 9]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Planning standard overstory Base 10 strata
221	U_ESRD10	U_ESRD10	SmallInteger	2	[0, 9]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Planning standard understory Base 10 strata
222	STD_ESRD10	STD_ESRD10	SmallInteger	2	[0, 9]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final assigned planning standard Base 10 strata
223	YLD_STRATA	YLD_STRATA	SmallInteger	2	[0, 522]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final assigned yield strata number
224	YLD_2011	YLD_2011	SmallInteger	2	[0, 40]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	2011 FMP yield strata equivalent
225	PCTDEC	PCTDEC	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Deciduous percent
226	STD_HT	STD_HT	SmallInteger	2	[0, 38]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final assigned stand height

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
227	PCTCON	PCTCON	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Coniferous percent
228	UPCTDEC	UPCTDEC	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory deciduous percent
229	UPCTCON	UPCTCON	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory coniferous percent
230	PCTSB	PCTSB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Black spruce percent
231	PCTLT	PCTLT	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Larch percent
232	PCTPL	PCTPL	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Pine percent
233	PCTSW	PCTSW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory White Spruce percent
234	PCTAW	PCTAW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Trembling aspen percent
235	PCTBW	PCTBW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory White birch percent
236	PCTPB	PCTPB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Balsam poplar percent
237	PCTFB	PCTFB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Overstory Balsam fir percent
238	UPCTSB	UPCTSB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory black spruce percent
239	UPCTLT	UPCTLT	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory larch percent
240	UPCTPL	UPCTPL	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory Pine percent

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
241	UPCTSW	UPCTSW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory White spruce percent
242	UPCTAW	UPCTAW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory Trembling aspen percent
243	UPCTBW	UPCTBW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory White birch percent
244	UPCTPB	UPCTPB	SmallInteger	2	[0, 0]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory balsam poplar percent
245	UPCTFB	UPCTFB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Understory Balsam fir percent
246	STD_ORIGIN	STD_ORIGIN	SmallInteger	2	[0, 2016]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final assigned Stand origin year
247	STD_AGE	STD_AGE	SmallInteger	2	[0, 286]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Assigned Stands age, Not used
248	STD_AGE5	STD_AGE5	SmallInteger	2	[0, 200]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Assigned stand age re-classed to nearest 5, not used
249	STD_SP1PER	STD_SP1PER	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final leading species percent
250	STD_PCTCON	STD_PCTCON	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final percent conifer
251	STD_PCTDEC	STD_PCTDEC	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final percent deciduous
252	STD_PCTLT	STD_PCTLT	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final larch percent
253	STD_PCTPL	STD_PCTPL	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final pine percent
254	STD_PCTSB	STD_PCTSB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final black spruce percent

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
255	STD_PCTSW	STD_PCTSW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final white spruce percent
256	STD_PCTAW	STD_PCTAW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final trembling aspen percent
257	STD_PCTBW	STD_PCTBW	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final white birch percent
258	STD_PCTPB	STD_PCTPB	SmallInteger	2	[0, 10]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	final balsam poplar percent
259	STD_PCTFB	STD_PCTFB	SmallInteger	2	[0, 10]	Calculated based on ARIS submission spreadsheet	final balsam fir percent
260	A_AGE	A_AGE	SmallInteger	2	[0, 43]	Calculated based on ARIS, AVI, Post-AVI Cutblock information	ARIS AGE -consolidation of AVI and cutblock reconciled information
261	A_BlockYear	A_BlockYear	SmallInteger	2	[0, 2016]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	ARIS block year -consolidation of AVI and cutblock reconciled information
262	A_SkidClearance	A_SkidClearance	Date	8	0	Calculated based on ARIS, AVI, Post-AVI Cutblock information	ARIS reconciled Skid Clearance Date
263	STD_ESRD10_TXT	STD_ESRD10_TXT	String	5	['NA', 'CD-P', 'C-PL', 'C-SW', 'D', 'CD-SW', 'DC-SX', 'DC-P', 'C-SB', '0', 'CD-SB']	Calculated based on ARIS, AVI, Post-AVI Cutblock information	Final assigned Planning standard base 10 strata text
264	YLD_STRATA_TXT	YLD_STRATA_TXT	String	10	<skipped>	Calculated based on EFM_Block_List_November_14_17.csv	Final assigned yield strata text
265	COVER_CLASS	COVER_CLASS	String	10	['0', 'CD', 'C_PL', 'C_SW', 'D', 'DC', 'C_SbLtFd']	Calculated based on EFM_Block_List_November_14_17.csv	AVI -consolidation ARIS, AVI, of AVI and cutblock reconciled information
266	C_OPEN_NUM	C_OPEN_NUM	String	11	<skipped>	Calculated based on ARIS extract	List -consolidation of AVI and cutblock reconciled information
267	GENETIC	GENETIC	SmallInteger	2	[0, 1]	Calculated with 4000_Netdown_001_ApplyCLB.py script	Genetic flag
268	NSR_STOCKING	NSR_STOCKING	Single	4	0	Calculated with 4000_Netdown_001_ApplyCLB.py script	Stocking percent for NSR openings
269	SERAL_STAGE	SERAL_STAGE	String	20	['Young (0-19)', 'Immature (20-79)', 'Mature (80-119)', 'Old (120-179)', 'Very Old (180+)', '0']	Calculated with 4000_Netdown_001_ApplyCLB.py script	Seral Stage for VOIT reporting (current to 2017), based on AGE_2017

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
270	A_AreaHa	A_AreaHa	Double	8	[0.00010558187847530807, 1288.7330117955316]	Calculated with 4000_Netdown_001_ApplyCLB.py script	ARIS reconciled Area in Hectares
271	SITE_INDEX	SITE_INDEX	Double	8	<skipped>	Calculated with 3001_Assign_SITE_INDEX.py	Calculated Site index; only used to remove low productivity stands with larch content.
272	ROLLUP	ROLLUP	String	255	['2. Administrative Removals', '1. Non-Forested', '5. Subjective', '4. Non-Merchantable', '6. Productive', '3. Buffers']	Calculated with 4000_Netdown_001_ApplyCLB.py script	Classified landbase Roll up category
273	NETDOWN_CODE	NETDOWN_CODE	SmallInteger	2	<skipped>	Calculated with 4000_Netdown_001_ApplyCLB.py script	Netdown code used for summarizing gross and net areas
274	NETCODE	NETCODE	String	255	<skipped>	Calculated with 4000_Netdown_001_ApplyCLB.py script	All possible netdown codes applied
275	NETDOWN	NETDOWN	String	255	['3. Provincial Parks', '1. Non-Contributing Dispositions', '8. No AVI', '5. Non-Forested Dispositions', '8. Isolated', '2. Naturally Non-Vegetated', '6. Non-Forested Burn', '7. Low Productivity (TPR = U)', '3. Anthropogenic Vegetated', '4. Pure Deciduous (DX)', '2. Conifer Leading (CD)', '1. Pure Conifer (CX)', '3. Deciduous Leading (DC)', '3. River', '4. Stream', '1. Steep Slopes', '8. Low Productivity Within Caribou Range', '3. A-Density DX Stands', '4. Non-	Calculated with 4000_Netdown_001_ApplyCLB.py script	Final Assigned Netdown Reason

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
					Forest Vegetated', '1. Anthropogenic Non-Vegetated', '5. Spring', '5. Subhydric Poor/Very Poor', '4. Low Density', '2. Black Spruce', '6. Stands Heavily Impacted by MPB', '2. Small Lake', '1. Large Lake', '1. Larch', '4. Mineral Lick', '5. Historic Resource Values', '6. Prime Protection (ESLUZ1)', "5. 'Switch' Stands (D_US)", '3. Trapper Cabin', '9. Not Sufficiently Restocked (NSR)', '2. Archaeology', '6. MPB Rehab', '5. Trumpeter Swan Buffers', '7. Unreconciled ARIS', '2. Private', '7. Unique Areas', '4. Provincial Recreation Areas', '9. Dunes']		
276	CONTCLAS	CONTCLAS	String	1	['X', 'N', 'C']	Calculated with 4000_Netdown_001_ApplyCLB.py script	Contributing Classification, (X=Non-forest/Non-Contributing, N= Non-Contributing Forest, C= Contributing forest)
277	ISOLATED	ISOLATED	SmallInteger	2	[0, 2]	4000_Netdown_002_Isolated_Stands.py	Isolated flag 1 = Small isolated, 2= isolated by steep along select rivers
278	RETENTION	RETENTION	SmallInteger	2	[0, 2]	4000_Netdown_004_IdentifyMappedProductiveRetention.py	Identified mapped insular retention from both existing harvest openings and currently planned openings

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s)	Description
279	DEFERRAL	DEFERRAL	SmallInteger	2	[0, 60]	4000_Netdown_004_IdentifyMappedProductiveRetention.py	Identifies deferral time (in years) for identified mapped insular retention, 60 years from Harvest Skidding date of associated opening
280	MPB_RValue	MPB_RValue	Double	8	[0.0, 9.4814002248975964]	4000_Netdown_005_AssignPineStrategyRanking.py	MPB strategy r-value
281	MPB_RClass	MPB_RClass	String	10	['', 'Low', 'Moderate', 'Very High', 'High']	4000_Netdown_005_AssignPineStrategyRanking.py	MPB strategy r class
282	MPB_SSI	MPB_SSI	SmallInteger	2	[0, 82]	4000_Netdown_005_AssignPineStrategyRanking.py	MPB overstory stand susceptibility index
283	MPB_USSI	MPB_USSI	SmallInteger	2	[0, 70]	4000_Netdown_005_AssignPineStrategyRanking.py	MPB understory stand susceptibility index
284	PINE_RANK	PINE_RANK	SmallInteger	2	[0, 3]	4000_Netdown_005_AssignPineStrategyRanking.py	MPB strategy pine rank 0=No Rank Assigned, 1 = Rank 1, 2=Rank 2, 3=Rank3,
285	SYMPTOM	SYMPTOM	String	25	['', 'Mortality']	2000_BuildResultant_003_AddProxyFeatures.py	Deciduous Mortality from 2018 Forest Health Overview
286	SUMMER_FIRE_BEHAVIOUR	SUMMER_FIRE_BEHAVIOUR	Single	4	0	4000_Netdown_007_AssignFireRisk_Annex3.py	Annex 3 Mean Summer Fire Behavior Potential
287	SPRING_FIRE_BEHAVIOUR	SPRING_FIRE_BEHAVIOUR	Single	4	0	4000_Netdown_007_AssignFireRisk_Annex3.py	Annex 3 Mean Spring Fire Behavior Potential
288	FALL_FIRE_BEHAVIOUR	FALL_FIRE_BEHAVIOUR	Single	4	0	4000_Netdown_007_AssignFireRisk_Annex3.py	Annex 3 Mean Fall Fire Behavior Potential

Appendix IV Modeling Landbase Data Dictionary

File: fragments20190501.shp

Number of Records: 441,423

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
1	FID	FID	OID	4	<skipped>	N/A	
2	Shape	Shape	Geometry	0	<skipped>	N/A	
3	FMA_NAME	FMA_NAME	String	100	[' ', 'Weyerhaeuser Company Limited (Grande Prairie)']	FMA_6900016	Name of FMA
4	NSRNAME	NSRNAME	String	25	['Subalpine', 'Lower Foothills', 'Upper Foothills', 'Central Mixedwood', 'Alpine', 'Dry Mixedwood', 'Montane']	Natural_Regions_Subregions_of_Alberta	Natural Sub Region
5	WS_KEY	WS_KEY	Integer	10	[0, 206]	Forestry_Watersheds	Watershed Key ID
6	SUBUNIT	SUBUNIT	String	50	['Redrock-Prairie Creek', 'Narraway', ' ']	Caribou_Range	Caribou SUBUNIT name
7	CARIBOU	CARIBOU	Integer	5	[0, 1]	Caribou_Range	Caribou range flag
8	CZ_NAME	CZ_NAME	String	50	[' ', 'Nose Creek', 'Grovedale Aspen Grove', 'Wanyandie Flats East', 'Gundy Saddle Oak', 'Woking']	FireSmart	Firesmart Community name
9	ACCESS_UNI	ACCESS_UNI	Integer	10	[0, 3128]	AccessUnits	Harvest Scheduling Unit within Caribou Range
10	GRAZING	GRAZING	String	3	[' ', 'FGL', 'GRL']	DIDs_GL_t	Grazing Disposition flag
11	NET_FACTOR	NET_FACTOR	Double	19	[0.0, 1.0]	Factor to account for seismic area	Calculated based on

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
							Seismic-AVI Union, used to aspatially account for seismic lines
12	SOURCE	SOURCE	String	25	[' ', 'WeycoLayoutComplete', 'NorbordHarvested', 'WeycoHarvested', 'WeycoFinalApproval', 'NorbordPlanned', 'CTP', 'TOLKO']	PLANNED_BLOCKS	Source of planned block
13	PLAN_KEY	PLAN_KEY	Integer	10	[0, 2903]	PLANNED_BLOCKS	Planned Block unique Key
14	Shape_Area	Shape_Area	Double	19	[10.000331425800001, 3828918.0233200002]	Polygon Shape area in square meters	Polygon Shape area in square meters
15	UNIT	UNIT	String	15	['MainBlock', 'SaddleHills']	Calculated field to distinguish two main blocks of the FMA	Calculated field to distinguish two main blocks of the FMA
16	RES_KEY	RES_KEY	Integer	10	[279, 637319]	Calculated field; Copy of CLB OID	Unique CLB resultant polygon key
17	NET_AREA	NET_AREA	Double	19	[0.0, 378.23659796599998]	Calculated	net area after accounting for seismic factor (NET_FACTOR)
18	G1_BREED	G1_BREED	Integer	5	[0, 1]	Majority Calculated from G1_BREED	G1 breeding area
19	B1_BREED	B1_BREED	Integer	5	[0, 1]	Majority Calculated from B1_BREED	B1 breeding area

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
20	B2_BREED	B2_BREED	Integer	5	[0, 1]	Majority Calculated from B2_BREED	B2 breeding area
21	HLIN_RATIO	HLIN_RATIO	Integer	5	[0, 1]	Majority Calculated from HLIN_RATIO_GT_1pct	Hard Linear ratio gt 1; used for Songbirds
22	STD_BCG	STD_BCG	String	4	['CD', 'DX', 'DC', 'CX']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned broad cover group
23	STD_DENSIT	STD_DENSIT	String	4	['C', 'A', 'B', 'D', ' ']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned Density
24	STD_TPR	STD_TPR	String	4	['M', 'U', 'G', 'F', ' ']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned timber productivity rating
25	STD_SP1	STD_SP1	String	4	['PL', 'PB', 'SW', 'AW', 'SB', 'SE', 'FA', 'FB', 'LT', ' ', 'BW']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned leading species
26	AGE_2017	AGE_2017	Integer	5	<skipped>	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Stand age as of 2017
27	YLD_STRATA	YLD_STRATA	Integer	5	[101, 522]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final assigned yield strata number
28	YLD_STRA_1	YLD_STRA_1	String	10	<skipped>	Calculated based on ARIS, AVI, Post-AVI Cutblock information	Final assigned yield strata text
29	C_OPEN_NUM	C_OPEN_NUM	String	11	<skipped>	Calculated based on ARIS, AVI, Post-AVI Cutblock information	Consolidated Opening number
30	NSR_STOCKI	NSR_STOCKI	Single	13	0	Calculated based on ARIS extract	Stocking percent for NSR openings

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
31	CONTCLAS	CONTCLAS	String	1	['N', 'C']	Calculated with 4000_Netdown_001_ApplyCLB.py script	Contributing Classification, (x=Non-forest/Non-Contributing, n= Non-Contributing Forest, c= Contributing forest)
32	RETENTION	RETENTION	Integer	5	[0, 2]	Calculated; 5000_ModelPrep_001_IdentifyMappedProductiveRetention.py	Identifies mapped insular retention
33	DEFERRAL	DEFERRAL	Integer	5	[0, 60]	Calculated; 5000_ModelPrep_001_IdentifyMappedProductiveRetention.py	Identifies deferral time (in years) for identified mapped insular retention, 60 years from Harvest Skidding date of associated opening
34	SYMPTOM	SYMPTOM	String	25	[' ', 'Mortality']	Forest Health Overview - Aspen Mortality	Identifies aspen mortality identified by forest health overview surveys
35	NSR_FACTOR	NSR_FACTOR	Single	13	0	Calculated	NSR reduction factor re-classified to nearest 5% stocking

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
36	BLOCK_ID	BLOCK_ID	Integer	10	[1, 317559]	Calculated	Unique Block ID, used to dissolve fragments into blocks

File: blocks_20190501.shp

Number of Records: 314,559

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
1	FID	FID	OID	4	<skipped>	N/A	
2	Shape	Shape	Geometry	0	<skipped>	N/A	
3	BLOCK_ID	BLOCK_ID	Integer	10	[1, 317559]	Block Cluster ID	Unique Block ID
4	FIRST_YLD_	FIRST_YLD_	Integer	10	[101, 522]	Calculated based on ARIS, AVI, Post-AVI Cutblock information; 3000_AssignYieldGroup.py	Final assigned yield strata number
5	FIRST_CONT	FIRST_CONT	String	1	['N', 'C']	Calculated with 4000_Netdown_001_ApplyCLB.py script	Contributing Classification, (x=Non-forest/Non-Contributing, n= Non-Contributing Forest, c= Contributing forest)
6	FIRST_CARI	FIRST_CARI	Integer	10	[0, 1]	Caribou_Range	Caribou range flag
7	FIRST_SUBU	FIRST_SUBU	String	50	['Redrock-Prairie Creek', 'Narraway', ' ']	Caribou_Range	Caribou SUBUNIT name
8	FIRST_UNIT	FIRST_UNIT	String	15	['MainBlock', 'SaddleHills']	Calculated field to distinguish two main blocks of the FMA	Calculated field to distinguish two main blocks of the FMA
9	FIRST_NSRN	FIRST_NSRN	String	25	['Subalpine', 'Lower Foothills', 'Upper Foothills',	Natural_Regions_Subregions_of_Alberta	Natural Sub Region

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
					'Central Mixedwood', 'Alpine', 'Dry Mixedwood', 'Montane']		
10	FIRST_G1_B	FIRST_G1_B	Integer	10	[0, 1]	Majority Calculated from G1_BREED	G1 breeding area
11	FIRST_B1_B	FIRST_B1_B	Integer	10	[0, 1]	Majority Calculated from B1_BREED	B1 breeding area
12	FIRST_B2_B	FIRST_B2_B	Integer	10	[0, 1]	Majority Calculated from B2_BREED	B2 breeding area
13	FIRST_STD_	FIRST_STD_	String	4	['CD', 'DX', 'DC', 'CX']	Calculated based on WEYGP_FMA_G16_AVI_ARIS attributes; 3000_AssignYieldGroup.py	Final assigned broad cover group
14	FIRST_WS_K	FIRST_WS_K	Integer	10	[0, 206]	Forestry_Watersheds	Watershed Key ID
15	FIRST_NSR_	FIRST_NSR_	Single	13	0	Calculated based on ARIS extract	Stocking percent for NSR openings
16	FIRST_RETE	FIRST_RETE	Integer	10	[0, 2]	Calculated; 5000_ModelPrep_001_IdentifyMappedProductiveRetention.py	Identifies mapped insular retention
17	FIRST_DEFE	FIRST_DEFE	Integer	10	[0, 60]	Calculated; 5000_ModelPrep_001_IdentifyMappedProductiveRetention.py	Identifies mapped insular retention
18	FIRST_FMA_	FIRST_FMA_	String	100	[' ', 'Weyerhaeuser Company Limited (Grande Prairie)']	FMA_6900016	Name of FMA
19	FIRST_GRAZ	FIRST_GRAZ	String	3	[' ', 'FGL', 'GRL']	DIDs_GL_t	Grazing Disposition flag
20	FIRST_NSR1	FIRST_NSR1	Single	13	0	Calculated based on ARIS extract	Stocking percent for NSR openings
21	FIRST_ACCE	FIRST_ACCE	Integer	10	[0, 3128]	AccessUnits	Harvest Scheduling Unit within Caribou Range
22	FIRST_PLAN	FIRST_PLAN	Integer	10	[0, 2903]	PLANNED_BLOCKS	Planned Block unique Key
23	FIRST_SYMP	FIRST_SYMP	String	25	<skipped.	Forest Health overview - Aspen Mortality	Flag to target aspen mortality

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Source(s) / Description	Description
24	SUM_FB	SUM_FB	Single	13	<skipped.	Annex 3 - Summer fire behaviour	Harvest Scheduling Unit within Caribou Range
25	SPRI_FB	SPRI_FB	Single	13	<skipped.	Annex 3 - Summer fire behaviour	Annex 3 - Summer fire behaviour
26	FAL_FB	FAL_FB	Single	13	<skipped.	Annex 3 - Summer fire behaviour	Annex 3 - Summer fire behaviour
27	ALL_FB	ALL_FB	Single	13	<skipped.	Annex 3 - All fire behaviour	Annex 3 - All fire behaviour
28	FIRE_TAR	FIRE_TAR	Integer	5	<skipped.	Annex 3 - All fire behaviour	Flag used to target high fire behaviour potential based on all seasons
29	WATERSHED	WATERSHED	String	254	<skipped.	Forestry_Watersheds	Watershed Key ID
30	Compartmen	Compartmen	String	8	<skipped.	AccessUnits	Harvest Scheduling Unit within Caribou Range, calculated to match format of Forcorp compartment naming convention
31	LT_FLAG	LT_FLAG	Integer	10	<skipped.	Larch flag	Larch flag

Weyerhaeuser Forest Management Plan

Annex V: Yield Curve Development

AUTHOR: Gyula Gulyas

DATE: October 1, 2018

REVISION DATE: June 3, 2019

2019

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

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Executive Summary

Weyerhaeuser Company Ltd. developed 38 new yield curves for the Grande Prairie Timberlands Forest Management Area (FMA #6900016). The curves will be used to facilitate the timber supply analysis being completed in support of the 2019-2029 Forest Management Plan. This document describes the data, methods, assumptions and processes used to develop yield estimates for natural and managed stands in the net landbase.

The yield curve development process was based on permanent sample plots from natural fire-origin and pre-1991 managed stands and RSA performance survey data collected across the defined forest area.

Stratification was based on Weyerhaeuser's base yield strata using either Alberta Vegetation Inventory attributes in natural stands and pre-1991 managed stands or a combination RSA stratification, silviculture declaration plus treatment information in managed stands. The strata are a modification of the Alberta Planning Standard base 10 yield strata, minus the Douglas-fir (Fd) stratum.

Gross merchantable volumes were compiled to 10 cm top diameter inside bark and 15 cm minimum stump diameter at 15 cm stump height for the FMA baseline utilization for both deciduous and conifer species groups. Adjustment for stand decline for the deciduous stand component was implemented using an age-based mortality constant. Cull and stand retention were not accounted for during the yield curve development.

Weyerhaeuser identified three main groups of stands within the net landbase for yield curve development:

Natural stands (NAT): include all fire-origin stands. Modeling was based on GYPSY in semi-empirical fashion whereby observed top height and basal area were used to constrain model projections using natural stand PSPs. Strata were based on the AVI polygon.

Pre-1991 managed stands (M91): include all openings that were harvested prior to March 1, 1991. Modeling was based on GYPSY in semi-empirical fashion whereby observed top height and basal area were used to constrain model projections using pre-1991 managed stand PSPs. Any yield strata with insufficient number of plots were defaulted to the respective natural stand yield curve. Strata were based on the AVI polygon.

Post-1991 managed stands (MGD): represent all exiting openings that were harvested on or after March 1, 1991. Modeling was based on GYPSY projection of RSA performance survey data. The projections were averaged by yield strata using the proper sample weights by RSA program year and population areas as per RSA protocols. AVI attributes were used for stratifying openings harvested prior to March 1, 1995 based on the AVI polygon. Strata were based on the RSA strata at the sampling unit (SU) level for all surveyed openings. Silviculture declaration and treatment information from ARIS were used to stratify the rest of the blocks at the opening-level.

Weyerhaeuser also developed tree improvement (genetic) yield curves for Regions B1 and B2 lodgepole pine and Region G1 white spruce to reflect yield increases resulting from the deployment of genetically improved stock from controlled parentage programs.

Agreement-in-principle (AIP) on the FMP yield projections was obtained on April 1, 2019 and additional information was embedded in this revised document with reference to the specific AIP condition number.

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1 Overview

Weyerhaeuser Company Limited (Weyerhaeuser) is required to complete a Forest Management Plan (FMP) for the Grande Prairie Timberlands (FMA # 6900016) by April 30, 2021. Weyerhaeuser intends to submit a new plan by April 30, 2019.

This document describes the data, methods, assumptions and processes used to develop yield estimates for natural and managed stands in support of the 2019 FMP. The yield curve development methods intend to follow the procedures published in the Alberta Forest Management Planning Standard (Planning Standard) version 4.1 (ASRD 2006b) and additional supporting documentation released over the past 12 years[1].

Some of the information contained in this document is a simplification of the work completed within the landbase netdown process. This information is provided solely as context for the yield curve document. Please refer to Annex IV for the full detailed documentation of the landbase netdown process and description of associated attributes.

1.1 Landbase Classification and Base Yield Strata

The landbase is initially defined based on Alberta Vegetation Inventory (AVI) polygons (AFLW 1991). Alterations to the clearcut and landbase polygon set occur through the cutblock reconciliation process or as an outcome of aerial or non-photo stratification as part of performance surveys. Additional modifications occur through overlays of other relevant spatial information such as land use layers and disposition boundaries. Through this process, the timber harvesting landbase (polygons eligible for forest management activities - ‘the active landbase’) is defined.

Polygons within the timber harvesting landbase are then assigned into yield strata using either AVI attributes (fire-origin stands and openings harvested prior to March 1, 1995)[2] or, in the case of managed stands harvested after March 1, 1995, a combination of silviculture declaration plus treatment information (e.g., planting, seeding and/or leave for natural treatments). In stands which have undergone a Regeneration Standard of Alberta (RSA) performance survey, yield strata are defined based on either new photo-interpreted aerial attributes or ground survey data for stands where aerial photos are not available.

All stand groups are differentiated into the same base set of yield strata, regardless of differences in rule sets used to assign the strata; Weyerhaeuser’s 8 base yield strata are described in Table 1-1. These strata are a modification of the Government of Alberta (GoA) base 10 yield strata, minus the Douglas-fir (Fd) stratum. Weyerhaeuser also maintains a D_US stratum that includes pure deciduous stands that are managed for the conifer understorey (“switch” stands). These base yield strata provide the basis for the development of yield groups.

[1] This document attempts to follow the structure and wording of other yield curve documents that have been produced in Alberta in recent years to help speed up the review process.

[2] As per current AAF protocols an exemption was given whereby stratification may be based on AVI attributes for openings harvested prior to March 1, 1995 instead of using ARIS records. Weyerhaeuser opted to utilize this exemption in the stratification process.

Natural stand yield groups were developed by splitting Weyerhaeuser's base yield strata based on AVI attributes as discussed in Section 2.2.2. Managed stands harvested prior to March 1, 1991 were assigned to yield groups by combining some of these base yield strata as discussed in Section 3.2.2.

Table 1-1. Description of Weyerhaeuser's base yield strata.

Weyerhaeuser Base Yield Stratum	GoA Base 10 Stratum	Broad Cover Group	Description
C_PL	Pl	C	Pure conifer stand - pine leading
C_SW	Sw	C	Pure conifer stand - white spruce leading
C_SB	Sb	C	Pure conifer stand - black spruce leading
CD_PL	PlHw	CD	Conifer mixedwood stand - pine leading
CD_SX	SwHw	CD	Conifer mixedwood stand - white spruce leading
	SbHw	CD	Conifer mixedwood stand - black spruce leading
DC_PL	HwPl	DC	Deciduous mixedwood stand - leading conifer pine
DC_SX	HwSx	DC	Deciduous mixedwood stand - leading conifer spruce
D	Hw	D	Pure deciduous stand
D_US	Hw	D	Pure deciduous stand - managed for the conifer US

1.2 Groups of Stands

Weyerhaeuser has identified four groups of stands within their timber harvesting landbase for purposes of yield curve development:

A. Natural Stands

Natural stands are defined as all fire-origin stands in the Grande Prairie Timberlands defined forest area (DFA) that are within the net landbase. Growth and yield projections will be developed using natural stand yield curves.

B. Managed Stands

Managed stands are defined as any post-harvest regenerated (PHR) stands that are identified with an Alberta Regeneration Information System (ARIS) record and have been reconciled with ARIS either during the preparation of the inventory and/or through the development of the net landbase.

There are three major types of managed stands that are required to project growth and yield for in the net landbase:

B.1. Existing managed stands harvested before March 1, 1991

B.2. Existing managed stands harvested on or after March 1, 1991

B.3. Future managed stands harvested after the effective date[3] of the FMP

[3] The 2019 FMP landbase effective date is set at May 1, 2017.

1.3 Growth Models

There are only two growth models available for use in Alberta; the Growth and Yield Projection System (GYPSY) and the Mixedwood Growth Model (MGM). An alternative option for yield curve development is to use empirical (regression-based) yield curve approaches; however, this option is only available for natural, not managed stands. Weyerhaeuser decided to use GYPSY for yield curve development in all stand types in the 2019 FMP. A brief description of GYPSY is provided here for context.

The GYPSY model is a stand-level growth model developed by the Province of Alberta (Huang *et al*. 2009a, 2009b). Model inputs include stand age plus species group[4]-specific inputs: top height or site index (SI), age, density, stocking (optional) and basal area (optional). Spatial patterning is modelled via an (optional) stocking input, which modifies both the density and basal area increment functions within the GYPSY model. If stocking is not provided to the model, a non-spatial version of GYPSY is used. Huang *et al.* (2009a) recommend using the non-spatial version of GYSPY for fire origin stands, and wherever possible, the spatial version for post-harvest stands.

Basal area inputs are used to localize predicted basal area increment curves to observed plot data. Where basal area inputs are not available, basal area increment is predicted by the model. Competition between species is built into the model's structure in two manners: via a species composition function as well as through interactions within several of the model functions. Aspen and black spruce species groups are unaffected by the presence of other species except via species composition equations embedded in the model. White spruce and pine species groups are affected by the presence of other species groups via modifiers to the density, basal area increment and percent stocking models.

General direction from AAF is to use GYPSY without any change or model coefficient re-calibration. However, plot data from the FMA must be used thus localizing the GYPSY model for FMA conditions.

1.4 Modelling Approach

A different modelling approach was used for yield curve development for each type of stand based on the input datasets, type of stand and other constraints. Each approach is described briefly here, and in more detail in each relevant chapter. All relevant data compilation and analysis steps were undertaken using the Statistical Analysis System (SAS) version 9.4 on Windows 7[5].

1.4.1 Natural Stands (NAT)

All natural fire-origin stands were projected using NAT yield curves. Yield curve development in natural stands involved the projection of local plot data using the GYPSY growth model. GYPSY was developed primarily from natural stand data and it is considered a suitable model for natural stand growth projections. The Planning Standard requires that standing timber (e.g. natural stand) yield curves be validated against plot data using AVI-based age as the basis for assigning stand age thus providing a direct link to the inventory. Weyerhaeuser natural stand yield strata assignments were based on AVI attributes at the AVI polygon level (Table 1-1).

[4] Species groups: AW (aspen, poplar and birch), PL (pines + larch), SB (black spruce), SW (white spruce + fir).
[5] We also used Python 2.7 scripting for the matrix algebra portion of height-dbh mixed effect modelling.

1.4.2 Pre-1991 Managed Stands (M91)

PHR stands that were harvested prior to March 1, 1991 were projected using M91 yield curves. The Planning Standard, Section 3.11ii, Annex 1, requires that "…areas harvested prior to March 1, 1991 shall be assigned to a yield stratum based on the vegetation inventory in place on the effective date of the inventory...". The stratification therefore was based on the AVI and followed the same basic stratification rules applied to the natural stands. Weyerhaeuser was using the same methodology and model applied to local plot data in pre-1991 managed stands as used in the development of natural stand yield curves. Any M91 yield group without sufficient plot data will default to a natural stand yield curve.

1.4.3 Post-1991 Managed Stands (MGD)

All existing PHR stands that were harvested on or after March 1, 1991 were projected using MGD yield curves. The Planning Standard, Section 3.11i, Annex 1, requires that areas harvested on or after March 1, 1991 be assigned to a yield stratum as defined in ARIS[6] and the most current information on the harvest area and its associated regeneration stratum in ARIS. Stratification was based on the GoA base 10 strata (Table 1-1).

Weyerhaeuser used all RSA survey data that had been submitted to the Forest Management Branch by May 15, 2017. These data sets included all Weyerhaeuser and Quota Holder cutblocks where aerial or non-photo RSA programs have been completed since 2009. Managed stand yield curves were developed using the RSA data projected by the GYPSY model. The GYPSY projections were averaged by yield strata using the proper sample weights by RSA program year and population areas by strata across program year as per RSA protocols.

Weyerhaeuser also developed tree improvement (genetic) yield curves for Region B lodgepole pine (B1 & B2) and Region G white spruce (G1) to reflect yield increases resulting from the deployment of genetically improved stock from controlled parentage programs (CPP). Genetic yields were applied in pure conifer cutblocks where at least 70% of seedlings were from seedlots deemed improved seed.

1.4.4 Future Managed Stands

All existing PHR stands that are harvested after the effective date of the landbase will be projected using MGD yield curves. Stratum assignment will use the transition rules as defined in the silviculture matrix developed for the 2019 FMP (Section 5.4). Stratification is based on the GoA base 10 strata (Table 1-1).

White spruce genetic curves will be applied to future harvested stands that are in the G1 breeding region in the Sw regeneration stratum. Lodgepole pine genetic curves will be applied to future harvested stands that are in the B1 and B2 breeding regions in the Pl regenerating stratum.

[6] Weyerhaeuser stratified stands harvested between March 1, 1991 and March 1, 1995 based on AVI attributes as per the AAF exemption.

1.5 Technical Specifications

1.5.1 Yield Curve Summary

A summary of all stand types, including the growth model used for yield curve development, scale of application and method of stratum assignment, is provided in Table 1-2.

Table 1-2. Model, scale and stratum assignment methods by stand type.

Groups of Stands	Model	Scale	Stratum Assignment
Natural	GYPSY	AVI Polygon	AVI attributes
Pre-1991 Managed	GYPSY	Opening	AVI attributes
Post-1991 Managed	GYPSY	Opening (1991-1995)*	AVI attributes
		RSA sampling unit**	RSA attributes
		Opening	Declaration+silviculture
Future Managed	GYPSY	Opening	Silviculture Matrix

** Openings harvested between March 1, 1991 and March 1, 1995.*

*** If an RSA survey is available for the opening.*

1.5.2 Eligible Species and Species Groups

Table 1-3 lists the species present in Weyerhaeuser's FMA area. All species are acceptable for the purposes of yield curve development except for larch, which is considered a non-merchantable species. For GYPSY modelling purposes, species groups are used rather than individual species; species groupings are as shown in Table 1-3, as well as the corresponding species type (conifer vs. deciduous).

Table 1-3. Species types and groups and their eligibility for yield curve development in the 2019 FMP.

Species Type	GYPSY Species Group	Species Code	Common Name	Latin Name	Acceptable Species
Deciduous	AW	Aw	Aspen	*Populus tremuloides*	Yes
		Pb	Poplar	*Populus balsamifera*	Yes
		Bw	Birch	*Betula papyrifera*	Yes
Conifer	PL	Pl	Lodgepole pine	*Pinus contorta*	Yes
		Lt	Tamarack	*Larix laricina*	No
	SB	Sb	Black spruce	*Picea mariana*	Yes
	SW	Sw	White spruce	*Picea glauca*	Yes
		Se	Engelmann spruce	*Picea engelmannii*	Yes
		Fb	Balsam fir	*Abies balsamea*	Yes

For GYPSY modelling purposes, larch is included in the PL species group. Larch was not dropped during the plot-level compilations before the GYPSY projections because these trees take up growing space in the plot and ignoring them would not be correct from the modelling standpoint. There was less than 1% of larch in the final modelling plot data set, so the impact of larch trees on the compilations and GYPSY projections is negligible.

1.5.3 Utilization Standards

The GYPSY model was used for yield curve development in the FMP that can predict gross merchantable volumes from plot data. The modeler needs to provide the following utilization parameters:

- minimum stump diameter outside bark (STUMPDOB);
- top diameter inside bark (TOPDIB); and
- stump height from the ground (STUMPHT).

GYPSY gross merchantable volumes are compiled and projected based on a 3.66 m usable length (also known as minimum merchantable length - MML - measured from the stump) using the tree-length (TL) system where the volume is fully utilized to the specified merchantable TOPDIB.

Weyerhaeuser developed FMP baseline yield curves using the following utilization limits:

Conifer:

STUMPDOB=15 cm, TOPDIB=10 cm, STUMPHT=15 cm, MML=3.66 m, SYSTEM=TL

Short notation: 15/10/15/366/TL

Deciduous:

STUMPDOB=15 cm, TOPDIB=10 cm, STUMPHT=15 cm, MML=3.66 m, SYSTEM=TL

Short notation: 15/10/15/366/TL

All FMP baseline yield curve volumes were projected to the baseline utilization limits. The short notation of the utilization limit will be used in the rest of this document.

The Weyerhaeuser Grande Prairie Timberlands FMA operating ground rules (Weyerhaeuser 2017c), quota holders and RSA target MAI standards require the projection of both conifer and deciduous gross merchantable volumes to utilization limits and systems as described in Table 1-4.

Table 1-4. Utilization matrix by company/operator for the 2019 FMP.

Company/Operators	Forest Management Unit	Conifer Utilization	Deciduous Utilization
FMP Baseline		*15/10/15/366**	*15/10/15/366*
Weyerhaeuser	G16	15/10/15/366	15/10/15/366
Norbord Inc.	G16	NA	15/10/15/366
Tolko Industries Ltd.	G16	NA	15/10/15/366
*RSA***	*ALL*	*15/10/30/366*	*15/10/30/366*

** Annual Allowable Cut (AAC) will be established based on tree-length (TL) processing. Cut-to-length (CTL) and other processing systems will not be considered in the context of FMP yield curves and AAC calculations.*

*** Regeneration Standard of Alberta yield curves can be used to calculate the target MAIs for ARIS.*

1.5.4 Cull

Cull information was developed based on the document titled "*Tree Length Utilization in Harvest Operations*" (AAF 2015c) that speaks to the importance of all yield estimates being compiled to a tree length utilization standard and the scaling system being dependent on all harvested timber crossing an approved scale.

Weyerhaeuser has long term contractual volume obligations to deliver roundwood pulp to International Paper's on-site facility. In order to meet this obligation, as well as deliver the fibre needed for their own lumber facility, Weyerhaeuser processes each stem down to a 4" top and include crook, sweep and forked stems as acceptable pulp loads. Both pulp loads and saw log loads are captured in their yard scaling program. Roundwood pulp accounts for, on average, 20% of the fibre brought across the scales in Grande Prairie. This practice satisfies the Province's requirement to account for tree length utilization and all harvested timber crossing an approved scale.

Weyerhaeuser submitted a cull proposal to AAF (Weyerhaeuser 2017d) quantifying the estimates of conifer and deciduous cull[7] by stand type and species group based on scale data from 2007-2016. In July 2017 an agreement-in-principle was received from the department (AAF 2017d). Total conifer cull deductions by broad cover group (BCG) stand type are presented in Table 1-5 and total deciduous cull deductions by BCG and stand type are presented in Table 1-6.

Table 1-5. Total conifer cull deductions by BCG and stand type.

	Stand Type	
Broad Cover Group	Natural Stands	Managed Stands
All	2.30%	2.30%

Table 1-6. Total deciduous cull deductions by BCG and stand type.

	Stand Type	
Broad Cover Group	Natural Stands	Managed Stands
C, CD and DC	6.33%	6.33%
D	4.73%	4.73%

Net volumes are calculated by deducting cull from the projected gross merchantable volumes. Cull deductions need to apply directly to yield projections not post-hoc AAC as defined in Section 4.2.7(d) of the Planning Standard. Cull is included here for reference only; application of yield reductions to account for cull is applied within the FMP timber supply analysis.

1.5.5 Mortality

Deciduous mortality may not be adequately captured in GYPSY model-based yield curve projections therefore we implemented an age-based mortality constant like the functions used in the 2011 FMP. In summary, deciduous volume in yield tables is capped at 110 years, flatlined to 130 years and then it declines at such a rate that the pure deciduous component has 75 m^3/ha at 180 years (Weyerhaeuser 2011a).

[7] With endorsement from Norbord Inc. and Tolko Industries Ltd.

The deciduous mortality function was applied to the deciduous component of all yield groups. However, the deciduous volume reduction in coniferous yield groups (C/CD/DC/DU) occurred at a constant rate until there was zero deciduous volume left in the stand. There is currently no data to support the deciduous mortality assumptions. Weyerhaeuser would prefer to model stand succession rather than use mortality assumptions with subsequent deciduous volume growth when the stand is regenerated in the timber supply model.

We did not find any evidence of significant decline in conifer volumes and therefore conifer volumes were not adjusted for additional mortality beyond the GYPSY model projections in any of the yield curves developed for the 2019 FMP.

1.5.6 Regeneration Lag

In managed stands, regeneration lag is incorporated into the yield curve development process by using skid clearance to determine stand age, while using plot-based species ages to initiate growth functions.

1.6 Available Data

Essential features of sample selection and data collection procedures used for yield curve development are briefly summarized here. For specific details on each sampling program, please refer to the documents referenced in each section. Data dictionaries are provided as separate digital documents with the yield curve submission.

1.6.1 Permanent Sample Plots

The permanent sample plot (PSP) program was initiated in 1975 by Procter & Gamble Cellulose on their Grande Prairie FMA. The initial objectives were to replace or update the base inventory and to provide a better estimate of future forest growth. Over the past 43 years, over 1,300 plots have been established and re-measured. Within the current FMA boundary, there are currently 1,202 active PSPs.

The PSPs provide up-to-date volume and growth information for the FMA and are located on a predetermined systematic fixed grid. This grid layout is identical for each township and consists of 12 plots per township. The locations of the plots in each township are depicted in Figure 1.

PSPs are established in the following locations:

Center of northwest quarter, section 1	*Center of northeast quarter, section 3*
Center of northwest quarter, section 4	*Center of northeast quarter, section 6*
Center of southwest quarter, section 13	*Center of southwest quarter, section 16*
Center of northeast quarter, section 19	*Center of northwest quarter, section 21*
Center of northeast quarter, section 22	*Center of northwest quarter, section 24*
Center of southwest quarter, section 33	*Center of southwest quarter, section 36*

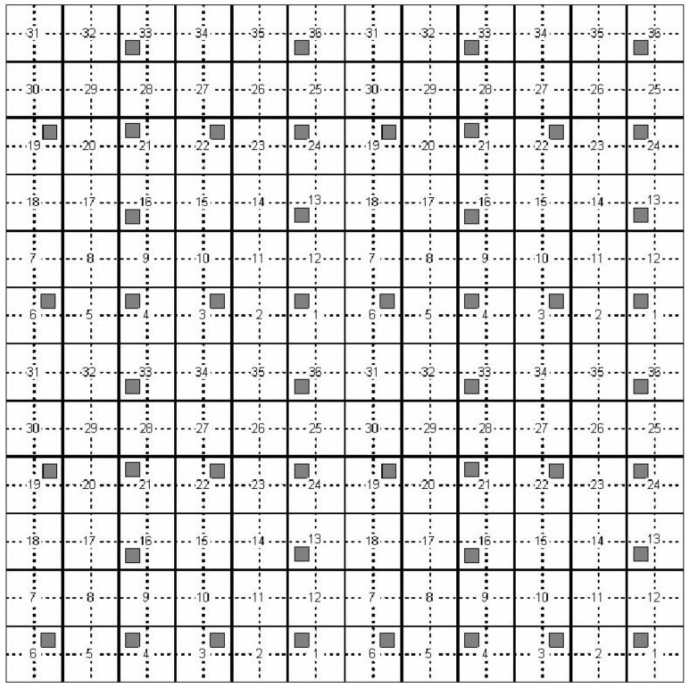

Figure 1. Original PSP sample grid design (showing 4 townships).

The PSPs are composed of three nested plots; the main plot is square with an area of 0.08 ha (0.04 ha in reduced size plots) and aligned in the cardinal directions. All trees greater than 50 mm DBH are tagged and measured in the main plot. The 0.02 ha sapling plot is nested in the northwest corner of the main plot. Trees from 1.3 m height to 50 mm DBH are tagged and measured in regenerated stands. There are four 0.001 ha regeneration plots within the sapling plot[8], located at cardinal bearings from the center post. Trees less than 1.3 m are tallied in the regeneration plots.

Age at stump height (30 cm)[9] is collected inside the main plot for 3 largest DBH conifer trees if the conifer tally is greater than 90% and the 3 largest DBH deciduous trees if deciduous tally is greater than 90%.

Age is collected on 2 conifer trees and 1 deciduous if greater than 50% of the tally is conifer and at least 10% is deciduous. Weyerhaeuser collects ages on 2 deciduous trees and 1 conifer if greater than 50% of the tally is deciduous but there is at least 1 conifer. Age tree selection was based on the largest DBH live trees without height damage or excessive defects and/or disease.

The distribution of plots by stand type is shown in Table 1-7. There are currently 928 natural stand PSPs[10] and 274 managed stand PSPs that are active.

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[8] Sapling and regeneration plots in natural stand PSPs were only established starting in the 2007 field season.

[9] Although ages were collected at stump height, they were always recorded as total age by using the AVI 2.1 years to reach stump height correction factors (ASRD 2005).

[10] There are an additional 25 plots (928+25=953) that were deactivated/deleted due to disturbance issues as per Weyerhaeuser's most up-to-date Plot Deletion Table in the PSP database. However, the last measurement of these plots were valid natural stand measurements based on the tree-level data and AVI photo interpretation and therefore were considered for the development of natural stand yield curves provided they met all netdown criteria for inclusion (Table 2-2).

Table 1-7. Distribution of PSPs by last measurement year and stand type.

Last Measurement Year	Number of Active Plots by Stand Type		
	Natural	Managed	*Total*
Pre-2000	61		*61*
2000	42		*42*
2001	70		*70*
2002	120		*120*
2003	11		*11*
2004	25		*25*
2005	11		*11*
2006	12		*12*
2007	57	3	*60*
2008	47	1	*48*
2009	38		*38*
2010	27		*27*
2011	60		*60*
2012	64	58	*122*
2013	72	47	*119*
2014	26	38	*64*
2015	29	91	*120*
2016	30	35	*65*
2017	126	1	*127*
Grand Total	**928**	**274**	**1202**

Starting in the 2012/13 field season, Weyerhaeuser identified genetically enhanced PSPs that were established in cutblocks that are “green field” planted 100% with genetic stock. Genetic trees are identified and tracked over time to assess their growth and see if these trees eventually become the main crop trees of the stand.

The importance of the impact of the MPB required the identification of attacked trees in the plot. Tree condition code 79-MPB was included in the field protocols. Plots can also be identified based on the detailed plot comments provided by the field crew and stored in the PSP database.

In 2010, Weyerhaeuser began to participate in the Foothills Research Institute (FRI) Mountain Pine Beetle Ecology Program to carry out focused research and investigations related to infestation of MPB. The information collected and analyzed will be used to inform timber supply analysis and operational planning through the improved development of stand regeneration and growth models forecasting post-disturbance conditions. To date Weyerhaeuser has contributed measurement data on 7 selected PSP’s impacted by MPB. Additional measurement and continuous monitoring of these PSPs will likely be required.

Plots are numbered according to their location in the grid system and whether they are in a natural (NAT) or managed (REG) stand. Plot numbers are composed of 12 digits; the first digit corresponds to the meridian, the next three to the township, the following two to the range, and the final six to the section (survey number). For example, PlotID = 605606000003_NAT represents natural plot #3 in township 56, range 6, and meridian 6.

A detailed description of Weyerhaeuser's PSP program and data collection protocols can be found in the *Weyerhaeuser PSP Manual* (Apical Forestry Consulting 2015).

1.6.2 Regeneration Standard of Alberta Performance Surveys

Regeneration Standard of Alberta (RSA) performance surveys collect detailed plot information within sampling units which can be at the opening or sub-opening level (AAF 2017a). The sampling frame for performance surveys in a given year was defined as all openings between 12 and 14 years of age belonging to a specific sustained yield unit.

Openings were subdivided into sampling units (SUs) either via aerial photography (for larger programs) or field reconnaissance (for smaller programs, also called non-photo programs). Before 2014, aerial programs employed a subsampling method in which a smaller subset of SUs were selected for ground sampling, whereas non-photo programs require a full ground sample (census) of SUs. Up to and including the 2013-14 timber year, the method for selecting aerial samples involved a slightly biased sample selection, which then required a complicated determination of a composite weight needed to account for this bias during the calculation of averaged results (described in detail in AESRD 2013). Simple stratified random sampling was introduced in the 2014-15 timber year thus equal sample weights were assigned to each ground sampled SU.

Within SUs selected for ground sampling, 10 m^2 plots were established using a grid-based method, with the number of plots varying depending on SU size and type of program. The number in aerial programs ranged from 32-64 plots, and in non-photo programs generally ranged from 41 plots up to 2.77 plots/ha in larger SUs.

Data were collected on conifer ≥0.3 m in height and deciduous ≥1.3 m in height. The following information was collected:

- Every plot: tally trees by species and type (seedling vs. advanced), with a separate tally for pine with western gall rust.
- Every 4th plot: within a 100 m^2 plot centered around the 10 m^2 plot, select the largest DBH tree by species group and record height, DBH (optional) and total age.
- Every 4th plot (optional): within the 10 m^2 plot, measure DBH and height (optional) of the 1st three trees by species group and type (seedling or advanced) and tally the number of seedling conifers above and below 1.3 m by species (to allow for calculation of basal area).

RSA data were available from Weyerhaeuser as well as all quota holders. All RSA-surveyed openings identified in ARIS were successfully matched with a corresponding RSA data set. The number of ground-sampled SUs available for yield curve development is presented in Table 1-8.

Table 1-8. Distribution of RSA performance surveys by company, program year and type.

Program ID	System Type	Program Year	Company	Population Area (ha)	Population # of SUs	Sampled Area (ha)	Sampled # of SUs	# of Blocks
1	Aerial	2009	Weyerhaeuser	3,927.1	228	357.4	37	144
2	Aerial	2010	Weyerhaeuser	9,494.4	509	468.1	42	362
3	Aerial	2012	Weyerhaeuser	9,619.6	645	901.7	89	424
4	Aerial	2014	Weyerhaeuser	157.9	14	138.3	14	6
5	Aerial	2014	Weyerhaeuser	8,374.4	540	810.2	81	313
6	Aerial	2016	Weyerhaeuser	9,695.9	538	924.1	106	385
7	NP[1]	2009	Weyerhaeuser	404.1	29	404.1	29	11
8	NP	2014	Weyerhaeuser	533.2	29	533.2	29	28
9	NP	2015	Weyerhaeuser	40.2	4	40.2	4	3
10	NP	2015	Weyerhaeuser	5.4	1	5.4	1	1
11	NP	2016	Weyerhaeuser	74.1	1	74.1	1	1
12	NP	2010	Norbord	47.5	1	47.5	1	1
13	NP	2014	Norbord	65.7	1	65.7	1	1
14	NP	2014	Norbord	154.8	3	154.8	3	3
15	NP	2009	FRIAA	26.5	5	26.5	5	4
16	NP	2010	FRIAA	23.5	5	23.5	5	5
17	NP	2011	FRIAA	53.8	9	53.8	9	8
18	NP	2012	FRIAA	69.0	10	69.0	10	9
19	NP	2013	FRIAA	69.5	10	69.5	10	10
20	NP	2014	FRIAA	42.5	8	42.5	8	6
21	NP	2016	FRIAA	51.5	3	51.5	3	3
Sub-total of eligible programs				**42,930.3**	**2,593**	**5,260.9**	**488**	**1,728**
EFM	Aerial	2014	Weyerhaeuser	138.9	13	106.3	13	9
EFM	Aerial	2016	Weyerhaeuser	517.8	33	311.3	30	27
REG	NP	2016	Norbord[2]					2
Sub-total of other programs				**656.7**	**46**	**417.6**	**43**	**38**
Total of all RSA Programs 2009-2017				**43,587.0**	**2,639**	**5,678.5**	**531**	**1,766**

[1] NP=Non-Photo RSA Program.

[2] Norbord 2016 NP program was not available.

For more details on RSA performance survey programs and protocols, please refer to the *Reforestation Standard of Alberta* (AAF 2017a).

2 Natural Stand Yield Curves (NAT)

Standing timber yield curves (NAT) representing all fire-origin (natural) stands within the Weyerhaeuser Grande Prairie Timberlands Defined Forest Area (DFA) net landbase will be used in the 2019 FMP.

2.1 Approach

Weyerhaeuser's preference for yield curve development was to use growth models for creating yield projections, rather than pursue a regression-based approach. The approach for natural stand yield curve development was constrained by availability of growth models: GYPSY is currently the only approved growth model for the Province of Alberta.

A second constraint was the Planning Standard requirement to use (or at least validate yields against) inventory-based ages. The GYPSY model was thus used in a semi-empirical fashion whereby top height and basal area were used to constrain model projections; this is described in further detail in Section 2.4. Weyerhaeuser submitted a proposal for the general approach to developing yield curves for natural stands (Weyerhaeuser 2017b). AAF provided an agreement in principle on August 1, 2017 (AAF 2017c).

2.2 Input Datasets

2.2.1 Source Data

All PSPs defined as natural origin in the Weyerhaeuser plot database were included in the preliminary set of plot data. A description of the PSP data collection protocols is provided in Section 1.6.1.

2.2.2 Yield Stratum Assignment

For the last FMP in 2011, Weyerhaeuser developed a series of yield strata that considered broad cover group, AVI species composition, crown closure class and natural subregion groups.

The 2017 FMP natural stand stratification was based on the GoA base 10 strata using the latest AVI attributes applied at the polygon-level. Some strata were split further by major conifer species content and AVI crown closure class to approximate the natural stand yield groups used in the previous Plan. This will ensure a level of continuity while meeting the requirements of the Planning Standard. The following guiding principles will apply:

- Use the latest AVI for natural stand stratification.
- Use broad cover group (BCG) and major species-group as part of the strata.
- Use the AAF extended strata as building blocks for the FMP yield strata (ASRD 2006b).
- Ensure that the strata "can be collapsed on different scales" with considerations given to the size of the resulting strata.

- Assign strata based on the overstorey (OS) or understorey (US). Management intent must be clearly stated based on the storey of primary management (SoPM).
- Have a clearly documented, transparent and repeatable process.

In the 2019 FMP Weyerhaeuser used the GoA "minimum 10" strata as outlined in the Planning Standard, as the basis for the stratification of natural stands (Table 1-1) using the overstorey layer as the SoPM for all but the D_US stratum. There is not enough landbase area to justify a separate SbHw stratum in the DFA therefore it will be aggregated with SwHw to create a CD-SX yield stratum The strata were further divided into yield groups based on inventory attributes as shown in Table 2-1. Net areas are based on the most up-to-date version of the landbase (**Version: September 30, 2018**).

Table 2-1. Yield group assignment rules for natural stands within the timber harvesting landbase.

Yield Group Label	SoPM[1]	GoA Base 10	Crown Closure	Yield Group Description	Net Area (ha)	Net Area (%)
D_AB	OS	Hw	AB	Pure Deciduous with A or B Density	51,386	8
D_CD	OS	Hw	CD	Pure Deciduous with C or D Density	134,420	22
D_US	US	Hw	ABCD	Conifer US "Switch" Stands	38,398	6
DC_PL	OS	HwPl	ABCD	Hardwood with Pine	7,943	1
DC_SX	OS	HwSx	ABCD	Hardwood with Spruce	39,042	6
CD_SX[2]	OS	SwHw/SbHw	ABCD	White Spruce or Black Spruce with Hardwood	35,071	6
CD_PL	OS	PlHw	ABCD	Pine with Hardwood	10,634	2
C_SW_AB	OS	Sw	AB	Pure White Spruce (>= 80%) with A or B Density	58,800	10
C_SW_CD	OS	Sw	CD	Pure White Spruce (>= 80%) with C or D Density	17,495	3
C_SWOC	OS	Sw	ABCD	White Spruce Leading (< 80%)	35,795	6
C_PL_AB	OS	Pl	AB	Pure Pine (>= 80%) with A or B Density	34,320	6
C_PL_CD	OS	Pl	CD	Pure Pine (>= 80%) with C or D Density	57,348	9
C_PLOC	OS	Pl	ABCD	Pine Leading (< 80%)	69,546	11
C_SB	OS	Sb	ABCD	Black Spruce Pure or Leading	17,023	3
Totals					**607,222**	**100**

[1] SoPM is based on overstorey (OS) for natural stands, with the exception of conifer US "switch" stands.
[2] SbHw will be lumped with SwHw due to the very small area in the landbase.

Based on the natural yield stratification, the following points should be considered:

- There are only eight GoA Base 10 strata in the net landbase as Fd is not present and SbHw is approximately 300 ha that is grouped under CD_SX.
- The C_PL, C_SW and C_SB strata require at least 80% PL, SW[11] or SB[12], respectively.
- The C_PLOC stratum represents pure conifer stands where the leading conifer is PL (<80%).
- The C_SWOC stratum represents pure conifer stands where the leading conifer is the SW species group (<80%).
- DC_PL represents a small portion of the net landbase (1%) with a limited number of plots. It will be necessary to group this stratum with CD_PL (2%) for yield curve development (MX_PL). Silviculture transitions will still be defined based on the original individual strata.

[11] The SW species group will also include FA, FB and SE in the AVI call.
[12] The SB species group will also include LT in the AVI call.

- C_SW_CD represents a small portion of the net landbase (3%) with a limited number of plots. It will be necessary to group this stratum with C_SW_AB (10%) for yield curve development (C_SW). Silviculture transitions will still be defined based on the original individual strata.
- The stratification rules for the conifer US “switch” stands (D_US) were revised from the 2011 FMP definition[13] to ensure that only stands with sufficient conifer understorey with an adequate spatial distribution are included (Weyerhaeuser 2018c, AAF 2018d). The general principle for the new rules is that the higher the deciduous overstory crown closure, the higher the threshold for understorey conifer stem density.
- The new criteria to assign switch stands (D_US) were defined as follows:

  The understorey must be ‘B’ or ‘C’ or ‘D’ density with Sw or Se as the leading species.
  And
  - ‘A’ density pure deciduous overstorey (BCG=’DX’); and
  - a conifer understorey > 250 stems per hectare (UDEN_CL ≥ 4).
  Or

  - ‘B’ density pure deciduous overstorey (BCG=’DX’); and
  - a conifer understorey > 500 stems per hectare (UDEN_CL ≥ 5); and
  - a canopy pattern[14] > 2.
  Or
  - ‘C’ density pure deciduous overstorey (BCG=’DX’); and
  - a conifer understory > 750 stems per hectare (UDEN_CL ≥ 6); and
  - a canopy pattern > 2.
  Or
  - ‘D’ density pure deciduous overstorey (BCG=’DX’); and
  - a conifer understorey > 1000 stems per hectare (UDEN_CL ≥ 7); and
  - a canopy pattern > 2.

- As a result of applying the new switch stand definitions, about 55% of the net area returned to the pure deciduous yield groups (D_AB and D_CD) as compared to the 2011 FMP definition.

As per the Planning Standard Section 4.2.4.a, the calibration of yield projections for natural stands must be based on plot data from the DFA. Attributes for the Weyerhaeuser natural stand PSPs were obtained via a spatial linkage to the net landbase. Weyerhaeuser utilized the last measurement of the PSPs within the DFA net landbase for natural stand yield curve development.

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[13] In the 2011 FMP, switch stands were defined as a stand with a pure deciduous overstorey and a conifer understorey with greater than 250 stems per hectare (UDEN_CL >= 4) regardless of the density of the overstorey layer or the spatial distribution of the conifer understorey.

[14] Canopy pattern codes are described in the document titled “Inventory Enhancements - Detection of Coniferous Understorey Under Deciduous Dominant Stands” (ASRD 2006a).

2.2.3 Data Exclusions and Inclusions

The following deletions/inclusions from the initial PSP dataset were applied to build the modelling data set for the natural stand yield curve development (Table 2-2):

- The initial number of plots that fell into natural stands was 953 PSPs.
- All plots outside the timber harvesting landbase (in the passive landbase) were deleted.
- All plots that have been harvested prior to the AVI photo year were deleted.
- All influential plots with potential data issues (large atypical volumes or high suspect volumes at a young stand age) were removed from the data set.
- Plots that have been disturbed between the last measurement and the AVI photo year were removed (e.g., MPB control).
- Plots with the last measurement > 10 years from the AVI photo year were removed. These were mostly PSPs that were systematically removed from further re-measurements in 2006 by creating a subset of the original sample grid as part of Weyerhaeuser's Growth and Yield Monitoring Plan (J.S. Thrower & Associates 2006).
- Plots that were in MPB-attacked stands according to the AVI but were last measured prior to the attack were also removed as per Weyerhaeuser's MPB Strategy document (Weyerhaeuser 2018a). The last measurement of these plots does not reflect the mortality observed in the stand at the time of the AVI photo year and therefore had to be excluded.
- Weyerhaeuser's Grande Prairie FMA was hit by MPB inflight from British Columbia in 2006 and again in 2009. The AVI photo interpretation identifies beetle-killed stands and the extent of loss in crown closure. However, there is no stand-specific information on the year of the MPB attack in the AVI. Weyerhaeuser used the recommendations by Devin Letourneau, Forest Health Officer (GoA) based on his assessment of helicopter flights and multiple observation flights in the Weyerhaeuser Grande Prairie FMA area to assign year of attack as follows:
    - 2006 MPB attack year for the Saddle Hills;
    - 2009 MPB attack year for the Main Block from township 66 and north;
    - 2010 MPB attack year for the Main Block from township 63 to 65; and
    - 2014 MPB attack year for the Main Block from township 58 to 62.
- Beetle-killed stands in the AVI can be identified based on the following rules: MOD1="BK"/"SN" or MOD2="BK"/"SN" with the corresponding extent >0.
- Only the last measurement of each PSP was used in the development of natural stand yield curves (within 10 years of the AVI photo year).

Table 2-2. Plot netdown in natural stands.

Plot Netdown		Number of Plot Locations
Initital number of plots that fall into natural stands as per CLB		**953**
Outside Active Landbase*		
1. Non-Forested	1. Anthropogenic Non-Vegetated	4
	2. Naturally Non-Vegetated	4
	3. Anthropogenic Vegetated	11
	4. Non-Forest Vegetated	22
	5. Non-Forested Dispositions	11
	6. Non-Forested Burn	6
2. Administrative Removals	1. Non-Contributing Dispositions	2
	2. Private	1
3. Buffers	1. Large Lake	6
	3. River	22
	4. Stream	55
	5. Trumpeter Swan Buffers	2
4. Non-Merchantable	1. Larch	18
	2. Black Spruce	10
	3. A-Density DX Stands	22
	4. Low Density	7
	5. Subhydric Poor/Very Poor	26
	6. Stands Heavily Impacted by MPB	1
	7. Low Productivity (TPR = U)	11
	8. Low Productivity Within Caribou Range	11
5. Subjective	1. Steep Slopes	5
	3. Trapper Cabin	3
	7. Unique Areas	2
	8. Isolated	3
Plot Deletions	Deactivated before AVI photo	1
	Excessive volumes (550m^3/ha+)	7
	Suspect (MPB cut control)	3
	Last measurement >10 years since AVI photo	181
	Last measurement before MPB-attack of stand	20
Total observations used for natural yield curves		**476**

** Netdown deletion codes are described in more detail in the Landbase document (Annex IV).*

The final number of observations by yield stratum is shown in Table 2-3. Outliers and influential points that were removed are listed in Appendix I.

Table 2-3. Number of plots by yield group.

Yield Group	Yield Curve	Number of Plots (#)	(%)
D_AB	D_AB	35	7
D_CD	D_CD	89	19
D_US	D_US	28	6
DC_PL CD_PL	MX_PL	17	4
DC_SX	DC_SX	38	8
CD_SX	CD_SX	32	7
C_SW_AB C_SW_CD	C_SW	58	12
C_SWOC	C_SWOC	35	7
C_PL_AB	C_PL_AB	29	6
C_PL_CD	C_PL_CD	41	9
C_PLOC	C_PLOC	58	12
C_SB	C_SB	16	3
Totals		**476**	**100**

2.2.4 Landbase Representation

The representation of the net landbase by the PSP data is shown by height class in Table 2-4 and by age class in Table 2-5.

Table 2-4. Distribution of natural stand PSPs and landbase area by AVI height class.

Yield		Actual by Height Class (m)						Percentage by Height Class (m)					
Group	Metric	1-5	6-10	11-15	16-20	21-25	26+	1-5	6-10	11-15	16-20	21-25	26+
D_AB	Area (ha)	95	829	3,433	10,678	27,354	8,997	0%	0%	1%	2%	5%	1%
	# Plots			1	2	23	9			0%	0%	5%	2%
D_CD	Area (ha)	23	148	2,568	36,469	70,281	24,932	0%	0%	0%	6%	12%	4%
	# Plots				23	47	19				5%	10%	4%
D_US	Area (ha)		299	2,628	11,057	18,539	5,876		0%	0%	2%	3%	1%
	# Plots				6	19	3				1%	4%	1%
MX_PL	Area (ha)	31	644	3,550	5,675	6,317	2,359	0%	0%	1%	1%	1%	0%
	# Plots			2	5	7	3			0%	1%	1%	1%
DC_SX	Area (ha)	39	256	5,007	12,063	15,266	6,410	0%	0%	1%	2%	3%	1%
	# Plots			4	15	15	4			1%	3%	3%	1%
CD_SX	Area (ha)	32	814	5,413	12,224	9,286	7,302	0%	0%	1%	2%	2%	1%
	# Plots			7	9	8	8			1%	2%	2%	2%
C_SW	Area (ha)	598	2,568	12,033	25,101	19,833	16,163	0%	0%	2%	4%	3%	3%
	# Plots		2	5	28	11	12		0%	1%	6%	2%	3%
C_SWOC	Area (ha)	185	1,438	6,689	15,074	8,608	3,800	0%	0%	1%	2%	1%	1%
	# Plots		1	4	14	10	6		0%	1%	3%	2%	1%
C_PL_AB	Area (ha)	65	1,210	7,592	16,529	7,524	1,400	0%	0%	1%	3%	1%	0%
	# Plots			5	16	6	2			1%	3%	1%	0%
C_PL_CD	Area (ha)	67	934	13,874	30,029	11,447	996	0%	0%	2%	5%	2%	0%
	# Plots			9	25	6	1			2%	5%	1%	0%
C_PLOC	Area (ha)	101	2,052	19,024	33,427	12,960	1,982	0%	0%	3%	6%	2%	0%
	# Plots		1	10	34	10	3		0%	2%	7%	2%	1%
C_SB	Area (ha)	31	1,685	7,371	7,636	287	13	0%	0%	1%	1%	0%	0%
	# Plots		2	6	7	1	0		0%	1%	1%	0%	0%

Table 2-5. Distribution of natural stand PSPs and landbase area by age class.

Yield Group	Metric	Actual by Age Class 1-50	51-100	101-150	151-200	200+	Percentage by Age Class 1-50	51-100	101-150	151-200	200+	Total Area/#	%
D_AB	Area (ha)	2,822	31,392	17,117	55		0%	5%	3%	0%		51,386	8%
	# Plots		22	13				5%	3%			35	7%
D_CD	Area (ha)	2,111	88,982	43,295	32		0%	15%	7%	0%		134,420	22%
	# Plots		60	29				13%	6%			89	19%
D_US	Area (ha)	3,532	22,486	12,369	10		1%	4%	2%	0%		38,398	6%
	# Plots		19	9				4%	2%			28	6%
MX_PL	Area (ha)	1,954	7,074	9,339	210		0%	1%	2%	0%		18,576	3%
	# Plots	1	5	11			0%	1%	2%			17	4%
DC_SX	Area (ha)	1,043	25,599	12,363	37		0%	4%	2%	0%		39,042	6%
	# Plots	1	27	10			0%	6%	2%			38	8%
CD_SX	Area (ha)	566	19,472	14,646	387		0%	3%	2%	0%		35,071	6%
	# Plots		20	12				4%	3%			32	7%
C_SW	Area (ha)	1,404	29,706	38,225	6,637	322	0%	5%	6%	1%	0%	76,295	13%
	# Plots		23	32	3			5%	7%	1%		58	12%
C_SWOC	Area (ha)	650	10,620	21,204	3,294	27	0%	2%	3%	1%	0%	35,795	6%
	# Plots		6	24	4	1		1%	5%	1%	0%	35	7%
C_PL_AB	Area (ha)	916	7,982	24,121	1,289	12	0%	1%	4%	0%	0%	34,320	6%
	# Plots		3	25	1			1%	5%	0%		29	6%
C_PL_CD	Area (ha)	876	13,382	40,134	2,951	6	0%	2%	7%	0%	0%	57,348	9%
	# Plots		10	29	2			2%	6%	0%		41	9%
C_PLOC	Area (ha)	1,467	14,587	47,044	6,229	218	0%	2%	8%	1%	0%	69,546	11%
	# Plots		13	38	7			3%	8%	1%		58	12%
C_SB	Area (ha)	19	2,409	11,150	3,025	420	0%	0%	2%	0%	0%	17,023	3%
	# Plots		3	7	5	1		1%	1%	1%	0%	16	3%

There is close representation of the landbase by height class; although the 16-20 m height class in the C_SW yield group is slightly overrepresented and the 21-25 m height class in the D_CD yield group is slightly underrepresented. There is also reasonably close representation of the landbase by age class. There is an underrepresentation of the 51-100 years age class in the D_CD yield group and overrepresentation occurs in the 51-100 years age class in the DC_SX yield group.

Overall, the D_CD yield group is under-represented and the DC_SX yield group is slightly over-represented by the available plots.

2.3 Data Preparation

In preparation for the 2019 FMP, Weyerhaeuser spent a considerable amount of time reviewing and, where possible, correcting their PSP data using validation code which provided checks within and between measurements for each plot. In the last 2 years in preparation of the FMP, Weyerhaeuser also thrived to re-measure most PSPs thus ensuring that a new measurement is available within 5-10 years of the AVI photo year. Additional plot-level age data was also collected by the main species groups wherever it was feasible.

In addition, all plots selected for the Provincial Growth and Yield Initiative (PGYI) were further cleaned to meet rigorous PGYI standards (AESRD 2014). All findings from the PGYI conversion process were incorporated into the FMP data preparation phase to ensure the best quality data possible.

2.3.1 Deletions

All trees with "dead" or "missing" condition codes were removed from the PSP dataset[15]. If the DBH and height along with the species code were all missing, the tree was presumed dead and removed. However, we recovered DBH and species where possible from previous measurements of the tree.

***AIP#1**: All trees with code 79 (mountain pine beetle) were removed from the data compilation.*

All live trees and saplings in the main plot were retained for all further tree- and plot-level compilations.

2.3.2 Missing Diameters

Missing diameters from trees ≥ 1.3 m tall were filled in using the DBH from the previous measurement where it was possible.

2.3.3 Missing Heights

As per PSP field protocols all trees were supposed to be measured for height but there were 60 trees with missing height information. The measured tree heights were first screened to remove trees with unusual height-diameter relationships using scatter plots (Figure 2). There were only 13 trees in the data set where the measured height was set to missing as a result of the data screening process.

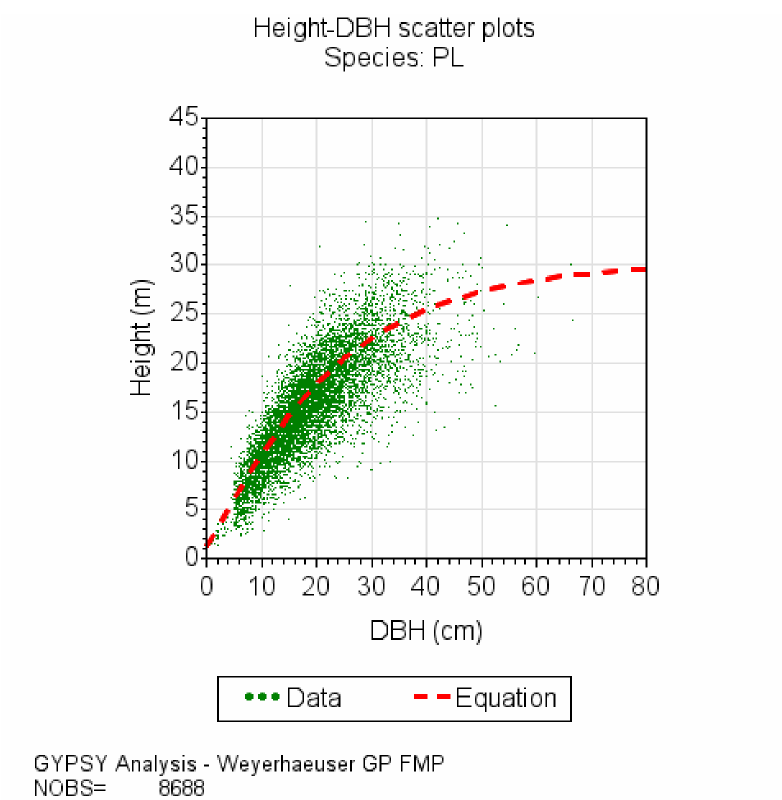

Figure 2. Height-DBH scatter for lodgepole pine for all live trees with measured height.

[15] An additional analysis regarding standing dead tree volumes was also carried out and discussed in Section 5.5.

Missing heights were predicted using Huang *et al*.'s *Population and Plot-Specific Individual Tree Height-Diameter Models for Major Alberta Tree Species* (Huang *et al*. 2013). The ratio of means approach as described in Huang *et al*. was used to adjust (localize) predicted heights based on available trees with measured heights.

All trees with measured heights were given a predicted height using Huang *et al*.'s equations. An average ratio of predicted to actual height was calculated by species, which was used to adjust the predicted heights of trees without an actual measurement. Ratios were calculated using the following rules: use ratio of means by species, plot and measurement; if no trees for that species are available, then use a ratio of means by species and plot. Any remaining trees without a valid ratio were assigned an unadjusted predicted height.

2.4 Data Compilation

Data were compiled to create species group-level inputs for the GYPSY model; these inputs could then be combined to create volume estimates by species type (coniferous vs. deciduous) for yield validation. Average density, basal area and volume were calculated on a unit-area (per hectare) basis by measurement and species group. Top height, site index and age were calculated by measurement and species group.

2.4.1 Density

Tree factors (number of stems represented by each sampled tree) were assigned to each live tree (DBH>5cm) and sapling (1.3 m height to 5 cm DBH) in the tree list based on the inverse of the respective plot size. Tree factors were then summed by species group for each PSP measurement. The sum of the tree factors represents density (stems/ha) by species group for each plot measurement.

Regeneration was not included for PSPs since high densities of small shade tolerant ingress in mature stands could impact GYPSY model simulations in a non-meaningful manner.

2.4.2 Basal Area

Basal area (cross-sectional area of each tree at 1.3 m above point of germination, represented in m^2) was calculated for each tree from measured DBH. Basal area values were then multiplied by each tree factor. Resulting values were summed by species group for each PSP by measurement.

As per GYPSY protocols, basal area must be used in the GYPSY forecasts (projections are adjusted to the observed basal area in the plot).

2.4.3 Volumes

Both gross and merchantable volumes were determined for each tree in the dataset. Volume compilation followed a standardized process developed based on equations provided in Huang's (1994a, 1994b) *Ecologically Based Individual Tree Volume Estimation for Major Alberta Tree Species*.

Natural subregion based variable exponent taper equation parameters were based on those developed by Huang (1994b) except for lodgepole pine in the central mixedwood, where Weyerhaeuser requested the use of localized taper parameters based on previous work in the FMA (Simons Reid Collins 1997).

The cylinder formula was used only below 15 cm stump height. Volume coefficients are listed in Appendix II.

Weyerhaeuser assigned the Alberta Township System (ATS) based natural subregion codes for proper linkage of the taper coefficients. Trees with zero merchantable volume were assigned a value of 0. Merchantable tree volumes were compiled to the FMP baseline utilization limits (Section 0).

Gross and merchantable volumes were then multiplied by each tree factor. Resulting values were summed by species group for each PSP.

2.4.4 Top Height

Top height was calculated by selecting the 100 largest DBH trees per hectare, by species group, from within the main plot so the target sample size for top height was 1 tree per 100 m^2 of plot size (800 or 400 m^2) whenever possible[16]. Trees marked as dead/dying, or with a broken or damaged top, fork or severe lean were excluded from top height tree selection. Saplings and regeneration were also excluded to avoid the potential selection of multiple cohorts. All trees were included for top height selection regardless of whether heights were measured or predicted (recall that predicted heights were localized using measured plot data). Average top height was then calculated for each PSP by species group[17].

2.4.5 Stand Age

Stand age was calculated for each plot measurement using the difference between AVI stand origin of the SoPM[18] and measurement year. No correction for growing season was done due to the resolution and accuracy of the origin calls for mature natural stands in the inventory.

2.4.6 Species Group Age

In the Weyerhaeuser PSPs, site trees were sampled within the plot, with a target of 3 trees per dominant species. If the plot was in a mixedwood stand, then two of the dominant conifers and one of the dominant deciduous stems were selected. The site trees had to be dominant or codominant stems that did not show signs of suppressed height growth and any major stem form defects. For each tree, height, DBH and total age were recorded (where not impacted by rot). Detailed field protocols can be found in the Weyerhaeuser PSP Manual (Apical Forestry Consulting Ltd. 2015).

Site tree age data was compiled by the following steps:

1. Review site tree information and remove duplicates or correct the age data.

2. Calculate origin from total age and measurement year for all site trees.

3. Calculate average origin by species group and plot. Median origins were also calculated[19].

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[16] Top height was calculated in some instances from a minimum of 2-4 trees/plot where there were not enough eligible top height trees in the plot.

[17] Dominant/co-dominant height and average tree height were also calculated in each plot by species group for potential model substitution, if top height was not available or it was suspect.

[18] Note that for switch stands (D_US stratum) management decisions are based on the understorey age but the reporting is completed on the age of the overstorey. When creating the D_US yield curves, the overstorey age is used to drive the projections (Weyerhaeuser 2018c).

4. Append average origin year back onto to each plot/measurement by species group.

Site-tree based origins were the main source of species group ages for the plots.

In addition, during the early years of the PSP program age trees in the plot buffer were sampled. Only the average conifer and deciduous total age were recorded in the plot measurement header (AMBIG_SOFT and AMBIG_HARD). Selection was based on dominant or co-dominant trees of the major species group of the main plot. There was no information regarding the selection of age trees in the buffer based on top height criteria.

Calculation of species group was based origins from age trees followed the steps outlined above for site trees. However, age tree-based origins were only used as supplemental information in cases where species group based plot age was not available from the site tree data.

2.4.7 Site Index

Site index was calculated using the same dataset used for species group age calculations using GYPSY site index equations (Huang *et al*. 2009a). Plot level species group age and top height was used as input.

Plot level top height by species group was based on the *topht_w* variable for close to 90% of the stand components (minor tree defect were allowed in the calculations, but no defect were allowed that would cause height growth impediment such as suppressed, dead or broken top, dying, fork or severe lean). For some stand components (plot measurement and species group) where top height was not available, dominant-codominant height was used (6.0%) and for very minor stand components (basal area<0.25m^2/ha) we used average height as a proxy in modeling (6.6%) which mostly represented a minor species component in the plot. Plot level species ages were based on site tree based origins or age tree based origins as a secondary option.

Maximum site index values were set by species group: AW-30 m, PL/SW-25 m, SB-18 m. Only 3 SW/PL and 1 SB component were slightly above the maxima and their site index values were set to missing.

Where site index was not available due to missing species group age for a plot measurement[20], the average site index by plot (all measurements)/species group was used. If the site index was still not available then the average site index by yield stratum/species group was used to fill in missing values; if a SI value was still not available for a specified species group within that yield stratum, an overall average was used.

[19] Any larger difference between the median and average origin was noted as by definition median is less sensitive to extreme values.

[20] Approximately 80% of the species ages were available from site trees (68%) or buffer tree ages (12%).

2.5 Modelling

2.5.1 Growth Modelling Approach

The GYPSY growth model (Huang *et al*. 2009a, 2009b) was selected for model projections. Additional constraints governed how the model was used. The Planning Standard requires use of inventory age for characterizing plots for yield validation and direct linkage to the inventory and FMP timber supply analysis.

The modelling approach followed the methodology outlined for natural (unmanaged stands) in the document titled *Use of GYPSY for Natural Yield Curve Development* (AAF 2015b).

As per the suggested methods, the 2 guiding principles were:

1. Use GYPSY to project the observed plot conditions by species group - "biological projection".

2. Adjust the average of the biological projections by yield strata to reflect the age difference between observed plot ages and the AVI stand ages.

The following sections describe the model inputs and outputs along with additional adjustments that were made to the natural stand yield curves.

2.5.2 Model Inputs

Inputs were provided as follows (for each PSP) based on the compilation methods described in Section 2.4:

- Observed plot total age by species group. Stand age was left blank and the maximum total age for the plot was calculated by the GYPSY model.
- Site index was only provided (Section 2.4.7) if the plot total age was not available for a species group so that species total age can be calculated from site index and observed top height. Site index was capped based on maxima defined by species group in Section 2.4.7.
- Observed plot top height by species group.
- Observed basal area by species group.
- Percent stocking was left blank, as recommended by Huang *et al*. (2009a) for use in natural stands.
- Observed density by species group. Because GYPSY cannot project growth for low densities (≤ 30 stems/ha), any species groups present in densities under 31 stems/ha were deleted and their projection was replaced by 0 merchantable volume[21].

[21] There were 2 plot measurements that were completely eliminated by the deletion of low density species groups. It was ensured that these plot measurements were accounted for with 0 volume projections in the average yield curve calculations in subsequent steps. There was 1 plot (606304000024), where the AW of 37.5 stems per hectare was also replaced by 0 volume projection to avoid erroneous projections of the small AW component.

2.5.3 Model Outputs

The GYPSY model was run for each PSP until age 300. GYPSY grows the stand both backwards and forwards from the input condition, producing a yield output from age 0 to 300 for each observation. GYPSY model projections were averaged by yield group using the plot maximum observed total age - this ensured that projections would have the same origin. Because plots were established on a systematic grid across the FMA area, weighting by polygon size (area) was not required.

Next the average difference between stand age (AVI-based) and the maximum total age observed in the plot was calculated by yield group (Table 2-6). The average yield projections (plot maximum total age based) were shifted by this age differential to account for differences between the AVI and plot ages and generate the finalized natural stand yield estimates by yield group.

Table 2-6. Average age offset by yield group.

Yield Group	Age Offset
D_AB	-3.1
D_CD	-0.3
D_US	-3.3
MX_PL	-2.6
DC_SX	-10.2
CD_SX	3.2
C_SW	-16.1
C_SWOC	-9.0
C_PL_AB	-15.5
C_PL_CD	-3.4
C_PLOC	-12.4
C_SB	1.3

2.5.4 Yield Adjustments

Decline due to deciduous stand breakup and mortality was underestimated in GYPSY, with yields showing insufficient reduction after maximum yield is expected. Weyerhaeuser chose to modify the resulting natural stand yield curves using an age-based mortality constant as discussed in Section 1.5.5.

Deciduous volume in natural stand yield tables is capped at 110 years, flatlined to 130 years and then it declines at such a rate that the pure deciduous component has 75 m^3/ha at 180 years.

The deciduous mortality function was applied to the deciduous component of all yield groups. However, the deciduous volume reduction in coniferous yield groups (C/CD/DC/DU) occurred at a constant rate until there was zero deciduous volume left in the stand.

Based on our PSP data, there was no evidence of significant natural stand decline in conifer volumes and therefore conifer volumes were not adjusted for additional mortality beyond the GYPSY model projections in any of the natural stand yield curves developed for the 2019 FMP.

2.5.5 Validation Statistics

Validation statistics were calculated using the most recent observation from each PSP. Percent bias, root mean squared error (RMSE) and the goodness of fit index (GOFI) were calculated for 1) the original unadjusted yield curves and 2) yield curves adjusted to account for mortality. Formulae are provided in Table 2-7.

Table 2-7. Validation statistics formulae.

$Bias = \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)}{n}$	$Bias\% = \frac{Bias}{\bar{y}} \times 100$
$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n}}$	$GoFI = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$

2.6 Results

2.6.1 Natural Stand Yield Curves

Preliminary (uncapped) yield curves are presented in Figure 3. Final (capped/adjusted) yield curves are presented in Figure 4. Adjustments for deciduous mortality had only a slight impact on the predicted final yields in the deciduous volumes at the older stand ages as generally older age classes did not have any data.

2.6.2 Validation Against Plot Data

Figure 5 presents the conifer merchantable yield for natural stands by yield stratum (capped). Yields are compared against the most recent observation from PSPs, grouped into 20-year intervals. Grey boxes represent the 95% confidence interval for the data, with the middle bar representing the mean. Green columns represent the number of observations in the validation dataset.

Figure 6 presents the deciduous merchantable yield for natural stands by yield stratum after deciduous mortality assumptions were applied (capped). Yields are compared against the most recent observation from PSPs grouped into 20-year intervals.

Figure 7 shows the total merchantable yield for natural stands by yield stratum (capped).

There is generally a good fit relative to validation data except at older ages in the pure deciduous and deciduous mixedwood stand types.

2.6.3 Individual Plot Measurements

Individual PSP measurements were graphed against the natural stand capped conifer and deciduous volume projections. The results are presented in Appendix III. Data show the expected range of variability for this type of exercise.

2.6.4 Validation Statistics

Validation is not based on an independent data set; however, the GYPSY model based predictions are compared against the observed plot volumes that were not directly used in the development of the yield curves. Only plots in the net landbase were used for yield validation.

Results are presented in Table 2-8. Percent bias is generally low, much less than 10% for most yield curves. The CD_SX and DC_SX strata show some underprediction of conifer volumes; however, these yield curves are only supported by a modest number of plots and represent little area in the net landbase, no upwards adjustment was made. The D_US stands also have an under-representation of the conifer volumes; however, there are only 28 plots and there is considerable "noise" in the plot data where higher than expected conifer volumes show at a young inventory age. Some plots poorly represent the stratum which makes the modelling of the stratum difficult. However, the predicted volumes are comparable to the previous FMP where direct regression was applied[22].

When adjusted for mortality, the fit did not improve much for deciduous volumes for the deciduous and mixedwood yield groups. This is mainly because there were no areas and plots in older age classes in the net landbase.

The overall percent volume bias for the conifer, deciduous and total merchantable volumes are well below 10%. The weighted total bias is 2.9% for the landbase.

[22] There was considerable change in the definition of D_US stands as compared to the 2011 FMP. Using improved imagery enables the interpreters to see more conifer that was not visible on the images of previous inventories.

Table 2-8. Fit statistics for original (uncapped) and final (capped) natural yield curves.

Yield Group	# of Obs.	Area (ha)	Area (%)	Curve Type[1]	Deciduous[2] %Bias	Deciduous[2] RMSE	Conifer[2] %Bias	Conifer[2] RMSE	Total %Bias	Total RMSE
C_PL_AB	29	34,320	5.7	*Original*	*35.5*	*29*	*-0.1*	*100*	*1.1*	*102*
				Final	**35.4**	**29**	**-0.1**	**100**	**1.1**	**102**
C_PL_CD	41	57,348	9.4	*Original*	*12.2*	*58*	*0.4*	*79*	*0.9*	*79*
				Final	**12.2**	**58**	**0.4**	**79**	**0.9**	**79**
C_PLOC	58	69,546	11.5	*Original*	*50.8*	*10*	*2.4*	*117*	*3.0*	*118*
				Final	**50.8**	**10**	**2.4**	**117**	**3.0**	**118**
C_SB	16	17,023	2.8	*Original*	*32.6*	*4*	*16.1*	*86*	*16.3*	*88*
				Final	**32.7**	**4**	**16.1**	**86**	**16.3**	**88**
C_SW	58	76,295	12.6	*Original*	*4.1*	*44*	*3.0*	*118*	*3.2*	*119*
				Final	**4.1**	**44**	**3.0**	**118**	**3.2**	**119**
C_SWOC	35	35,795	5.9	*Original*	*34.9*	*51*	*6.4*	*102*	*8.5*	*112*
				Final	**34.9**	**51**	**6.4**	**102**	**8.5**	**112**
CD_SX	32	35,071	5.8	*Original*	*8.8*	*83*	*18.6*	*82*	*14.1*	*115*
				Final	**10.5**	**84**	**18.6**	**82**	**14.9**	**116**
D_AB	35	51,386	8.5	*Original*	*-3.3*	*119*	*40.5*	*43*	*1.4*	*118*
				Final	**-2.9**	**120**	**40.5**	**43**	**1.7**	**119**
D_CD	89	134,420	22.1	*Original*	*-3.8*	*100*	*34.8*	*40*	*-1.2*	*92*
				Final	**-3.6**	**100**	**34.8**	**40**	**-1.0**	**92**
D_US	28	38,398	6.3	*Original*	*-2.2*	*80*	*24.0*	*59*	*5.3*	*86*
				Final	**-2.2**	**80**	**24.0**	**59**	**5.3**	**86**
DC_SX	38	39,042	6.4	*Original*	*-3.2*	*93*	*15.0*	*70*	*3.7*	*91*
				Final	**-3.2**	**93**	**15.0**	**70**	**3.7**	**91**
MX_PL	17	18,576	3.1	*Original*	*-12.2*	*96*	*9.6*	*113*	*2.5*	*112*
				Final	**-11.0**	**96**	**9.6**	**113**	**2.9**	**112**
ALL	476	607,222	100.0	*Original*	*-2.0*		*6.5*		*2.7*	
				Final	**-1.7**		**6.5**		**2.9**	

[1] Original = original unadjusted yield curves; Final = curves adjusted for mortality assumptions.

[2] Primary volume of interest shaded in light green.

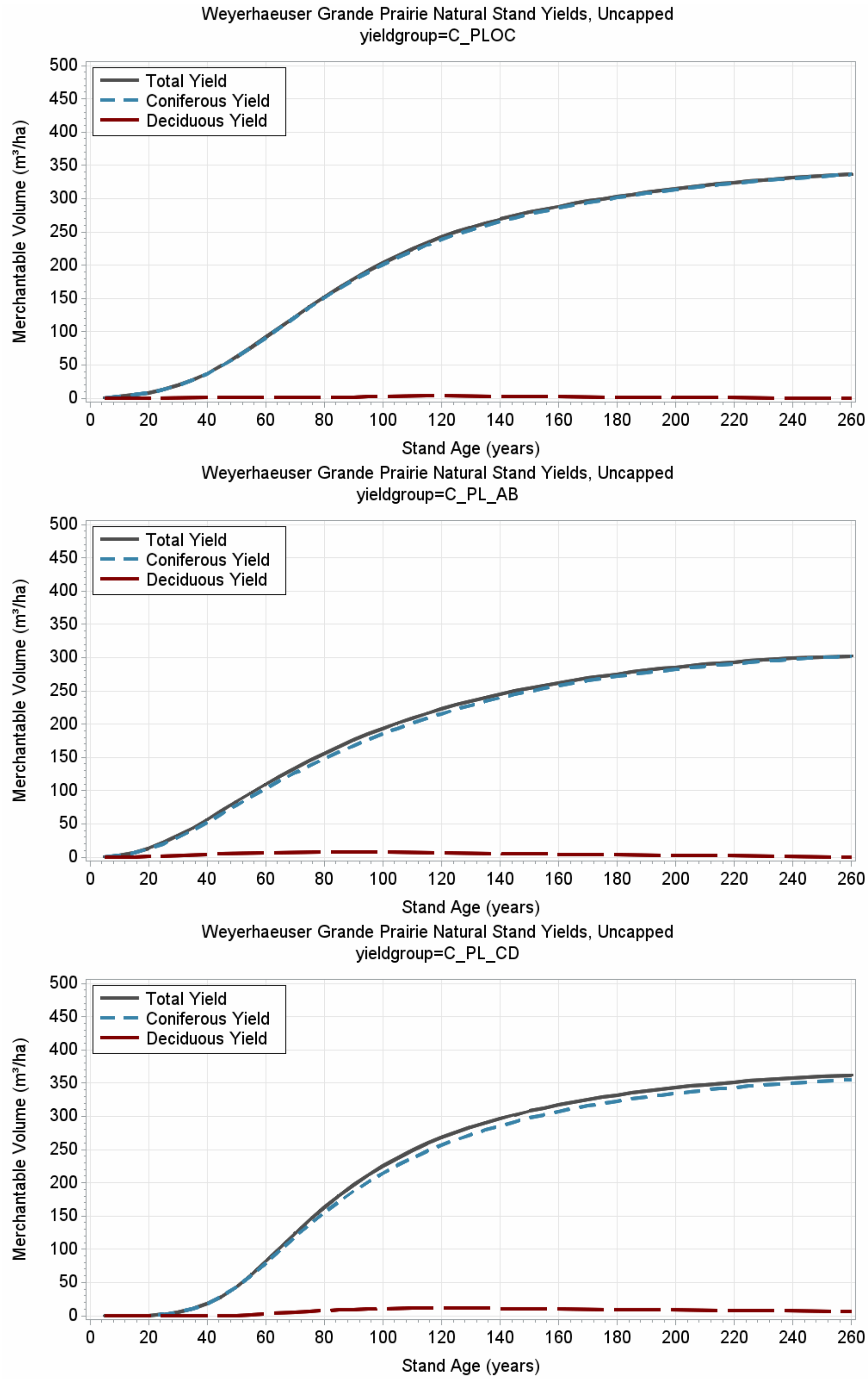


Figure 3. Natural stand yield curves (uncapped).

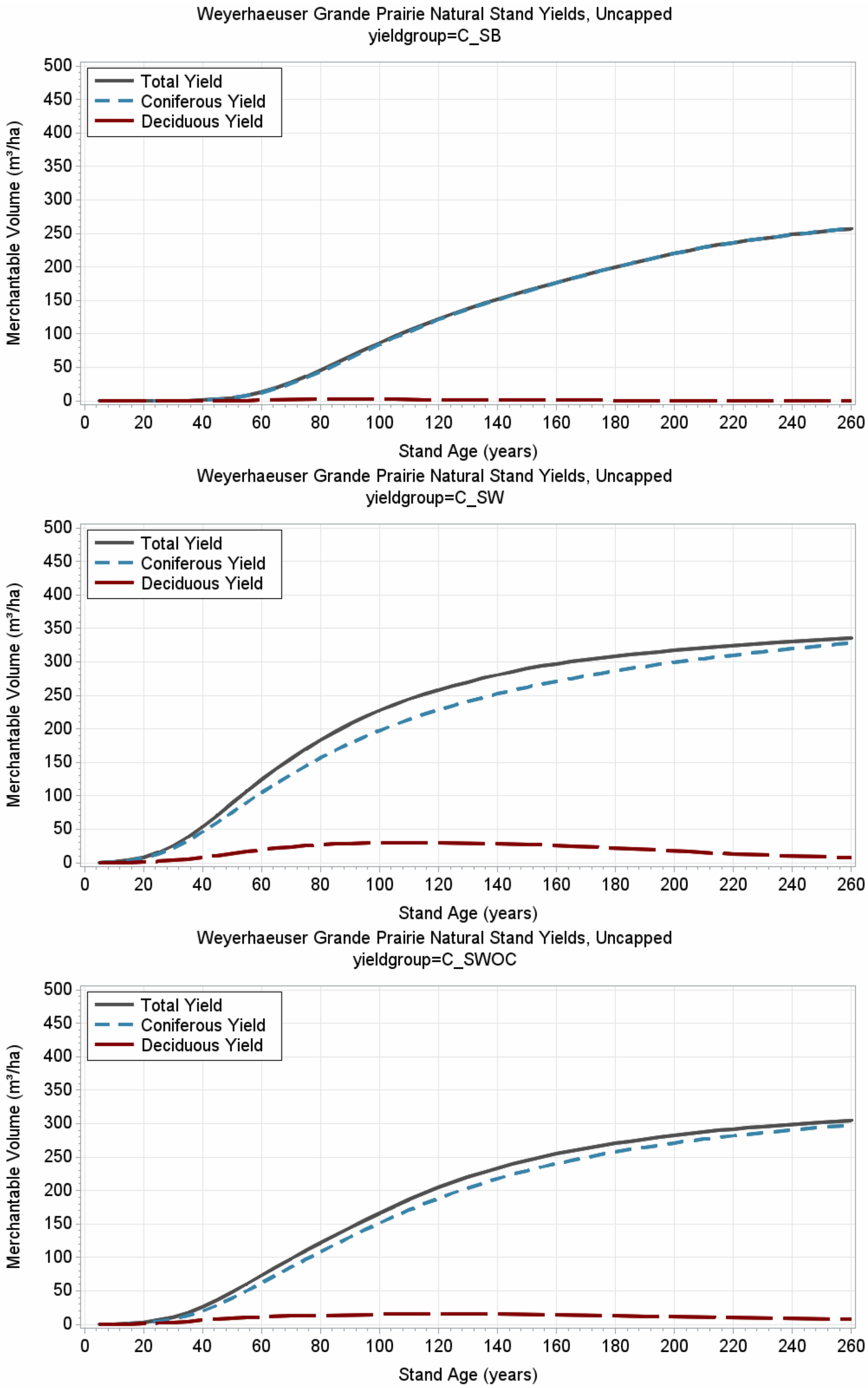


Figure 3. Natural stand yield curves (uncapped).

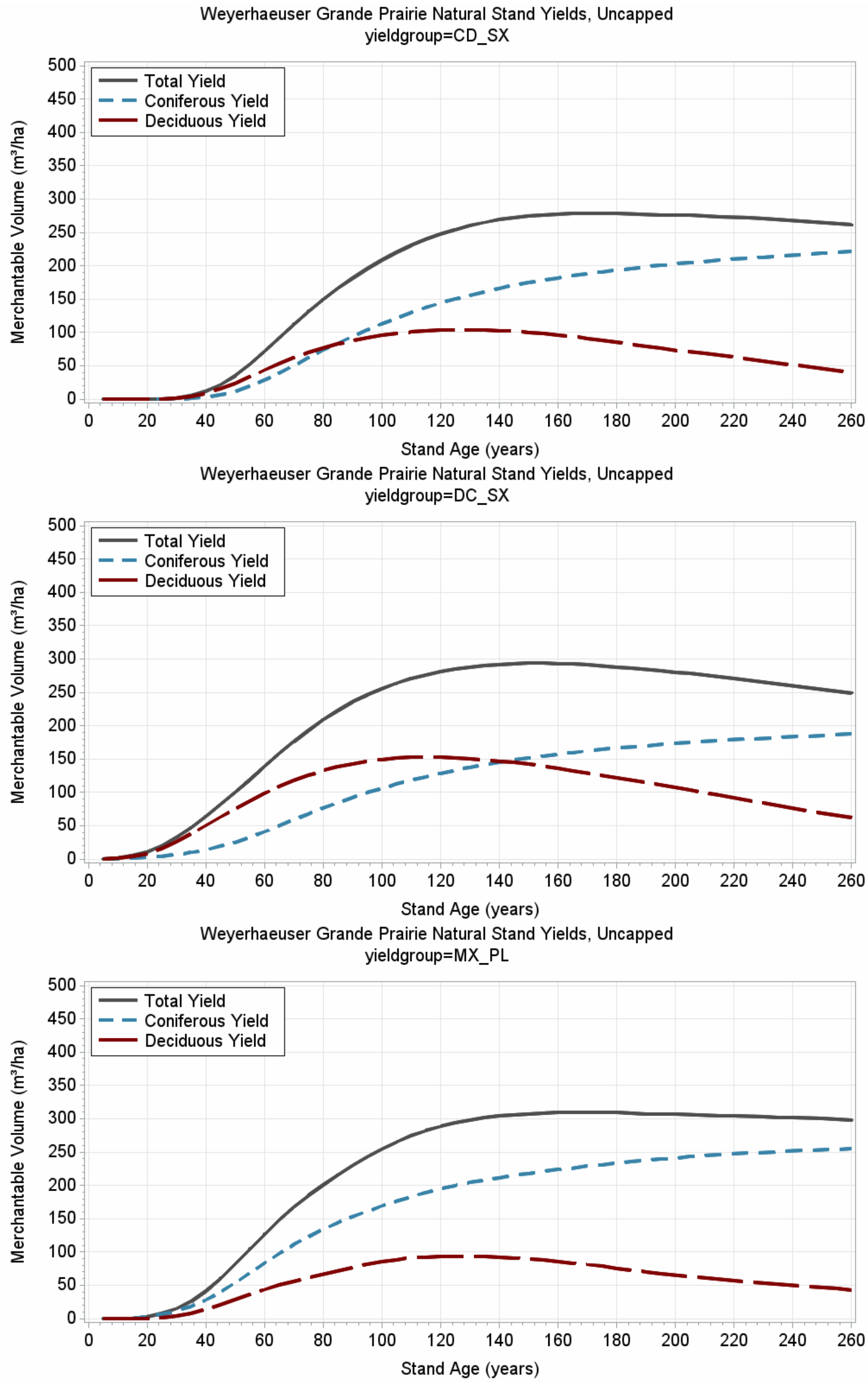


Figure 3. Natural stand yield curves (uncapped).

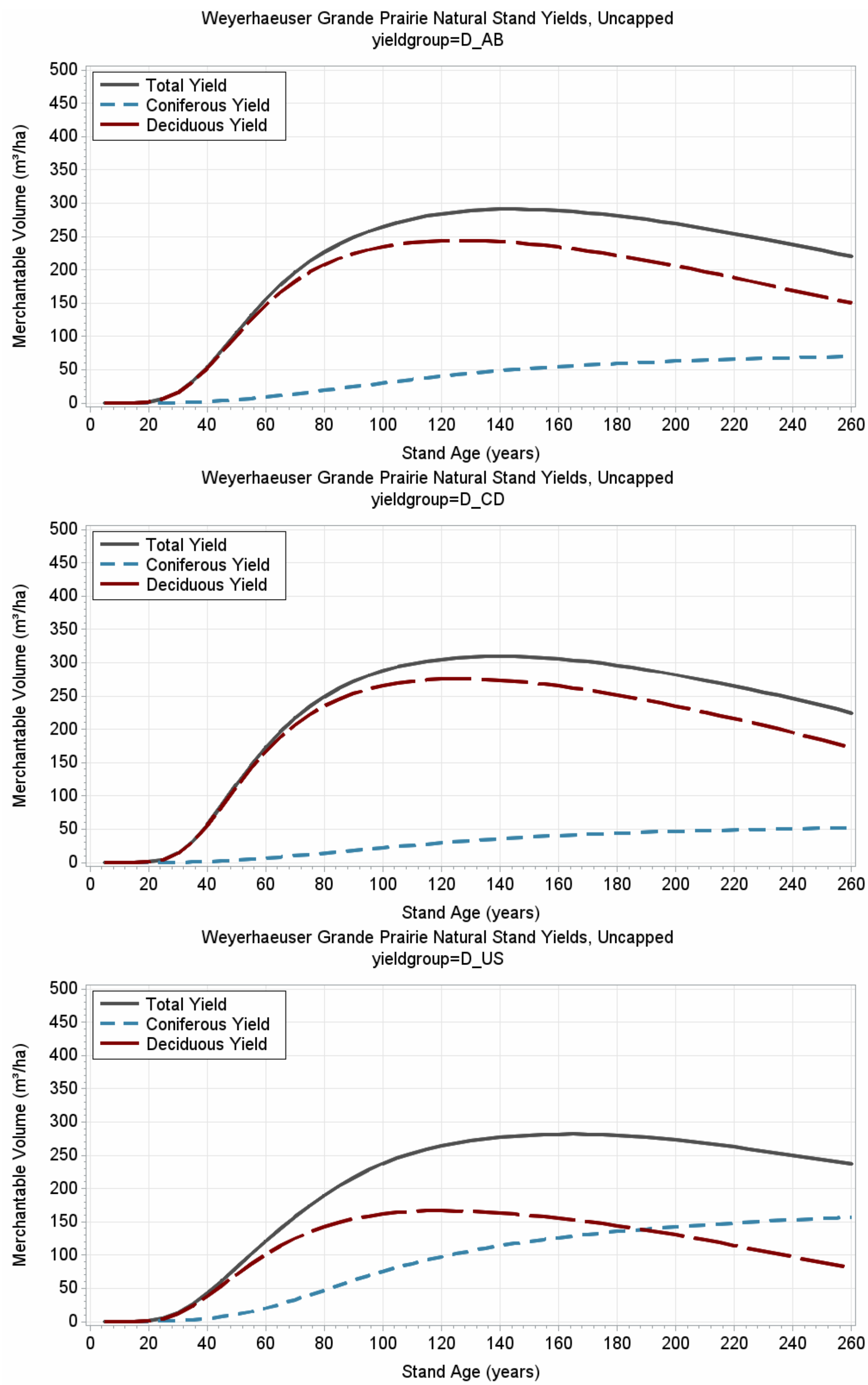
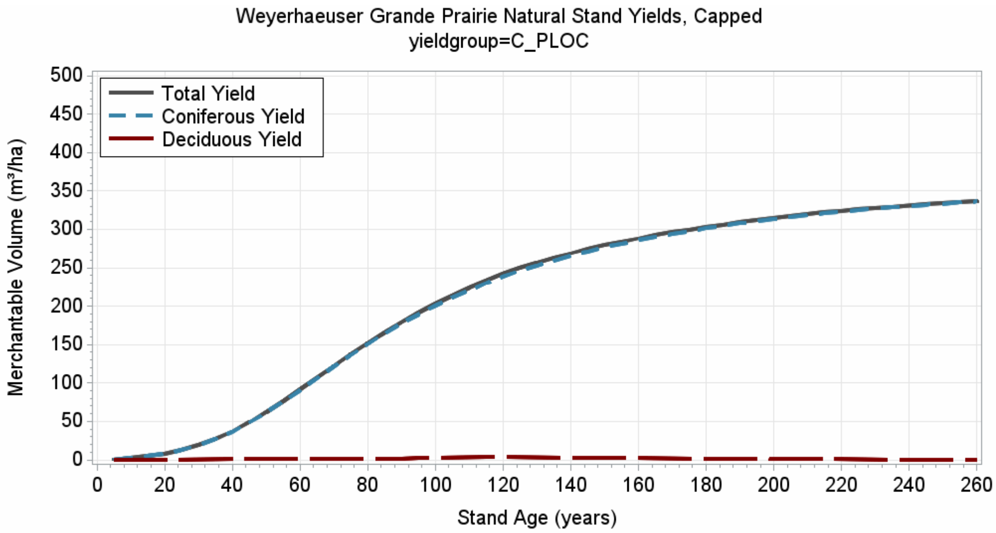
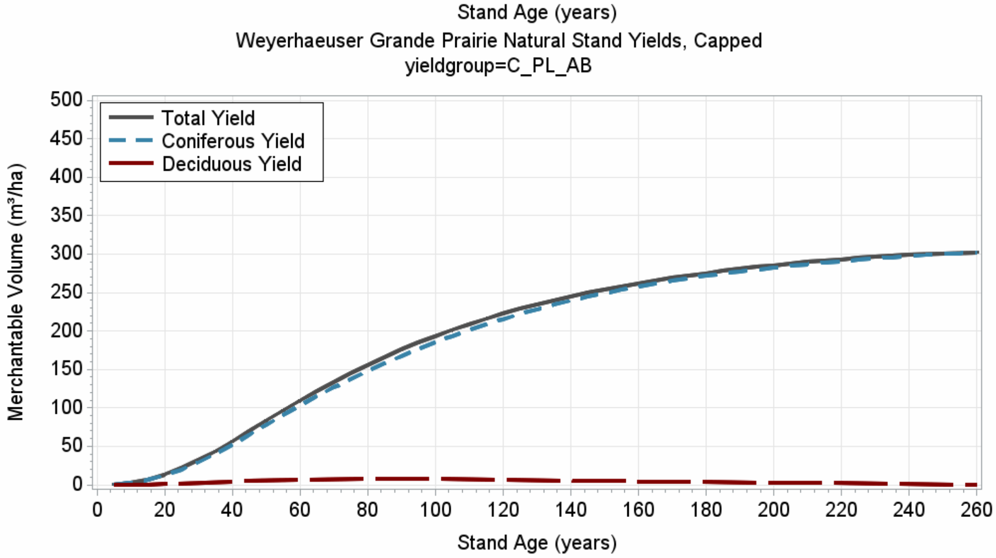


Figure 3. Natural stand yield curves (uncapped).





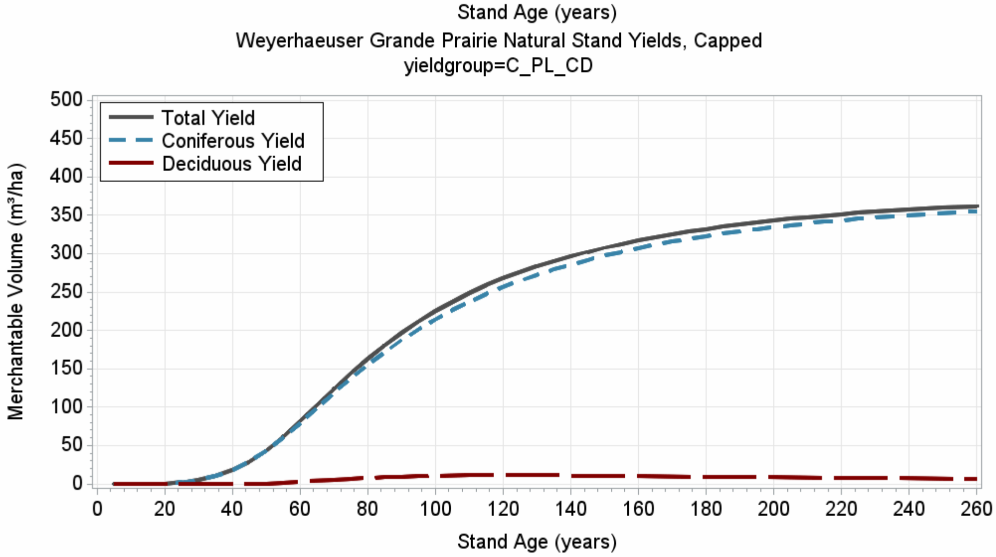


Figure 4. Final natural stand yield curves (capped).

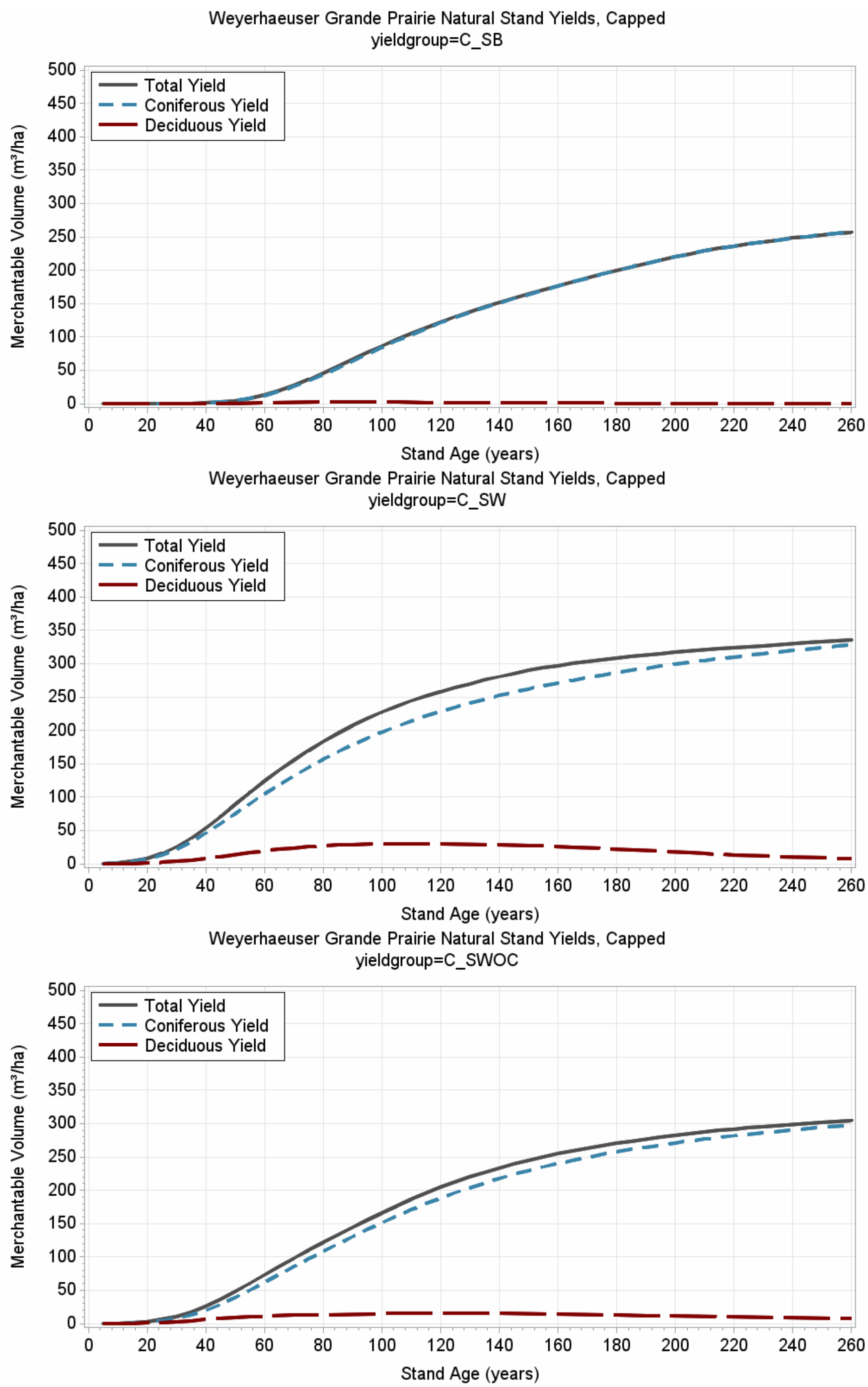


Figure 4. Final natural stand yield curves (capped).

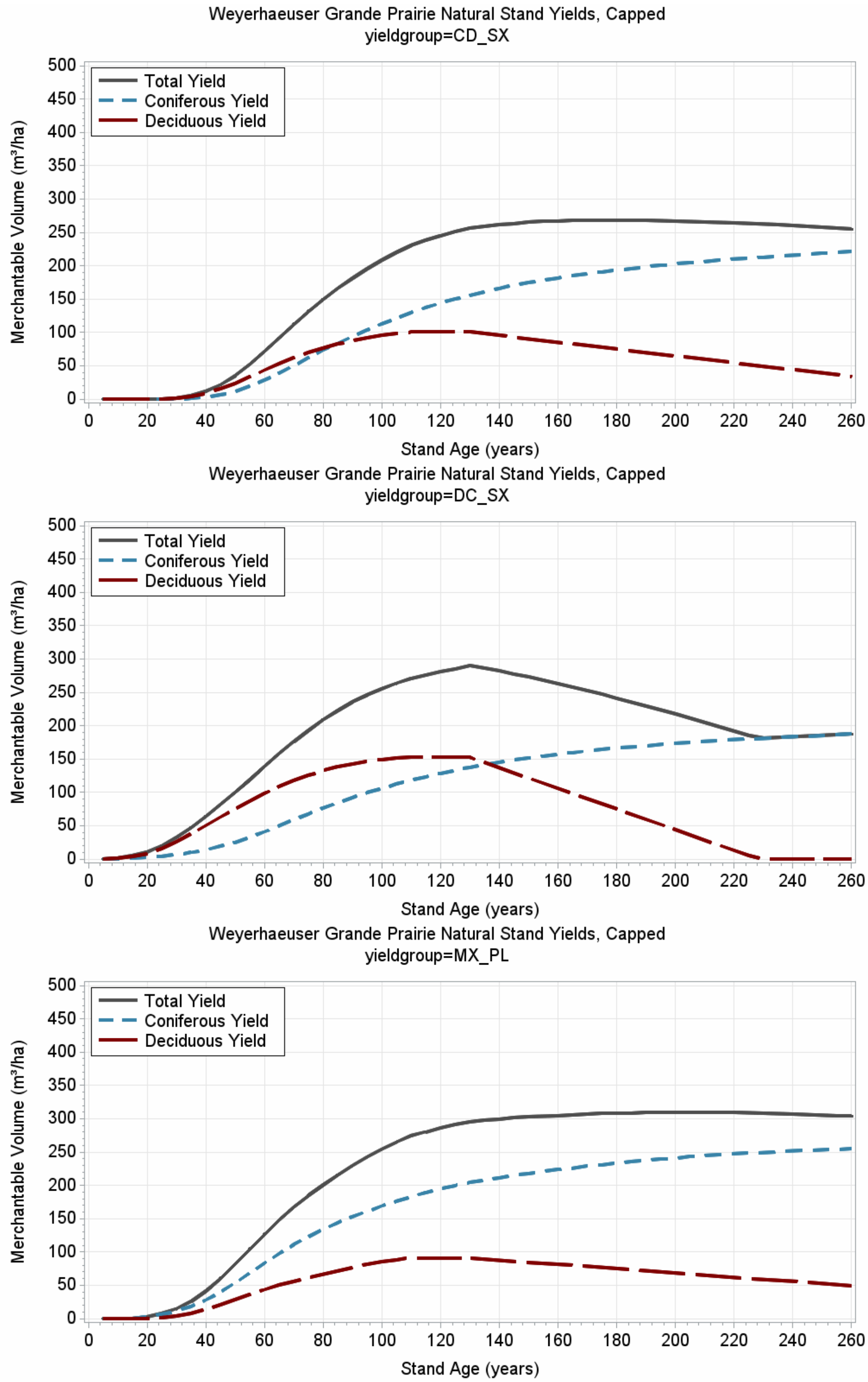


Figure 4. Final natural stand yield curves (capped).

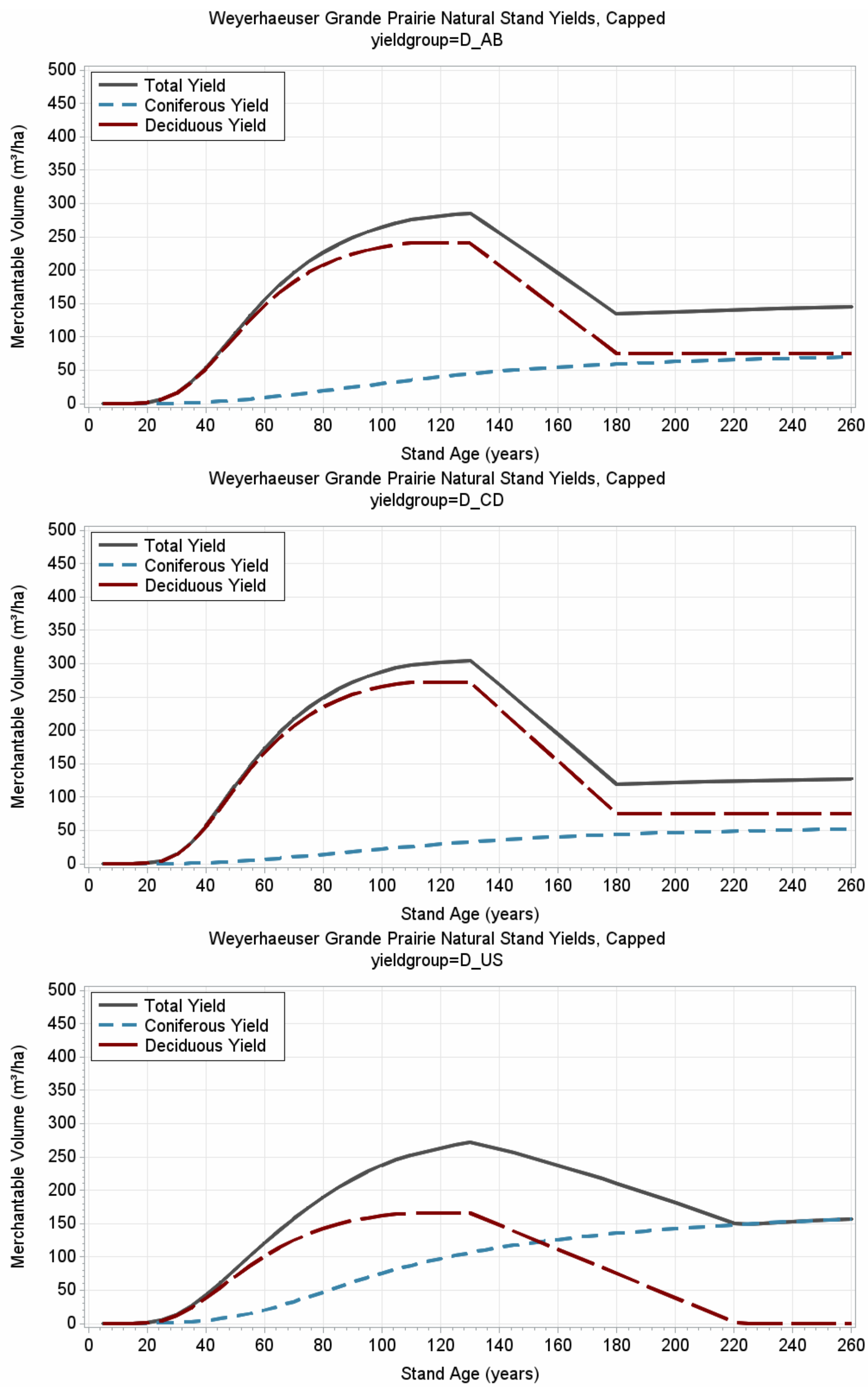


Figure 4. Final natural stand yield curves (capped).

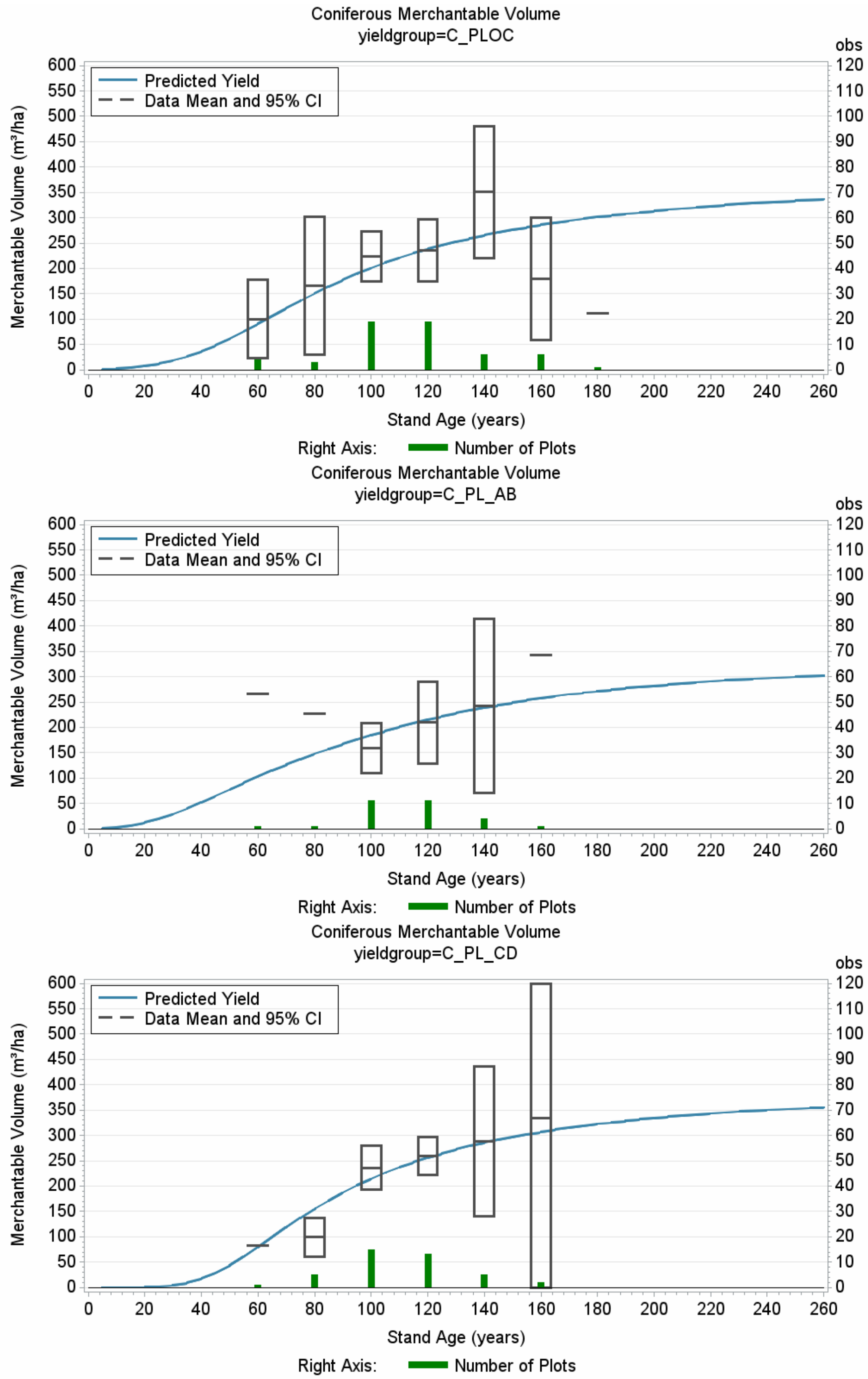


Figure 5. Final natural stand conifer yield curves against 20-year plot averages.

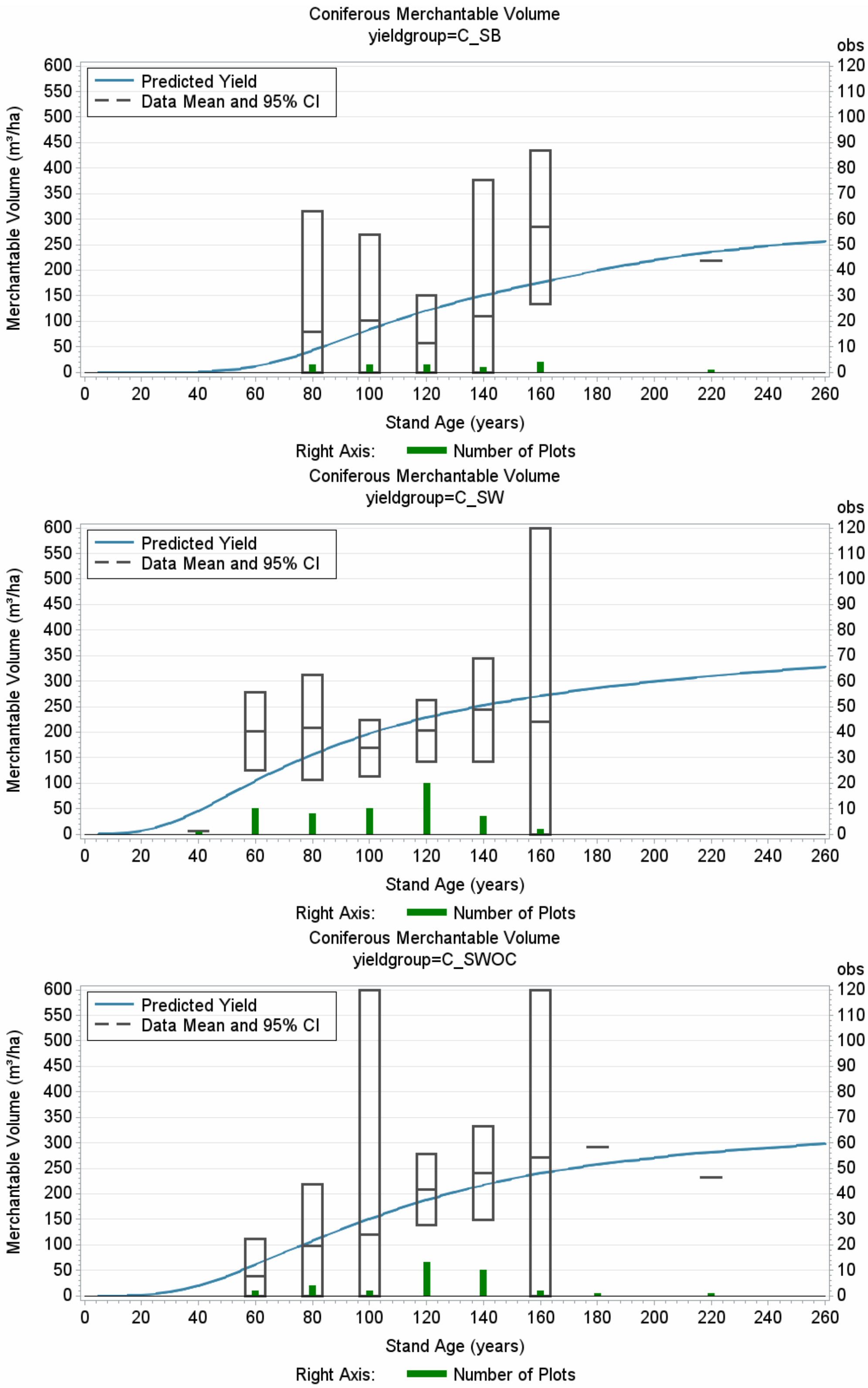


Figure 5. Final natural stand conifer yield curves against 20-year plot averages.

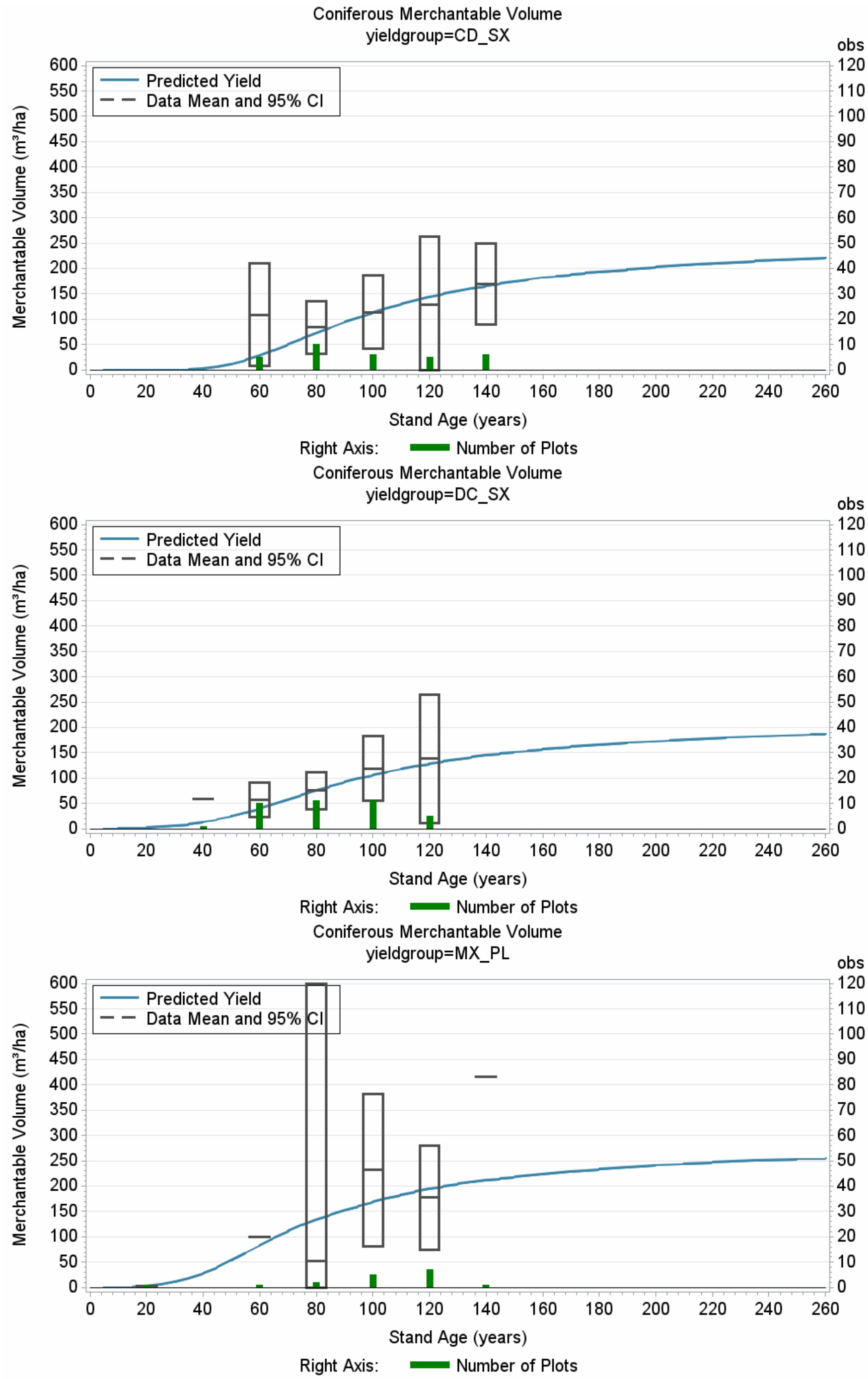


Figure 5. Final natural stand conifer yield curves against 20-year plot averages.

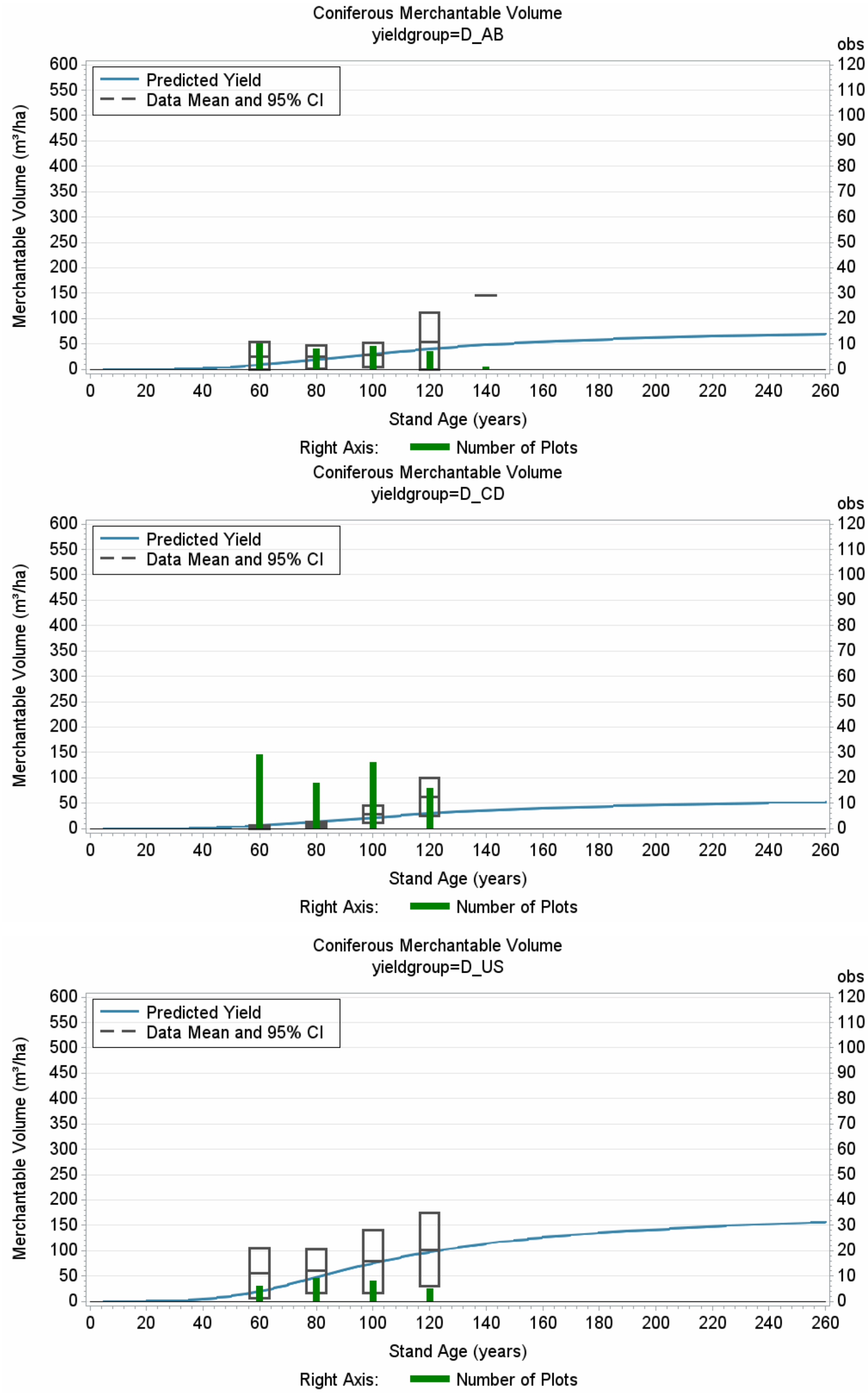
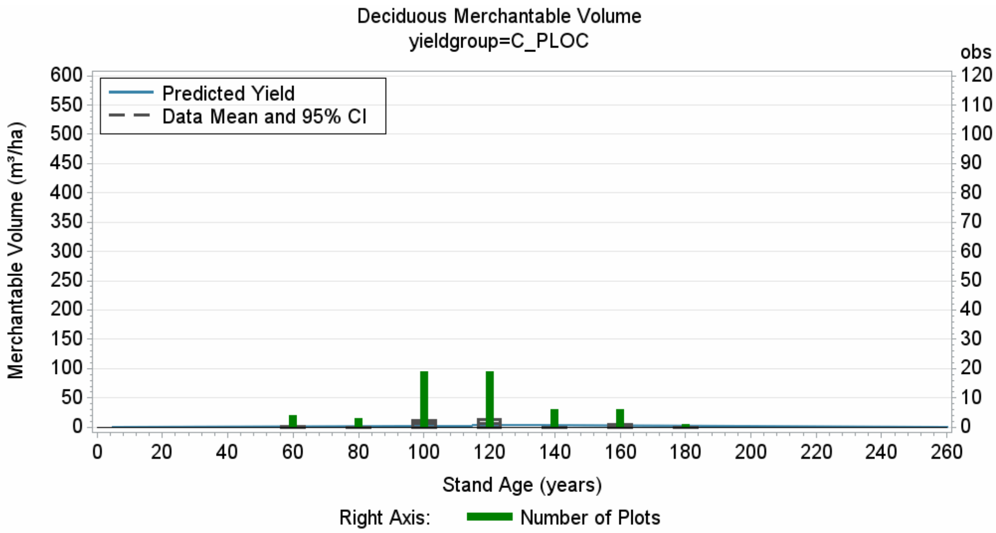


Figure 5. Final natural stand conifer yield curves against 20-year plot averages.



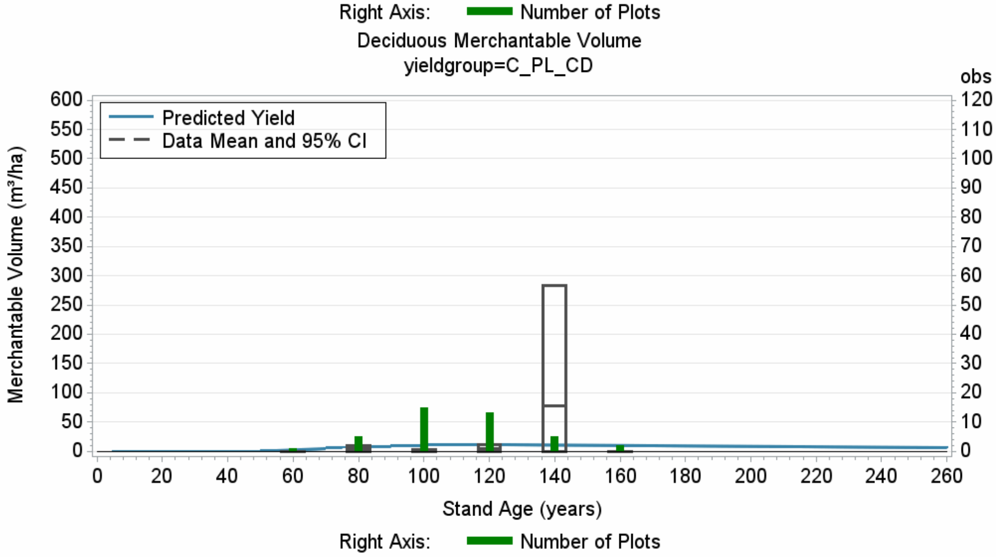


Figure 6. Final natural stand deciduous yield curves against 20-year plot averages.

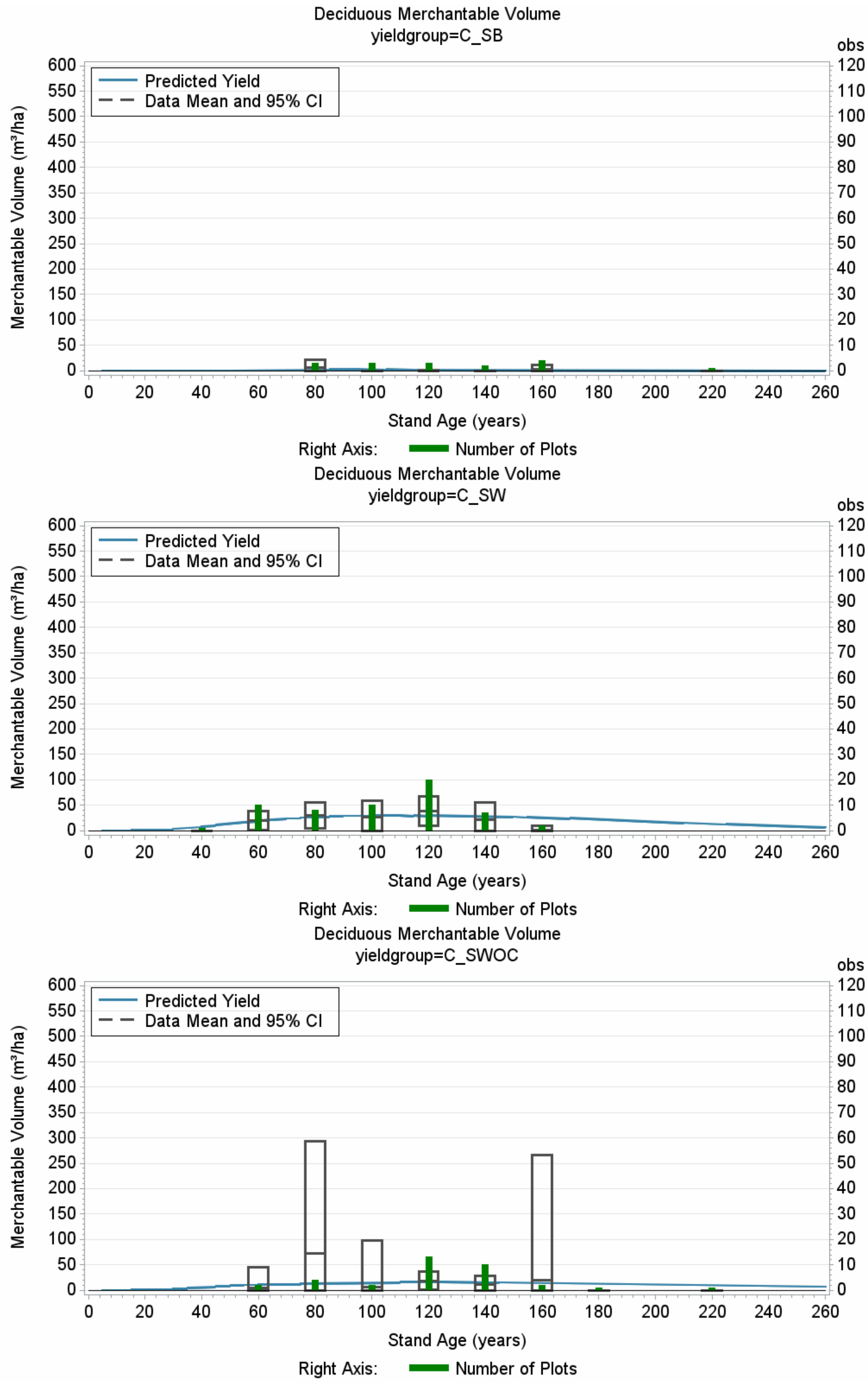


Figure 6. Final natural stand deciduous yield curves against 20-year plot averages.

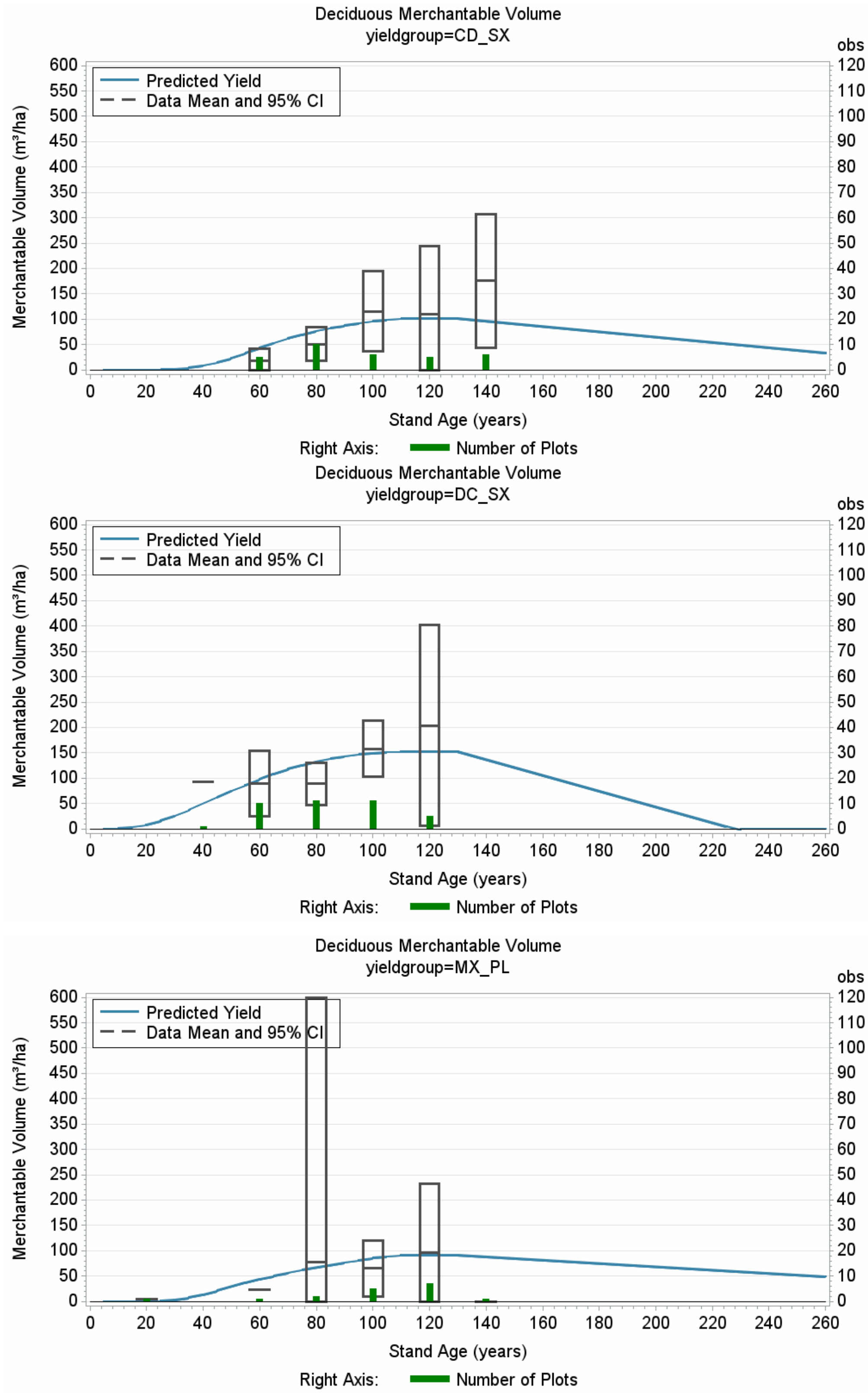


Figure 6. Final natural stand deciduous yield curves against 20-year plot averages.

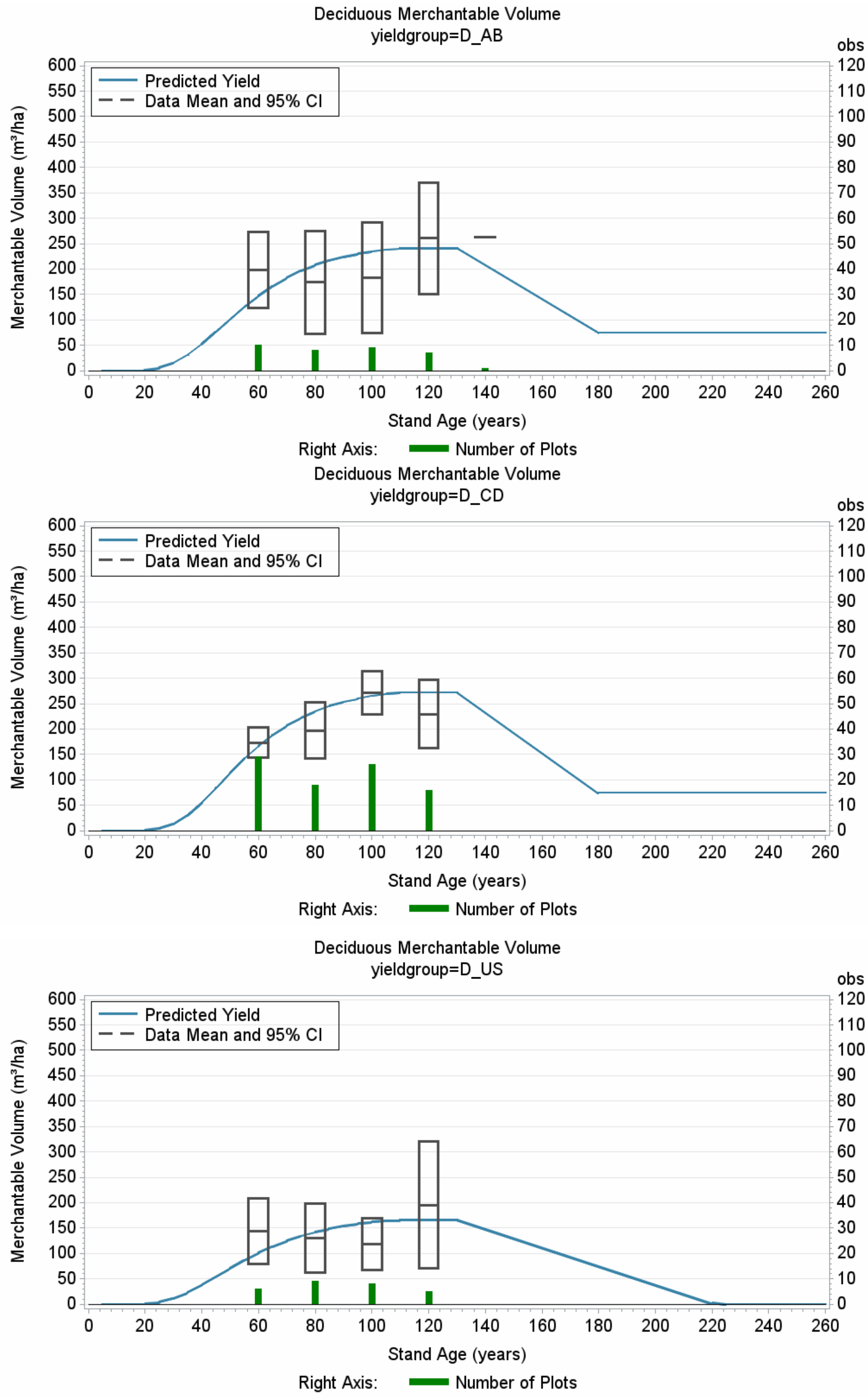


Figure 6. Final natural stand deciduous yield curves against 20-year plot averages.

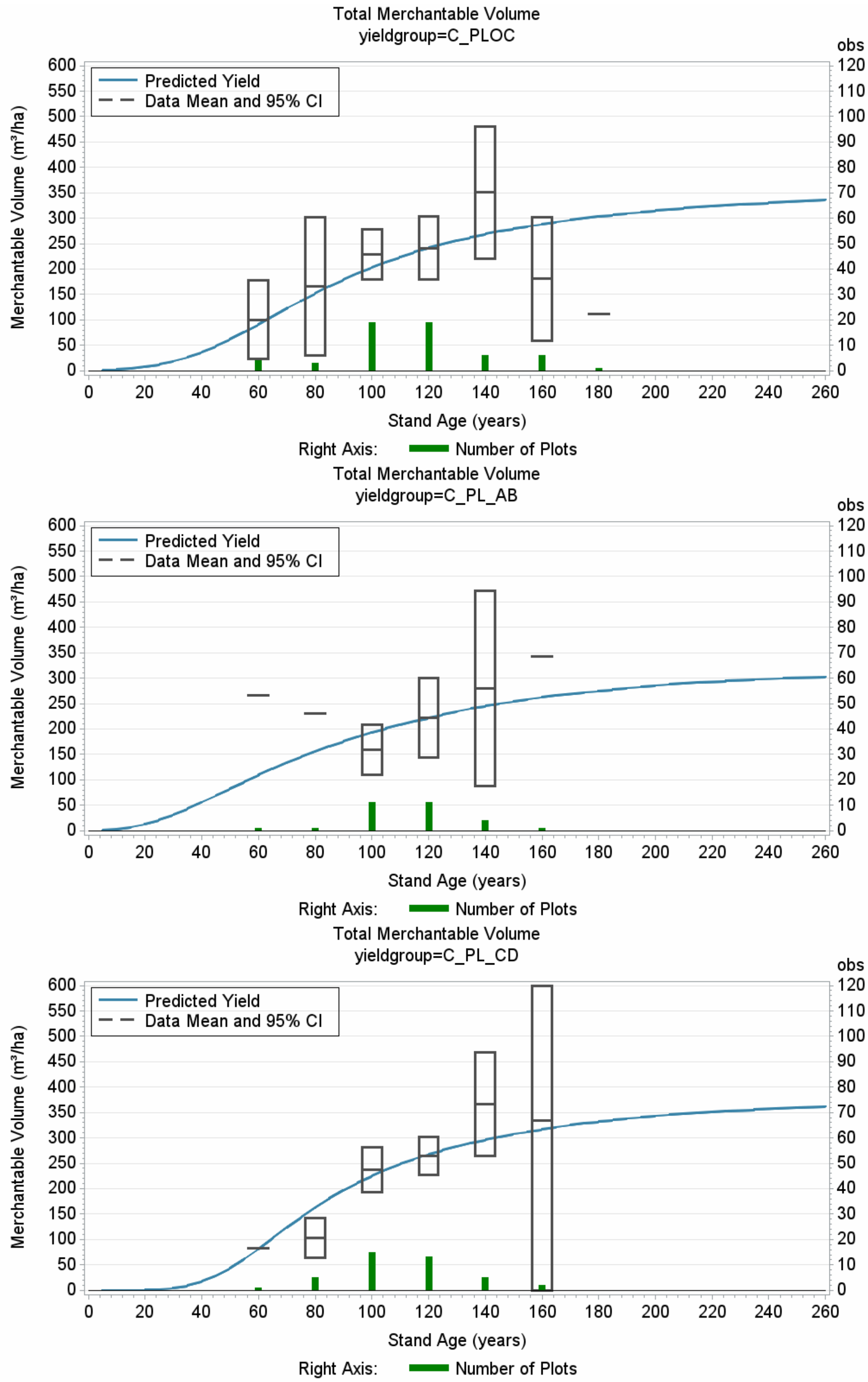


Figure 7. Final natural stand total yield curves against 20-year plot averages.

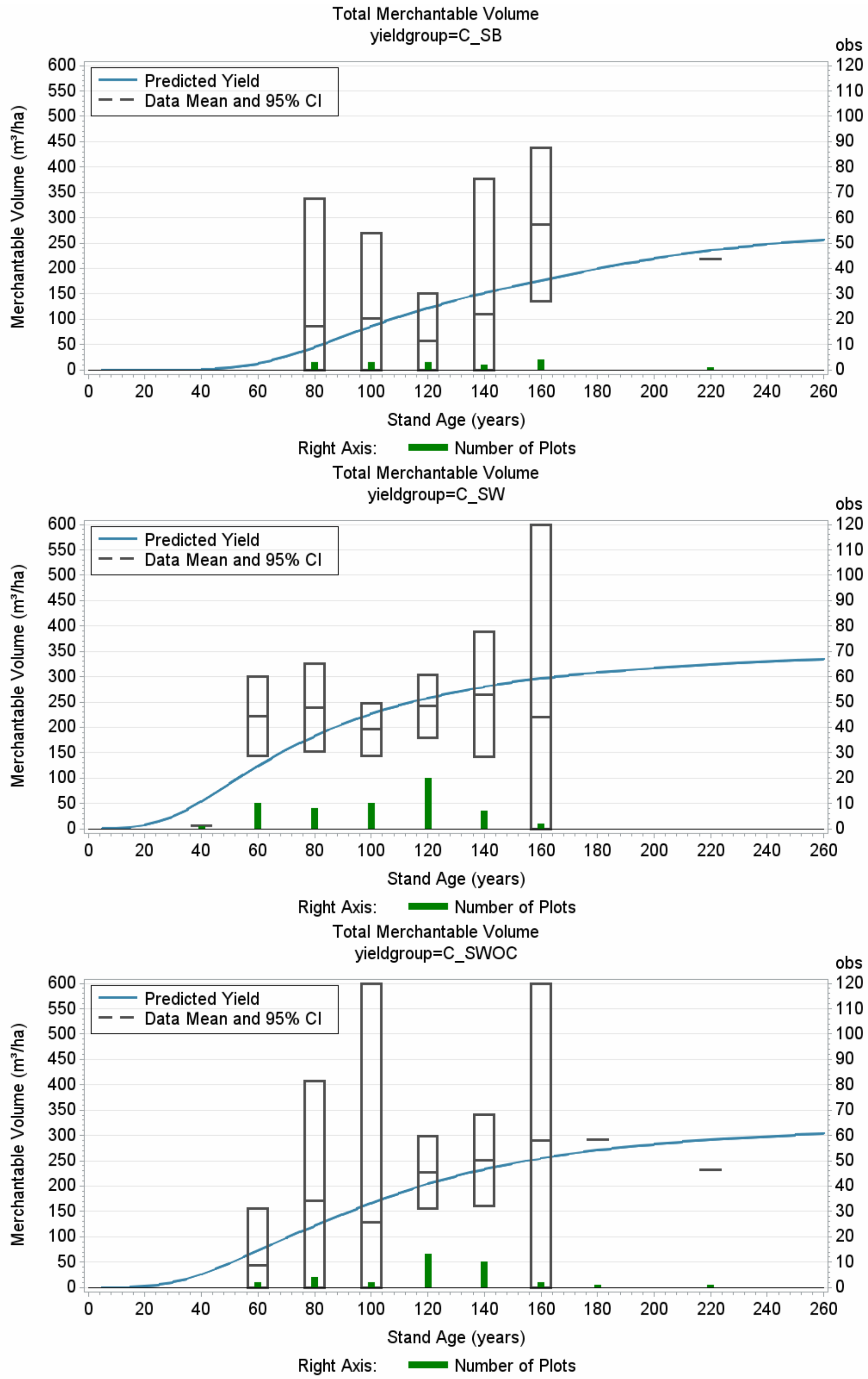


Figure 7. Final natural stand total yield curves against 20-year plot averages.

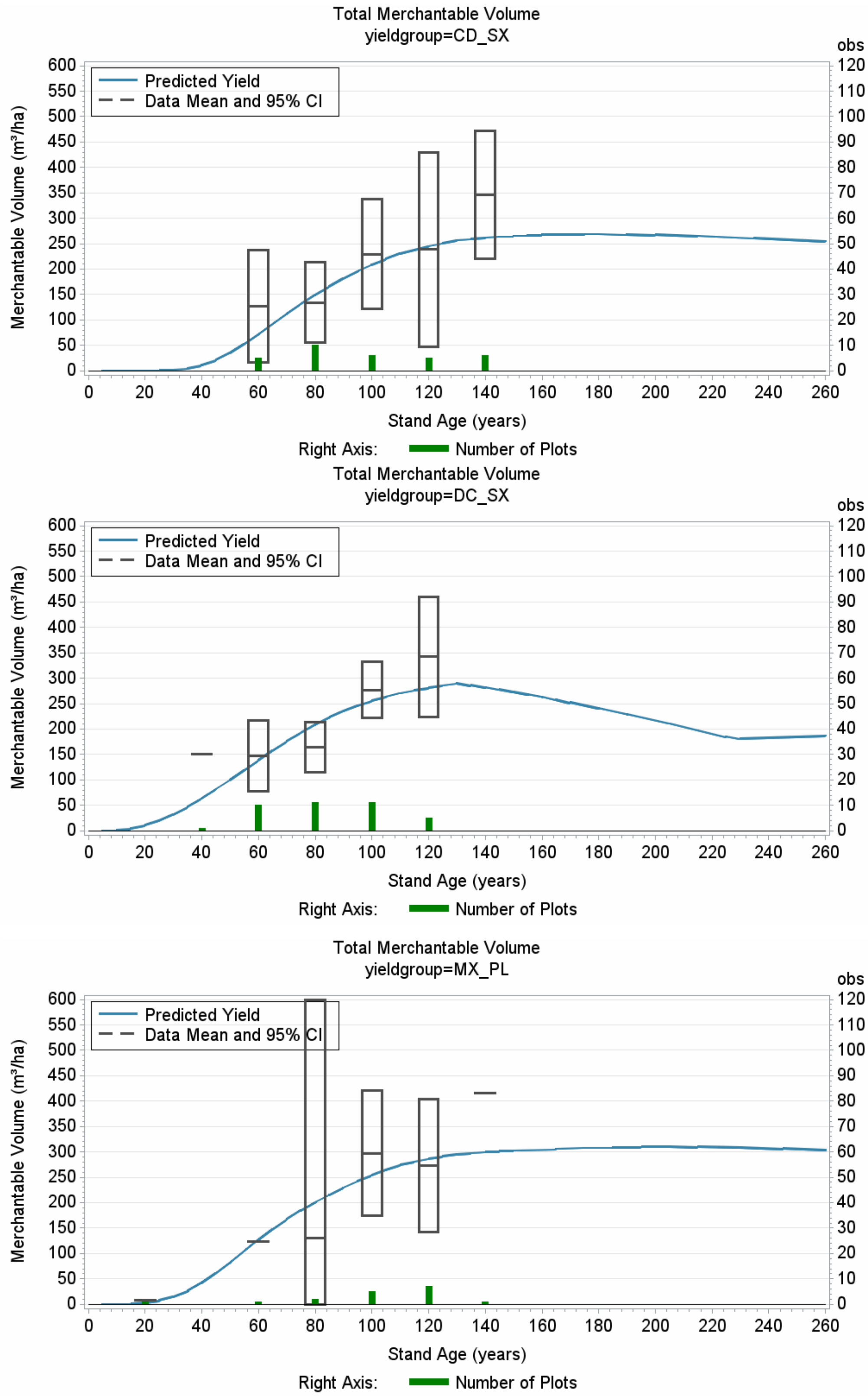


Figure 7. Final natural stand total yield curves against 20-year plot averages.

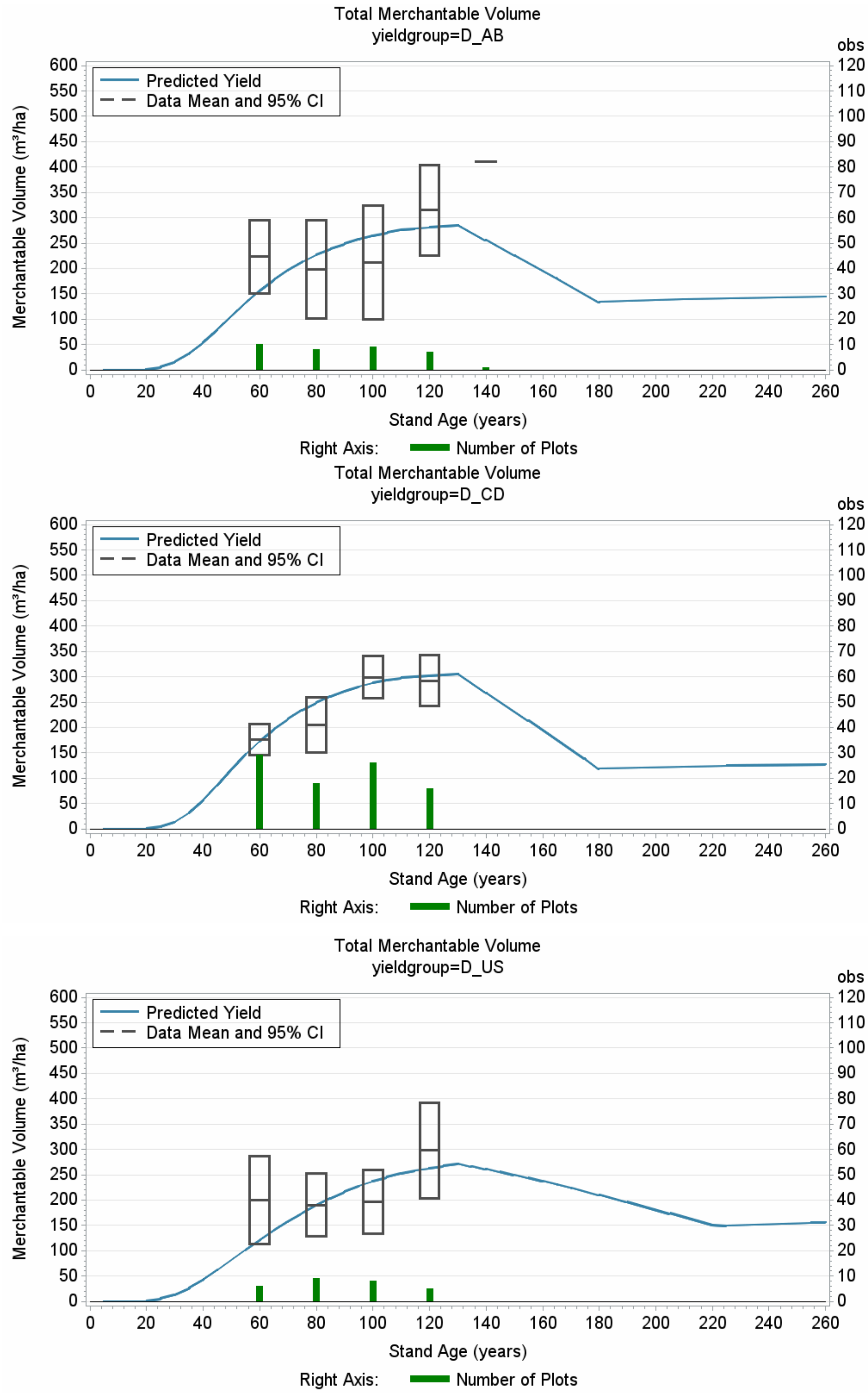
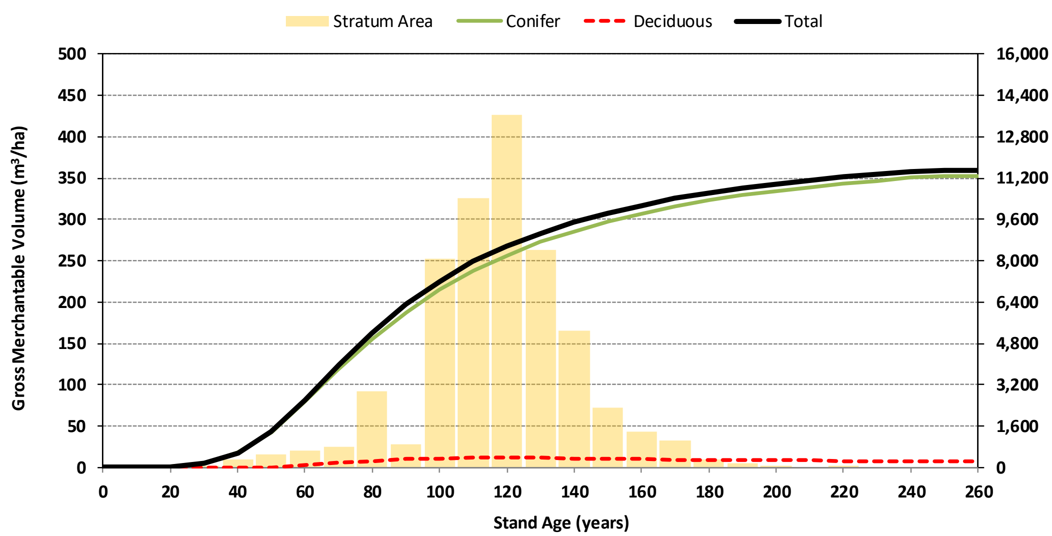


Figure 7. Final natural stand total yield curves against 20-year plot averages.

2.6.5 Final Yields

Final natural stand yield tables are provided in Appendix IV an example is presented in Figure 8.

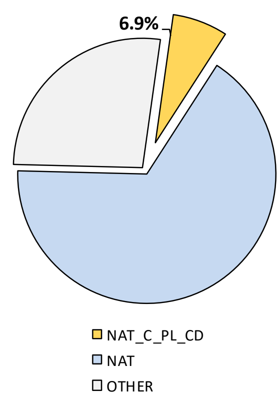
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	NATURAL STANDS STRATUM: C_PL_CD



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	0.0	0.6	0.03	0.00	0.03
30	5.0	0.0	5.0	0.17	0.00	0.17
40	17.8	0.0	17.8	0.44	0.00	0.44
50	43.2	0.4	43.7	0.86	0.01	0.87
60	79.1	2.8	81.9	1.32	0.05	1.36
70	118.2	5.8	124.0	1.69	0.08	1.77
80	155.1	8.0	163.1	1.94	0.10	2.04
90	187.3	9.7	196.9	2.08	0.11	2.19
100	214.5	10.8	225.2	2.14	**0.11**	2.25
110	237.3	11.4	248.7	**2.16**	0.10	**2.26**
120	256.3	11.5	267.8	2.14	0.10	2.23
130	272.3	11.4	283.7	2.09	0.09	2.18
140	285.9	10.9	296.7	2.04	0.08	2.12
150	297.4	10.4	307.8	1.98	0.07	2.05
160	307.2	10.0	317.2	1.92	0.06	1.98
170	315.7	9.5	325.2	1.86	0.06	1.91
180	323.0	9.2	332.2	1.79	0.05	1.85
190	329.2	8.9	338.1	1.73	0.05	1.78
200	334.7	8.5	343.2	1.67	0.04	1.72
210	339.4	8.2	347.6	1.62	0.04	1.66
220	343.5	7.9	351.4	1.56	0.04	1.60
230	347.1	7.6	354.7	1.51	0.03	1.54
240	350.2	7.3	357.5	1.46	0.03	1.49
250	353.0	7.0	360.0	1.41	0.03	1.44
260	353.0	7.0	360.0	1.36	0.03	1.38

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	NAT_C_PL_CD	57,348	6.9%

Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	13,932,087	243
Deciduous	15/10/15/366/TL	607,385	11
Total		14,539,725	254

Note: Peak MAIs are highlighted in yellow.
Standing timber volumes are approximate.

Figure 8. Final natural yield table summary for yield group: C_PL_CD.

3 Pre-1991 Managed Yield Curves (M91)

Pre-1991 managed stand yield curves (M91) representing PHR stands that were harvested prior to March 1, 1991 within the Weyerhaeuser Grande Prairie DFA net landbase will be used in the 2019 FMP.

3.1 Approach

Weyerhaeuser used the same methodology and growth model that was used in the development of the natural stand yield curves (NAT). The data set included PSPs that were established in pre-1991 openings as per the classified net landbase.

Weyerhaeuser submitted a proposal for the general approach to developing yield curves for managed stands (Weyerhaeuser 2017a). AAF provided an agreement in principle on August 1, 2017 (AAF 2017c).

3.2 Input Datasets

3.2.1 Source Data

All managed stand PSPs that were in pre-1991 openings in the net landbase were identified and stratified for the development of M91 yield curves.

3.2.2 Yield Stratum Assignment

Yield stratification followed the same methodology and guiding principles as presented for natural stands in Section 2.2.2. A summary of areas in the net harvestable landbase by M91 strata and the number of PSPs is presented in Table 3-1. The Mx stratum represents a summary of the Mx_PL (5,929 ha) and Mx_SX (3,331 ha) yield groups.

Table 3-1. The number of plots and net area in pre-1991 openings.

Yield Group	Description	Net Area (Ha)	Net Area (%)	Number of Plots (#)	Number of Plots (%)
C_SB	Pure conifer - Black Spruce Leading	240	0	1	1
D_AB	Pure Deciduous with A or B Density	7,747	15	9	10
D_CD	Pure Deciduous with C or D Density	4,844	9	6	7
D_US	Conifer US "Switch" Stands	5,366	10	12	14
Mx	Mixedwood with Pine or Spruce	9,259	17	16	19
PL	Pure Conifer - Pine Leading	21,779	41	33	38
SW	Pure Conifer - White Spruce Leading	3,699	7	9	10
Totals		**52,934**	**100**	**86**	**100**

Due to the limited number of plots and harvest history in the FMA prior to 1991, Weyerhaeuser proposed that new yield curves be developed for the PL, SW and the combined mixedwood (Mx) strata (Weyerhaeuser 2017). The pure black spruce (C_SB), pure deciduous (D_AB, D_CD) and conifer understorey switch stands (D_US) M91 yield curves will default to the natural stand yield curves for their respective stratum[23].

Further details on the stratum assignment in M91 stands can be found in Annex IV - Landbase Assignment document.

3.2.3 Data Exclusions

All 86 managed stand PSPs were originally identified and stratified. Two plots were dropped from the Mx stratum due to a plot having its last measurement 19 years before the AVI photo was taken and another with suspect Aw data. All data for the 56 remaining PSPs located in the PL, SW and Mx strata were retained for the yield analysis.

3.3 Data Preparation

In preparation for the 2019 FMP, Weyerhaeuser spent a considerable amount of time reviewing and, where possible, correcting their PSP data using validation code which provided checks within and between measurements for each plot.

In addition, all plots selected for the Provincial Growth and Yield Initiative (PGYI) were further cleaned to meet rigorous PGYI standards (AESRD 2014). All findings from the PGYI conversion process were incorporated into the FMP data preparation phase to ensure the best quality data possible.

3.4 Data Compilation

Data compilation followed the exact same methodology used for the compilation of the natural stand PSPs (Section 2.4)[24].

3.5 Modelling

The growth modelling approach was also identical to the methods used for the natural yield curves including the compiled model inputs and outputs.

The GYPSY model was run for each PSP until age 300. GYPSY grows the stand both backwards and forwards from the input condition, producing a yield output from age 0 to 300 for each observation. GYPSY model projections were averaged by yield group using the plot maximum observed total age - this ensured that projections would have the same origin. Because plots were established on a systematic grid across the FMA area, weighting by polygon size (area) was not required.

Next the average difference between stand age (AVI-based) and the maximum total age observed in the plot was calculated by yield group (Table 3-2). The average yield projections (plot maximum total age

[23] Considerations were given to defaulting pure conifer - white spruce leading (SW) stands to the C_SW natural stand yield curve due to the low number of plots, but the yield estimates were very similar to the natural stand yields and were therefore retained for the analysis.

[24] The only difference was to use 28 m for site index capping for the PL and SW species groups instead of 25 m.

based) were shifted by this age differential to account for differences between the AVI and plot ages and generate the finalized natural stand yield estimates by yield group.

Table 3-2. Average age offset by M91 yield group.

Yield Group	Age Offset
Mx	-8.9
PL	-1.4
SW	-2.8

Pre-1991 managed stand yield curves were adjusted for deciduous decline and stand breakup the same way as natural stand yield curves described in Section 2.5.4.

3.6 Results

3.6.1 Pre-1991 Managed Stand Yield Curves

The final (capped/adjusted) yield curves for pre-1991 managed stands in the target population are shown in Figure 9 for the Mx, PL and SW strata. All other yield groups were substituted with the respective natural stand yield curve.

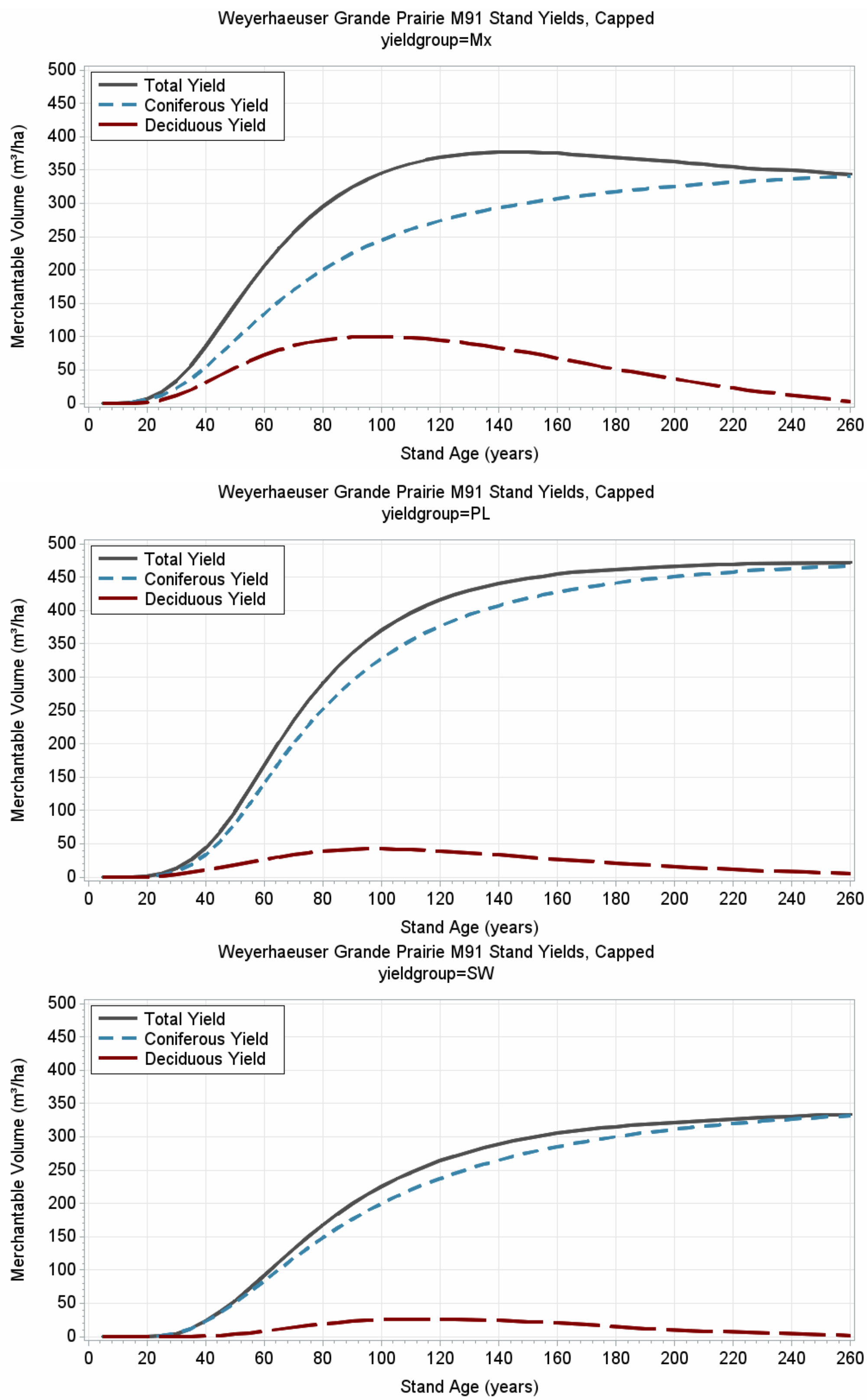


Figure 9. Final pre-1991 managed stand yield curves (M91).

3.6.2 Validation Against Plot Data

Figure 10 presents the total merchantable yield for pre-1991 managed stands by yield stratum after deciduous mortality assumptions were applied (capped). Yields are validated against the most recent observation from PSPs, grouped into 20-year intervals. Grey boxes represent the 95% confidence interval for the data, with the middle bar representing the mean. Green columns represent the number of observations in the validation dataset.

Capped conifer and deciduous volume projections were also compared against the most recent observation from PSPs grouped into 20-year intervals. The resulting graphs are included in Figure 11 and Figure 12, respectively.

Obviously, at this early stage of stand development yield predictions must be accepted with caution and continued monitoring of stand development is required to ensure that volume trajectories stay the course.

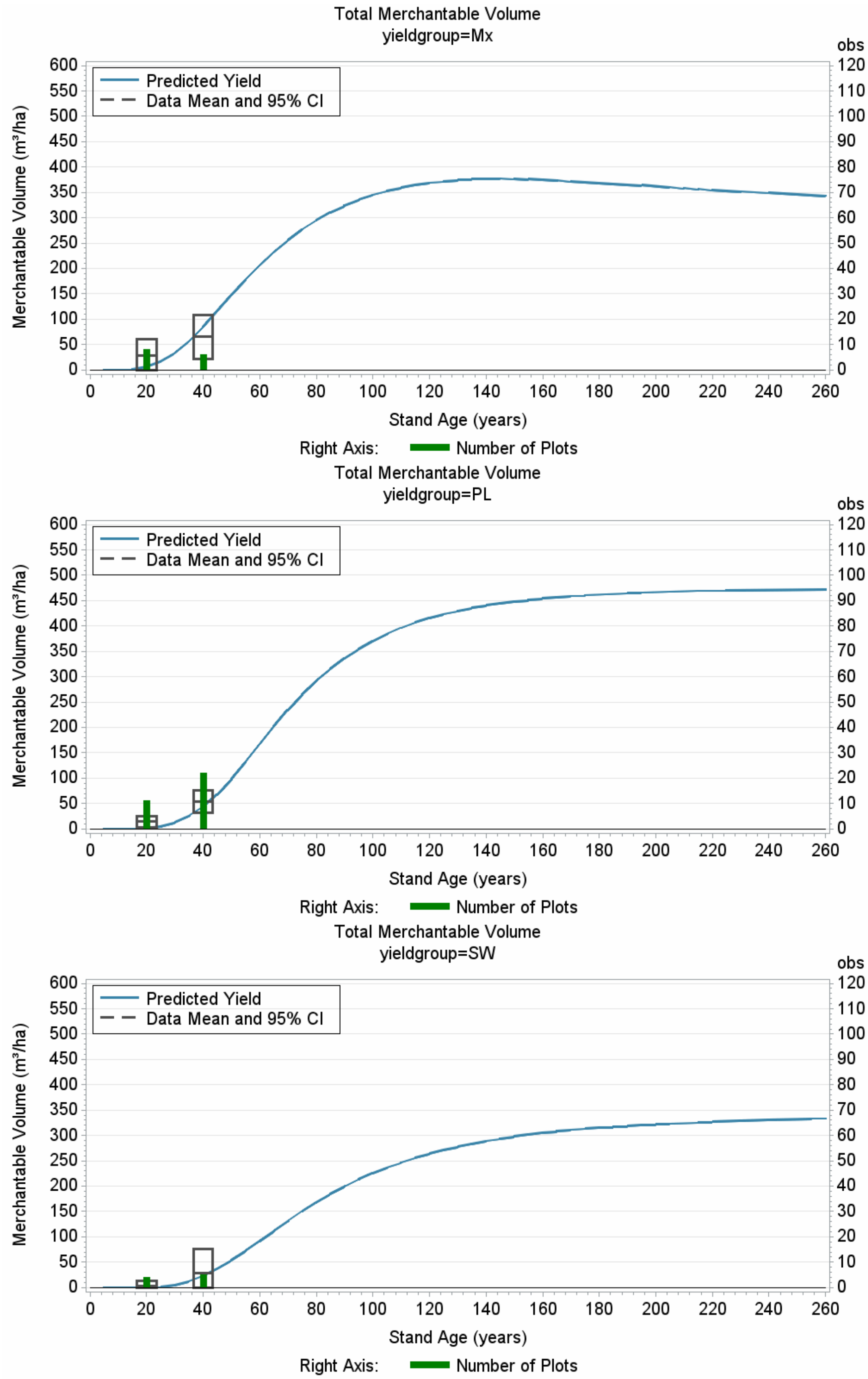
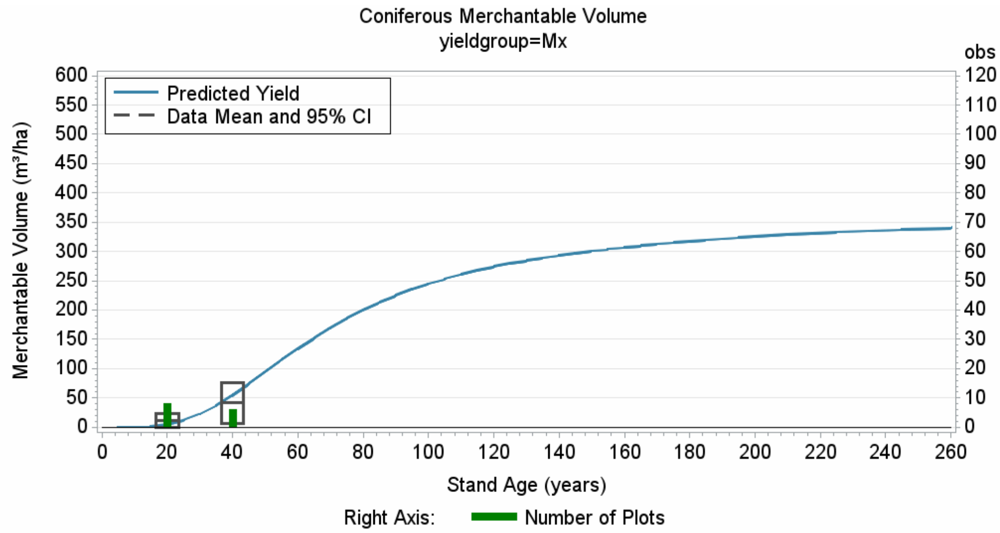
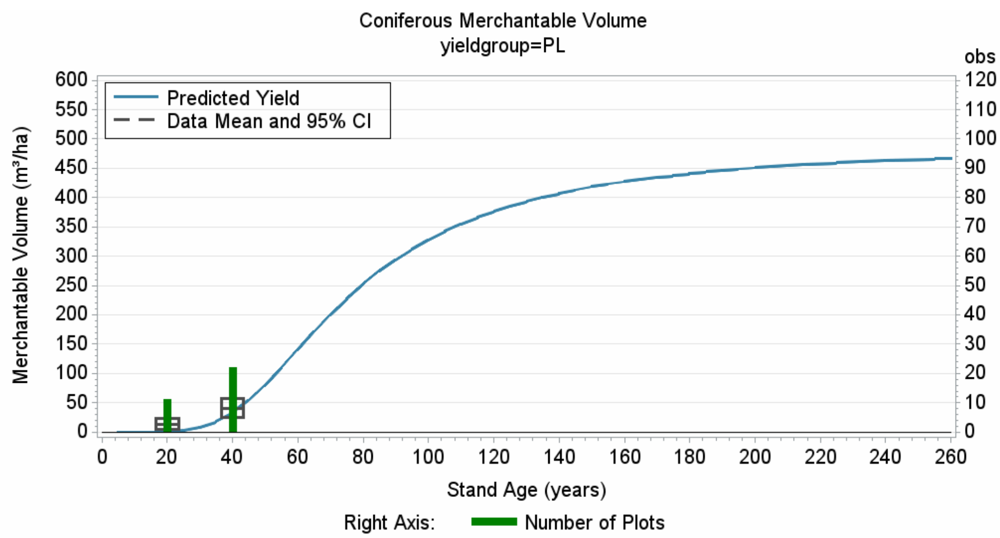


Figure 10. Average total merchantable volume by age class against the M91 yield curves.





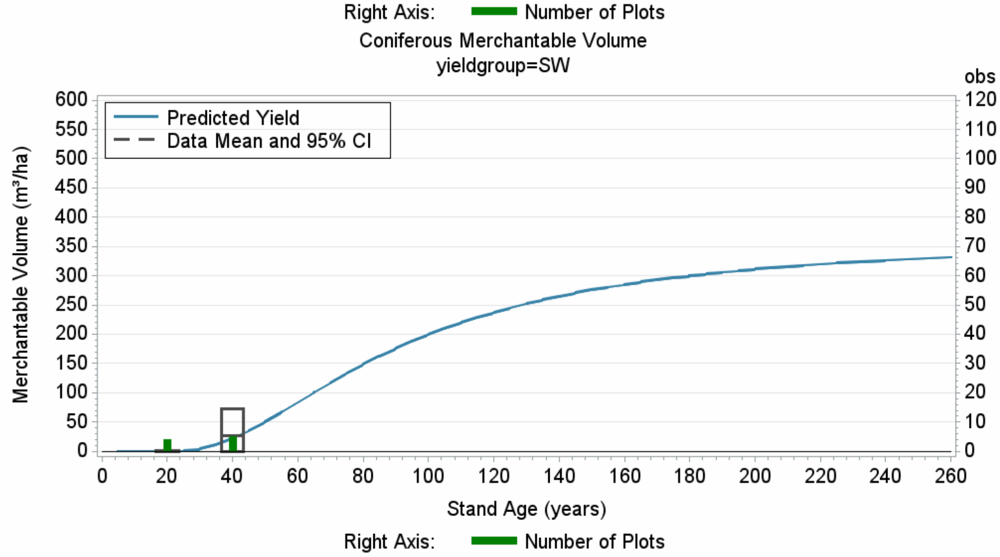


Figure 11. Average conifer merchantable volume by age class against the M91 yield curves.

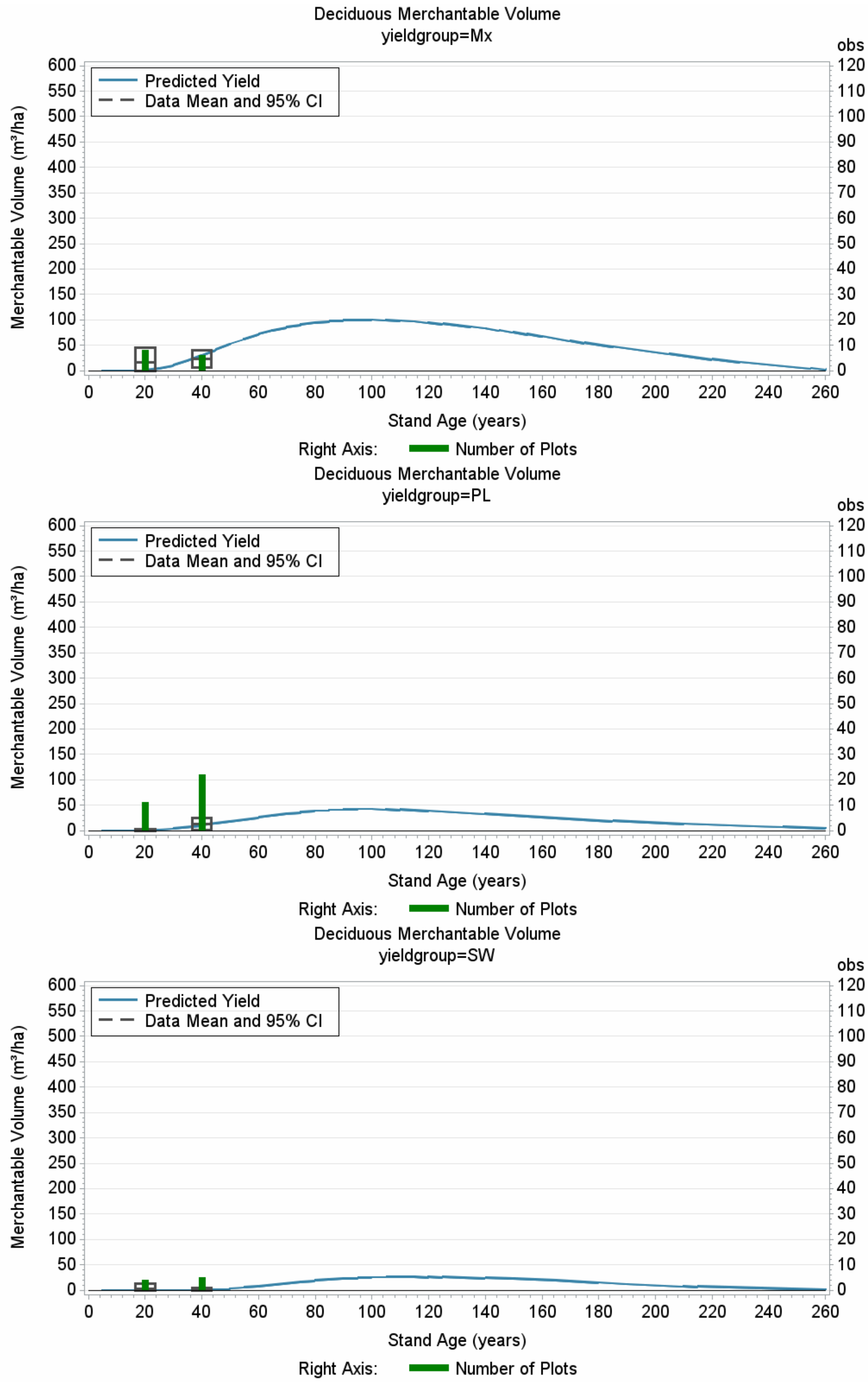


Figure 12. Average deciduous merchantable volume by age class against the M91 yield curves.

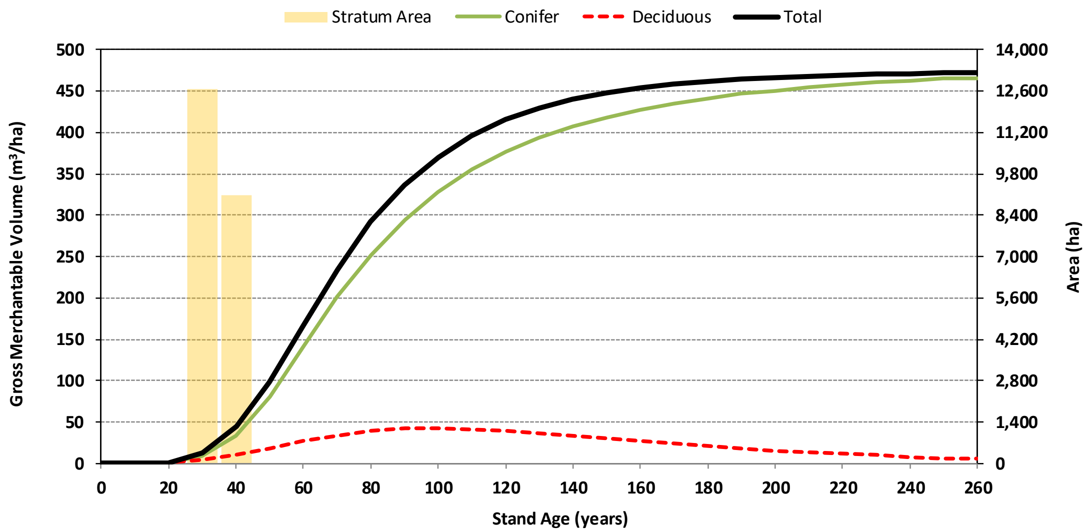
3.6.3 Final Yields

The final M91 yield tables are provided in Appendix V. An example is presented in Figure 13.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

PRE-1991 CUTBLOCKS

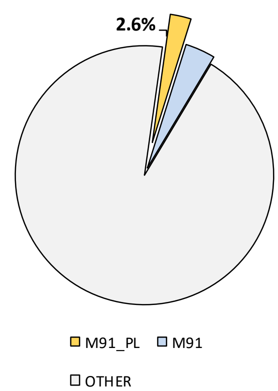
STRATUM: PL



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	0.5	1.1	0.03	0.03	0.06
30	8.3	4.3	12.7	0.28	0.14	0.42
40	33.5	10.6	44.1	0.84	0.27	1.10
50	80.0	18.1	98.1	1.60	0.36	1.96
60	140.9	26.5	167.4	2.35	0.44	2.79
70	200.8	34.0	234.8	2.87	0.49	3.35
80	252.3	39.2	291.4	3.15	0.49	3.64
90	294.2	41.9	336.1	3.27	0.47	3.73
100	328.0	42.5	370.5	3.28	0.42	3.70
110	354.9	41.4	396.4	3.23	0.38	3.60
120	376.4	39.2	415.6	3.14	0.33	3.46
130	393.6	36.3	429.9	3.03	0.28	3.31
140	407.3	33.3	440.6	2.91	0.24	3.15
150	418.4	29.9	448.3	2.79	0.20	2.99
160	427.5	26.9	454.3	2.67	0.17	2.84
170	434.9	23.9	458.8	2.56	0.14	2.70
180	441.2	20.6	461.8	2.45	0.11	2.57
190	446.4	18.0	464.4	2.35	0.09	2.44
200	450.9	15.7	466.6	2.25	0.08	2.33
210	454.7	13.6	468.2	2.17	0.06	2.23
220	457.9	11.7	469.6	2.08	0.05	2.13
230	460.7	9.8	470.5	2.00	0.04	2.05
240	463.1	8.0	471.1	1.93	0.03	1.96
250	465.1	6.6	471.7	1.86	0.03	1.89
260	465.1	6.6	471.7	1.79	0.03	1.81

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_PL**	**21,779**	**2.6%**

Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	410,001	19
Deciduous	15/10/15/366/TL	151,335	7
Total		561,361	26

Note: Peak MAIs are highlighted in yellow.
Standing timber volumes are approximate.

Figure 13. Final pre-1991 managed stand yield table summary for yield group: PL.

AIP#3: *As per AAF directions, the following changes to the stratification and substitutions of natural stand yield curves were implemented in pre-1991 managed stands (M91):*

- *The SW stratum will use the natural C_SW_CD yield curve. No relabeling of the stratum is required.*
- *The Mx_PL stratum yield curves (Mx) will be removed and we will add the CD_PL and DC_PL natural stand yield curves. The yield stratification labels therefore will also change to the natural stand strata of CD_PL and DC_PL.*
- *The Mx_SX stratum yield curves (Mx) were removed and we will add the CD_SX and DC_SX natural stand yield curves. The yield stratification labels therefore will also change to the natural stand strata of CD_SX and DC_SX.*

4 Post-1991 Managed Stand Yield Curves (MGD)

Post-1991 managed stand yield curves (RSA) representing C, CD and DC declared PHR stands that were harvested on or after March 1, 1991 within the Weyerhaeuser Grande Prairie DFA net landbase will be used in the 2019 FMP. Post-1991 managed stand that were declared as D (pure deciduous) will be based on the D_CD natural stand yield curve.

Genetic yield curves were created for Sw Region G1 (G351 seed orchard) and for Pl Region B1 (G147 and G804 seed orchards) and Pl Region B2 (G303 seed orchard) where improved stock is deployed in PHR stands.

4.1 Overview

After discussion with AAF, the post-1991 yield curves were developed as per the methodology submitted by Weyerhaeuser (Weyerhaeuser 2017a). Agreement-in-principle was obtained on August 1, 2017 (AAF 2017c).

4.2 Input Datasets

4.2.1 Source Data

Available RSA performance survey data from 1,766 openings were assembled to develop post-1991 managed stand yield curves. All RSA submissions from 2009 to May 15, 2017 were recompiled and compared to the original submissions. All reported MAIs at the opening level were also verified against the ARIS submission based on the ARIS data extract provided by AAF[25]. A description of RSA data and the RSA compiler is provided in Section 1.6.2.

4.2.2 Yield Stratum Assignment

The Planning Standard, Section 3.11i, Annex 1, requires that areas harvested on or after March 1, 1991 be assigned to a yield stratum as defined in ARIS and the most current information on the harvest area and its associated regeneration stratum in ARIS.

The new AVI incorporated a link to ARIS and the skid clearance date via the cutblock reconciliation process completed by FORCORP (FORCORP 2018).

[25] ARIS data extract was provided by Gareth Davies (AAF) on June 27, 2017.

All openings were assigned to a yield group consistent with the most recent of the following ARIS data[26]:

- declared stratum[27];
- stratum resulting from an establishment survey finding; or
- stratum resulting from a performance survey finding.

Stratification was based on the GoA Base 10 regenerating strata (Table 1-1). ARIS declaration and silviculture records were used to assign openings at the opening-level to species-specific yield strata where RSA performance survey stratum was not available. If an RSA performance survey stratum was available, the SU linework was retained and yield strata were assigned at the SU-level.

AIP#5*: Spatial boundaries of RSA spatial information for openings as delivered was not consistent with ARIS-reconciled AVI opening boundaries. To be consistent with GoA requirements, several data cleaning steps were applied to ensure RSA SU boundaries aligned properly to the ARIS-reconciled AVI opening boundaries. First, all ARIS-reconciled AVI boundaries that had matching opening IDs to those in the RSA feature classes were selected from the ARIS-reconciled AVI and dissolved on the reconciled opening ID. RSA linework was then intersected with the dissolved AVI openings. Any portion of a reconciled AVI opening smaller than two ha that had no RSA coverage was then merged with the neighboring polygon that had the longest shared border. After that, small polygons that remained were also merged with the neighboring polygon that had the longest shared border. The resulting modified RSA features were used as the RSA input into the Classified Landbase. This process ensured inconsistencies between RSA boundaries and ARIS-reconciled boundaries did not propagate into the classified landbase product while preserving internal RSA SU delineations. RSA strata information was maintained, and this information was used for final yield stratification in the classified landbase. Further information on the process can be found in Sections 8.1.25 and 8.2.2 of Annex IV.*

Aerial programs used the photo-interpreted species class label (SP_CL) as the basis for the yield stratum assignment. Given that ground-interpreted labels are sometimes inaccurate[28] when compared to observed ground data and that ground-based labels are at coarser resolution than aerial program labels (e.g., MxPl); we reassigned non-photo programs based on the ground survey information. Ground survey based densities were used following the rules of aerial stratum assignment as per the RSA survey manual (AAF 2017a). A detailed description of the rule set used to assign yield strata to existing managed stands is provided in Annex IV - Net Landbase Development document.

4.2.3 Data Exclusions

There were 1766 openings with completed RSA survey as per the official ARIS extract provided by AAF (STOCKING_STATUS_CODE=PSC)[29]. There were two openings with non-photo surveys from 2016 by Norbord that were not available at the time of the RSA program reconciliation and therefore were excluded from yield curve development. In the aerial programs, there were 36 Weyerhaeuser openings (9 in 2014 and 27 in 2016) that were part of the EFM population and were removed. Altogether there

[26] Openings harvested between March 1, 1991 and March 1, 1995 were assigned with a regenerating stratum based on the AVI attributes as per the AAF exemption.

[27] If a harvest area is less than 2 years old and has not received a stratum declaration (reforestation target), use the harvest stratum assignment.

[28] Early non-photo programs tend to have some discrepancies between ground interpreted labels and observed ground data.

[29] One FRIAA opening appeared to be a true duplicate and was dropped.

were 1728 openings with a survey population area of 42,930 ha were used in the development of MGD yield curves (Table 1-8).

No other deletions were applied to the dataset, regardless of whether openings were spatially represented on the landbase, at the direction of AAF. The total area and number of ground-sampled SUs by program type (aerial vs. non-photo) and yield stratum is presented in Table 4-1.

Table 4-1. Number of ground sampled SUs and population areas by RSA program and yield stratum.

Yield	Aerial		Non-Photo		Total	
Stratum	SUs	Area (ha)	SUs	Area (ha)	SUs	Area (ha)
Hw	13	91.2	5	167.7	18	258.8
HwPl	48	448.3			48	448.3
HwSx	47	725.0	36	411.0	83	1,136.0
Pl	91	26,532.8	7	107.3	98	26,640.1
PlHw	50	884.5	8	210.4	58	1,094.9
Sb*	0	26.4			0	26.4
Sw	65	11,499.7	18	177.0	83	11,676.6
SwHw	55	1,061.5	45	587.7	100	1,649.2
Grand Total	**369**	**41,269.3**	**119**	**1,661.1**	**488**	**42,930.3**

** where sampling strata represent more than one yield stratum, e.g. a combined Sw/Sb sampling stratum, separate yield curves will be created for each stratum with identical yields. The total population area will be assigned to each yield stratum within its respective program.*

4.3 Data Preparation

Several edits to 2009 performance survey data were required in order to load these data into the existing RSA compiler. These edits included:

- Adding nil tally plots;
- Constructing photo interpretation and opening tables (not required in the 2009 submissions)
- Moving shrub percentages to the plot location table; and
- Making the minimum number of data edits possible to enable data loading within the compiler.

In some of the original RSA datasets, there were 61 incorrect opening numbers that were not corrected in the original data, but rather during submission of results into ARIS; the RSA compiler was edited to change these data to the correct opening number. All MAIs were independently compiled and validated against the official ARIS submission. There were only 2 Norbord openings where the ARIS record showed that an RSA performance survey was completed in 2016 but no data was received.

4.4 Data Compilation

Data from the RSA compiler was used for yield curve development. SU-level density, basal area, site index and age (stand and species-level) were obtained from the GYPSY_INPUT table. The methods used for compiling data are documented in the Regeneration Standard of Alberta (AESRD 2013, AAF 2017a)[30]. Data were compiled to FMP base utilizations for the post-1991 managed stand yield curves.

4.5 Modelling

4.5.1 Growth Modelling Approach

The GYPSY model (Huang *et al*. 2009a, 2009b) was used for growth projections. Although the RSA compiler stored yield table outputs, these data are provided in 10-year increments which was unsuitable for timber supply analysis needs. Compiled RSA data were therefore re-projected using GYPSY to obtain 5-year outputs.

4.5.2 Model Inputs

SU-level inputs were taken from the RSA compiler's GYPSY_INPUT tables. Inputs included stand age, species age, site index, density, percent stocking and, where available, basal area. While basal area was not collected for all programs, it was used when available (in order to maintain consistency with the original RSA model projections).

4.5.3 Model Outputs

The GYPSY model was projected to age 300 for all sampling units. Yield curves were generated from SU-level outputs as follows:

Aerial Programs

An average yield was generated for each aerial program by sampling stratum, employing the composite weighting approach developed for the RSA program (AESRD 2013) to roll individual projections to the program/sampling stratum level. Where sampling strata represented more than one yield stratum, e.g. a combined SbHw/SwHw sampling stratum, separate yield curves were created for each stratum with identical yields. The total population area (including all SUs, not just ground sampled SUs) was then assigned to each yield stratum within its respective program.

Non-Photo Programs

Each sampling unit had its own yield stratum assignment, yield projection, and area.

Averaging Across Programs

Yield curves were created by calculating area-weighted averages across all yield strata, combining program-level averaged yields from aerial programs and individual SU-level yields from non-photo programs.

[30] Note that changes to sample selection protocols and compilation routines occurred in 2014, therefore both of the 2013 and 2017 manuals are specifically being referenced here.

4.5.4 Yield Curves for Deciduous Declared Openings

As per RSA protocols, no deciduous declarations were surveyed as part of the legislated performance survey standard, therefore the presence of Hw strata in RSA sampling units indicate “failed conifer treatment” in C/CD/DC declared openings. Up until 2014, pure deciduous declared openings were only subjected to a field stocking survey if they received a CSR (Conditional Satisfactorily Restocked) status[31] to determine the adequacy of stocking, survival and growth.

It is expected that the post-1991 managed stand yield curves for the Hw stratum constructed from legislated performance survey data (RSA) in C, CD and DC declared openings will reflect failed conifer treatments and therefore higher than normal conifer content when compared to regenerating Hw in stands from D declaration (Figure 14).

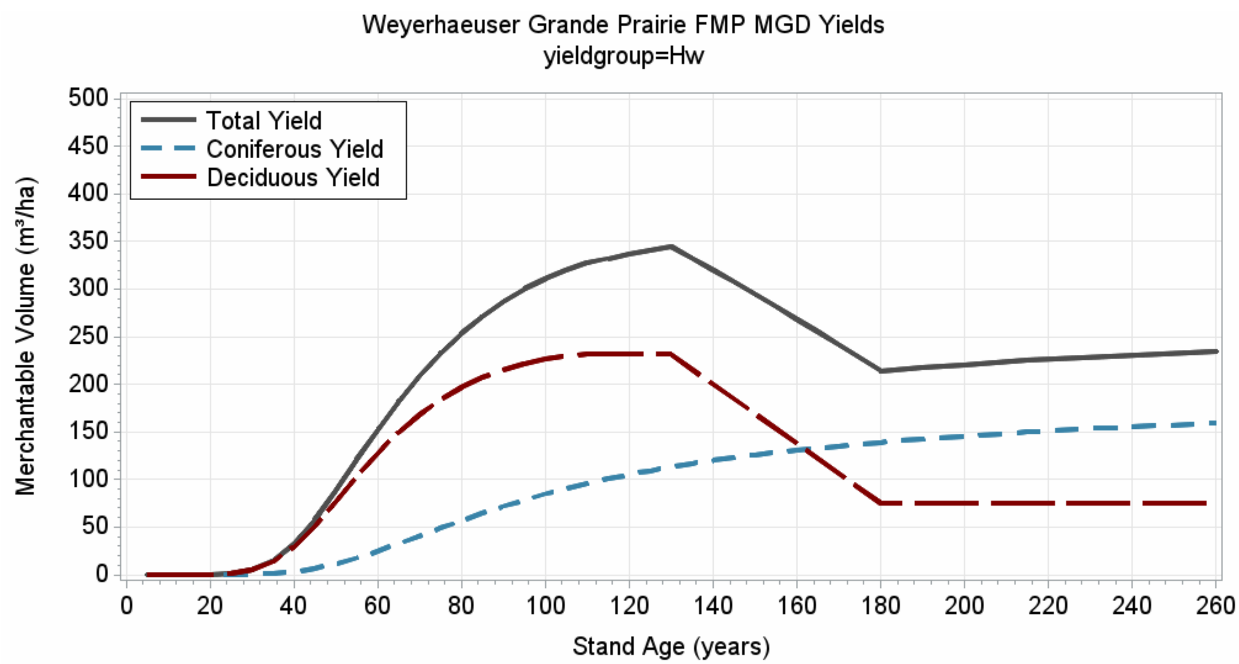


Figure 14. Average RSA survey yield projection of the Hw stratum in C/CD/DC declared openings.

Weyerhaeuser therefore will use the D_CD natural stand yield curves as the substitute for the post-1991 pure deciduous managed stand yield curves. The MGD yield curve for the Hw stratum will only be used in SUs that were assigned to Hw in the RSA performance survey in C, CD and DC declared openings.

4.5.5 Yield Curves for Black Spruce Leading Openings

Any post-1991 PHR stand stratified as pure conifer black spruce leading will be assigned with the C_SB natural stand yield curve. The MGD yield curve for the Sb stratum will only be used in SUs that were assigned to Sb in the RSA performance survey in C, CD and DC declared openings.

[31] This applies only in openings where the establishment survey was completed prior to May 1, 2010 (AESRD 2013).

4.5.6 Genetic Yield Curves

Weyerhaeuser is a proponent of Regions B1 and B2 controlled parentage programs (CPP) for lodgepole pine and the region G1 CPP for white spruce with growth and yield improvement as a primary objective.

Weyerhaeuser developed tree improvement (genetic) yield curves to reflect increases in yield resulting from the deployment of genetically improved stock.

Genetic yield curves were assigned to existing ARIS declared C openings where improved stock was deployed and were located within the respective breeding region.

Regenerated stands genetic yield curves were developed for all future cutblocks that are located within the approved boundaries of the tree improvement program deployment zones subject to seed availability and deployment schedules. The genetic yield curves will be assigned as per regeneration transitions defined in the Silviculture Matrix (Table 5-4).

The currently approved genetic height gains in the Grande Prairie FMA area by species, breeding region and seed orchard are summarized in Table 4-2.

Table 4-2. Approved genetic height gains in the Grande Prairie FMA area.

Species	Region	Seed Orchard	Phase	Height Gain	Yield Group Label	Letter of Approval Reference
Pl	B1	G147	1	4.00%	Pl_G147p1	Ken Greenway (ASRD) - January 26, 2011
Pl	B1	G147	2	6.17%	Pl_G147p2	Erica Samis (AAF) - July 21, 2017
Pl	B1	G804		9.26%	Pl_G804	
Pl	B2	G303		2.18%	Pl_G303	
Sw	G1	G351	1	2.60%	Sw_G351p1	Vicky Bossé (ASRD) - July 29, 2009
Sw	G1	G351	2	5.04%	Sw_G351p2	Erica Samis (AAF) - March 2, 2018

Under the current practice, a straight volume multiplier equal to twice the percent approved height gain is applied to the conifer component of the managed yield curve to obtain a genetically improved yield curve (AESRD 2006).

As per discussions with AAF, Weyerhaeuser proposed the following approach to attain genetic volume gain (Weyerhaeuser 2018b):

1. Use a genetic volume multiplier of 1.75xHT% instead of the current practice of 2xHT%.
2. Apply the genetic volume gain to the PL or SW volume in the GYPSY projections instead of the overall conifer volume.

The proposed new approach was borne out of concern that the genetic gain multiplier is applied to not only the planted stock but also to the ingress that is observed in performance surveys and to other conifer species not planted to genetic stock (AAF 2017b).

Genetic yield curves were developed from the basic silviculture managed stand yield curves (MGD) for Pl and Sw for all six approved height gain percentages.

4.5.7 Yield Adjustments

Post-1991 managed stand yield curves were adjusted for deciduous decline and stand breakup the same way as natural stand yield curves described in Section 2.5.4.

4.6 Results

4.6.1 Area Summary

A summary of areas in the net harvestable landbase by post-1991 MGD strata is presented in Table 4-3.

Table 4-3. Area summary by yield group in the post-1991 existing managed stands.

Yield Group	Description	Net Area (ha)	Net Area (%)
D_CD	ARIS D declared blocks	41,393	24.4
Hw	Pure deciduous in RSA SUs	86	0.1
HwPl	ARIS DC declared - HwPl block or HwPl RSA SU	719	0.4
HwSx	ARIS DC declared - HwSx block or HwSx RSA SU	1,566	0.9
Pl	ARIS C declared - Pl block or Pl RSA SU	73,864	43.5
PlHw	ARIS CD declared - PlHw block or PlHw RSA SU	5,974	3.5
Sb	Sb in RSA SUs	24	0.0
C_SB	ARIS C declared - Sb block	972	0.6
Sw	ARIS C declared - Sw block or Sw RSA SU	18,715	11.0
SwHw	ARIS CD declared - SwHw block or SwHw RSA SU	4,565	2.7
PL_G147p1	ARIS C declared - Pl block or Pl RSA SU identified as genetic	17,398	10.3
SW_G351p1	ARIS C declared - Sw block or Sw RSA SU identified as genetic	4,402	2.6
Total		**169,678**	**100.0**

4.6.2 RSA Data Quality

All RSA programs to date have been accepted by AAF and the MAI results were submitted to ARIS. In order to ensure no systematic bias existed between the company submitted RSA data and the field audits conducted as part of Alberta's Forest Operations Monitoring Program (FOMP) activities, the MAIs were compared as shown in Figure 15.

FOMP RSA field audit reports were provided for Weyerhaeuser's aerial and non-photo programs and FRIAA's non-photo programs. No RSA audit was conducted on the Norbord non-photo programs to date. There were 26 field audited SUs for Weyerhaeuser and 13 SUs for FRIAA programs in the FOMP reports provided by GoA.

There appears to be no significant and systematic bias in the RSA programs collected to date for the assessed conifer and deciduous MAIs as shown in Figure 15.

The orange marks indicate the genetic (EFM) programs that are not being used in the development of the managed stand base yield curves.

As shown in the graphs, the slope of the linear regression line (bold black) is not significantly different from 1 which would indicate a perfect agreement between the RSA survey and independent field audit results as depicted by the 45-degree red line.

Future reporting and checking on RSA data quality and associated field data quality standards will be part of the FOMP activities as part of standard operating protocols[32].

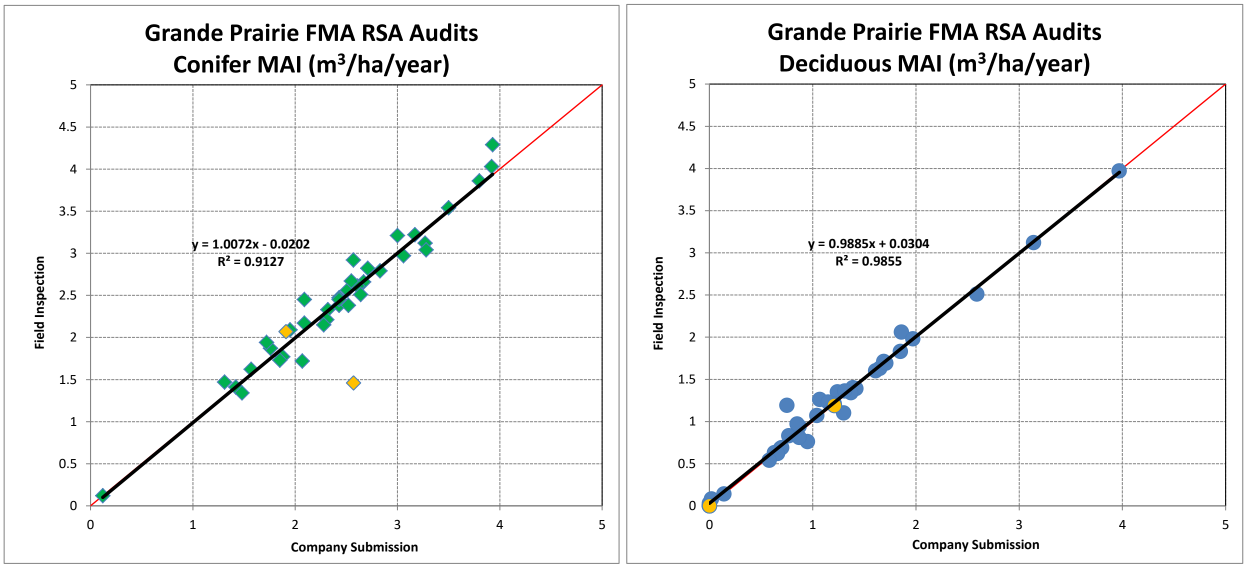


Figure 15. Comparison of conifer and deciduous MAIs between RSA surveys and FOMP field audit.

4.6.3 Post-1991 Managed Stand Yield Curves

The final adjusted yield curves for post-1991 managed stands are shown in Figure 16 for basic silviculture treatment and in Figure 17 for tree improvement (genetic).

[32] Cosmin Tansanu (AAF) pers. comm (2016).

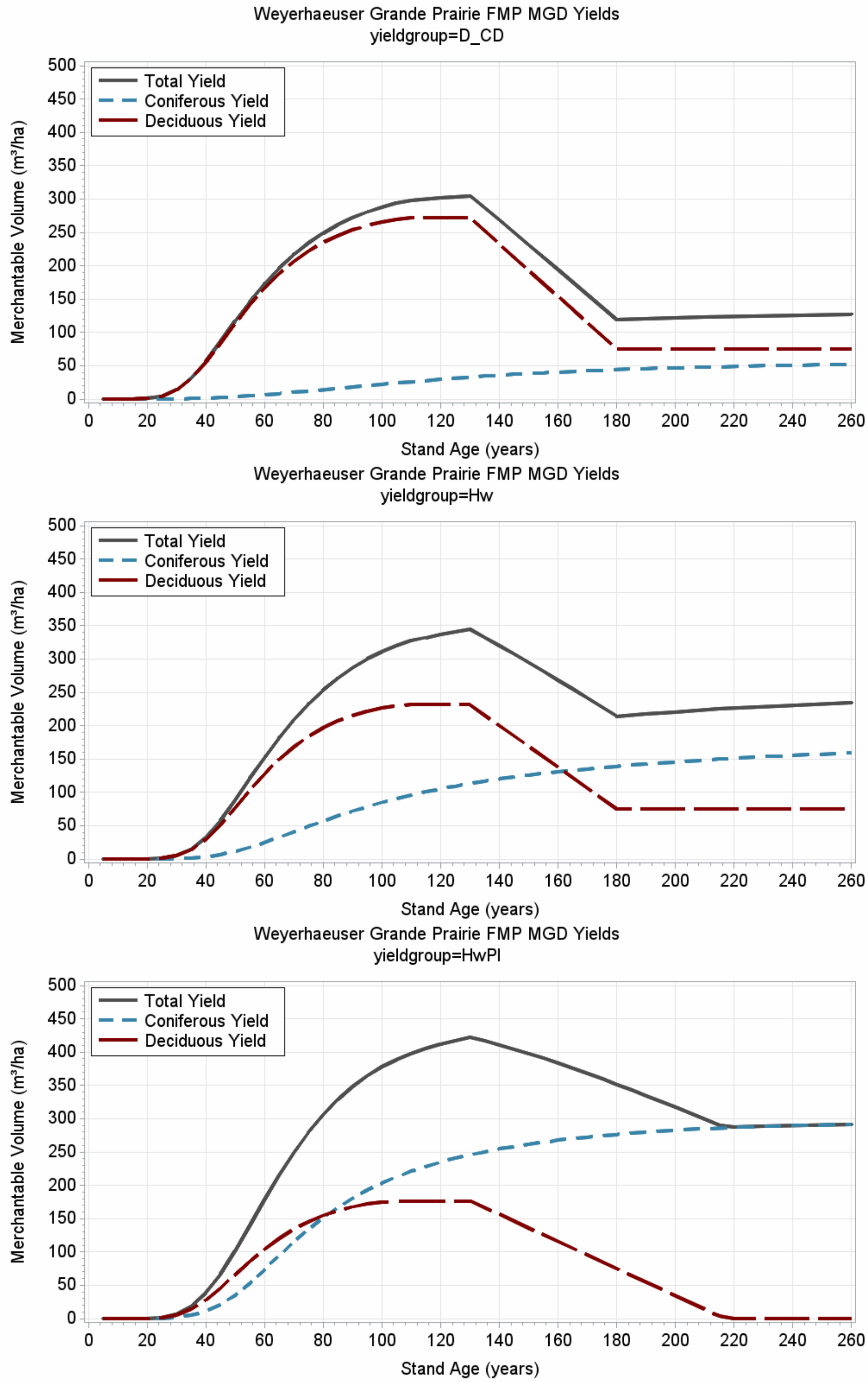


Figure 16. Final post-1991 managed stand yield curves (MGD - basic silviculture).

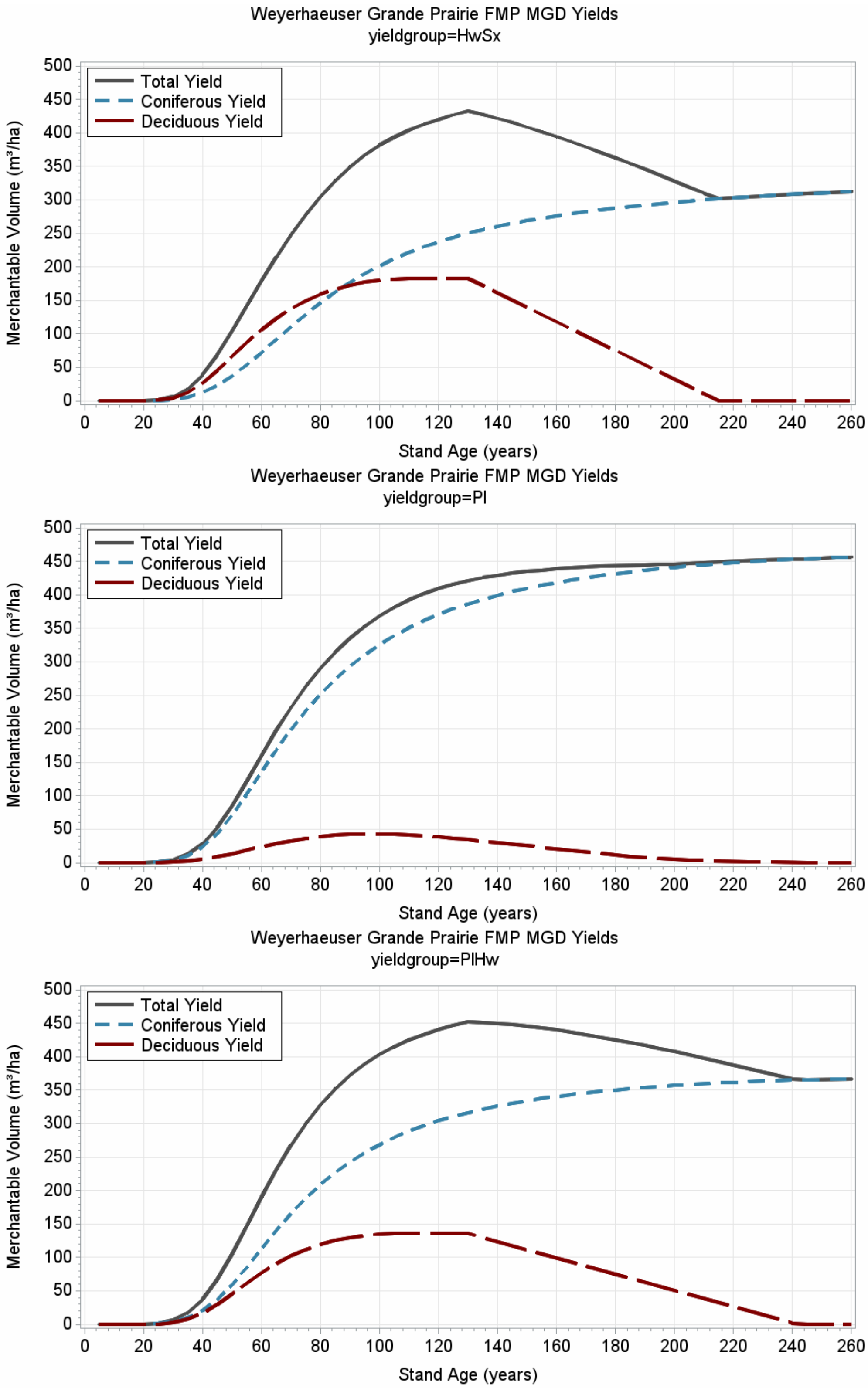
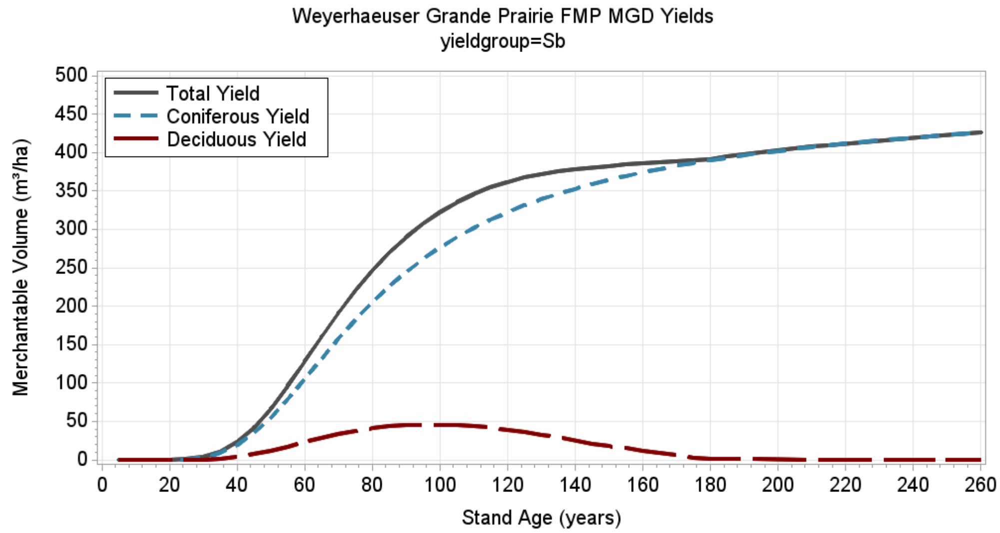


Figure 16. Final post-1991 managed stand yield curves (MGD - basic silviculture).



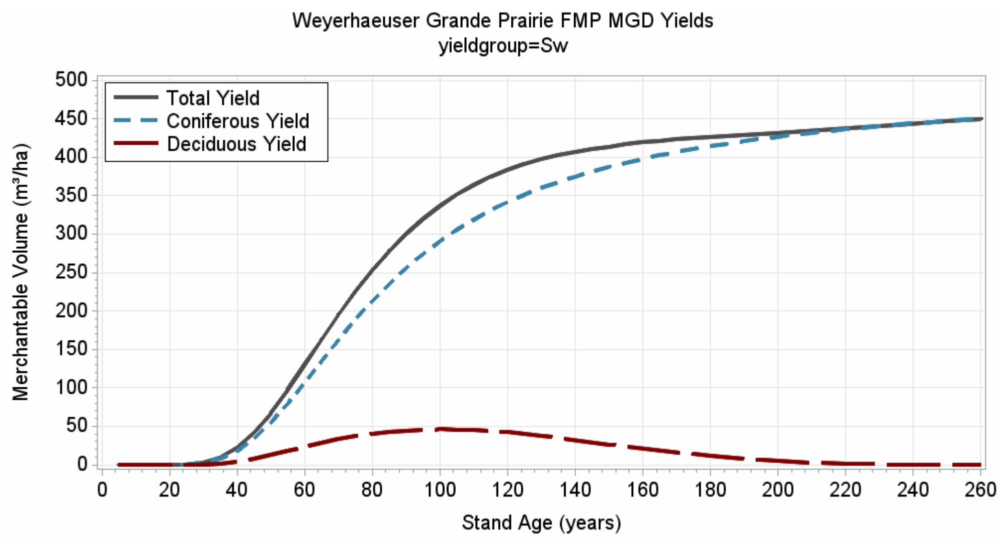


Figure 16. Final post-1991 managed stand yield curves (MGD - basic silviculture).

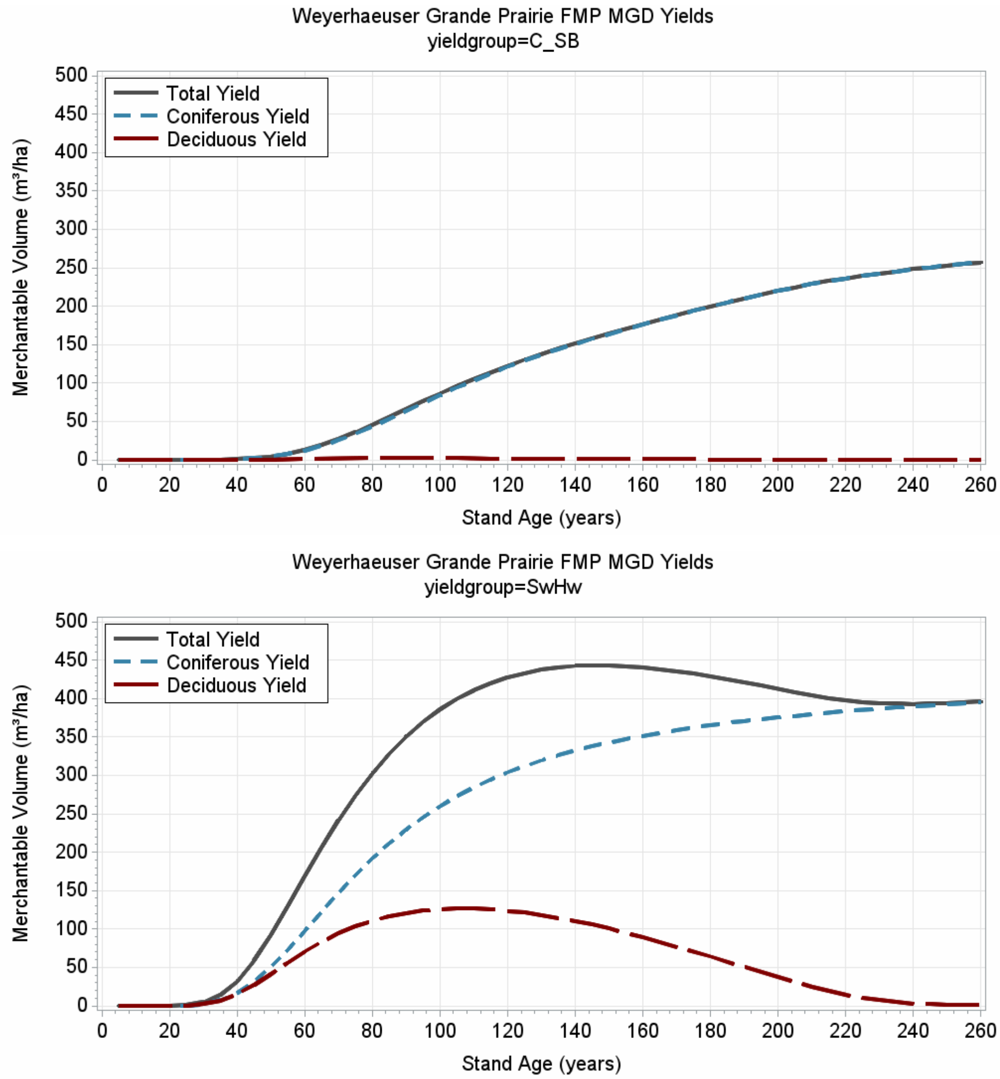


Figure 16. Final post-1991 managed stand yield curves (MGD - basic silviculture).

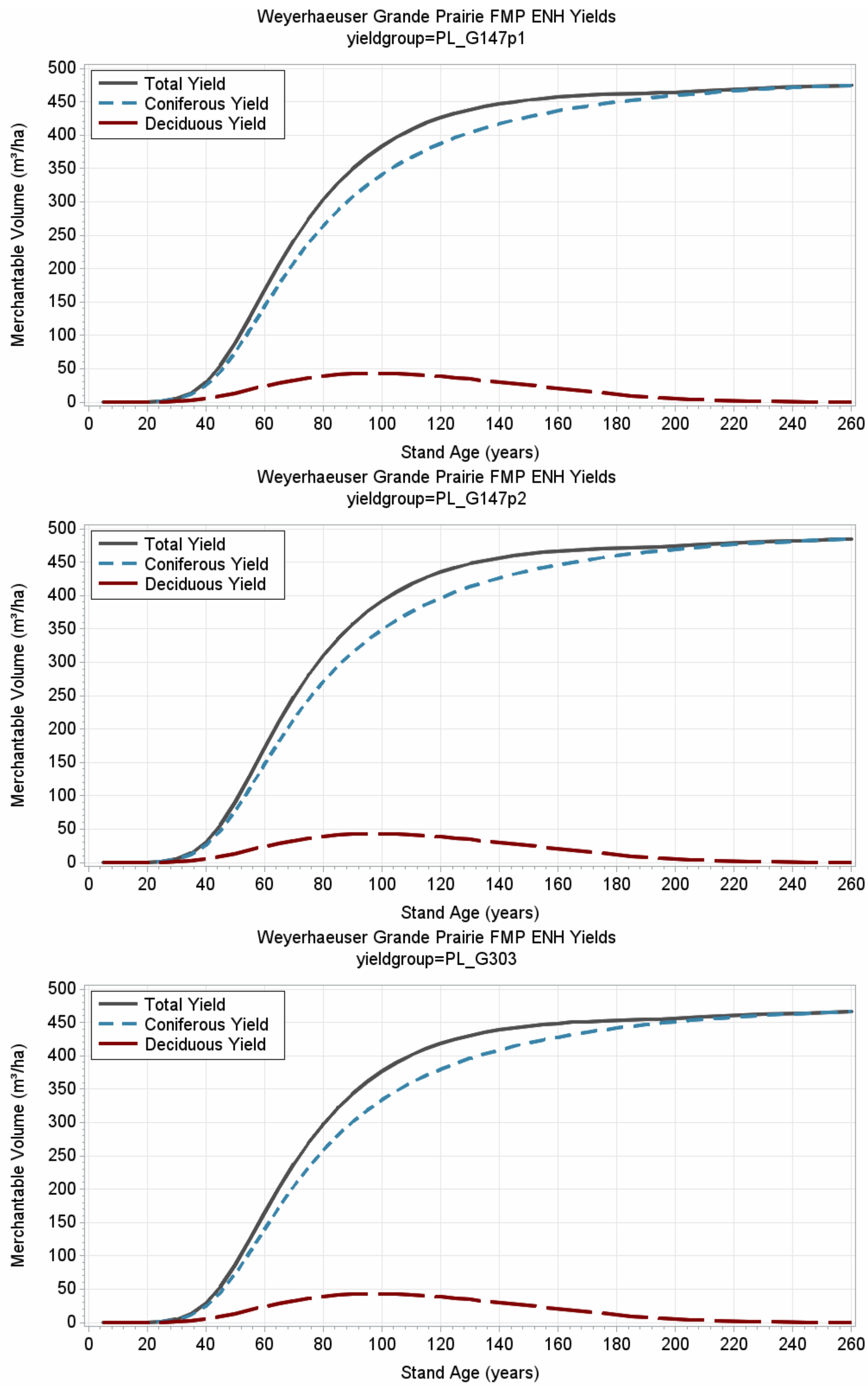


Figure 17. Final post-1991 managed stand yield curves (MGD - genetic).

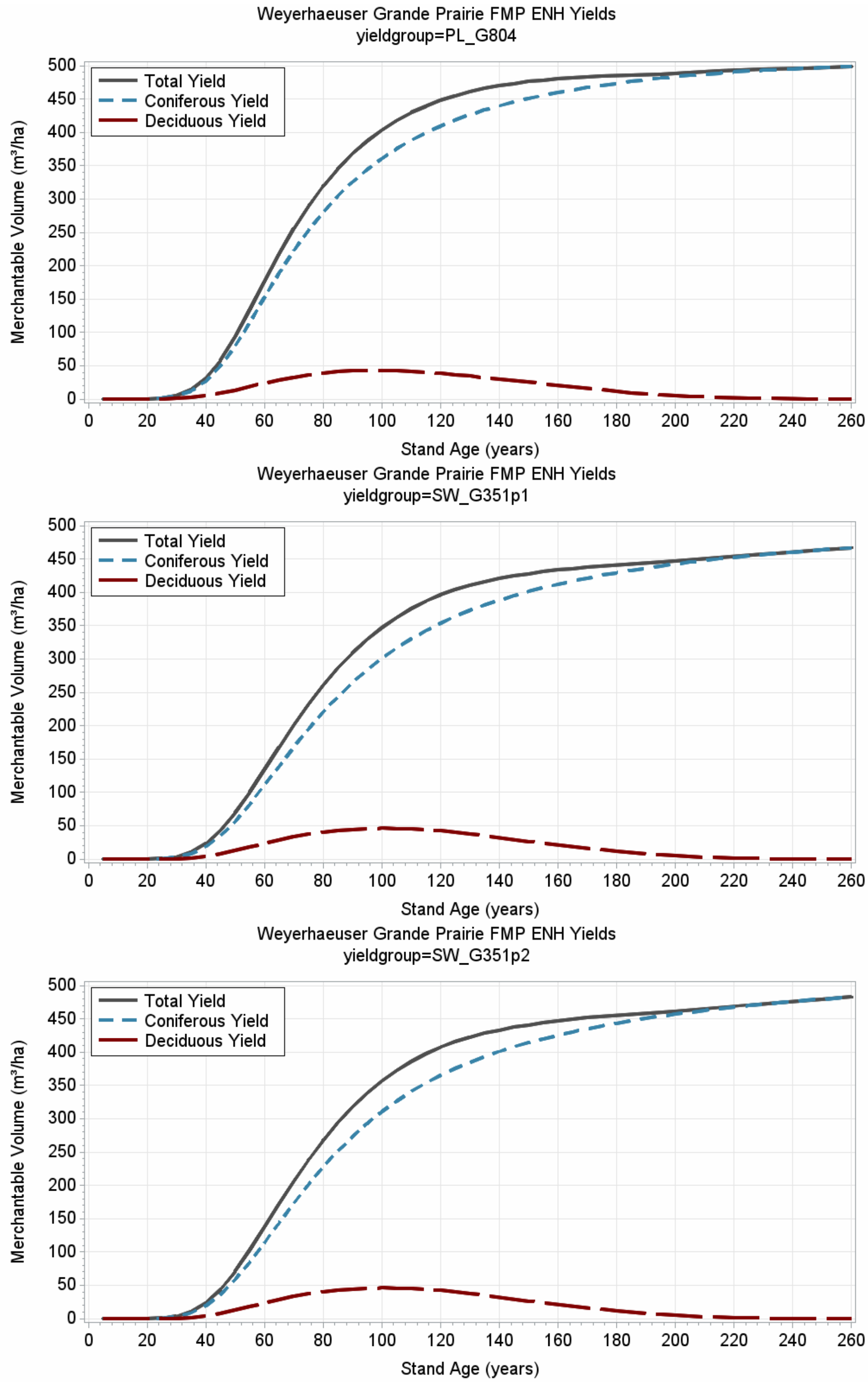


Figure 17. Final post-1991 managed stand yield curves (MGD - genetic).

4.6.4 Validation Against Managed Stand PSP Data

The managed PSP data was compiled following the same protocols used for the natural stand PSP data. Gross merchantable volumes were compiled to FMA baseline utilization for the 150 plots that were in post-1991 (MGD) openings as per the landbase intersect. The number of PSPs is not sufficient to draw any statistical conclusions from the data.

Over 85% of the plots accumulated 0 m^3/ha total merchantable volume and another 10% contributed less than 10 m^3/ha. The remaining 5% with higher volumes were contributed from a remnant veteran layer. The stands are still in the very early development phase where merchantable volume starts to accumulate. Volume accumulation will need to be continually monitored to ensure that yield projections are on track.

AIP#7: *The current status of the managed stand PSPs and aggressive FMP timelines do not allow for a more detailed analysis of auxiliary data of stand densities, top height development and site index. Significant additional data cleaning and filtering of the active plot measurements will be required.*

Weyerhaeuser has one of the more advanced managed stand PSP data sets and a largest amount of completed EFM RSA surveys in the Province. Weyerhaeuser will commit to carrying out a detailed validation exercise for the Forest Stewardship Report as part of the growth and yield performance reporting. This commitment will be described in the Growth and Yield Program.

4.6.5 Yield Comparison of Genetic and Basic Silviculture

The effective genetic volume gains due to tree improvement are shown in Figure 18 as per the methodology described in Section 4.5.6.

AIP#6: *The Growth and Yield Program will need to include a monitoring plan for tree improvement yield and genetic gains.*

AIP#8: *The impact of managed stand yields and additional genetic gains on the AAC will be evaluated as part of the standard set of sensitivity analyses carried out during the TSA process.*

AIP#9: *Weyerhaeuser's Growth and Yield Program will include a robust monitoring program for the regenerated and genetically improved stands' population, to ensure the assumptions in the FMP hold throughout time.*

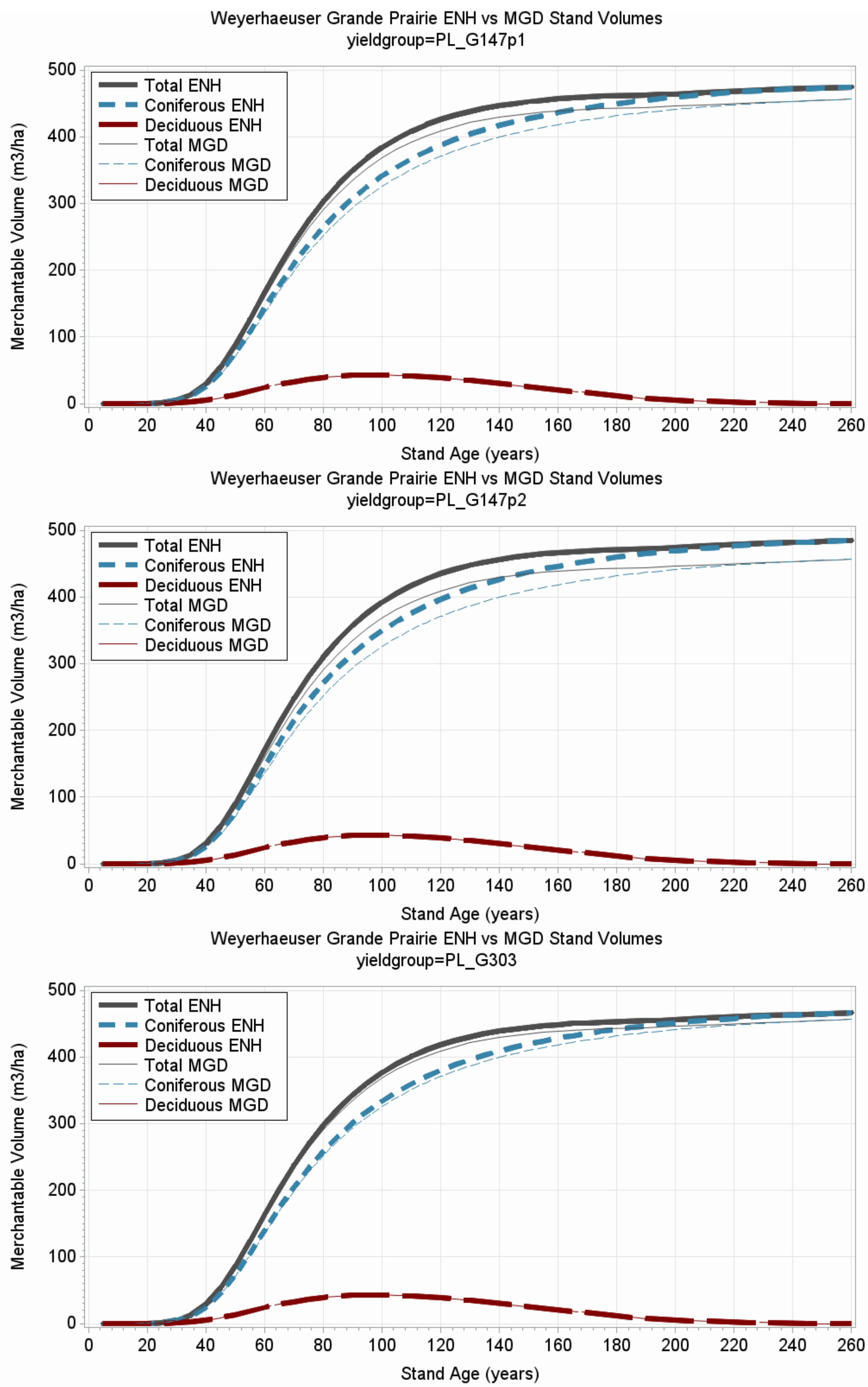


Figure 18. Comparison of genetic gain to basic silviculture yield curves.

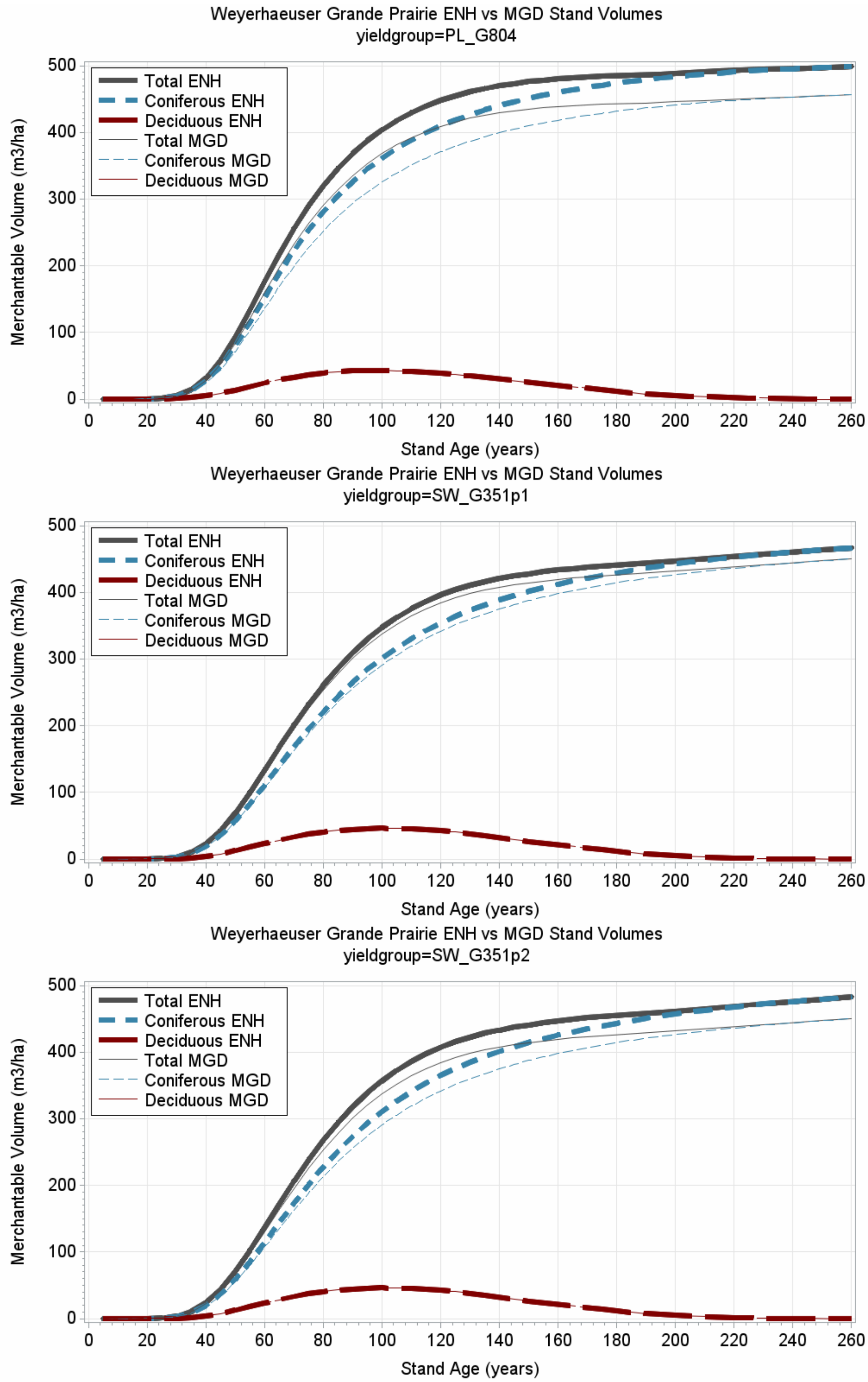


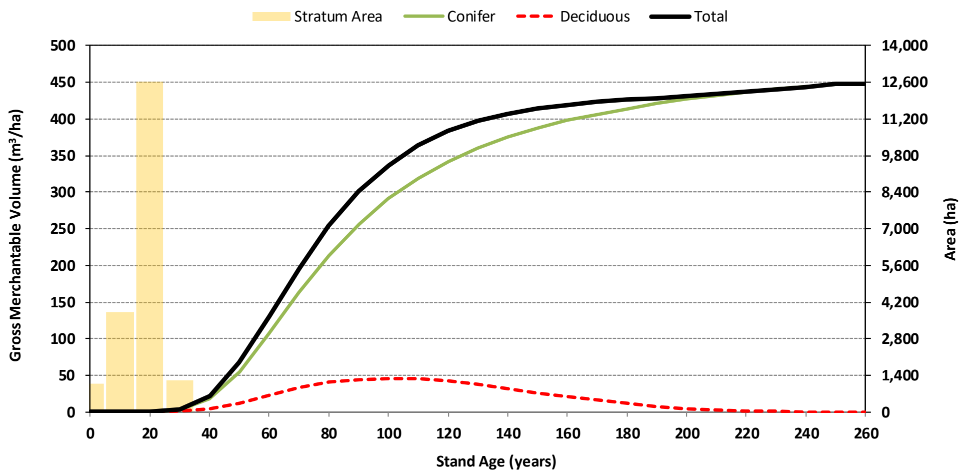
Figure 18. Comparison of genetic gain to basic silviculture yield curves.

4.6.6 Final Yields

The final RSA yield tables are provided in Appendix VI. An example is presented in Figure 19.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS
STRATUM: Sw

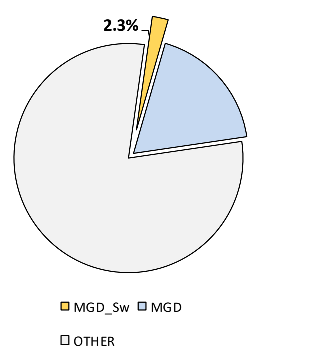


Stand Age	Gross Merchantable Volume (m^3/ha) Conifer	Deciduous	Total	Mean Annual Increment (m^3/ha/year) Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.00	0.00	0.00
30	2.6	0.6	3.2	0.09	0.02	0.11
40	18.2	4.2	22.4	0.46	0.10	0.56
50	54.9	12.4	67.3	1.10	0.25	1.35
60	106.9	23.2	130.1	1.78	0.39	2.17
70	162.4	33.1	195.6	2.32	0.47	2.79
80	213.2	40.4	253.5	2.66	0.50	3.17
90	256.0	44.6	300.6	2.84	0.50	3.34
100	290.9	46.1	337.0	2.91	0.46	3.37
110	319.1	45.2	364.2	2.90	0.41	3.31
120	341.7	42.3	384.0	2.85	0.35	3.20
130	360.0	37.9	397.9	2.77	0.29	3.06
140	375.0	32.3	407.3	2.68	0.23	2.91
150	387.4	26.4	413.8	2.58	0.18	2.76
160	397.9	21.4	419.2	2.49	0.13	2.62
170	406.7	16.4	423.1	2.39	0.10	2.49
180	414.3	11.5	425.8	2.30	0.06	2.37
190	421.0	7.7	428.6	2.22	0.04	2.26
200	426.8	4.7	431.5	2.13	0.02	2.16
210	431.9	2.8	434.6	2.06	0.01	2.07
220	436.4	1.5	437.9	1.98	0.01	1.99
230	440.4	0.5	441.0	1.91	0.00	1.92
240	444.0	0.0	444.0	1.85	0.00	1.85
250	447.2	0.0	447.2	1.79	0.00	1.79
260	447.2	0.0	447.2	1.72	0.00	1.72

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	MGD_Sw	18,715	2.3%

Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	m3/ha
Conifer	15/10/15/366/TL	3,841	0
Deciduous	15/10/15/366/TL	987	0
Total		4,828	0

Note: Peak MAIs are highlighted in yellow.
Standing timber volumes are approximate.

Figure 19. Final post-1991 managed stand yield table summary for yield group: Sw.

AIP#4: *As per AAF directions, the following changes to the stratification and substitutions of natural stand yield curves were implemented in post-1991 managed stands for basic silviculture:*

- *The Sb stratum (24 ha) will use the natural C_SB yield curve instead of the RSA data based yield projections. No relabeling of the stratum is required.*

5 Additional Analysis

5.1 Area-Weighted Yield Curves

Area-weighted yield curves were created at the broad cover group level, using natural stand yield curves and natural stand landbase areas. A summary of net landbase areas is provided in Table 5-1.

Table 5-1. Natural stand net landbase areas.

BCG	Yield Group	Net Area (ha)	Net Area (%)
C	C_PL_AB	34,320	5.7
	C_PL_CD	57,348	9.4
	C_PLOC	69,546	11.5
	C_SW_AB	58,800	9.7
	C_SW_CD	17,495	2.9
	C_SWOC	35,795	5.9
	C_SB	17,023	2.8
CD	CD_PL	10,634	1.8
	CD_SX	35,071	5.8
DC	DC_PL	7,943	1.3
	DC_SX	39,042	6.4
D	D_AB	51,386	8.5
	D_CD	134,420	22.1
DU	D_US	38,398	6.3
Total		**607,222**	**100.0**

Area-weighted yield curves by BCG and overall are presented in Figures 20 to 25.

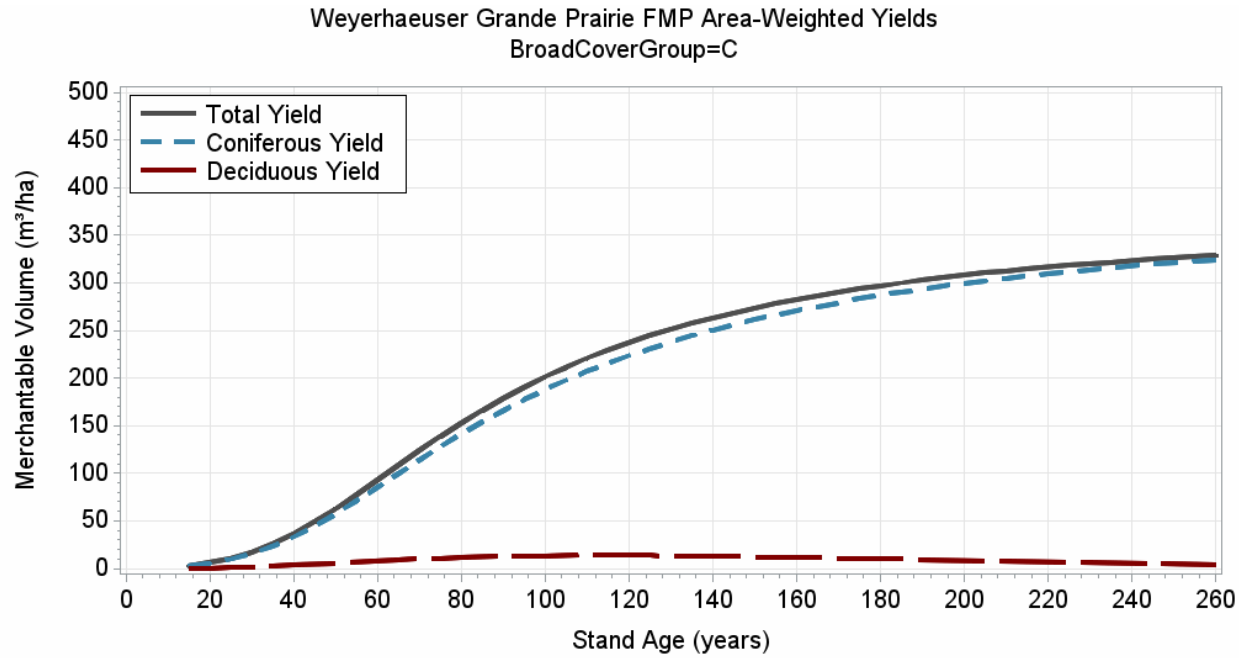


Figure 20. Area-weighted natural stand yield curve for BCG=C.

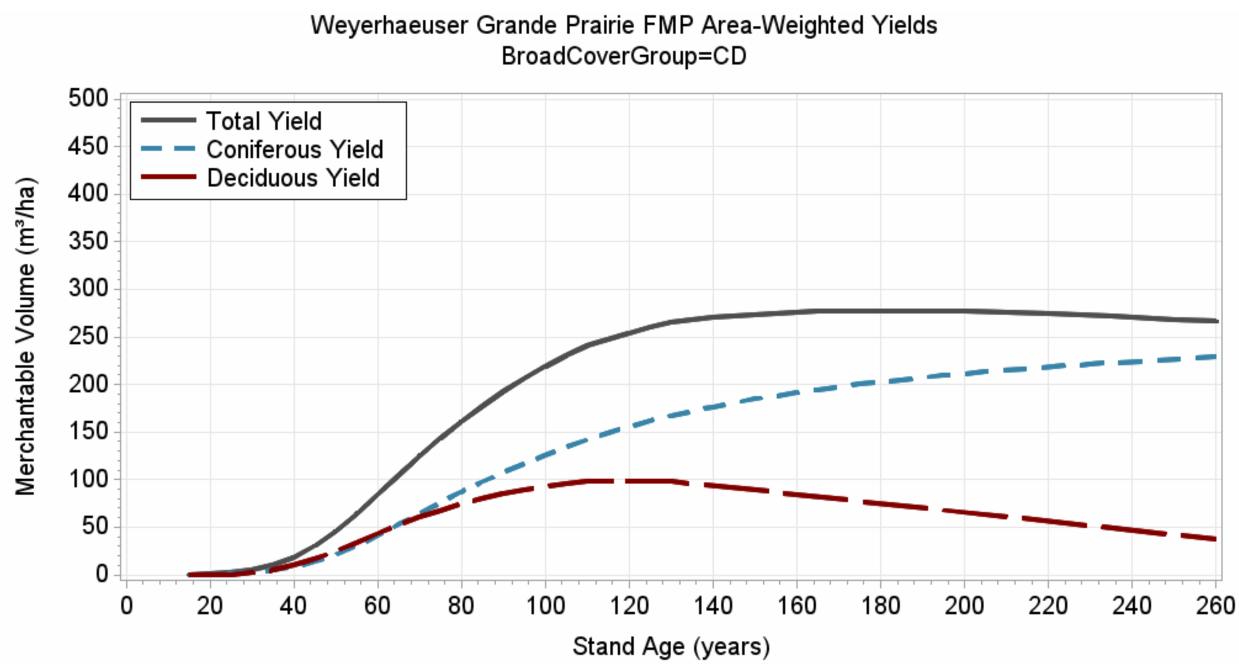


Figure 21. Area-weighted natural stand yield curve for BCG=CD.

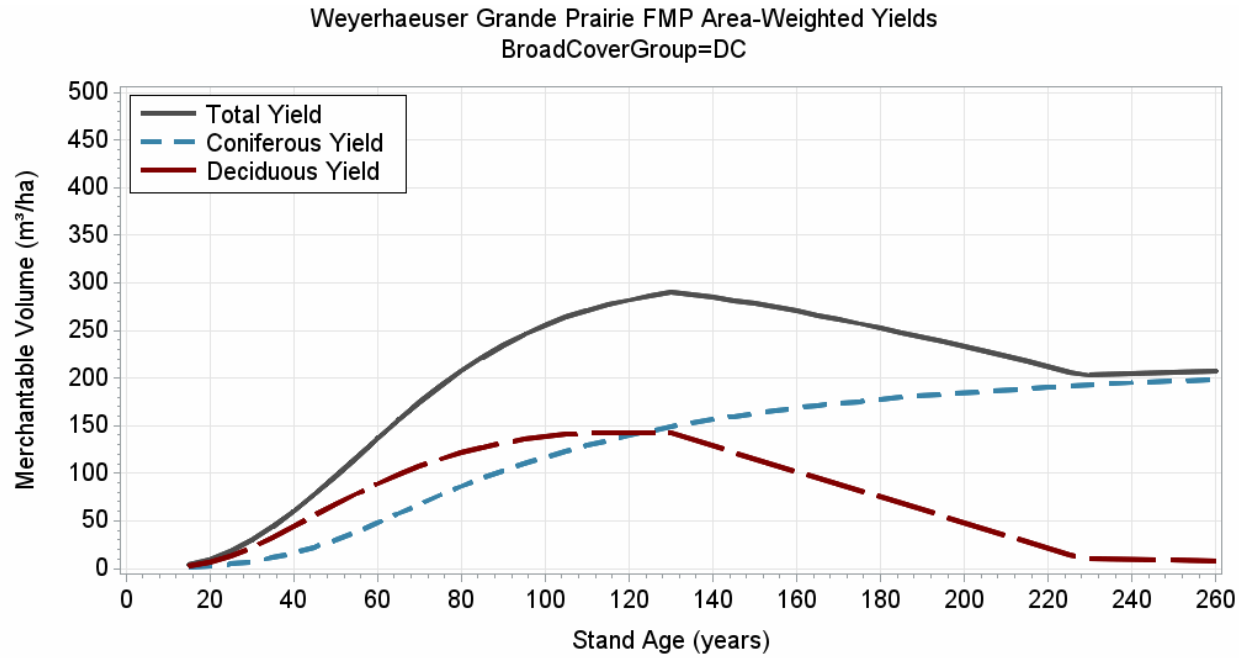


Figure 22. Area-weighted natural stand yield curve for BCG=DC.

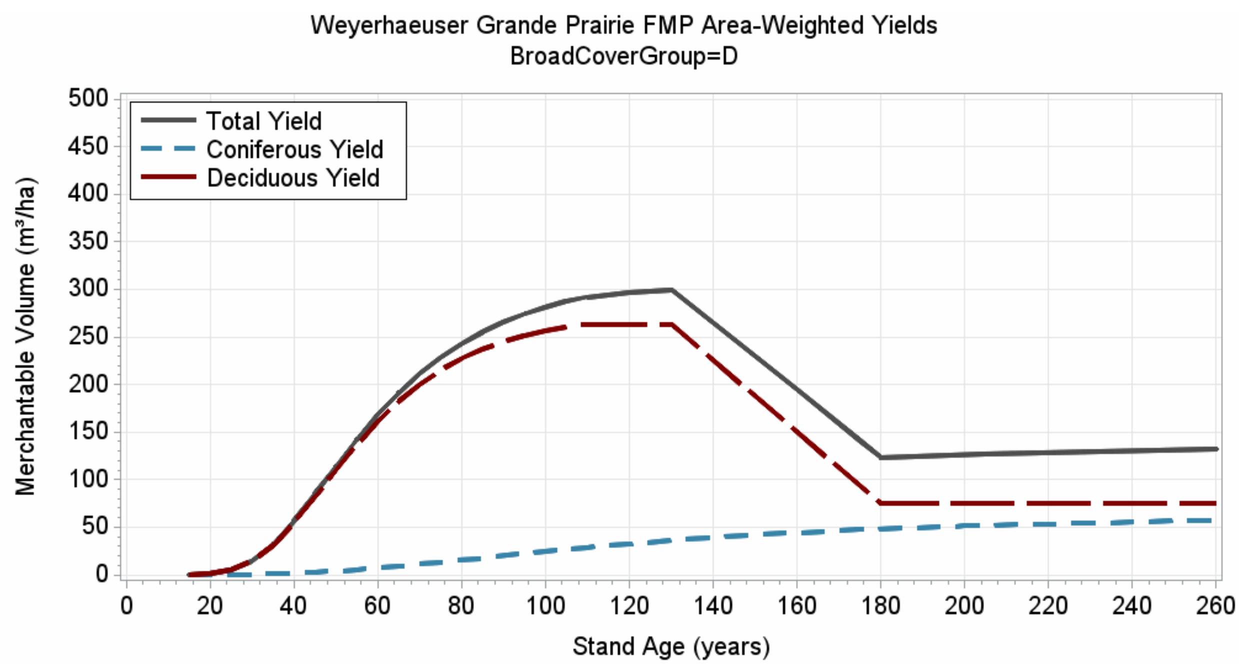


Figure 23. Area-weighted natural stand yield curve for BCG=D.

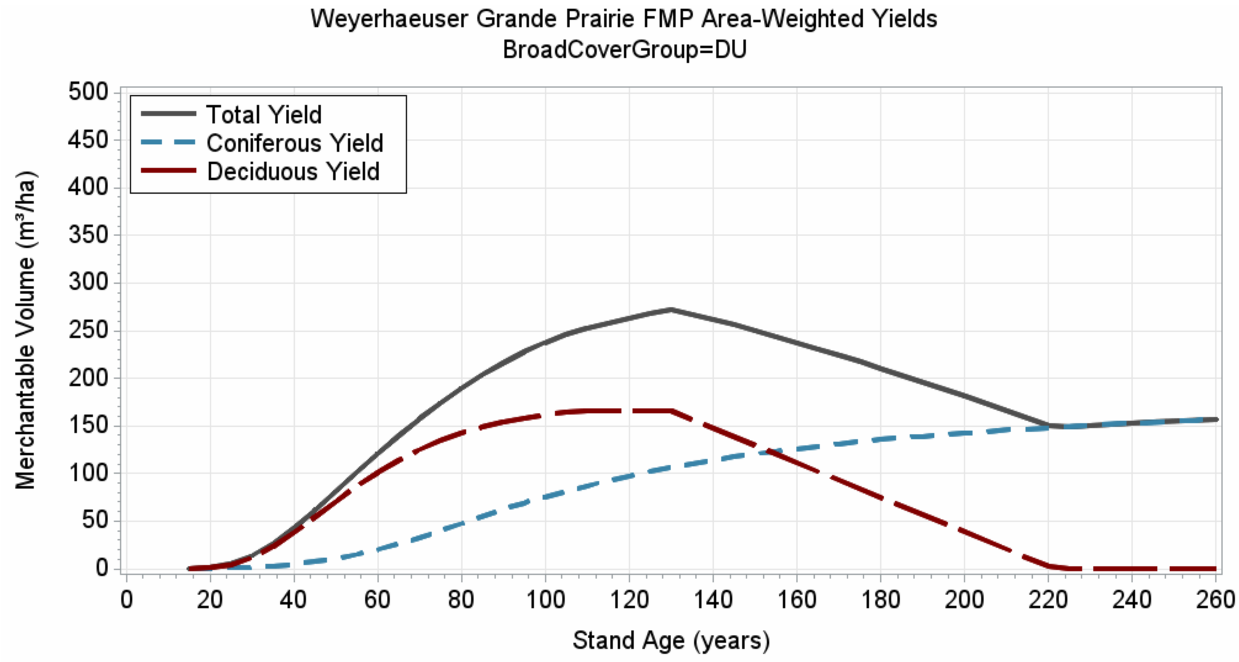


Figure 24. Area-weighted natural stand yield curve for BCG=DU.

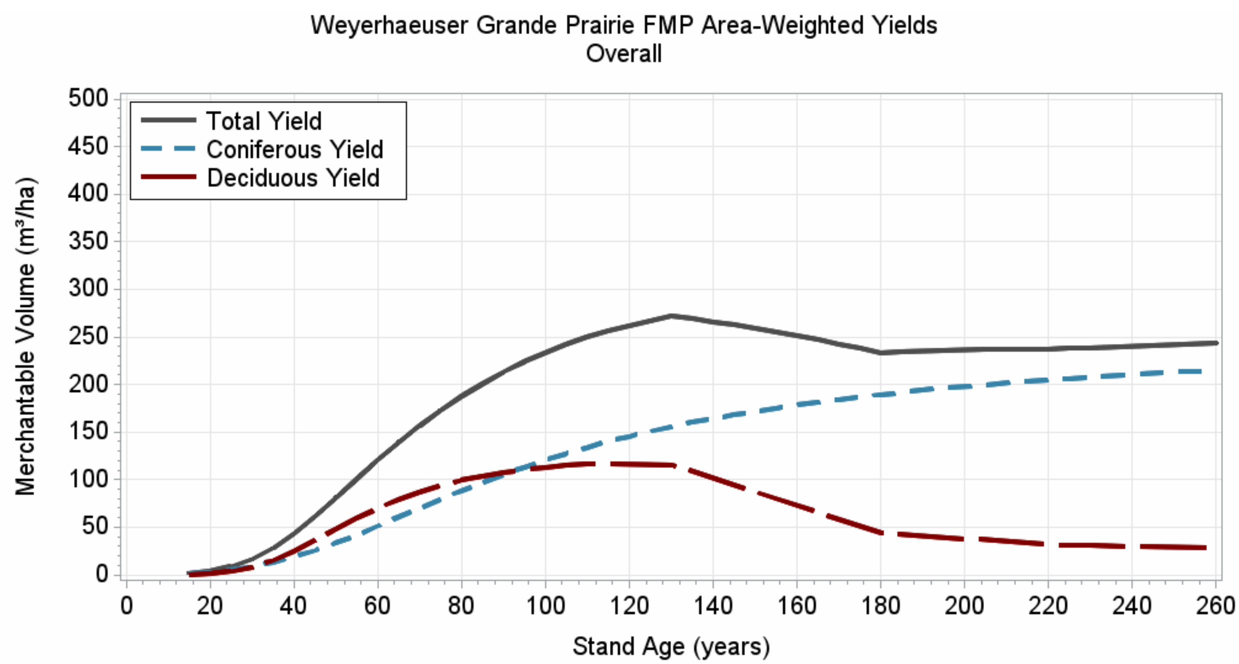


Figure 25. Area-weighted natural stand yield curve for BCG=ALL.

The overall area-weighted natural stand total yield curves were also compared against the 20-year age class based PSP average total volumes as presented in Figure 26.

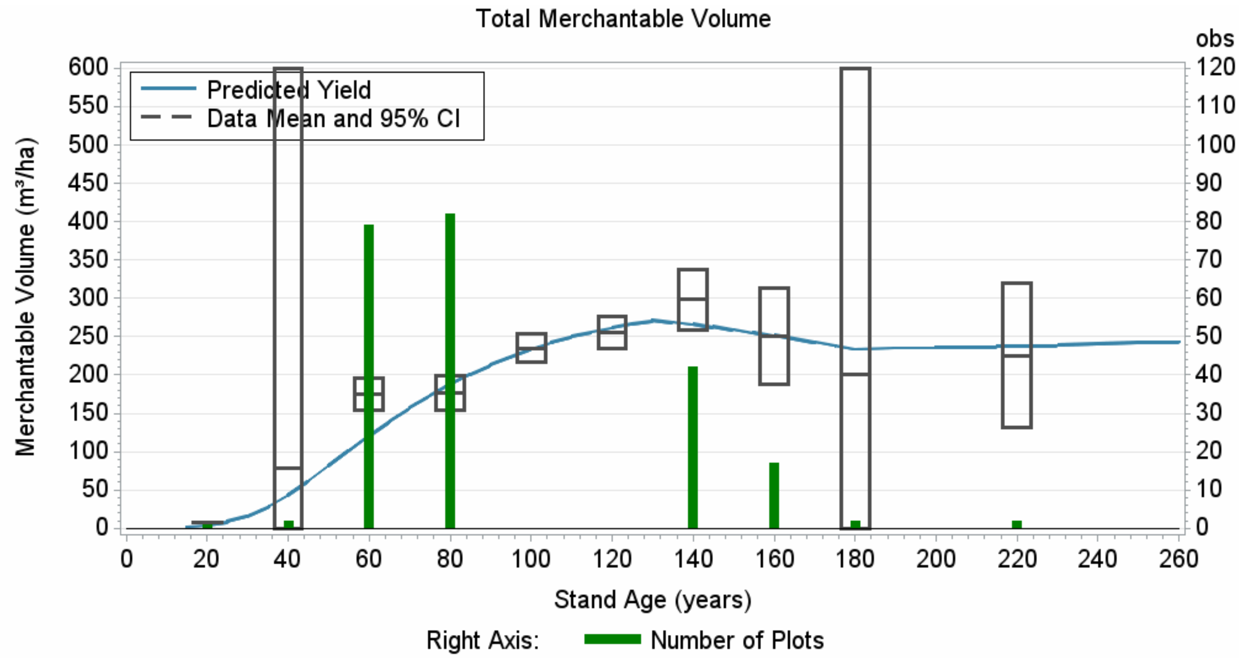


Figure 26. Average PSP volumes vs. area-weighted natural stand total yield by 20-year age class.

5.2 Piece Size Curves

The Planning Standard requires piece size to be included as part of the standard yield table output. Average piece size is especially important for the conifer component of the yield curves and its relative change over the planning horizon is being reported in the timber supply analysis. Piece size is a reported performance statistic only and it is not used as a constraint in the AAC determination.

5.2.1 Natural Stands

Due to the poor prediction of merchantable densities for natural stands in the GYPSY model, it was decided to predict conifer and deciduous piece size as the function of stand age using regression:

$$ps = t_0 * age^{t_1} * \exp{(-t_0 * age)}$$

where

ps: conifer or deciduous piece size (m^3/tree)

age: AVI stand age (years)

t_0, t_1: regression coefficients

The regression equations were run by natural yield group except for the mixedwood stands where all CD and DC yield groups were combined for the conifer piece size and all CD groups were combined for the deciduous piece size. The same set of plots assembled for natural stand yield curve development (see Section 2.2.1) was used for piece size curve development. The data set was limited to stands between 40 and 200 years to avoid potential convergence issues due to missing or erroneous data. The fit statistics are presented in Table 5-2.

Table 5-2. Fit statistics for the natural stand conifer and deciduous piece size equations.

Species Type	Group	# of Plots*	t0**	t1	sse	status**
Conifer	CD_DC	86	0.004784	1.14696	19.7262	
	C_PLOC	58	0.004854	1.03791	3.9195	
	C_PL_AB	29	0.000149	1.67942	1.5510	
	C_PL_CD	41	0.000572	1.33738	1.1002	
	C_SB	15	0.000668	1.19621	0.0909	
	C_SW	58	0.005524	1.09297	8.1970	
	C_SWOC	34	0.002828	1.13246	3.1325	
	D_AB	35	0.001738	1.29900	6.6478	
	D_CD	89	0.004711	1.02766	2.5240	
	D_US	23	0.000019	2.22938	1.0522	
Deciduous	CD_DC	48	0.000010	2.38073	10.7390	
	C_PLOC	58	0.001259	1.32926	4.8062	NS
	C_PL_AB	29	0.000006	2.57853	6.4357	NS
	C_PL_CD	41	0.000000	4.62434	4.7384	DNC
	C_SB	15	0.000000	4.60150	0.0155	NS
	C_SW	58	0.000028	2.13810	8.7571	
	C_SWOC	34	0.000225	1.78412	23.7277	NS
	DC_SX	38	0.000000	3.22321	2.5268	
	D_AB	35	0.001498	1.37319	3.5694	
	D_CD	89	0.000573	1.54901	8.1285	
	D_US	23	0.002786	1.16944	0.4522	

** Plot measurements between 40-200 years stand age were used.*

*** NS:regression not significant (p=99%), DNC: regression did not converge*

All conifer piece size equations converged using the Marquardt method in SAS. There was a relatively poor fit for the deciduous piece size in the pure conifer yield groups due to the limited amount of deciduous stems in these strata therefore we substituted the C_SB for all pine-leading pure conifer yield groups (C_PL_AB, C_PL_CD and C_PLOC) and used C_SW for all white spruce leading pure conifer yield groups (C_SW_AB, C_SW_CD and C_SWOC).

Conifer piece size predictions were capped at 200 years and deciduous piece size predictions were capped at 120 years. The piece size for the deciduous component was set to a missing value once the stand reached 0 m^3/ha merchantable volume. The resulting piece size curves were plotted against the observed average piece size values by 20-year age class of the PSPs in the net landbase the same way merchantable volumes were done in Section 2.6.2.

The resulting validation chart for the conifer piece size in the C_PLOC stratum and the deciduous piece size in the D_CD stratum which are the 2 largest natural strata are shown in Figure 27 and Figure 28, respectively.

The rest of the validation charts and the piece size curves are presented in Appendix VII.

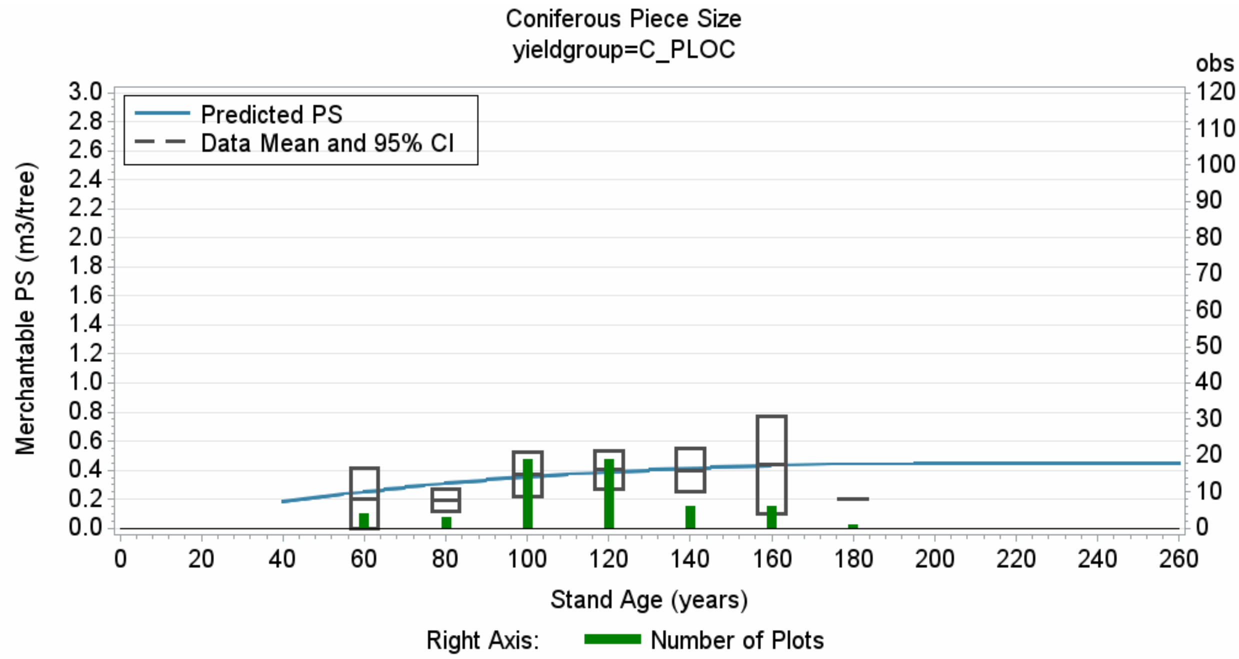


Figure 27. Conifer piece size curve against 20-year plot averages for yield group: C_PLOC.

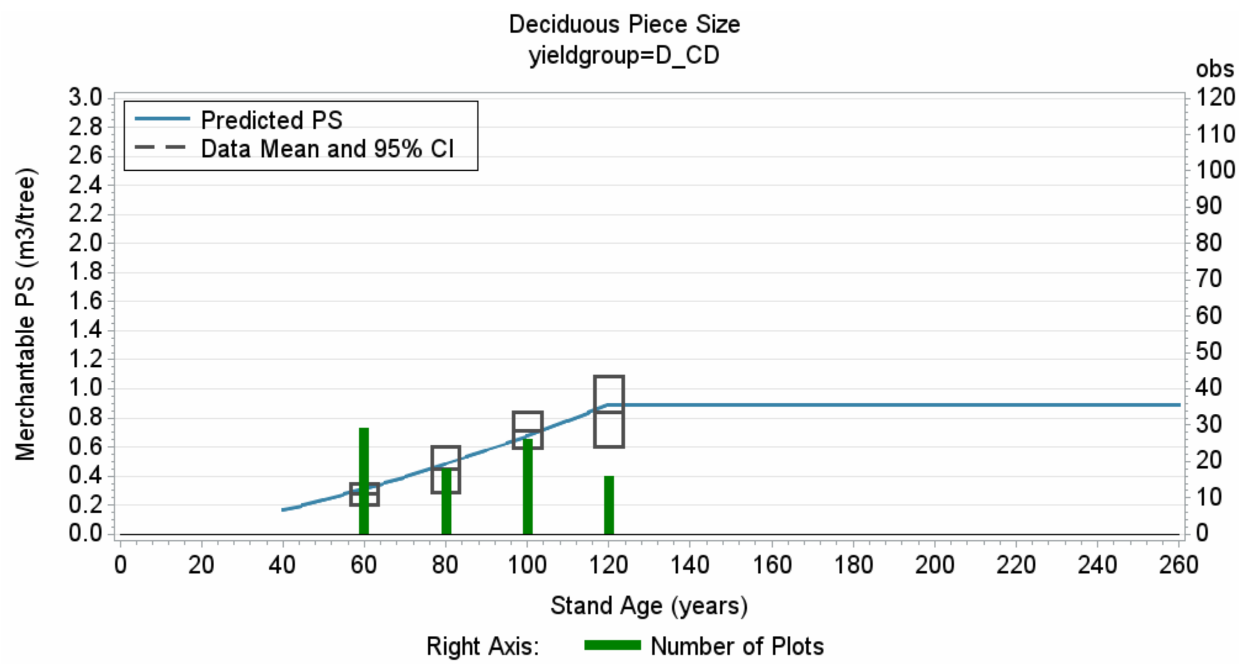


Figure 28. Deciduous piece size curve against 20-year plot averages for yield group: D_CD.

5.2.2 Pre-1991 Managed Stands

Piece size curves for pre-1991 managed stands were based on the curves developed for natural stand yield groups. The C_PL_CD piece size curves were substituted for the PL yield group; the C_SW_CD piece size curves were substituted for the SW yield group and the CD_PL and CD_SX curves were substituted for the Mx_PL and Mx_SX yield groups, respectively.

5.2.3 Post-1991 Managed Stands

Piece size curves for post-1991 managed stands were created based on RSA performance survey data-based GYPSY yield and merchantable density projections[33].

Merchantable density and merchantable volume were obtained from GYPSY model projections by species group, and then summed across species groups to create estimates for deciduous and coniferous species types. Piece size was then calculated as m^3/tree (dividing merchantable volume by merchantable density) over stand age. The resultant deciduous piece size curves showed some sudden fluctuations due to some implausibly large piece size estimates at older ages. This appears to be an artifact of the GYPSY model when merchantable density decreases much faster than volume in certain stands (usually with low site index and low initial volumes). The resultant deciduous curves were “smoothed” by fitting a regression to the average data points for the Pl, PlHw, Sw and SwHw regenerating yield strata.

The piece size curves for post-1991 managed stand yield groups are presented in Appendix VIII.

[33] Post-1991 managed stands have demonstratively different tree taper characteristics as reflected by the tree slenderness coefficient measured by the height-DBH ratio. It is expected that piece size development of these stands will be different from those in natural stands due to different early stand densities and spatial distribution of the stems. There is currently not enough data on merchantable stems.

5.3 MAI Targets

As per the current Regeneration Standard of Alberta (AAF 2017a):

"Development of MAI standards are a mandatory component of the forest management planning process. Once developed and approved, the MAI standards will apply to all timber disposition operations covered by the Forest Management Plan (FMP). Should multiple Timber Supply Analyses (TSA) be included in the FMP (i.e., a TSA run for each FMU within an FMA), then the MAI standards shall reflect each TSA ... The number of MAI standards shall reflect the number of regenerated yield strata assumed in the FMP to a minimum of the Base 10 strata, as outlined in the Forest Management Planning Standard."

Since Weyerhaeuser's timber supply will be analyzed as one FMU (G16), culmination mean annual increment (MAI) targets were developed specific to FMU G16.

- The D_CD yield stratum is managed for deciduous yield, and therefore deciduous culmination was used to select MAI targets.
- All coniferous and mixedwood strata are managed primarily for coniferous yield, and therefore coniferous culmination was used to select MAI targets.

MAI targets are provided for Weyerhaeuser and quota holders in Table 5-3. Note that except for the D_CD and C_SB strata, all targets were derived by recompiling the RSA performance survey based MGD yield curves at 15/10/30/TL RSA utilization standard for both the conifer and deciduous components.

We used the Provincial Utilization Standard Conversion Tool (Stadt *et al.* 2014) to convert the FMP utilization to the RSA standard for the Foothills natural region. The conifer volume conversion factor was 0.970 and the deciduous conversion factor was 0.978 for the 1-D GoA base 10 stratum that was used to derive target MAIs for the D_CD yield group. The conifer volume conversion factor was 0.908 and the deciduous conversion factor was 0.976 for the 9-C-SB GoA base 10 stratum that was used to derive target MAIs for the C_SB yield group.

Table 5-3. Culmination MAI targets for FMU G16.

Silviculture	Yield Group	GoA Base 10	Yield Type	Culm. Age	Culmination MAI (m^3/ha/yr)		
					Conifer	Deciduous	Total
Basic	D_CD	Hw	DEC	70	0.14	2.89	3.03
	C_SB	Sb	CON	180	1.01	0.00	1.01
	Pl	Pl	CON	100	3.18	0.42	3.60
	PlHw	PlHw	CON	100	2.63	1.33	3.96
	Sw	Sw	CON	110	2.83	0.40	3.23
	SwHw	SwHw	CON	100	2.53	1.24	3.77
Genetic	Pl_G147p2	Pl	CON	100	3.41	0.42	3.83
	Pl_G303	Pl	CON	100	3.26	0.42	3.68
	Pl_G804	Pl	CON	100	3.53	0.42	3.95
	Sw_G351p2	Sw	CON	110	3.02	0.40	3.42

5.4 Regeneration Transitions

Weyerhaeuser's planned silviculture transitions to the 6 basic and 4 genetic regenerating strata for areas harvested after the effective date of the plan are presented in Table 5-4.

Table 5-4. Regeneration transitions for FMU G16 (Post-AIP).

Yield Type		Current Yield Group	Net Area (ha)	(%)	Regenerate To Basic	Regenerate To Genetic
NATURAL	NAT	D_AB	51,386	6.2	D_CD	
	NAT	D_CD	134,420	16.2	D_CD	
	NAT	D_US	38,398	4.6	SwHw	
	NAT	DC_PL	7,943	1.0	PlHw	
	NAT	DC_SX	39,042	4.7	SwHw	
	NAT	CD_SX	35,071	4.2	SwHw	
	NAT	CD_PL	10,634	1.3	PlHw	
	NAT	C_SW_AB	58,800	7.1	Sw	Sw_G351p2
	NAT	C_SW_CD	17,495	2.1	Sw	Sw_G351p2
	NAT	C_SWOC	35,795	4.3	Sw	Sw_G351p2
	NAT	C_PL_AB	34,320	4.1	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_PL_CD	57,348	6.9	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_PLOC	69,546	8.4	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_SB	17,023	2.1	C_SB	
PRE-1991 MANAGED	M91	PL	21,779	2.6	Pl	Pl_G147p2, Pl_G804, Pl_G303
	M91	SW	3,699	0.4	Sw	Sw_G351p2
	M91	CD_PL/DC_PL	5,929	0.7	PlHw	
	M91	CD_SX/DC_SX	3,331	0.4	SwHw	
	M91	D_AB	7,747	0.9	D_CD	
	M91	D_CD	4,844	0.6	D_CD	
	M91	D_US	5,366	0.6	SwHw	
	M91	C_SB	240	0.0	C_SB	
POST-1991 MANAGED	MGD	Hw	86	0.0	D_CD	
	MGD	HwPl	719	0.1	PlHw	
	MGD	HwSx	1,566	0.2	SwHw	
	MGD	PlHw	5,974	0.7	PlHw	
	MGD	SwHw	4,565	0.6	SwHw	
	MGD	Pl	73,864	8.9	Pl	Pl_G147p2, Pl_G804, Pl_G303
	MGD	Sw	18,715	2.3	Sw	Sw_G351p2
	MGD	Sb	24	0.0	C_SB	
	MGD	C_SB	972	0.1	C_SB	
	MGD	D_CD	41,393	5.0	D_CD	
	MGD	Pl_G147p1	17,398	2.1		Pl_G147p2, Pl_G804
	MGD	Sw_G351p1	4,402	0.5		Sw_G351p2

Genetic:

Tree Improvement, genetic stock planted in the B1, B2 (Pl) or G1(Sw) seed zones in Weyerhaeuser openings. Must be conifer declared openings based on caps and deployment schedules in the TSA.

5.5 Assessment of Standing Dead Volume

In order to assess the amount of standing dead[34] volume by yield group, all live and standing dead trees were compiled for merchantable volume for the natural stand PSPs used for yield curve development. Missing species codes were recovered from previous measurements for all snags. Missing DBH was replaced by the last recorded DBH of the tree for most standing dead trees (99%).

Most pine-dominated stands that were at risk of MPB attack had been harvested as part of the FMA healthy pine strategy in the last 10 years.

Table 5-5. Conifer standing dead volume by yield group in natural stands.

Yield	Average Conifer Yield (m^3/ha)			Snag	Number of
Group	Live	Snag	All	%	Plots
CD_SX	116	7	124	6	32
C_PLOC	223	30	252	12	58
C_PL_AB	202	11	213	5	29
C_PL_CD	234	15	249	6	41
C_SB	143	9	152	6	16
C_SW	200	22	222	10	58
C_SWOC	197	34	231	15	35
DC_SX	91	8	99	8	38
D_AB	35	14	49	29	35
D_CD	22	4	26	15	89
D_US	72	5	77	7	28
MX_PL	178	29	207	14	17

5.6 Yield Comparison to the 2011 DFMP

The predicted area-weighted yields by BCG were compared to those developed for the 2011 DFMP. Strata based comparisons are not possible as the stratification rules changed significantly between the plans.

There are several factors that make this comparison very difficult:

1. There was a new AVI completed in 2016 that used leaf-off photography and SOFTCOPY technology which could accurately detect conifer understorey down to 100 cm in height. This resulted in an overall increase of mixedwood stands and “switch” stands (conifer understorey stands).
2. The definition of “switch” stands changed significantly, which resulted in a 55% drop in the D_US stratum as compared to the 2011 DFMP definition. Most of these areas were in A and B density pure deciduous stands which shifted back to the deciduous landbase or netted out if it met the criteria for A-density deciduous stand subjective deletion.
3. Net landbase removal in the 2019 FMP will exclude areas in TPR=U that were included in the previous DFMP.

[34] Standing dead trees were identified as tree condition code = 5 (snags) and 79 (MPB-attacked stems).

4. Large amount of pine stands were harvested due to the MBP infestation. Most of these stands were on good sites and generally represented better timber and larger piece size.
5. Dead pine stems were discounted in the inventory calls for species composition, which also contributed to some stands shifting from pure conifer to mixedwood or even pure deciduous strata. These stands were identified through the inventory call modifier and some areas were subjectively deleted.
6. There were changes to some definitions and management of the Caribou Zone, Eastern Slopes and the steep slope definitions and removal.
7. More larch stands (and black spruce consequently) were included in the current FMP landbase which generally impacts yields for the pure conifer/other conifer strata.
8. The PSP data used in the 2011 DFMP included all measurements but used the stratum from the last measurement based on the AVI. The data included measurements that might have been impacted by the MPB infestation. The new plan only uses the last measurement and the impact of the MPB is accounted for as best possible to reflect the mortality levels at the time of the AVI.
9. The stratum definition changed to follow the GoA Base 10 strata rules and modeling changed from the 2-stage regression modeling to a semi-empirical regression fitting using the GYPSY model.

Many of these factors offset each other's impact and the change in modelling approach and data make it almost impossible to draw conclusions from yield comparisons of the two plans. Generally, we expect somewhat less conifer (due to the harvesting of predominantly pine stands), but it is slightly offset by the exclusion of TPR=U stands, and the new leaf off AVI that identified more conifer. The overall result of the yield comparison is shown in Figure 29, the results by BCG are included in Appendix IX.

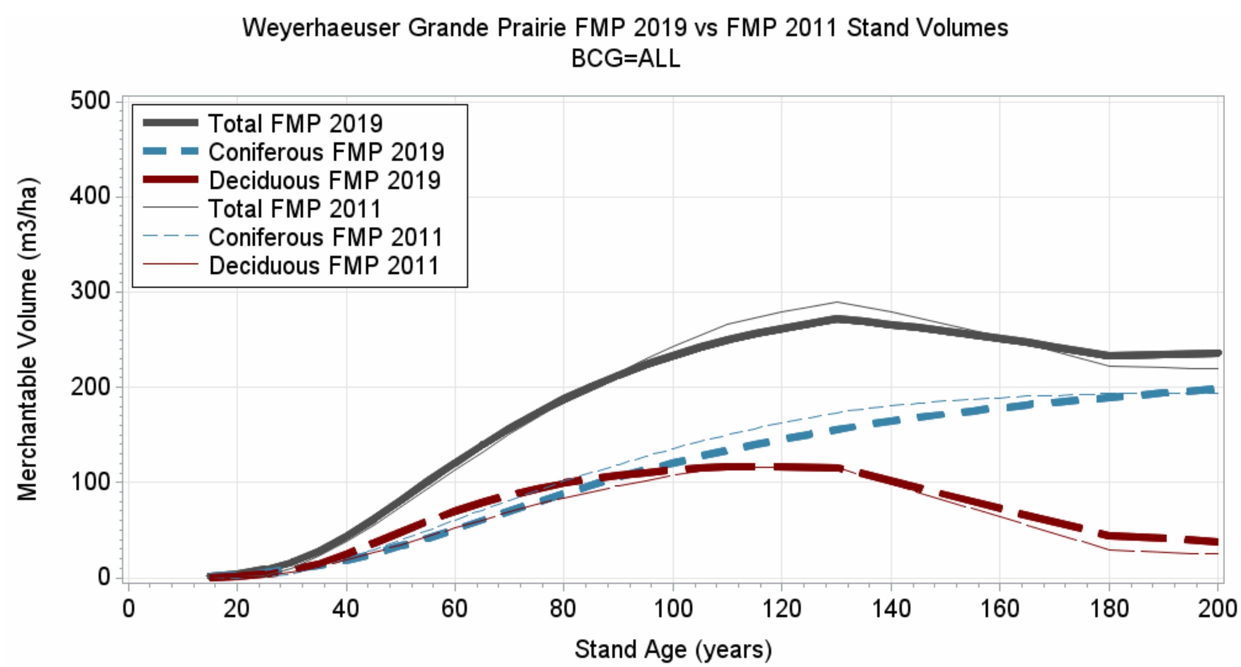


Figure 29. Overall area-weighted yield curves FMP 2019 vs FMP 2011.

5.7 Switch Stand Yield Curves with Conifer Regeneration

One of the shortcomings of GYPSY is the inability of the model to handle multiple cohorts of the same species. In natural stands, where basal area and top height drive the yield projections there is generally no issues when regeneration (trees <130 cm height) and even smaller trees (saplings) are excluded as they do not carry significant basal area and do not significantly impact the resulting yield curves.

Saplings may need to be accounted for the determination of top height to ensure that site index predictions are not adversely impacted by including two different cohorts with significant age differences. This was handled in the natural stand yields by excluding saplings from the top height determination and only mature trees were eligible. In addition, individual plots species components were also constrained by capping the predicted site index values.

Ignoring the regeneration however will impact yield curve prediction of the D_US stratum, where two cohorts of spruce are generally present. The spruce in conifer understorey layer below the pure deciduous overstorey is generally 30-40 years younger and carry some merchantable volume that is captured in the current GYPSY modeling approach. However, there is also a much younger cohort of spruce regeneration that is also identified in the AVI leaf off photography as a tertiary storey or as a conifer understorey stem count and canopy pattern (spatial distribution).

The growth of the conifer regeneration layer cannot be captured under the current modeling approach due to GYPSY's inability to project multiple cohorts of the same species.

In order to capture the growth resulting from the conifer regeneration, we calculated the average attributes as observed in the PSPs in the D_US stratum as shown in Table 5-6Table 5-6.

Table 5-6. Conifer regeneration in D_US stands.

Yield Stratum	Stand Age	Species	N (stems/ha)	Site Index (m)	Species Age	Percent Stocking
D_US	84	SW	205.4	14.7	11	18

As shown in Table 5-6, the average live conifer regeneration density is 205 stems/ha which is relatively low. This is mainly due to two factors: 1) regeneration plots in natural stand PSPs were not established until the 2007-2008 field season; and 2) some of the plots simply do not necessarily reflect the AVI stratum when it comes to conifer regeneration. Nevertheless, all plots without conifer regeneration were included with a 0 count that will result in a conservative estimate.

Regenerating trees do not provide for reliable top height estimates[35] and therefore the average white spruce site index of the D_US stratum was retained. Species age was calculated from the recorded total ages of conifer regeneration in the D_US plots.

In order to project the young stand component in GYPSY, percent stocking was estimated from the observed average density and assuming a random spatial distribution using the equation from Feng *et al*. 2006:

$$PS=100 *(1-exp(-(((1.7273*0.001*perha)/((1+distr)^{0.7608}))^{(1.0582-0.0353*distr)})))$$

where:

[35] Regenerating trees are below 130 cm therefore they do not have DBH.

PS: Percent stocking (%)

perha: observed conifer density (stems per hectare)

distr: spatial distribution value (random=1)

The conifer regeneration was projected as an independent stand component using GYPSY (Figure 30).

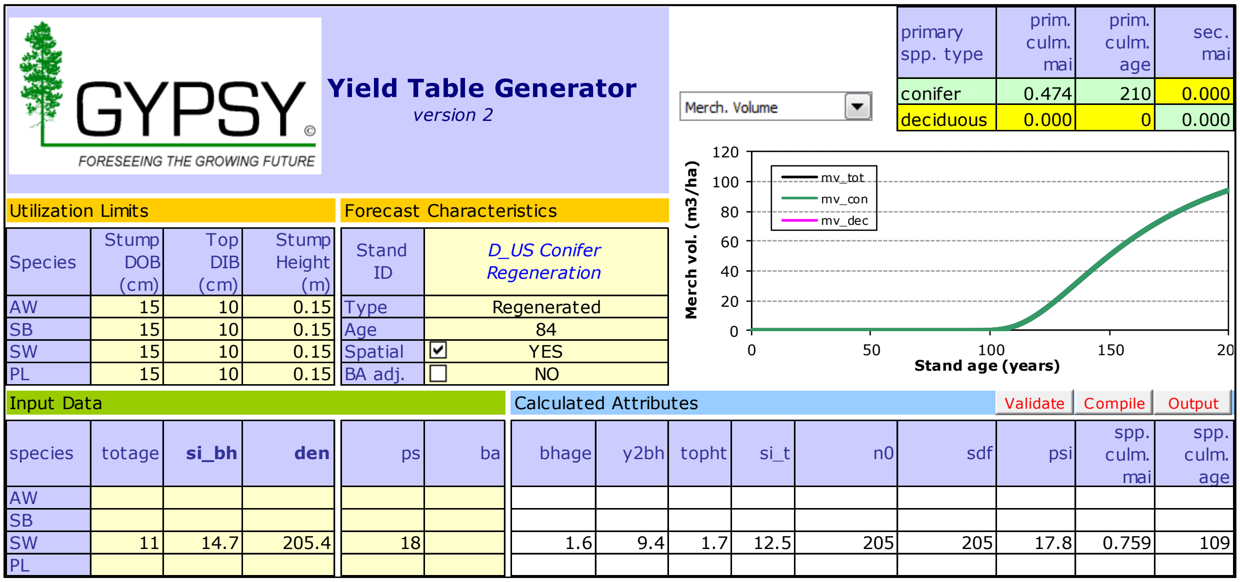


Figure 30. GYPSY volume projection of the conifer regeneration in the D_US stratum.

The projected volumes from the conifer regeneration were simply added to the original D_US yield curve. Note that there was an average 73 years difference between the stand age of the deciduous overstorey and the conifer regeneration in these PSPs.

The final D_US yield curve that accounts for conifer regeneration is presented in Figure 31.

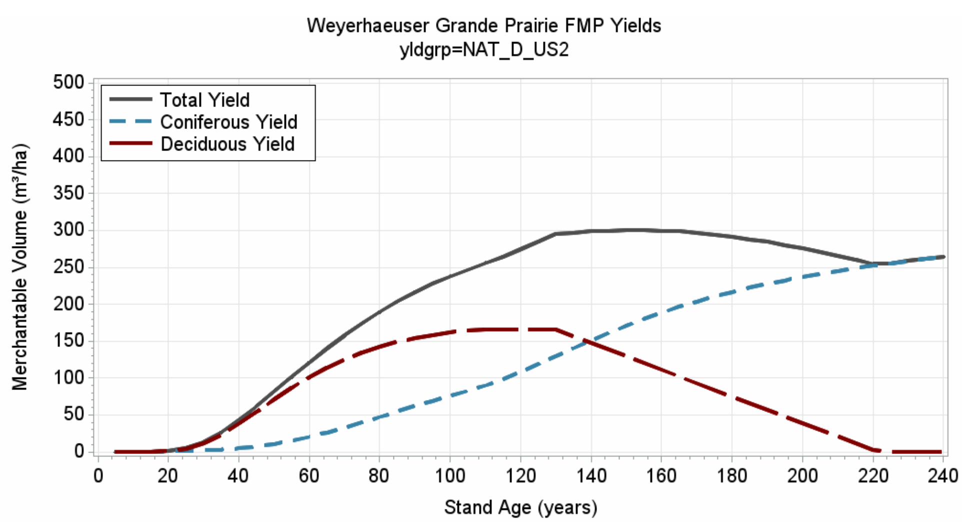


Figure 31. Proposed final yield curve for the D_US stratum.

***AIP#2**: As per directions by AAF, the basic D_US yield curve without the addition of the regeneration layer projection will be used in the FMP timer supply analysis and AAC determination.*

5.8 Post-AIP Larch Volume Adjustment

For the 2011 FMP, Weyerhaeuser subjectively deleted stands where greater than or equal to 20% of the stand's composition was larch. In the 2019 FMP Weyerhaeuser intends to include stands with up to 40% larch in the contributing land base and to operate these stands as they become eligible for harvest and are sequenced in the spatial harvest sequence (Weyerhaeuser 2019).

If a stand has greater than 40% larch or if a stand has greater than 10% larch and a calculated site index less than 8 m[36]; and either of these types of stands has never been harvested and is not planned for harvest; then these stands are removed from the classified landbase.

Weyerhaeuser's intent is not to have the larch volume contribute to the conifer AAC; therefore, the stands with 10-40% larch in the AVI that remain in the land base will be adjusted for conifer volume to remove the larch volume contribution.

The adjustment for the larch volume was done by calculating the area-weighted larch proportion of the AVI polygons by yield group and pro-rating the result as a percentage of the area-weighted conifer proportion based on the overstory[37].

Table 5-7. Larch adjustment factors by yield group.

Yield Group	Total Contributing Area (ha)	Net Area Weighted Conifer (%)	Net Area Weighted Deciduous (%)	Net Area Weighted Larch (%)	Larch Adjustment Factor (%)
D_AB	51,586	7.34	92.66	0.01	0.129
D_CD	135,889	4.48	95.52	0	0.024
D_US	38,509	10.41	89.59	0.01	0.102
DC_PL	7,903	37.19	62.81	0.03	0.073
DC_SX	39,381	34.91	65.09	0.24	0.686
CD_SX	35,286	63.86	36.14	0.41	0.644
CD_PL	10,496	65.78	34.22	0.11	0.162
C_SW_AB	58,956	93.36	6.64	0.25	0.266
C_SW_CD	17,481	91.25	8.75	0.11	0.119
C_SWOC	35,154	92.03	7.97	2.46	2.677
C_PL_AB	34,158	96.96	3.04	0.16	0.169
C_PL_CD	57,529	98.16	1.84	0.01	0.009
C_PLOC	69,393	95.23	4.77	0.28	0.296
C_SB	15,205	97.82	2.18	3.96	4.045

[36] The original AIP submission did not account for the 8 m site index minimum criteria. As a result, two plots would have been lost and removed from the landbase (606709000021 in C_SB and 607713000024 in C_SW_AB). These plots occur in very low productivity sites (16 m^3/ha and 99 m^3/ha observed volume at last measurement) and will have a minimal conservative impact on the resulting yields.

[37] The understory was used for the D_US stratum.

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Appendix I – Outliers Removed from Yield Analysis

Plot ID	Meas Year	Yield Group	Stand Age	Merch Vol. (m^3/ha)	Reason for Deletion
606411000013	2014	C_PL_CD	147		plot was deactivated before AVI photo
606511000036	2017	D_AB	87	688.5	high volume above 550 m^3/ha -suspect plot data
606113000024	2008	C_PL_CD	117	576.3	high volume above 550 m^3/ha -suspect plot data
606212000004	2012	C_PLOC	117	574.3	high volume above 550 m^3/ha -suspect plot data
606107000006	2017	C_SWOC	117	573.6	high volume above 550 m^3/ha -suspect plot data
606410000033	2004	C_PL_CD	137	570.1	high volume above 550 m^3/ha -suspect plot data
606305000033	2014	DC_SX	117	557.1	high volume above 550 m^3/ha -suspect plot data
606809000004	2012	D_CD	107	551.9	high volume above 550 m^3/ha -suspect plot data
606411000019	2013	D_AB	97		influential point pure C component in pure D, AVI after MPB control - invalid measurement does not reflect AVI
606309000024	2008	D_AB	117		influential point pure C component in pure D, AVI after MPB control - invalid measurement does not reflect AVI
606006000001	2010	D_CD	77		influential point pure C component in pure D, AVI after MPB control - invalid measurement does not reflect AVI

Appendix II – Taper Equation Coefficients

spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
AW	0	0.79041	1.02694	0.99752	0.60058	-0.06568	-0.17381	0.12136	0.06325	0.225
AW	1	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	2	0.94452	0.93803	1.00164	0.69536	-0.06785	0.05060	-0.01633	0.11643	0.225
AW	3	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	4	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	5	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	6	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	7	0.58884	1.16190	0.99210	0.70930	-0.07545	-0.11604	0.04095	0.11364	0.225
AW	8	0.58884	1.16190	0.99210	0.70930	-0.07545	-0.11604	0.04095	0.11364	0.225
AW	9	0.90562	0.96489	1.00005	0.55324	-0.04974	-0.28077	0.17069	0.07579	0.225
AW	10	0.58884	1.16190	0.99210	0.70930	-0.07545	-0.11604	0.04095	0.11364	0.225
AW	11	0.90562	0.96489	1.00005	0.55324	-0.04974	-0.28077	0.17069	0.07579	0.225
AW	12	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	13	0.84190	0.99706	0.99871	0.53687	-0.06402	-0.23447	0.17996	0.03155	0.225
AW	14	0.94452	0.93803	1.00164	0.69536	-0.06785	0.05060	-0.01633	0.11643	0.225
AW	15	0.94452	0.93803	1.00164	0.69536	-0.06785	0.05060	-0.01633	0.11643	0.225
AW	16	0.94452	0.93803	1.00164	0.69536	-0.06785	0.05060	-0.01633	0.11643	0.225
AW	17	0.79041	1.02694	0.99752	0.60058	-0.06568	-0.17381	0.12136	0.06325	0.225
AW	18	0.79041	1.02694	0.99752	0.60058	-0.06568	-0.17381	0.12136	0.06325	0.225
AW	19	0.79041	1.02694	0.99752	0.60058	-0.06568	-0.17381	0.12136	0.06325	0.225
AW	20	0.79041	1.02694	0.99752	0.60058	-0.06568	-0.17381	0.12136	0.06325	0.225
BW	0	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	1	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	2	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	3	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	4	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	5	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	6	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	7	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	8	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	9	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	10	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	11	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	12	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	13	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	14	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	15	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225

spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
BW	16	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	17	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	18	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	19	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
BW	20	0.89436	1.00772	0.99138	-0.48307	0.15559	-2.27312	1.32650	0.16890	0.225
FA	0	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FA	1	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	2	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	3	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	4	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	5	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	6	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	7	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FA	8	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FA	9	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	10	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FA	11	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	12	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	13	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	14	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	15	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	16	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FA	17	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FA	18	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FA	19	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FA	20	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FB	0	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FB	1	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	2	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	3	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	4	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	5	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	6	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	7	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FB	8	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FB	9	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	10	1.10801	0.89838	1.00182	1.33834	-0.30463	2.69436	-1.27762	0.08744	0.225
FB	11	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	12	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225

spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
FB	13	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	14	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	15	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	16	0.91865	0.99023	0.99729	1.56851	-0.38426	3.50347	-1.67719	0.12817	0.225
FB	17	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FB	18	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FB	19	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FB	20	1.00202	0.94408	0.99992	1.33633	-0.32035	2.83950	-1.32482	0.07745	0.225
FD	0	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	1	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	2	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	3	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	4	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	5	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	6	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	7	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	8	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	9	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	10	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	11	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	12	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	13	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	14	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	15	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	16	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	17	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	18	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	19	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
FD	20	0.91315	0.96439	0.99839	1.38632	-0.28650	1.78390	-0.91693	0.05883	0.225
LT	0	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	1	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	2	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	3	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	4	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	5	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	6	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	7	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	8	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	9	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225

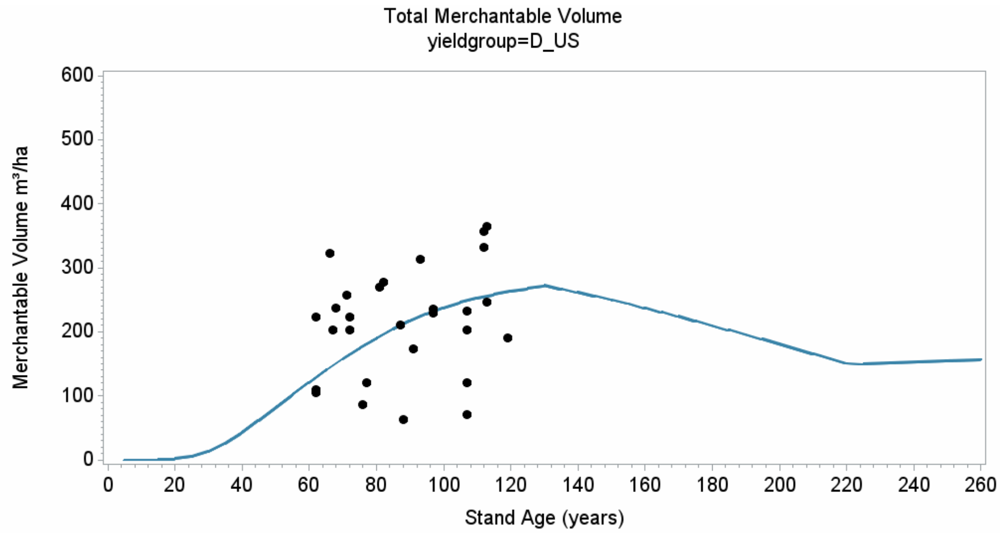
spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
LT	10	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	11	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	12	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	13	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	14	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	15	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	16	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	17	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	18	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	19	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
LT	20	0.93352	0.96547	0.99839	2.07946	-0.46203	3.73206	-1.95019	0.19043	0.225
PB	0	0.86118	0.95148	1.00096	0.75258	-0.16731	0.69361	-0.22414	0.00821	0.225
PB	1	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	2	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	3	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	4	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	5	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	6	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	7	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	8	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	9	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	10	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	11	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	12	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	13	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	14	0.91333	0.92259	1.00257	0.30845	-0.06567	-0.10213	0.22634	0.02315	0.225
PB	15	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	16	0.80437	0.98287	0.99953	0.99696	-0.22325	1.10673	-0.45982	-0.00339	0.225
PB	17	0.86118	0.95148	1.00096	0.75258	-0.16731	0.69361	-0.22414	0.00821	0.225
PB	18	0.86118	0.95148	1.00096	0.75258	-0.16731	0.69361	-0.22414	0.00821	0.225
PB	19	0.86118	0.95148	1.00096	0.75258	-0.16731	0.69361	-0.22414	0.00821	0.225
PB	20	0.86118	0.95148	1.00096	0.75258	-0.16731	0.69361	-0.22414	0.00821	0.225
PJ	0	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	1	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	2	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	3	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	4	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	5	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	6	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225

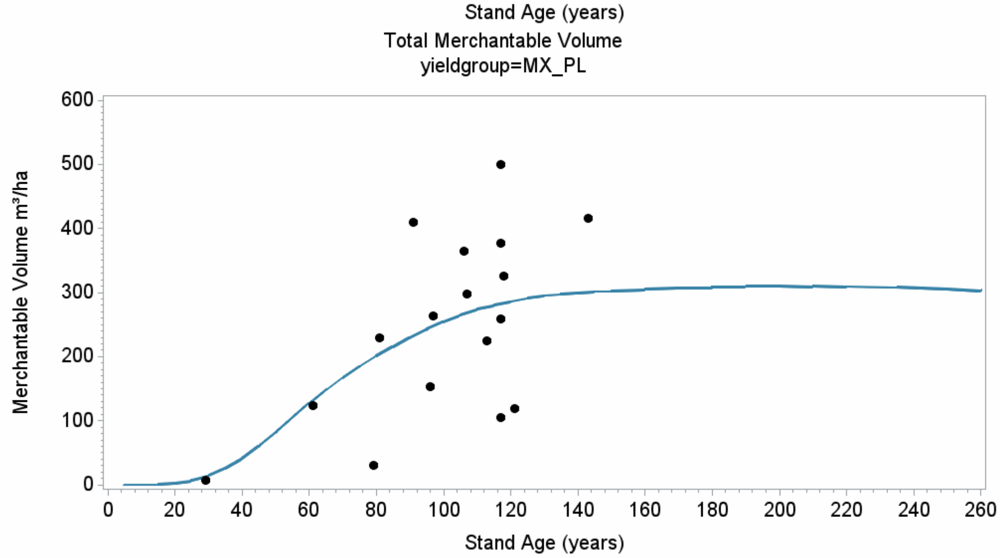
spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
PJ	7	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	8	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	9	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	10	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	11	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	12	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	13	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	14	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	15	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	16	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	17	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	18	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	19	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PJ	20	0.94083	0.95558	0.99933	0.11631	-0.02817	-0.38443	0.30406	0.07219	0.225
PL	0	0.89762	0.98852	0.99874	0.67576	-0.13031	0.57063	-0.27546	0.10540	0.225
PL	**1**	**0.61050**	**1.16503**	**0.99128**	**0.63440**	**-0.09797**	**0.47517**	**-0.24073**	**0.14085**	**0.225**
PL	2	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	3	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	4	0.82867	1.02420	0.99749	0.59619	-0.11878	0.46559	-0.19618	0.08309	0.225
PL	5	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	6	0.95716	0.95999	0.99977	0.76675	-0.14076	0.66604	-0.35505	0.13214	0.225
PL	7	0.80065	1.05354	0.99557	0.56835	-0.12511	0.61009	-0.23844	0.04540	0.225
PL	8	0.80065	1.05354	0.99557	0.56835	-0.12511	0.61009	-0.23844	0.04540	0.225
PL	9	0.95716	0.95999	0.99977	0.76675	-0.14076	0.66604	-0.35505	0.13214	0.225
PL	10	0.82867	1.02420	0.99749	0.59619	-0.11878	0.46559	-0.19618	0.08309	0.225
PL	11	0.95716	0.95999	0.99977	0.76675	-0.14076	0.66604	-0.35505	0.13214	0.225
PL	12	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	13	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	14	0.95716	0.95999	0.99977	0.76675	-0.14076	0.66604	-0.35505	0.13214	0.225
PL	15	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	16	1.03357	0.91362	1.00077	0.25663	-0.04909	-0.25212	0.17427	0.12372	0.225
PL	17	0.89762	0.98852	0.99874	0.67576	-0.13031	0.57063	-0.27546	0.10540	0.225
PL	18	0.89762	0.98852	0.99874	0.67576	-0.13031	0.57063	-0.27546	0.10540	0.225
PL	19	0.89762	0.98852	0.99874	0.67576	-0.13031	0.57063	-0.27546	0.10540	0.225
PL	20	0.89762	0.98852	0.99874	0.67576	-0.13031	0.57063	-0.27546	0.10540	0.225
SB	0	0.94070	0.95721	0.99964	1.39578	-0.34467	2.83592	-1.39646	0.15249	0.225
SB	1	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	2	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	3	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225

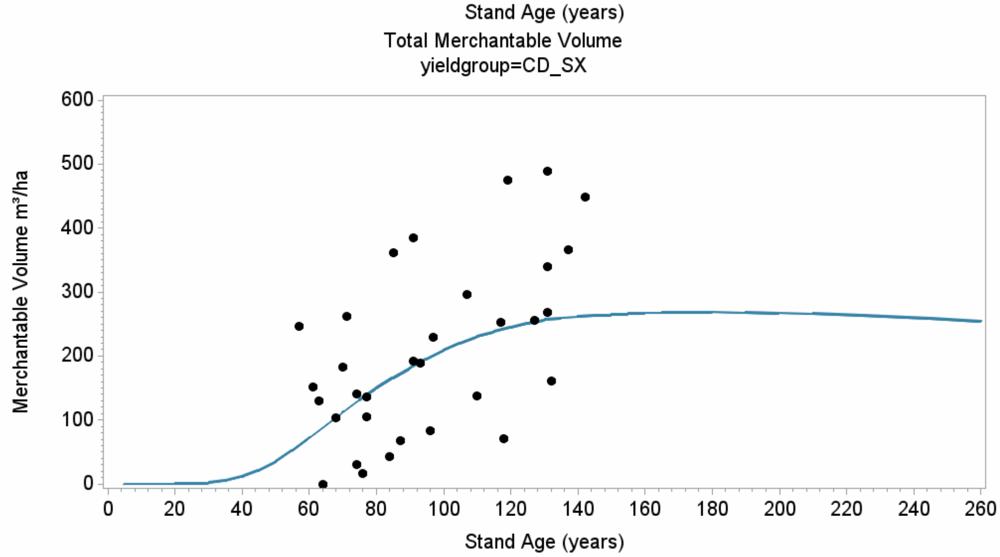
spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
SB	4	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	5	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	6	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	7	0.95762	0.94674	1.00045	1.43046	-0.35670	2.95073	-1.45547	0.15426	0.225
SB	8	0.95762	0.94674	1.00045	1.43046	-0.35670	2.95073	-1.45547	0.15426	0.225
SB	9	0.95762	0.94674	1.00045	1.43046	-0.35670	2.95073	-1.45547	0.15426	0.225
SB	10	0.95762	0.94674	1.00045	1.43046	-0.35670	2.95073	-1.45547	0.15426	0.225
SB	11	0.95762	0.94674	1.00045	1.43046	-0.35670	2.95073	-1.45547	0.15426	0.225
SB	12	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	13	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	14	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	15	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	16	0.92904	0.96772	0.99851	1.23660	-0.30820	2.53551	-1.22206	0.14624	0.225
SB	17	0.94070	0.95721	0.99964	1.39578	-0.34467	2.83592	-1.39646	0.15249	0.225
SB	18	0.94070	0.95721	0.99964	1.39578	-0.34467	2.83592	-1.39646	0.15249	0.225
SB	19	0.94070	0.95721	0.99964	1.39578	-0.34467	2.83592	-1.39646	0.15249	0.225
SB	20	0.94070	0.95721	0.99964	1.39578	-0.34467	2.83592	-1.39646	0.15249	0.225
SE	0	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	1	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	2	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	3	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	4	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	5	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	6	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	7	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	8	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	9	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	10	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	11	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	12	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	13	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	14	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	15	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	16	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	17	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	18	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	19	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SE	20	1.07258	0.89777	1.00192	1.30183	-0.30544	2.26572	-1.11967	0.12352	0.225
SW	0	0.86044	0.99541	0.99849	1.04022	-0.25239	1.84282	-0.85223	0.11036	0.225

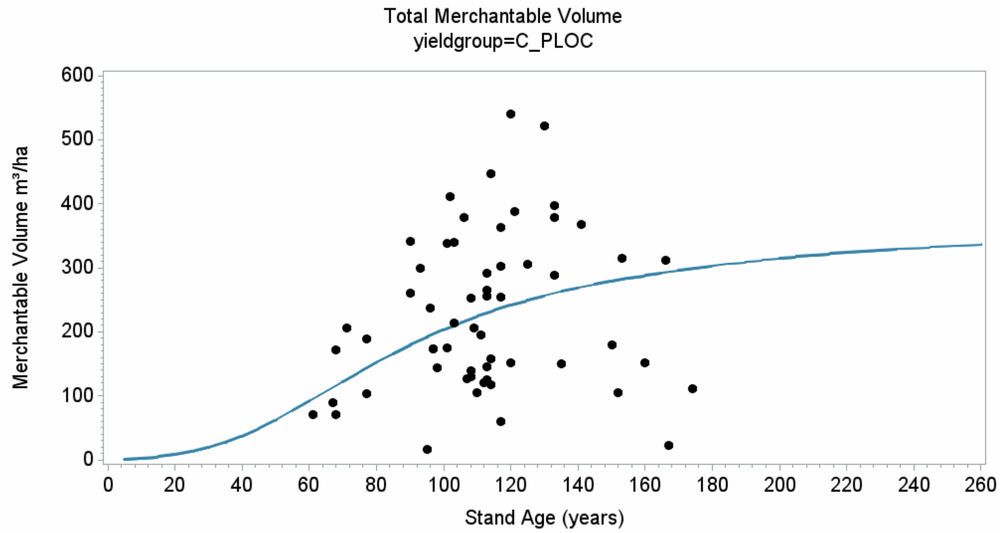
spp	nsr	a0	a1	a2	b1	b2	b3	b4	b5	p
SW	1	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	2	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	3	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	4	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	5	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	6	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	7	0.71339	1.07153	0.99607	1.15368	-0.28381	2.02271	-0.95378	0.10161	0.225
SW	8	0.71339	1.07153	0.99607	1.15368	-0.28381	2.02271	-0.95378	0.10161	0.225
SW	9	0.86269	0.99315	0.99877	1.13502	-0.25238	1.88532	-0.92144	0.15023	0.225
SW	10	0.71339	1.07153	0.99607	1.15368	-0.28381	2.02271	-0.95378	0.10161	0.225
SW	11	0.86269	0.99315	0.99877	1.13502	-0.25238	1.88532	-0.92144	0.15023	0.225
SW	12	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	13	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	14	0.86269	0.99315	0.99877	1.13502	-0.25238	1.88532	-0.92144	0.15023	0.225
SW	15	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	16	0.90353	0.97514	0.99902	0.84698	-0.24497	1.78310	-0.73024	0.04100	0.225
SW	17	0.86044	0.99541	0.99849	1.04022	-0.25239	1.84282	-0.85223	0.11036	0.225
SW	18	0.86044	0.99541	0.99849	1.04022	-0.25239	1.84282	-0.85223	0.11036	0.225
SW	19	0.86044	0.99541	0.99849	1.04022	-0.25239	1.84282	-0.85223	0.11036	0.225
SW	20	0.86044	0.99541	0.99849	1.04022	-0.25239	1.84282	-0.85223	0.11036	0.225

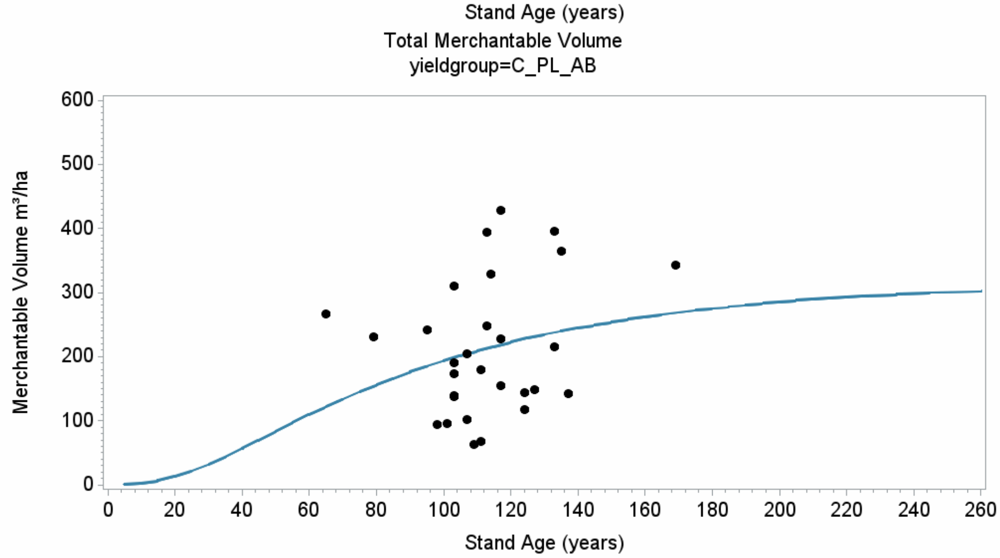
Appendix III – Individual PSP Measurements vs. Natural Yield Curves

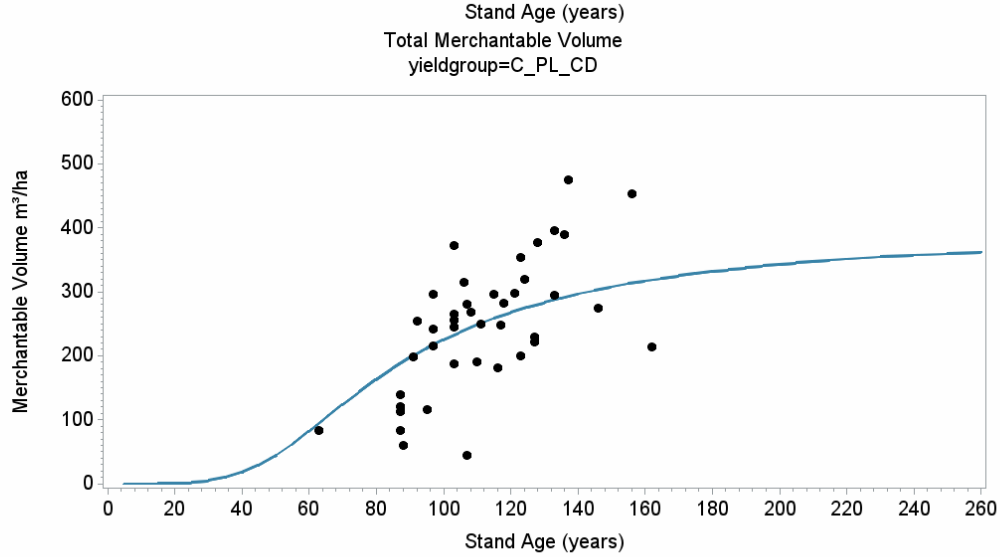

Total Merchantable Volume
yieldgroup=D_US
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

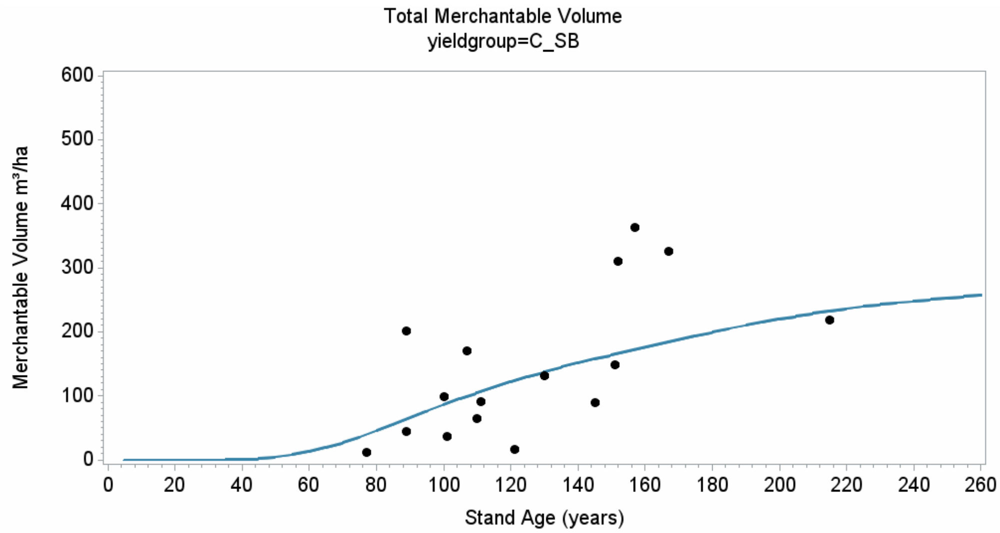

Total Merchantable Volume
yieldgroup=MX_PL
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

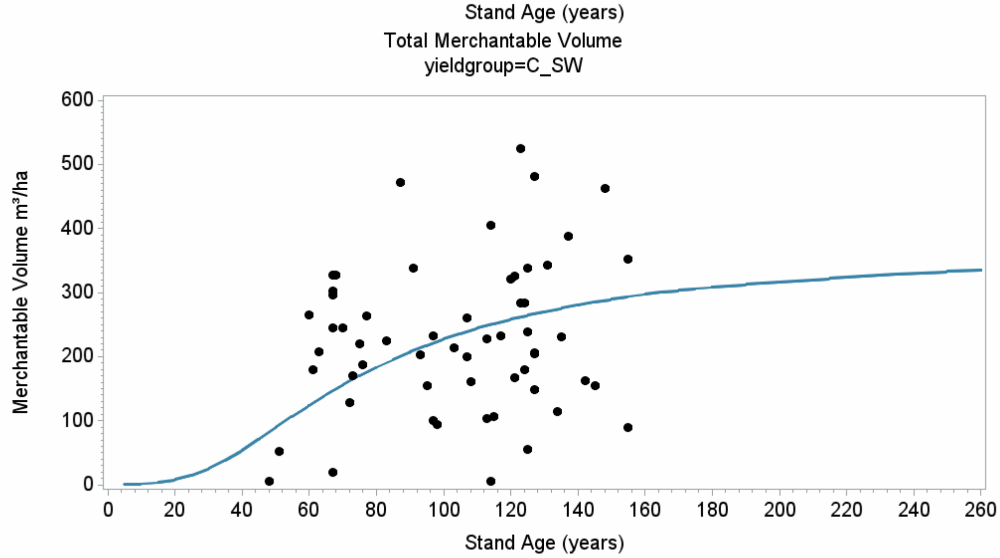

Total Merchantable Volume
yieldgroup=CD_SX
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

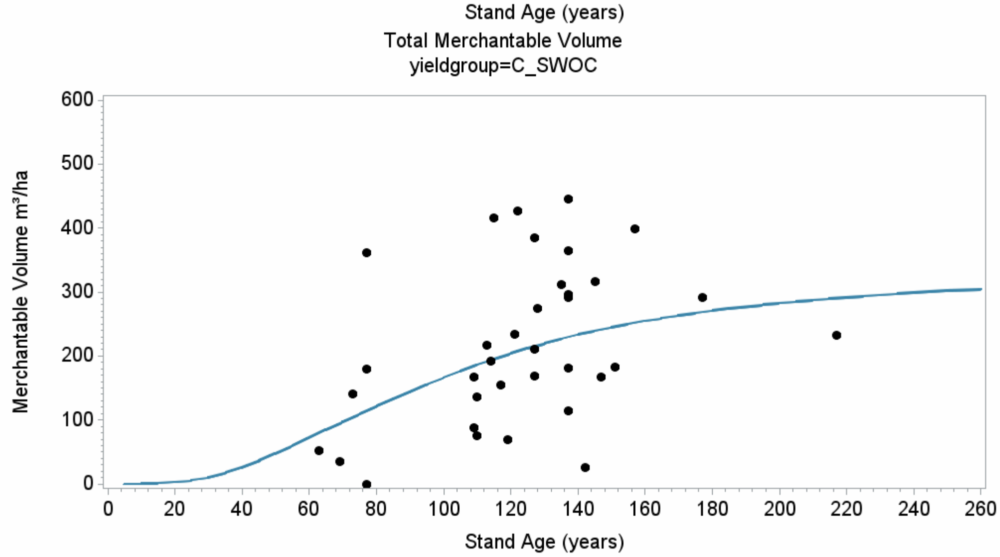

Total Merchantable Volume
yieldgroup=C_PLOC
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

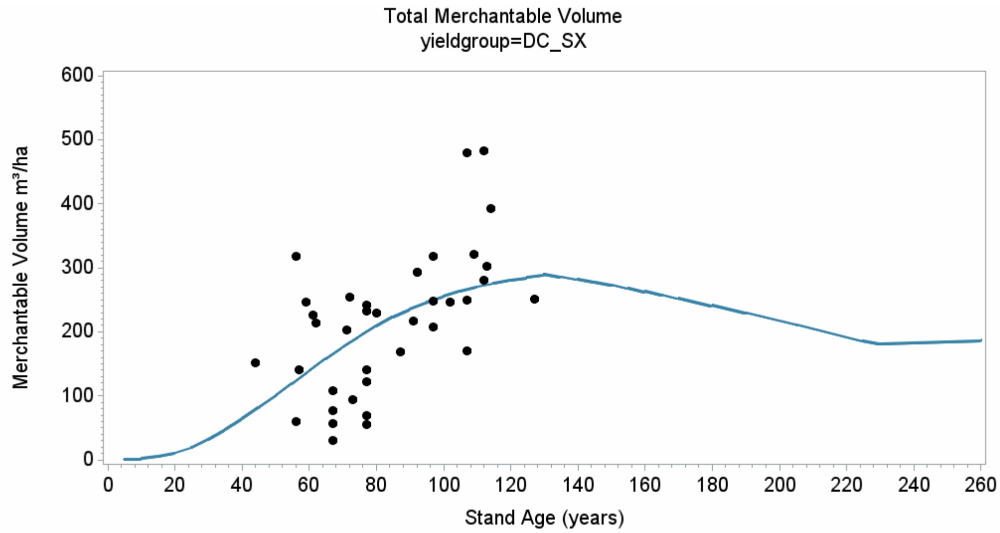

Total Merchantable Volume
yieldgroup=C_PL_AB
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

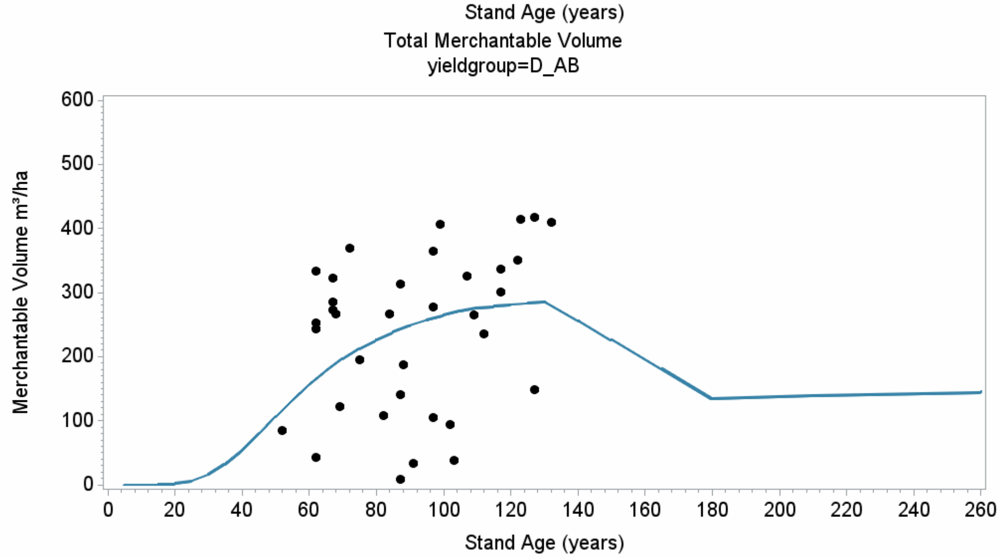

Total Merchantable Volume
yieldgroup=C_PL_CD
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

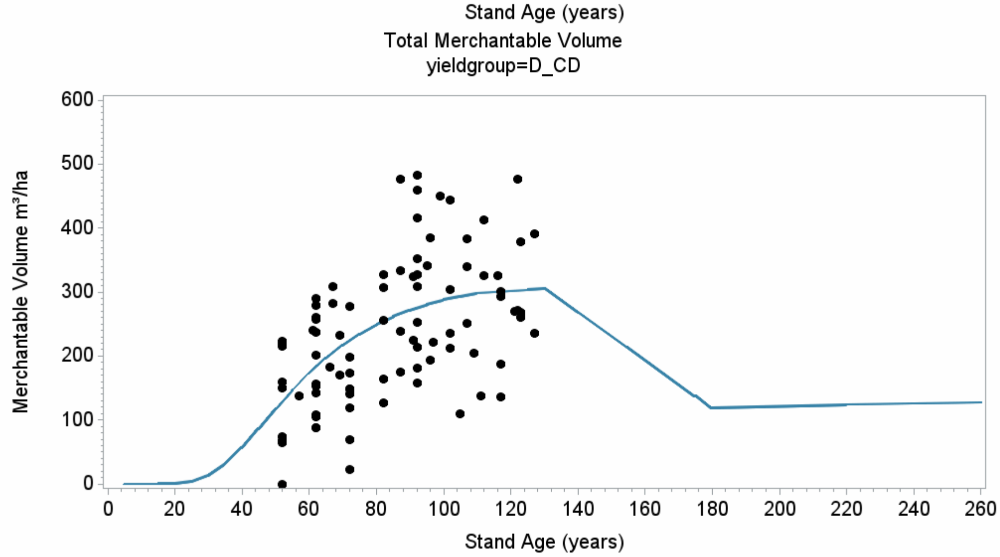

Total Merchantable Volume
yieldgroup=C_SB
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

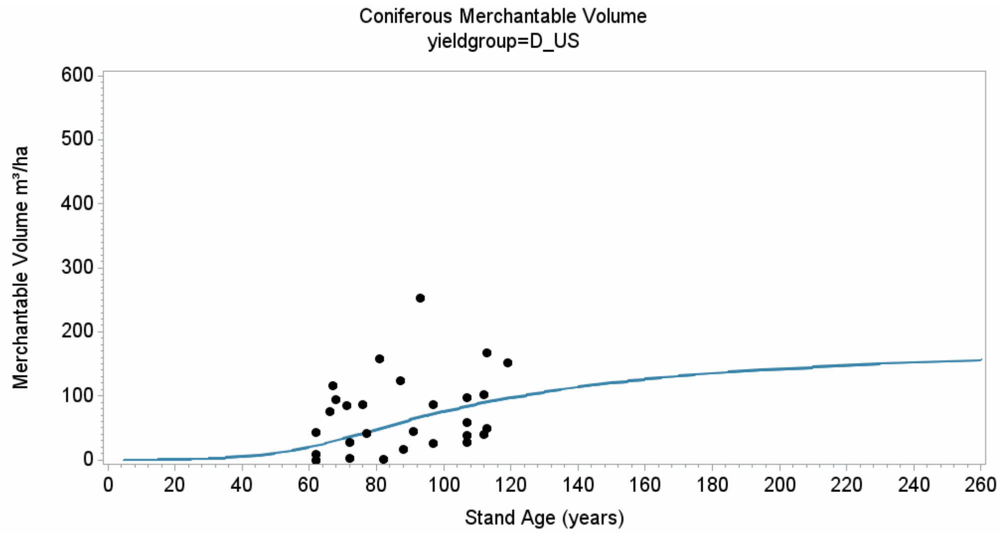

Total Merchantable Volume
yieldgroup=C_SW
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

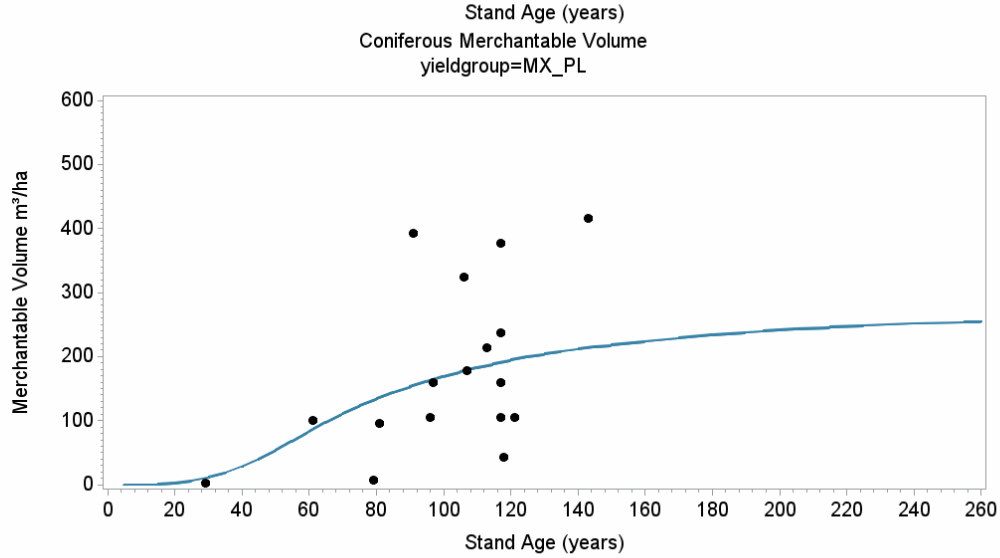

Total Merchantable Volume
yieldgroup=C_SWOC
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260

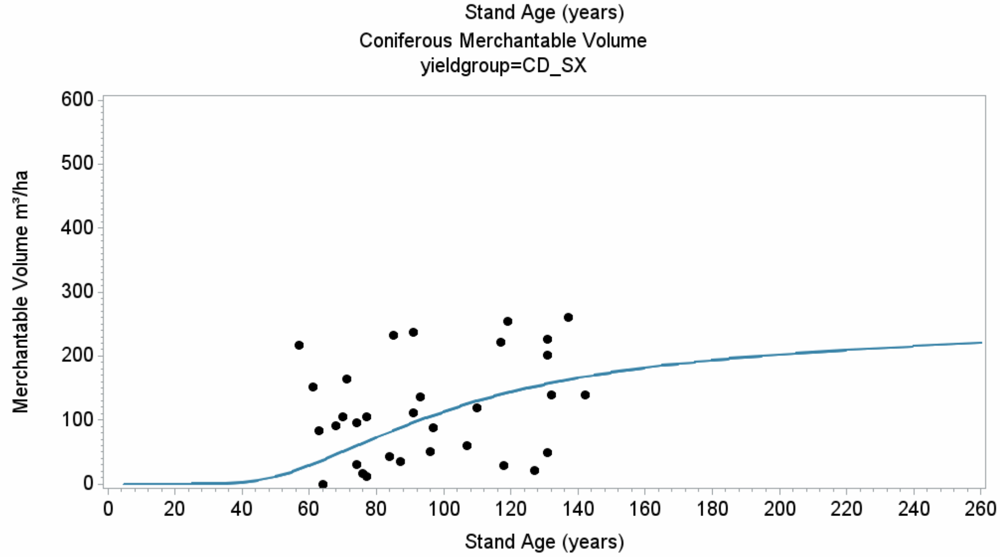

Total Merchantable Volume
yieldgroup=DC_SX
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

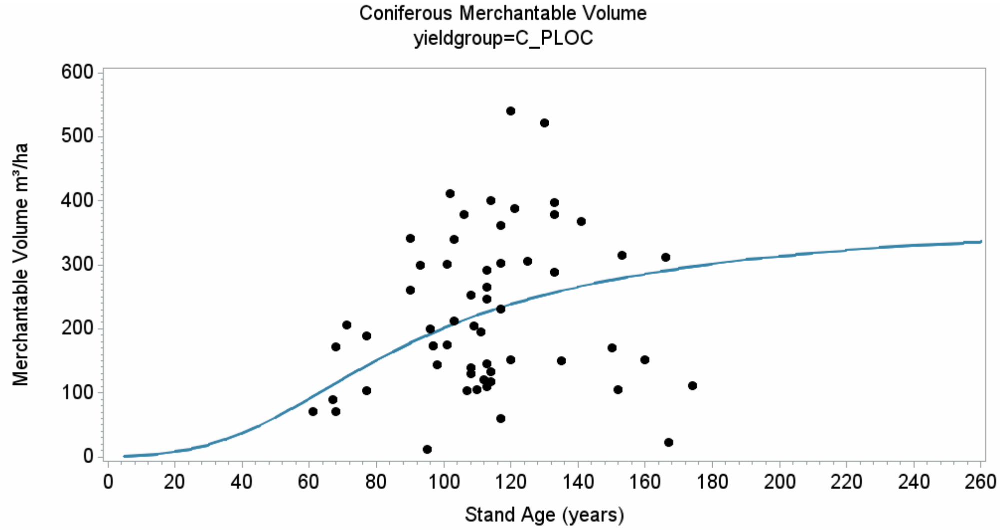

Total Merchantable Volume
yieldgroup=D_AB
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

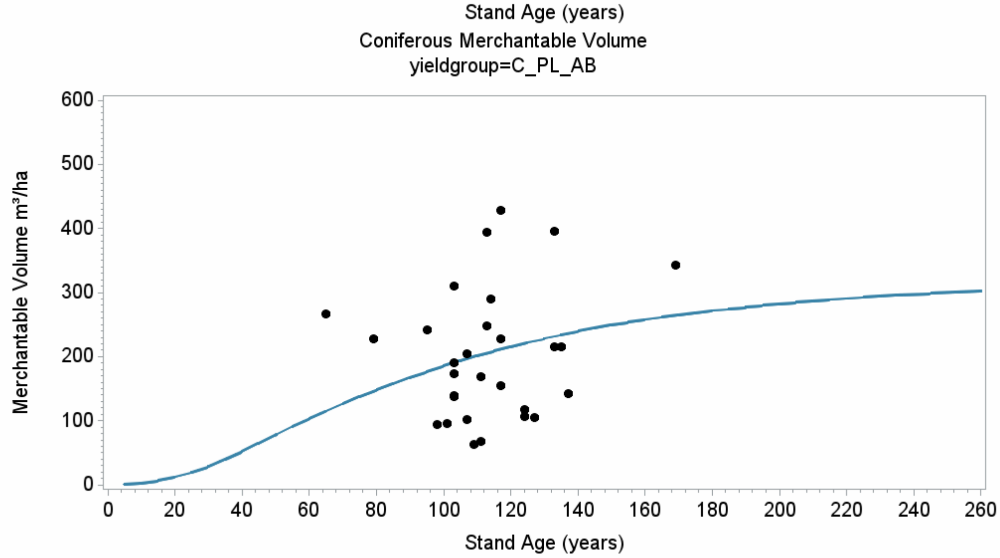

Total Merchantable Volume
yieldgroup=D_CD
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

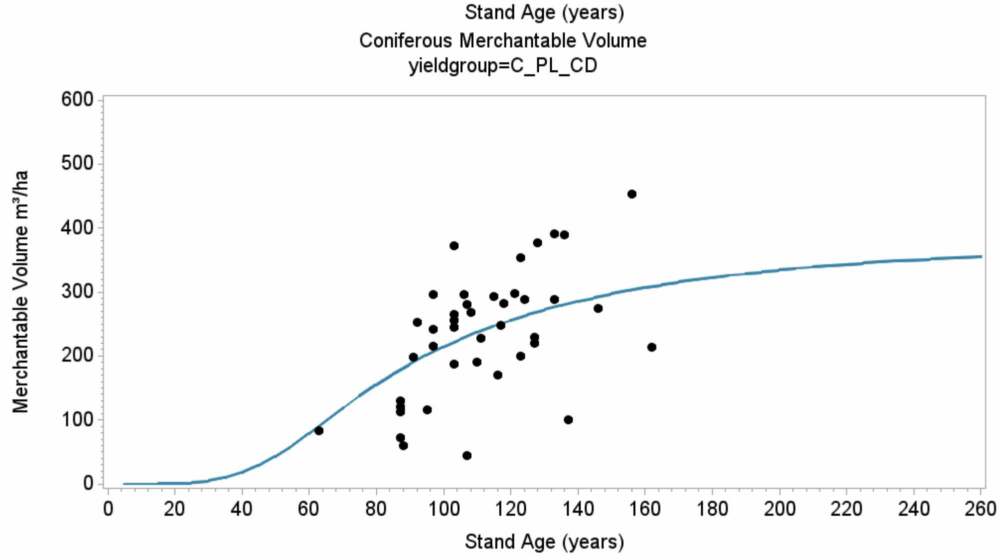

Coniferous Merchantable Volume
yieldgroup=D_US
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

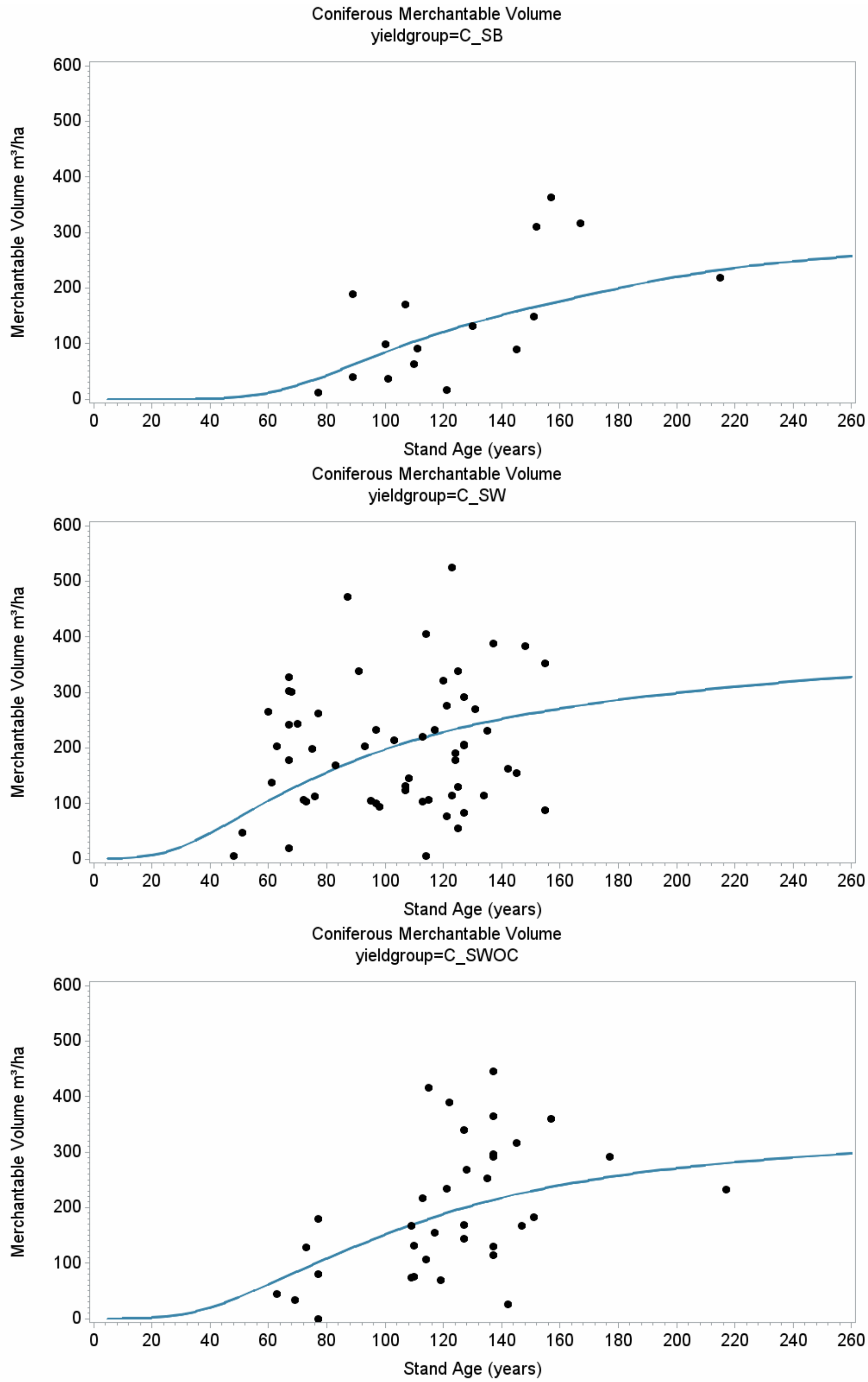

Coniferous Merchantable Volume
yieldgroup=MX_PL
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

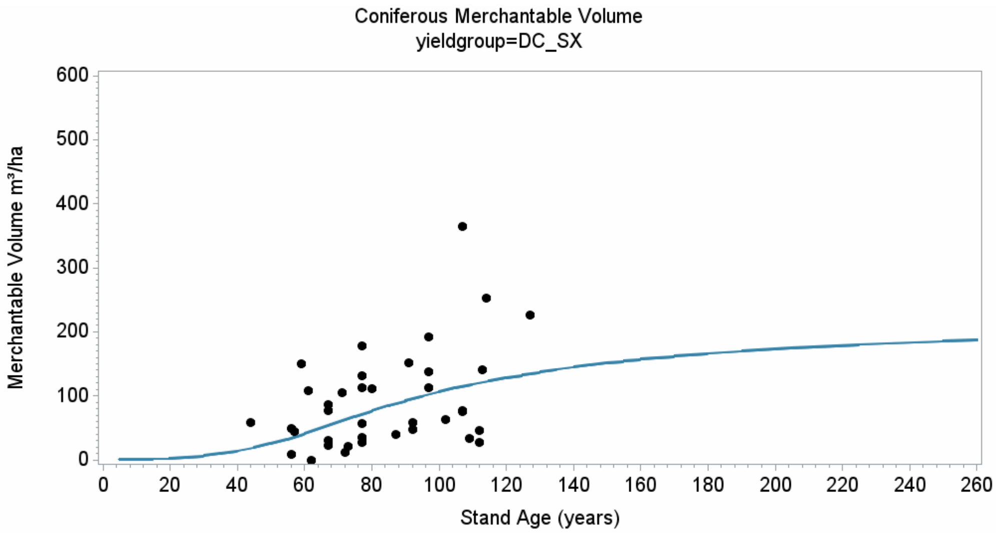

Coniferous Merchantable Volume
yieldgroup=CD_SX
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

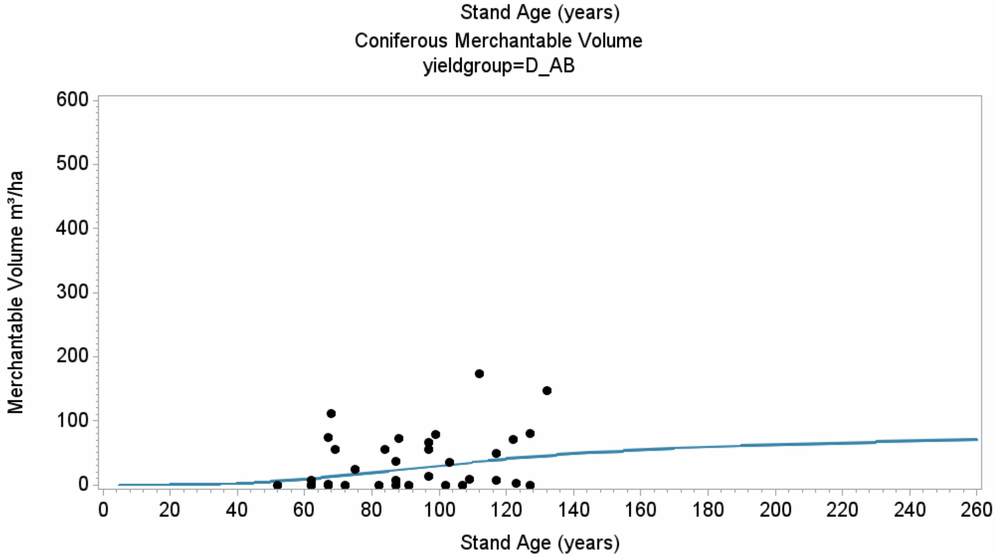

Coniferous Merchantable Volume
yieldgroup=C_PLOC
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0 20 40 60 80 100 120 140 160 180 200 220 240 260

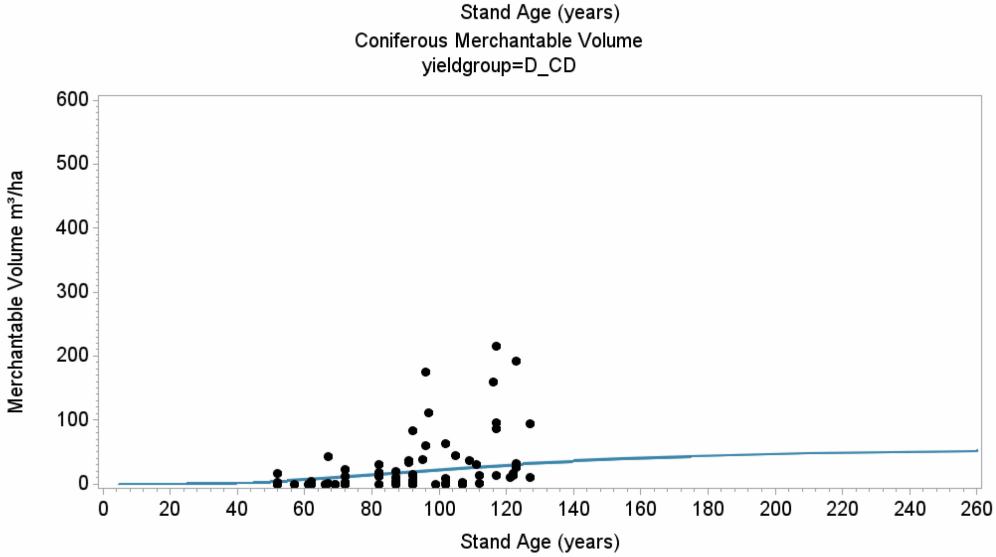

Coniferous Merchantable Volume
yieldgroup=C_PL_AB
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0 20 40 60 80 100 120 140 160 180 200 220 240 260

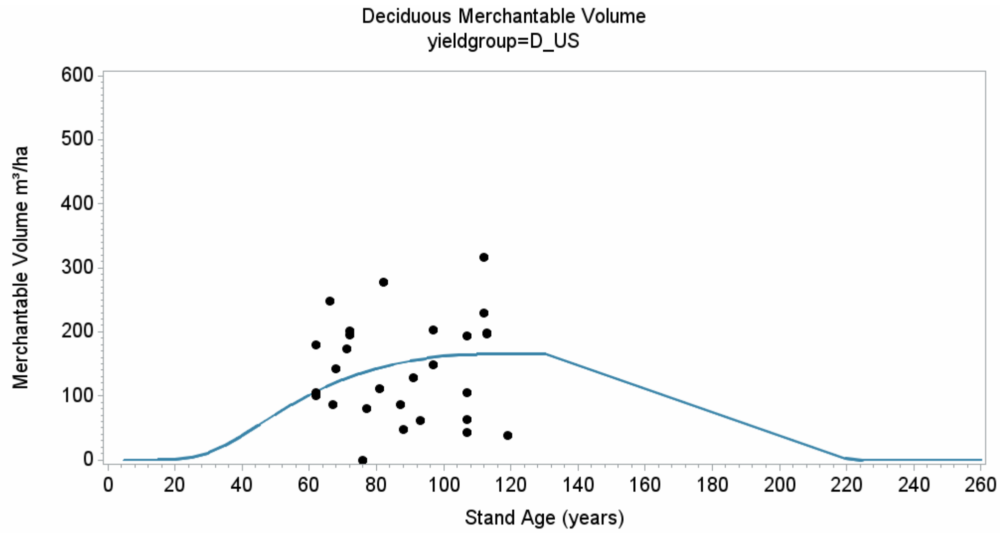

Coniferous Merchantable Volume
yieldgroup=C_PL_CD
Merchantable Volume m³/ha
Stand Age (years)
0
100
200
300
400
500
600
0 20 40 60 80 100 120 140 160 180 200 220 240 260

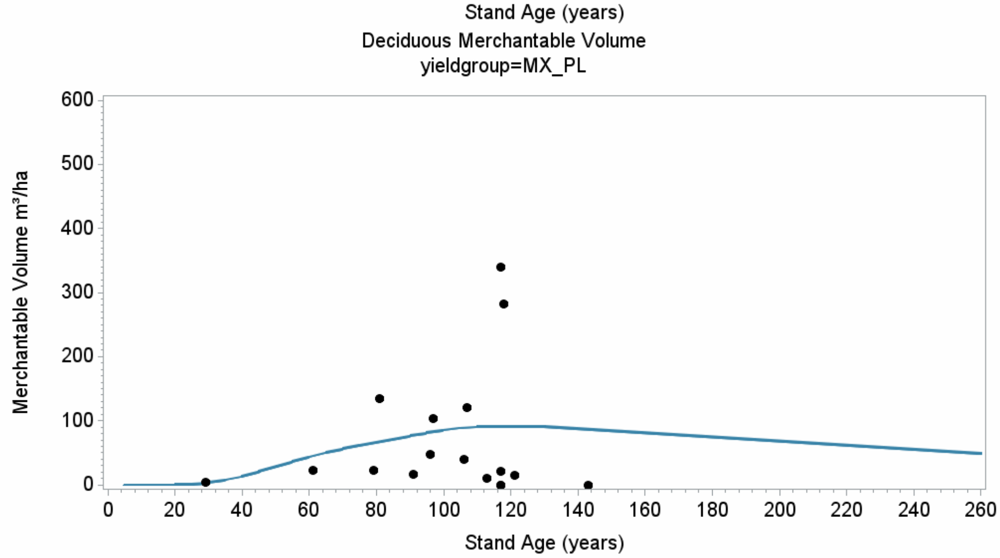

Coniferous Merchantable Volume
yieldgroup=C_SB
Merchantable Volume m³/ha
Stand Age (years)
Coniferous Merchantable Volume
yieldgroup=C_SW
Merchantable Volume m³/ha
Stand Age (years)
Coniferous Merchantable Volume
yieldgroup=C_SWOC
Merchantable Volume m³/ha
Stand Age (years)

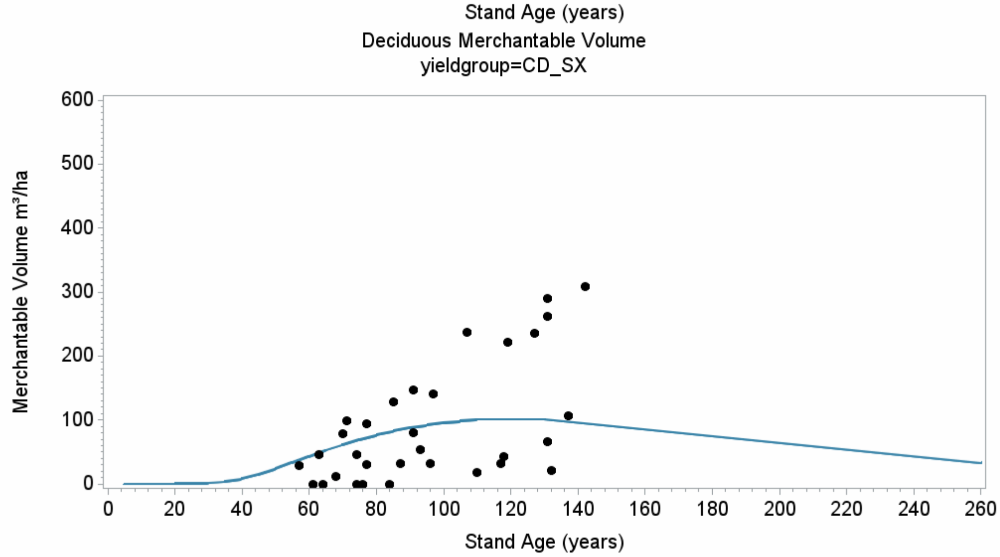

Coniferous Merchantable Volume
yieldgroup=DC_SX
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

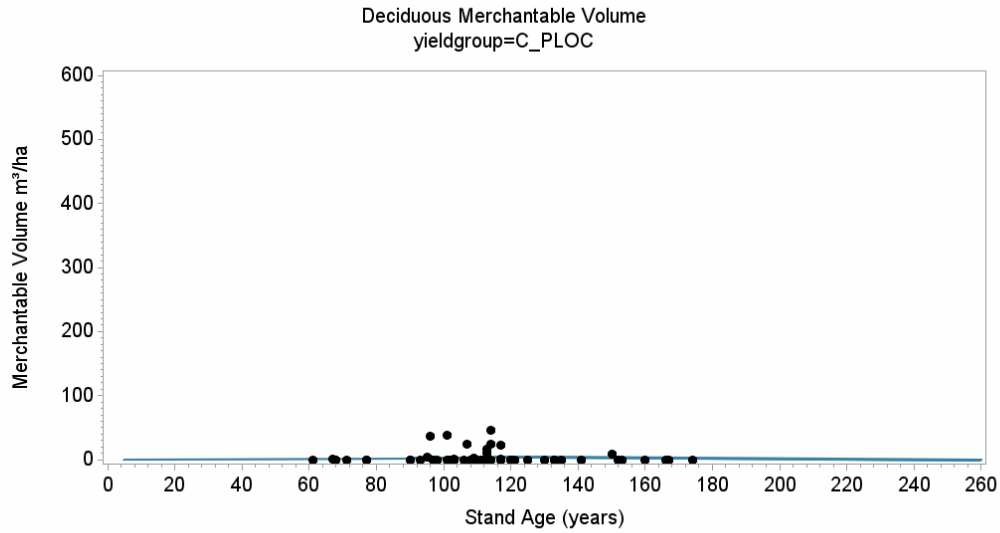

Coniferous Merchantable Volume
yieldgroup=D_AB
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

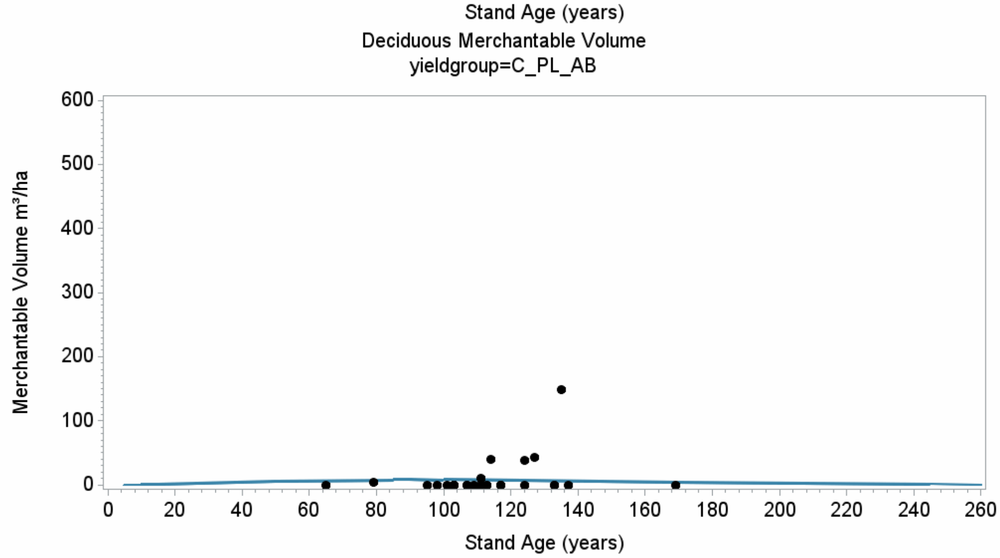

Coniferous Merchantable Volume
yieldgroup=D_CD
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

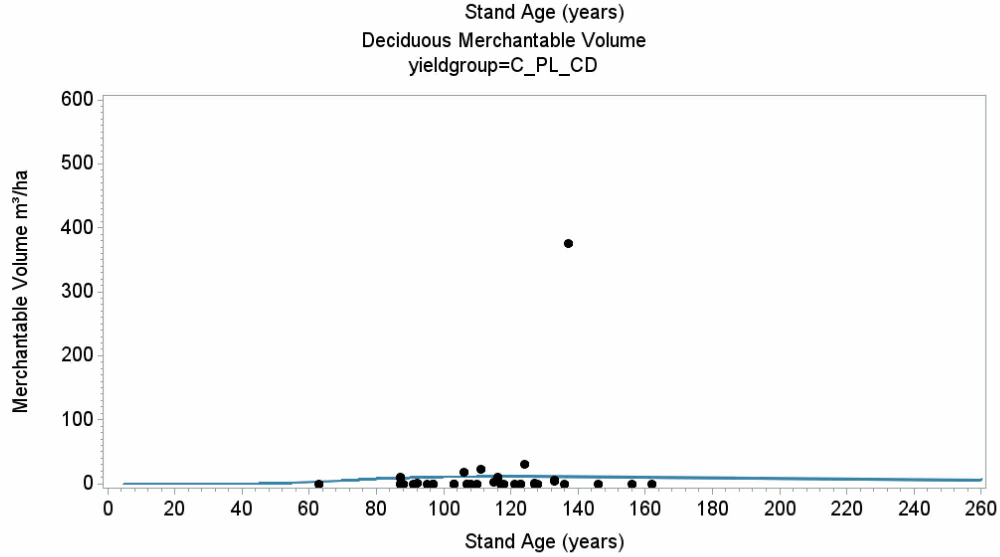

Deciduous Merchantable Volume
yieldgroup=D_US
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

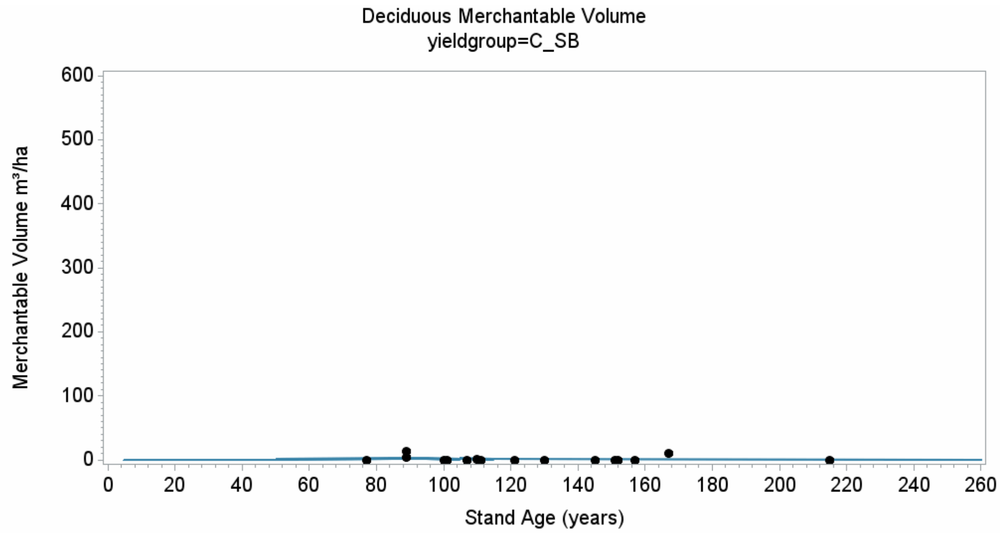

Deciduous Merchantable Volume
yieldgroup=MX_PL
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

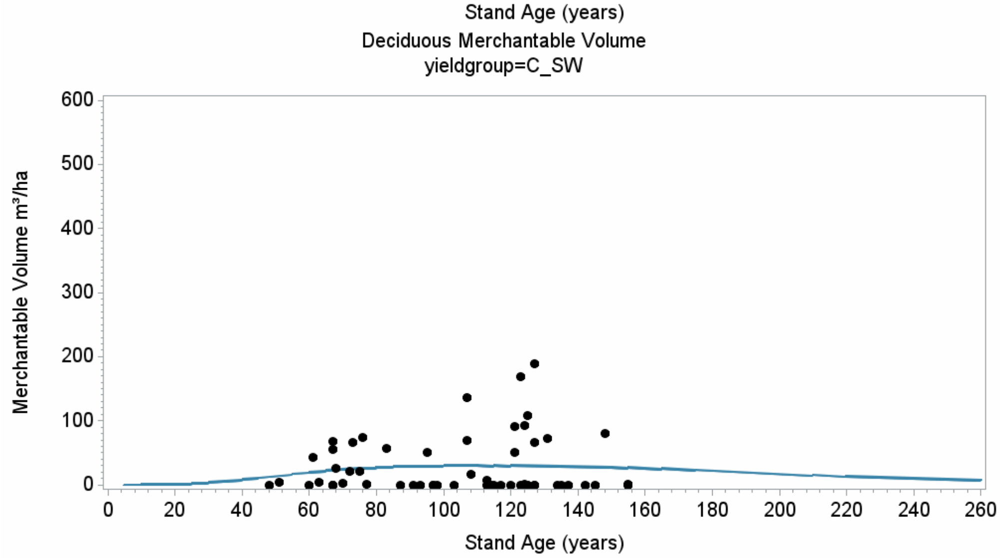

Deciduous Merchantable Volume
yieldgroup=CD_SX
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

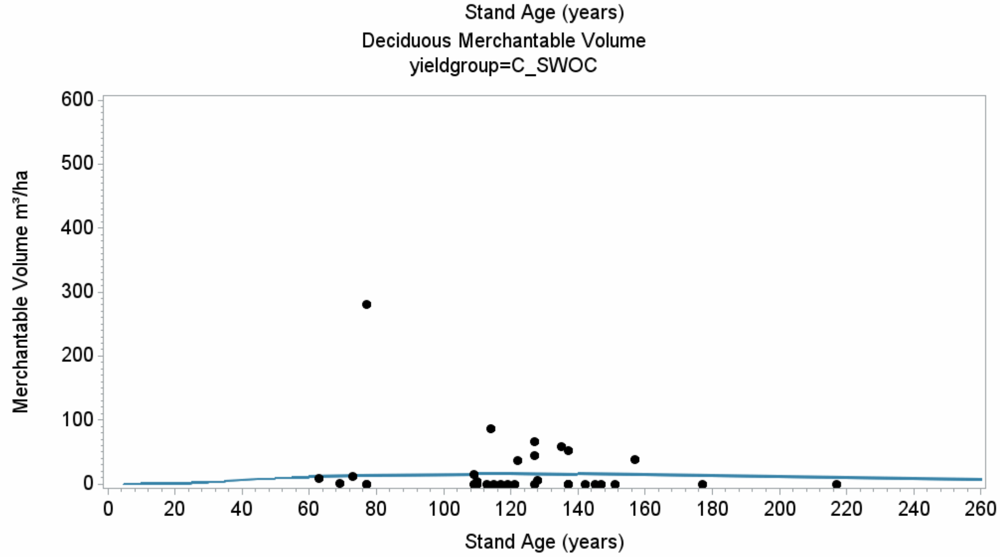

Deciduous Merchantable Volume
yieldgroup=C_PLOC
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)

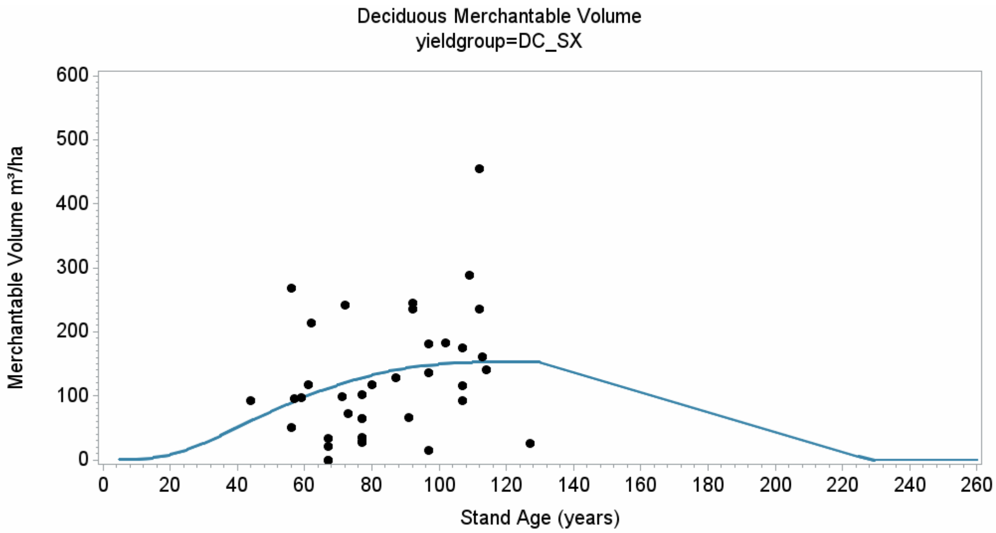

Deciduous Merchantable Volume
yieldgroup=C_PL_AB
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)

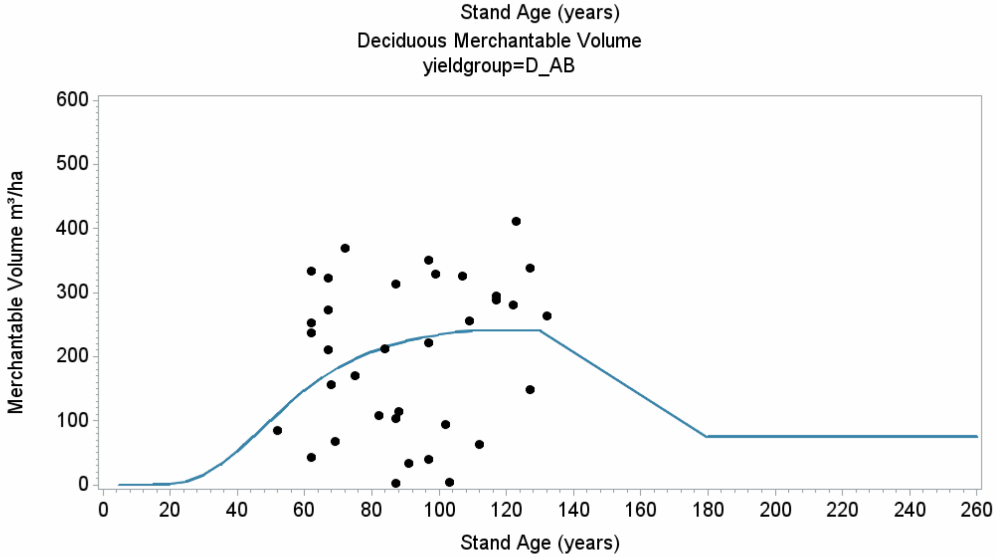

Deciduous Merchantable Volume
yieldgroup=C_PL_CD
Merchantable Volume m³/ha
600
500
400
300
200
100
0
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)

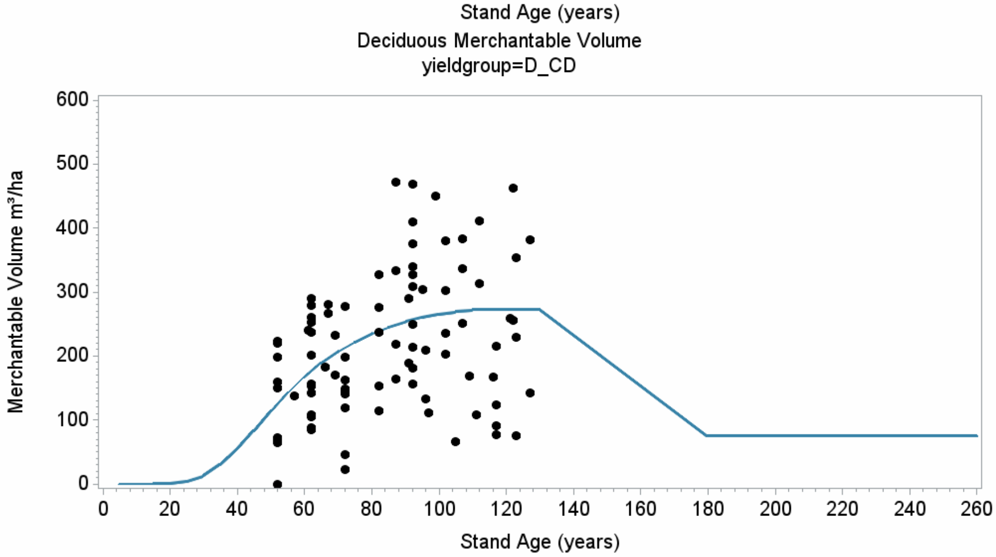

Deciduous Merchantable Volume
yieldgroup=C_SB
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)


Deciduous Merchantable Volume
yieldgroup=C_SW
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)


Deciduous Merchantable Volume
yieldgroup=C_SWOC
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)


Deciduous Merchantable Volume
yieldgroup=DC_SX
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)


Deciduous Merchantable Volume
yieldgroup=D_AB
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

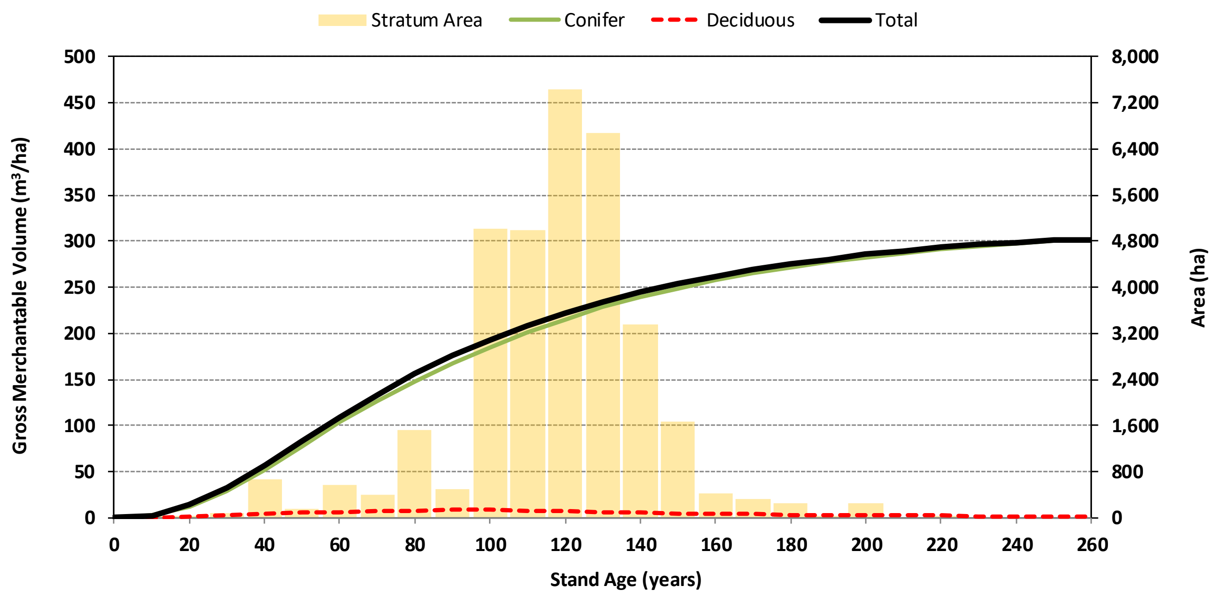

Deciduous Merchantable Volume
yieldgroup=D_CD
Merchantable Volume m³/ha
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Stand Age (years)

Appendix IV – Natural Stand Yield Tables

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

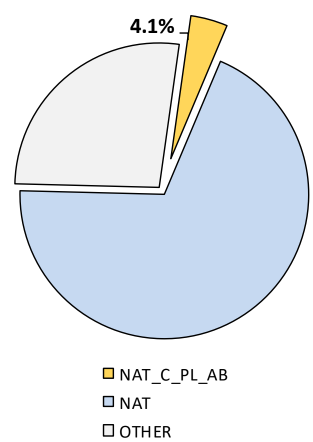
STRATUM: C_PL_AB



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	2.6	0.1	2.7	0.26	0.01	0.27
20	12.4	1.1	13.5	0.62	0.06	0.68
30	29.3	2.7	32.0	0.98	0.09	1.07
40	52.2	4.2	56.4	1.31	0.11	1.41
50	77.9	5.5	83.4	1.56	0.11	1.67
60	103.0	6.5	109.5	1.72	0.11	1.82
70	126.6	7.2	133.8	1.81	0.10	1.91
80	148.0	7.9	155.9	1.85	0.10	1.95
90	167.5	8.4	175.9	1.86	0.09	1.95
100	185.2	8.2	193.4	1.85	0.08	1.93
110	201.3	7.6	208.9	1.83	0.07	1.90
120	215.6	6.9	222.5	1.80	0.06	1.85
130	228.4	6.4	234.8	1.76	0.05	1.81
140	239.6	5.7	245.3	1.71	0.04	1.75
150	249.4	5.0	254.3	1.66	0.03	1.70
160	257.8	4.3	262.1	1.61	0.03	1.64
170	265.3	3.7	269.0	1.56	0.02	1.58
180	271.8	3.4	275.2	1.51	0.02	1.53
190	277.5	3.3	280.7	1.46	0.02	1.48
200	282.5	3.1	285.6	1.41	0.02	1.43
210	287.0	2.8	289.7	1.37	0.01	1.38
220	290.9	2.4	293.3	1.32	0.01	1.33
230	294.3	2.0	296.3	1.28	0.01	1.29
240	297.3	1.5	298.8	1.24	0.01	1.24
250	299.9	0.9	300.8	1.20	0.00	1.20
260	299.9	0.9	300.8	1.15	0.00	1.16

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_PL_AB**	**34,320**	**4.1%**

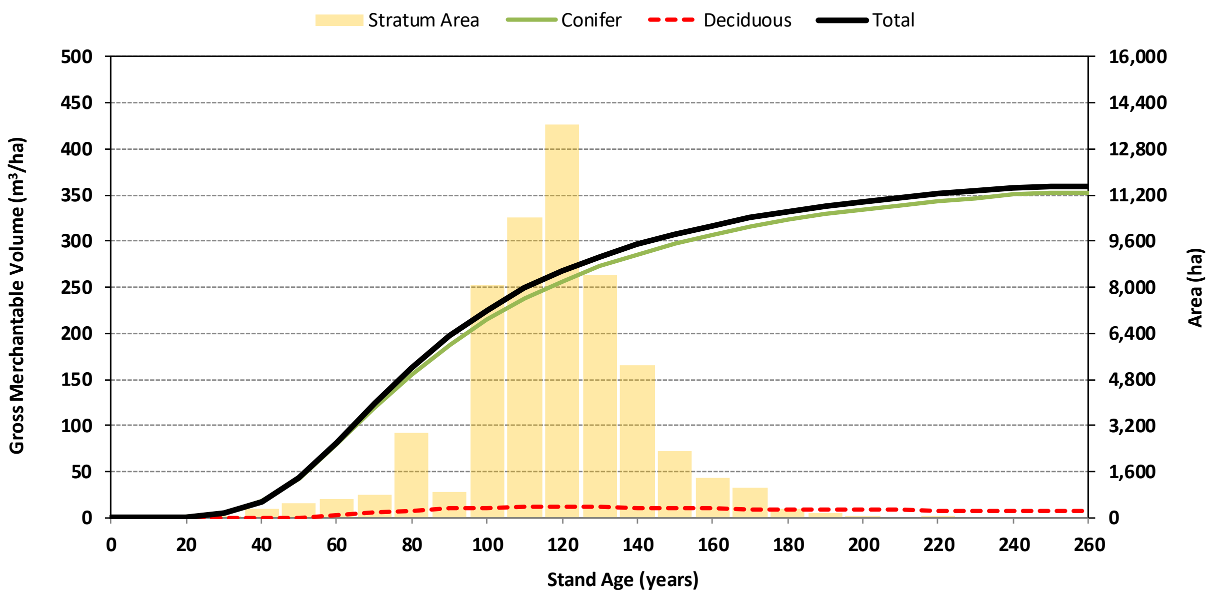
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	7,090,994	207
Deciduous	15/10/15/366/TL	231,796	7
Total		7,323,003	213

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

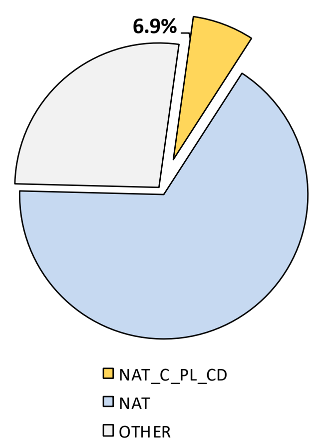
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	NATURAL STANDS STRATUM: C_PL_CD



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	0.0	0.6	0.03	0.00	0.03
30	5.0	0.0	5.0	0.17	0.00	0.17
40	17.8	0.0	17.8	0.44	0.00	0.44
50	43.2	0.4	43.7	0.86	0.01	0.87
60	79.1	2.8	81.9	1.32	0.05	1.36
70	118.2	5.8	124.0	1.69	0.08	1.77
80	155.1	8.0	163.1	1.94	0.10	2.04
90	187.3	9.7	196.9	2.08	0.11	2.19
100	214.5	10.8	225.2	2.14	**0.11**	2.25
110	237.3	11.4	248.7	**2.16**	0.10	**2.26**
120	256.3	11.5	267.8	2.14	0.10	2.23
130	272.3	11.4	283.7	2.09	0.09	2.18
140	285.9	10.9	296.7	2.04	0.08	2.12
150	297.4	10.4	307.8	1.98	0.07	2.05
160	307.2	10.0	317.2	1.92	0.06	1.98
170	315.7	9.5	325.2	1.86	0.06	1.91
180	323.0	9.2	332.2	1.79	0.05	1.85
190	329.2	8.9	338.1	1.73	0.05	1.78
200	334.7	8.5	343.2	1.67	0.04	1.72
210	339.4	8.2	347.6	1.62	0.04	1.66
220	343.5	7.9	351.4	1.56	0.04	1.60
230	347.1	7.6	354.7	1.51	0.03	1.54
240	350.2	7.3	357.5	1.46	0.03	1.49
250	353.0	7.0	360.0	1.41	0.03	1.44
260	353.0	7.0	360.0	1.36	0.03	1.38

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_PL_CD**	**57,348**	**6.9%**

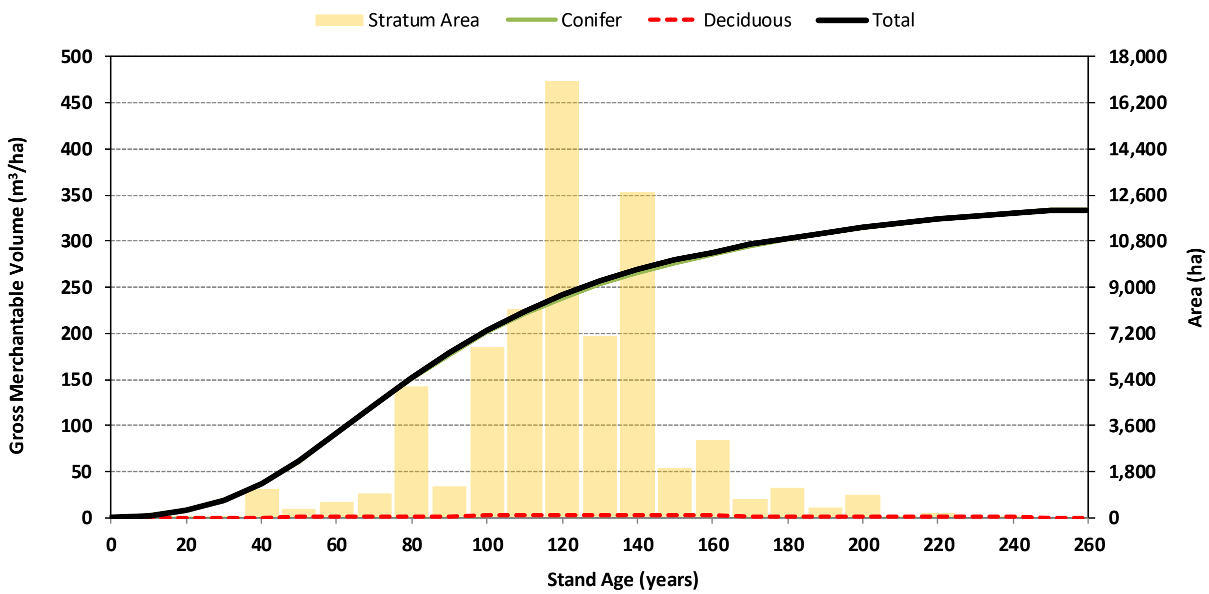
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	13,932,087	243
Deciduous	15/10/15/366/TL	607,385	11
Total		14,539,725	254

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	NATURAL STANDS STRATUM: C_PLOC

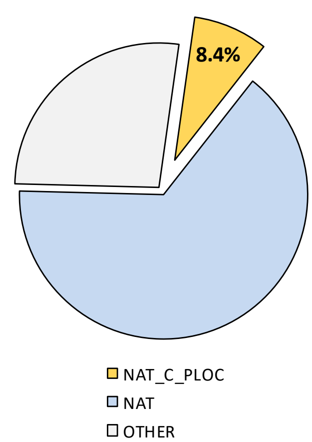


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	2.2	0.0	2.2	0.22	0.00	0.22
20	8.2	0.0	8.2	0.41	0.00	0.41
30	19.0	0.1	19.1	0.63	0.00	0.64
40	36.7	0.4	37.0	0.92	0.01	0.93
50	61.6	0.7	62.2	1.23	0.01	1.24
60	91.0	1.0	92.0	1.52	0.02	1.53
70	121.6	1.2	122.8	1.74	0.02	1.75
80	150.8	1.5	152.3	1.89	0.02	1.90
90	177.5	1.8	179.3	1.97	0.02	1.99
100	200.9	2.5	203.4	2.01	0.02	2.03
110	221.1	3.1	224.2	**2.01**	0.03	**2.04**
120	238.4	3.5	241.9	1.99	**0.03**	2.02
130	253.1	3.5	256.6	1.95	0.03	1.97
140	265.7	3.2	268.9	1.90	0.02	1.92
150	276.5	2.8	279.3	1.84	0.02	1.86
160	285.9	2.4	288.3	1.79	0.02	1.80
170	294.1	2.0	296.1	1.73	0.01	1.74
180	301.4	1.6	303.1	1.67	0.01	1.68
190	307.9	1.5	309.4	1.62	0.01	1.63
200	313.6	1.3	314.9	1.57	0.01	1.57
210	318.6	1.2	319.8	1.52	0.01	1.52
220	323.1	1.0	324.1	1.47	0.00	1.47
230	327.1	0.8	327.9	1.42	0.00	1.43
240	330.6	0.5	331.1	1.38	0.00	1.38
250	333.7	0.2	333.9	1.33	0.00	1.34
260	333.7	0.2	333.9	1.28	0.00	1.28

Note: Peak MAIs are highlighted in yellow.
Standing timber volumes are approximate.

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_PLOC**	**69,546**	**8.4%**

Stratum % of the Active Landbase

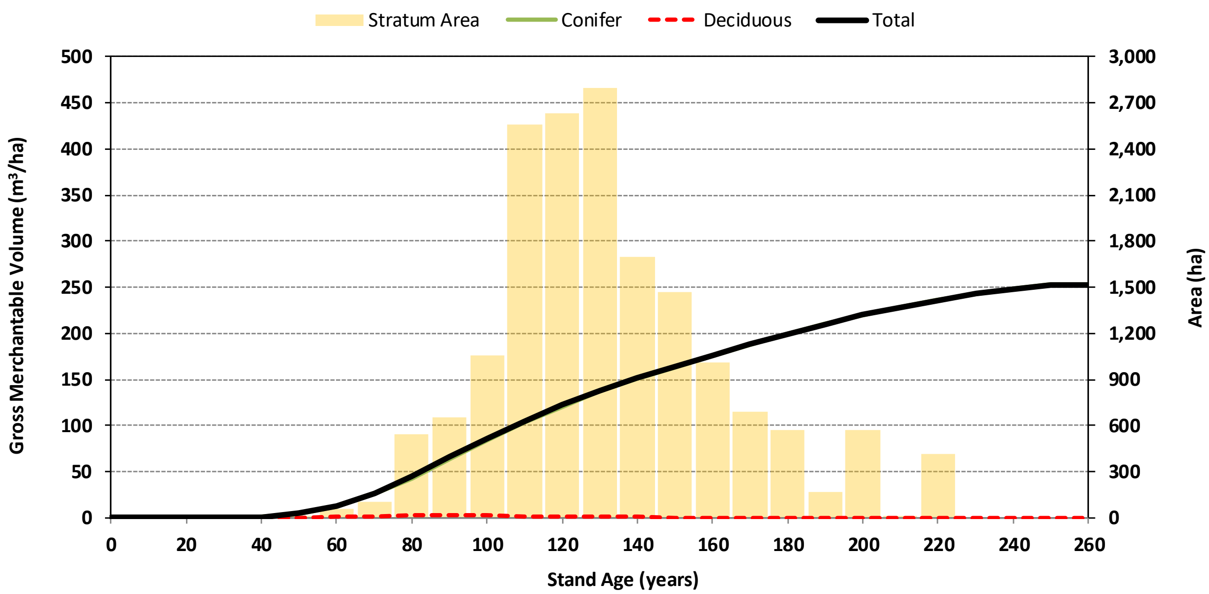


FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	16,062,628	231
Deciduous	15/10/15/366/TL	197,489	3
Total		16,260,351	234

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

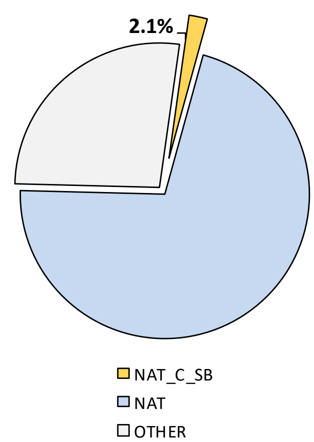
STRATUM: C_SB



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.0	0.0	0.00	0.00	0.00
30	0.0	0.0	0.0	0.00	0.00	0.00
40	0.9	0.0	0.9	0.02	0.00	0.02
50	4.3	0.2	4.5	0.09	0.00	0.09
60	12.1	0.8	12.9	0.20	0.01	0.21
70	25.5	1.5	27.0	0.36	0.02	0.39
80	43.2	2.2	45.4	0.54	0.03	0.57
90	63.4	2.5	65.9	0.70	0.03	0.73
100	83.9	2.4	86.3	0.84	0.02	0.86
110	103.4	1.7	105.1	0.94	0.02	0.96
120	121.1	1.2	122.3	1.01	0.01	1.02
130	136.8	1.0	137.9	1.05	0.01	1.06
140	150.9	0.8	151.7	1.08	0.01	1.08
150	163.8	0.5	164.3	1.09	0.00	1.10
160	176.1	0.2	176.3	1.10	0.00	1.10
170	188.0	0.1	188.1	1.11	0.00	1.11
180	199.6	0.0	199.6	1.11	0.00	1.11
190	210.4	0.0	210.4	1.11	0.00	1.11
200	220.2	0.0	220.2	1.10	0.00	1.10
210	228.8	0.0	228.8	1.09	0.00	1.09
220	236.2	0.0	236.2	1.07	0.00	1.07
230	242.6	0.0	242.6	1.05	0.00	1.05
240	248.2	0.0	248.2	1.03	0.00	1.03
250	253.0	0.0	253.0	1.01	0.00	1.01
260	253.0	0.0	253.0	0.97	0.00	0.97

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_SB**	**17,023**	**2.1%**

Stratum % of the Active Landbase



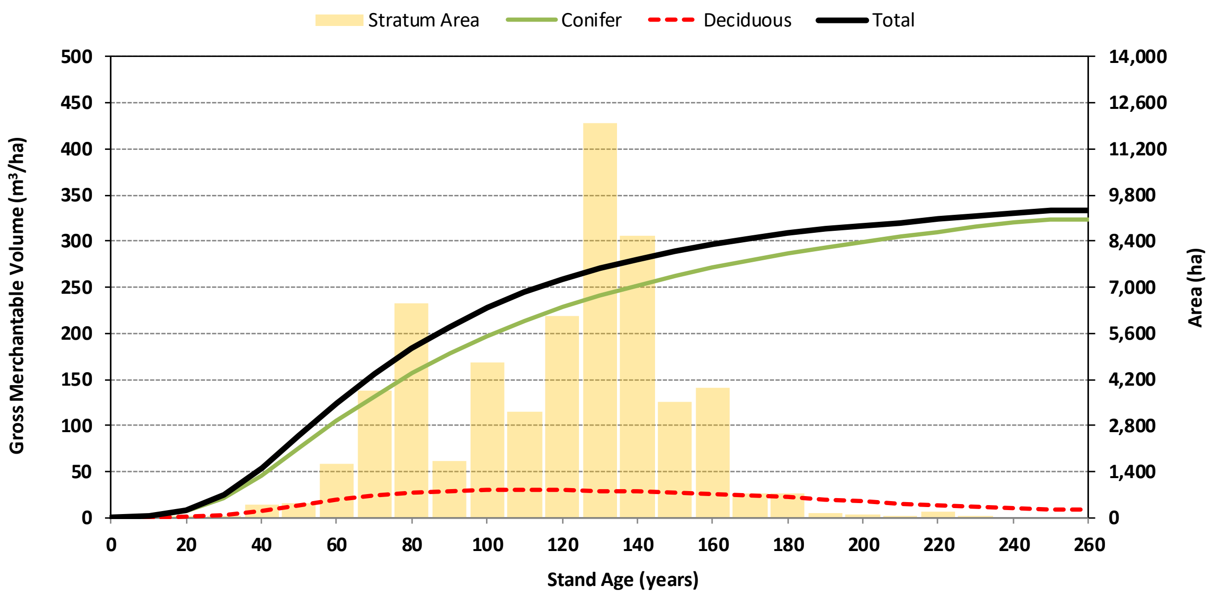
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	2,302,633	135
Deciduous	15/10/15/366/TL	18,275	1
Total		2,321,044	136

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

STRATUM: C_SW_AB

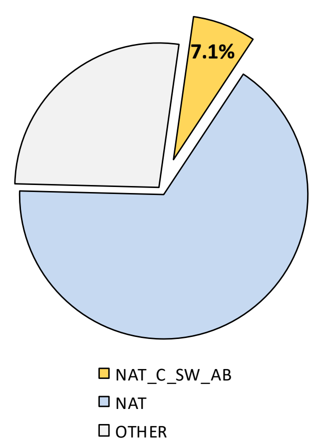


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	1.3	0.1	1.4	0.13	0.01	0.14
20	7.0	1.0	7.9	0.35	0.05	0.40
30	21.8	3.5	25.3	0.73	0.12	0.84
40	45.9	7.8	53.7	1.15	0.20	1.34
50	75.4	13.8	89.3	1.51	0.28	1.79
60	104.7	19.6	124.2	1.74	0.33	2.07
70	131.8	23.9	155.7	1.88	**0.34**	2.22
80	156.4	27.0	183.4	1.96	0.34	2.29
90	178.3	28.9	207.1	**1.98**	0.32	**2.30**
100	197.3	30.0	227.3	1.97	0.30	2.27
110	213.9	30.4	244.3	1.94	0.28	2.22
120	228.4	29.9	258.3	1.90	0.25	2.15
130	241.1	29.0	270.0	1.85	0.22	2.08
140	252.3	28.2	280.5	1.80	0.20	2.00
150	262.3	27.4	289.7	1.75	0.18	1.93
160	271.1	26.1	297.2	1.69	0.16	1.86
170	279.1	24.4	303.4	1.64	0.14	1.78
180	286.4	22.2	308.6	1.59	0.12	1.71
190	293.1	19.9	312.9	1.54	0.10	1.65
200	299.3	17.5	316.8	1.50	0.09	1.58
210	305.0	15.3	320.3	1.45	0.07	1.53
220	310.3	13.4	323.7	1.41	0.06	1.47
230	315.2	11.9	327.1	1.37	0.05	1.42
240	319.7	10.4	330.1	1.33	0.04	1.38
250	323.9	8.9	332.8	1.30	0.04	1.33
260	323.9	8.9	332.8	1.25	0.03	1.28

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_SW_AB**	**58,800**	**7.1%**

Stratum % of the Active Landbase



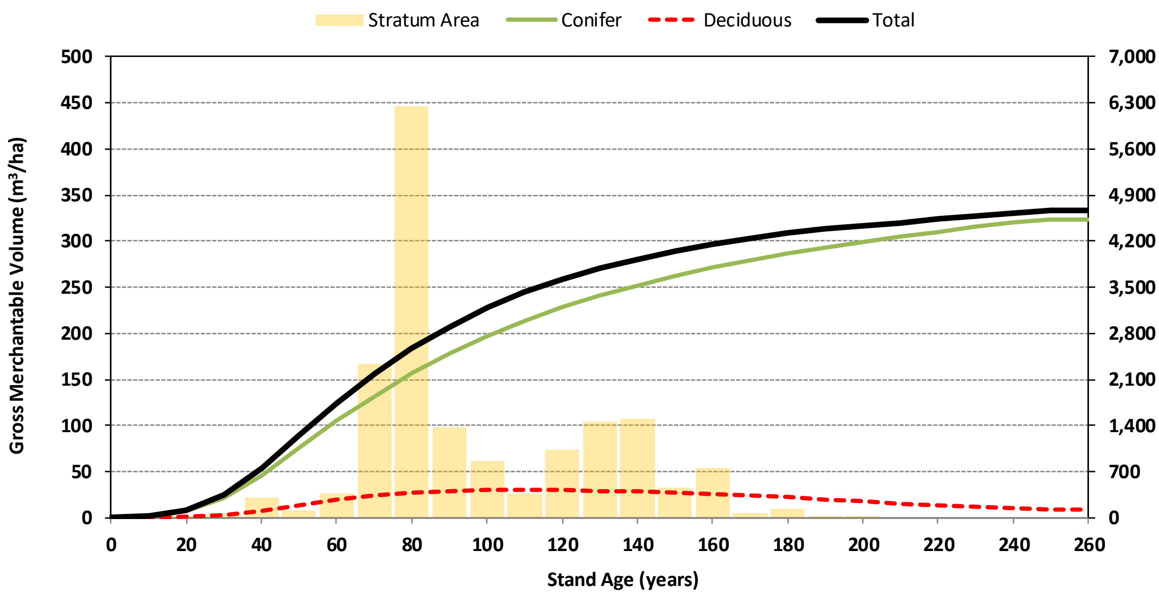
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	12,709,077	216
Deciduous	15/10/15/366/TL	1,614,384	27
Total		14,323,704	244

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

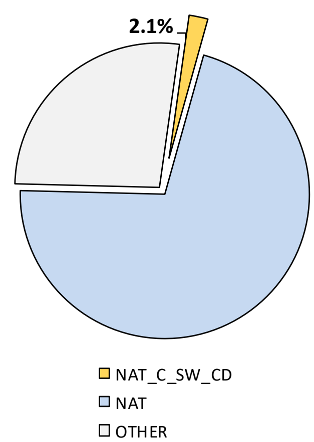
STRATUM: C_SW_CD



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	1.3	0.1	1.4	0.13	0.01	0.14
20	7.0	1.0	7.9	0.35	0.05	0.40
30	21.8	3.5	25.3	0.73	0.12	0.84
40	45.9	7.8	53.7	1.15	0.20	1.34
50	75.4	13.8	89.3	1.51	0.28	1.79
60	104.7	19.6	124.2	1.74	0.33	2.07
70	131.8	23.9	155.7	1.88	**0.34**	2.22
80	156.4	27.0	183.4	1.96	0.34	2.29
90	178.3	28.9	207.1	**1.98**	0.32	**2.30**
100	197.3	30.0	227.3	1.97	0.30	2.27
110	213.9	30.4	244.3	1.94	0.28	2.22
120	228.4	29.9	258.3	1.90	0.25	2.15
130	241.1	29.0	270.0	1.85	0.22	2.08
140	252.3	28.2	280.5	1.80	0.20	2.00
150	262.3	27.4	289.7	1.75	0.18	1.93
160	271.1	26.1	297.2	1.69	0.16	1.86
170	279.1	24.4	303.4	1.64	0.14	1.78
180	286.4	22.2	308.6	1.59	0.12	1.71
190	293.1	19.9	312.9	1.54	0.10	1.65
200	299.3	17.5	316.8	1.50	0.09	1.58
210	305.0	15.3	320.3	1.45	0.07	1.53
220	310.3	13.4	323.7	1.41	0.06	1.47
230	315.2	11.9	327.1	1.37	0.05	1.42
240	319.7	10.4	330.1	1.33	0.04	1.38
250	323.9	8.9	332.8	1.30	0.04	1.33
260	323.9	8.9	332.8	1.25	0.03	1.28

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_SW_CD**	**17,495**	**2.1%**

Stratum % of the Active Landbase



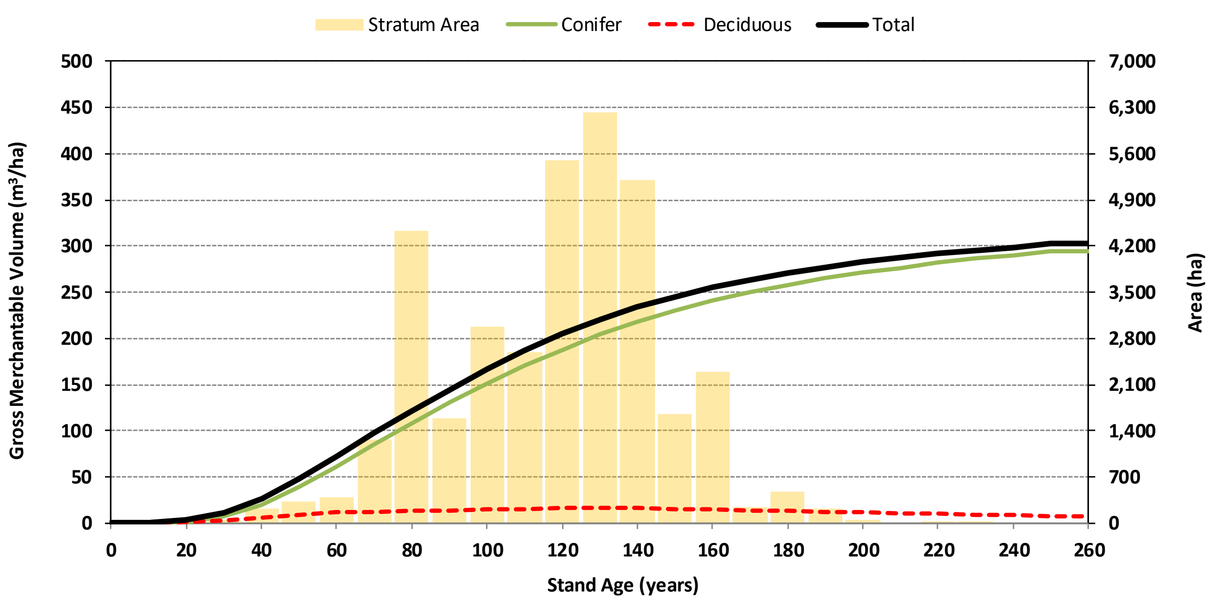
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	3,200,112	183
Deciduous	15/10/15/366/TL	465,990	27
Total		3,666,311	210

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

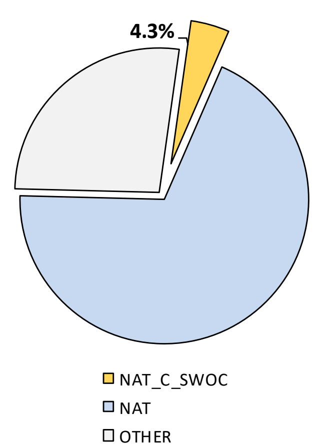
STRATUM: C_SWOC



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.2	0.1	0.3	0.02	0.01	0.03
20	1.9	1.2	3.1	0.10	0.06	0.15
30	7.6	3.1	10.7	0.25	0.10	0.36
40	19.8	6.1	26.0	0.50	0.15	0.65
50	38.8	9.1	47.9	0.78	0.18	0.96
60	61.6	11.2	72.8	1.03	0.19	1.21
70	85.2	12.4	97.7	1.22	0.18	1.40
80	108.3	13.3	121.6	1.35	0.17	1.52
90	130.3	14.2	144.5	1.45	0.16	1.61
100	151.2	15.1	166.3	1.51	0.15	1.66
110	170.8	15.8	186.5	1.55	0.14	1.70
120	188.3	16.1	204.4	1.57	0.13	1.70
130	203.9	16.1	220.0	1.57	0.12	1.69
140	217.7	15.8	233.5	1.55	0.11	1.67
150	229.8	15.2	245.0	1.53	0.10	1.63
160	240.3	14.7	255.0	1.50	0.09	1.59
170	249.5	13.9	263.5	1.47	0.08	1.55
180	257.6	13.1	270.8	1.43	0.07	1.50
190	264.8	12.2	277.0	1.39	0.06	1.46
200	271.1	11.6	282.7	1.36	0.06	1.41
210	276.7	10.9	287.6	1.32	0.05	1.37
220	281.8	10.1	291.9	1.28	0.05	1.33
230	286.4	9.3	295.7	1.25	0.04	1.29
240	290.6	8.4	298.9	1.21	0.03	1.25
250	294.3	7.8	302.1	1.18	0.03	1.21
260	294.3	7.8	302.1	1.13	0.03	1.16

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_C_SWOC**	**35,795**	**4.3%**

Stratum % of the Active Landbase



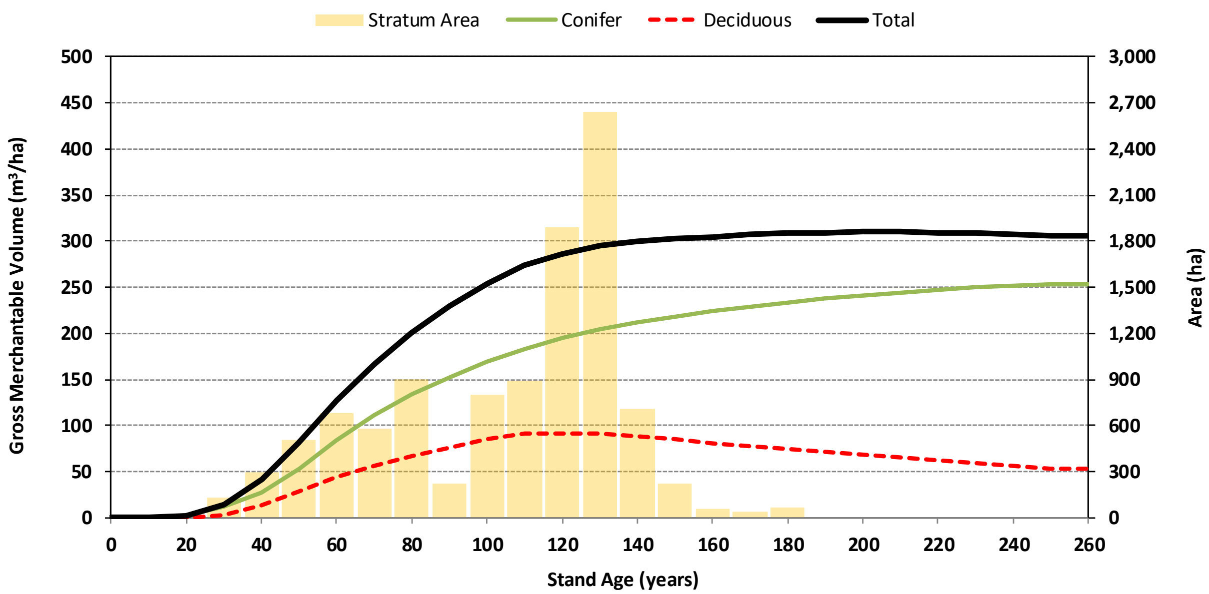
FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	6,365,115	178
Deciduous	15/10/15/366/TL	534,531	15
Total		6,899,838	193

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

STRATUM: CD_PL

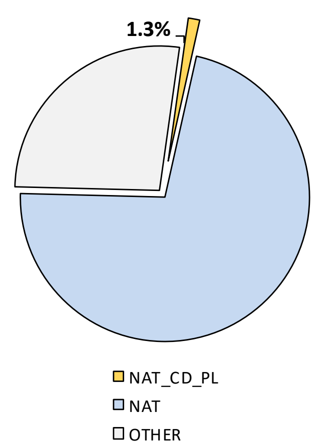


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	2.6	0.2	2.8	0.13	0.01	0.14
30	11.5	3.4	14.9	0.38	0.11	0.50
40	28.0	13.7	41.7	0.70	0.34	1.04
50	53.5	28.6	82.1	1.07	0.57	1.64
60	83.3	43.5	126.8	1.39	0.73	2.11
70	111.3	56.3	167.6	1.59	0.80	2.39
80	134.2	66.7	200.9	1.68	0.83	2.51
90	153.0	76.8	229.8	**1.70**	0.85	**2.55**
100	169.1	85.4	254.5	1.69	**0.85**	2.55
110	183.2	91.1	274.3	1.67	0.83	2.49
120	194.9	91.1	286.0	1.62	0.76	2.38
130	204.3	91.1	295.4	1.57	0.70	2.27
140	211.8	87.9	299.7	1.51	0.63	2.14
150	218.0	84.7	302.7	1.45	0.56	2.02
160	223.6	81.4	305.0	1.40	0.51	1.91
170	228.7	78.2	307.0	1.35	0.46	1.81
180	233.5	75.0	308.5	1.30	0.42	1.71
190	237.7	71.8	309.4	1.25	0.38	1.63
200	241.3	68.6	309.9	1.21	0.34	1.55
210	244.5	65.4	309.9	1.16	0.31	1.48
220	247.3	62.1	309.4	1.12	0.28	1.41
230	249.6	58.9	308.6	1.09	0.26	1.34
240	251.6	55.7	307.3	1.05	0.23	1.28
250	253.3	52.5	305.8	1.01	0.21	1.22
260	253.3	52.5	305.8	0.97	0.20	1.18

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_CD_PL**	**10,634**	**1.3%**

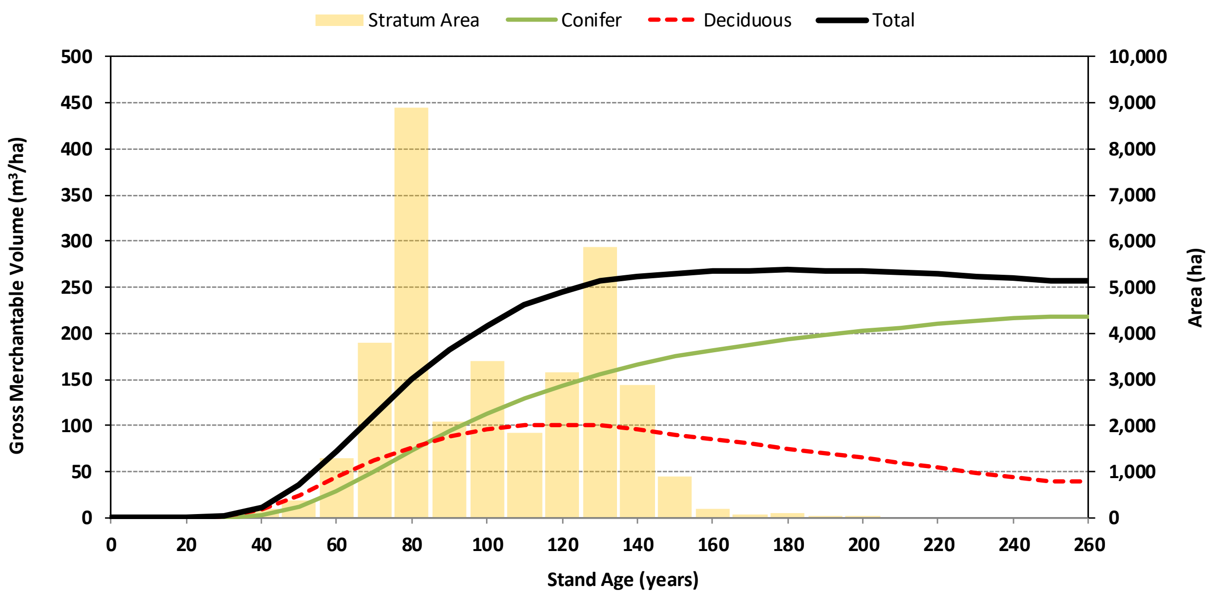
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	1,755,182	165
Deciduous	15/10/15/366/TL	814,476	77
Total		2,569,899	242

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

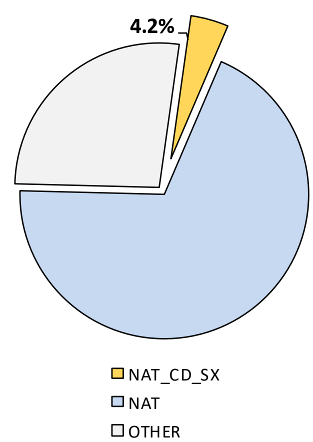
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	NATURAL STANDS STRATUM: CD_SX



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.1	0.1	0.00	0.00	0.00
30	0.3	1.6	1.9	0.01	0.05	0.06
40	2.8	8.8	11.6	0.07	0.22	0.29
50	11.6	23.7	35.3	0.23	0.47	0.71
60	28.6	43.3	71.9	0.48	0.72	1.20
70	50.4	61.8	112.2	0.72	0.88	1.60
80	73.1	76.6	149.7	0.91	0.96	1.87
90	94.0	87.6	181.6	1.04	0.97	2.02
100	113.1	95.7	208.7	1.13	0.96	2.09
110	129.9	100.8	230.6	1.18	0.92	2.10
120	144.0	100.8	244.8	1.20	0.84	2.04
130	156.1	100.8	256.8	1.20	0.78	1.98
140	166.2	95.6	261.8	1.19	0.68	1.87
150	174.7	90.5	265.2	1.16	0.60	1.77
160	182.0	85.3	267.3	1.14	0.53	1.67
170	188.1	80.2	268.3	1.11	0.47	1.58
180	193.6	75.0	268.6	1.08	0.42	1.49
190	198.3	69.9	268.2	1.04	0.37	1.41
200	202.6	64.7	267.3	1.01	0.32	1.34
210	206.4	59.6	266.0	0.98	0.28	1.27
220	209.9	54.4	264.3	0.95	0.25	1.20
230	213.1	49.3	262.3	0.93	0.21	1.14
240	216.0	44.1	260.1	0.90	0.18	1.08
250	218.7	39.0	257.6	0.87	0.16	1.03
260	218.7	39.0	257.6	0.84	0.15	0.99

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_CD_SX**	**35,071**	**4.2%**

Stratum % of the Active Landbase



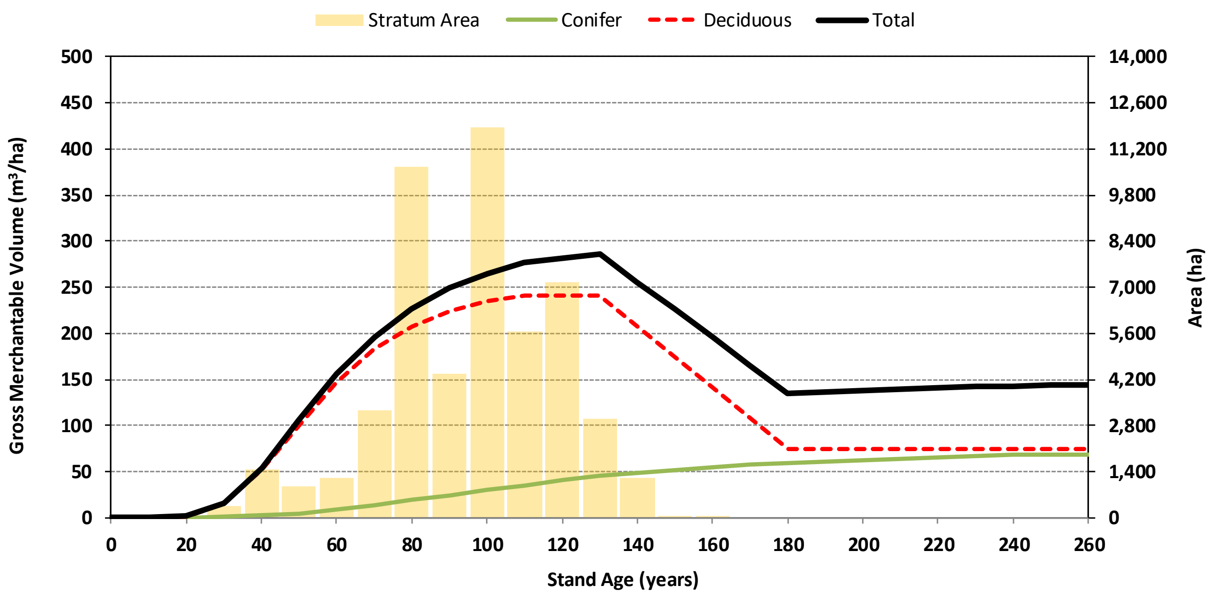
FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	3,779,489	108
Deciduous	15/10/15/366/TL	2,972,265	85
Total		6,751,946	193

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

STRATUM: D_AB

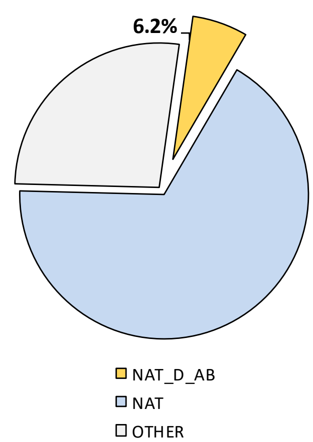


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	1.6	1.7	0.01	0.08	0.09
30	0.7	15.6	16.3	0.02	0.52	0.54
40	2.3	52.0	54.2	0.06	1.30	1.36
50	5.0	101.0	106.0	0.10	2.02	2.12
60	8.9	147.1	156.0	0.15	2.45	2.60
70	13.8	182.9	196.7	0.20	**2.61**	2.81
80	19.0	207.8	226.8	0.24	2.60	**2.83**
90	24.4	224.3	248.7	0.27	2.49	2.76
100	30.0	234.6	264.6	0.30	2.35	2.65
110	35.6	240.6	276.2	0.32	2.19	2.51
120	40.6	240.6	281.2	0.34	2.01	2.34
130	44.9	240.6	285.5	0.35	1.85	2.20
140	48.6	207.5	256.2	**0.35**	1.48	1.83
150	51.9	174.4	226.3	0.35	1.16	1.51
160	54.7	141.3	196.0	0.34	0.88	1.22
170	57.2	108.1	165.3	0.34	0.64	0.97
180	59.3	75.0	134.3	0.33	0.42	0.75
190	61.2	75.0	136.2	0.32	0.39	0.72
200	62.9	75.0	137.9	0.31	0.38	0.69
210	64.4	75.0	139.4	0.31	0.36	0.66
220	65.8	75.0	140.8	0.30	0.34	0.64
230	67.0	75.0	142.0	0.29	0.33	0.62
240	68.2	75.0	143.2	0.28	0.31	0.60
250	69.2	75.0	144.2	0.28	0.30	0.58
260	69.2	75.0	144.2	0.27	0.29	0.55

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_D_AB**	**51,386**	**6.2%**

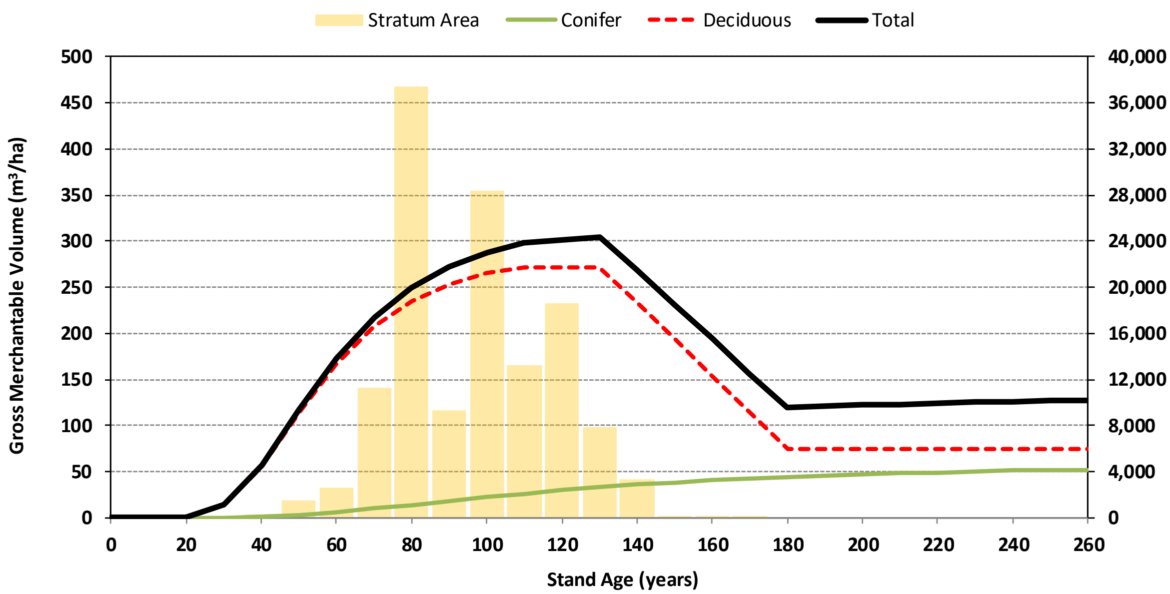
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	1,421,951	28
Deciduous	15/10/15/366/TL	11,018,050	214
Total		12,440,243	242

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

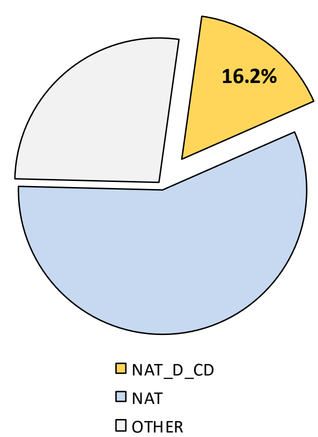
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	NATURAL STANDS STRATUM: D_CD



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.8	0.9	0.00	0.04	0.04
30	0.4	13.6	13.9	0.01	0.45	0.46
40	1.5	55.2	56.7	0.04	1.38	1.42
50	3.5	113.6	117.1	0.07	2.27	2.34
60	6.5	166.9	173.4	0.11	2.78	2.89
70	10.1	207.0	217.1	0.14	2.96	3.10
80	14.2	234.9	249.1	0.18	2.94	3.11
90	18.4	253.6	271.9	0.20	2.82	3.02
100	22.3	265.4	287.7	0.22	2.65	2.88
110	26.1	272.2	298.3	0.24	2.47	2.71
120	29.6	272.2	301.8	0.25	2.27	2.52
130	32.9	272.2	305.1	0.25	2.09	2.35
140	35.8	232.8	268.6	0.26	1.66	1.92
150	38.4	193.3	231.7	0.26	1.29	1.54
160	40.6	153.9	194.5	0.25	0.96	1.22
170	42.5	114.4	157.0	0.25	0.67	0.92
180	44.2	75.0	119.2	0.25	0.42	0.66
190	45.7	75.0	120.7	0.24	0.39	0.64
200	47.0	75.0	122.0	0.23	0.38	0.61
210	48.1	75.0	123.1	0.23	0.36	0.59
220	49.1	75.0	124.1	0.22	0.34	0.56
230	50.1	75.0	125.1	0.22	0.33	0.54
240	50.9	75.0	125.9	0.21	0.31	0.52
250	51.7	75.0	126.7	0.21	0.30	0.51
260	51.7	75.0	126.7	0.20	0.29	0.49

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_D_CD**	**134,420**	**16.2%**

Stratum % of the Active Landbase



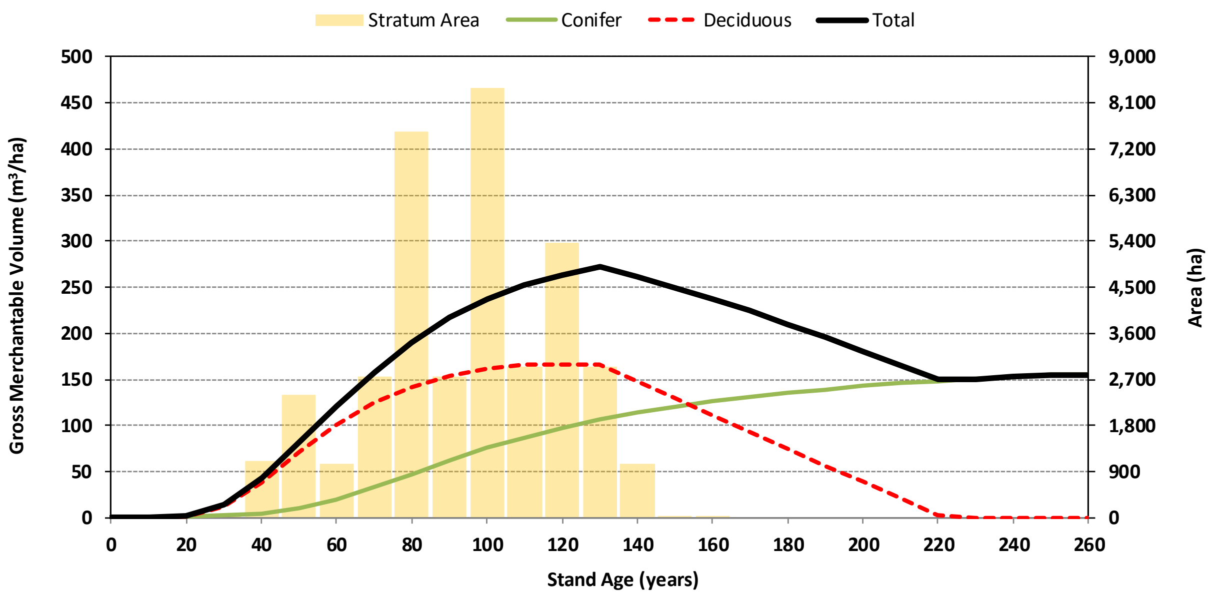
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	2,756,129	21
Deciduous	15/10/15/366/TL	33,290,308	248
Total		36,046,705	268

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

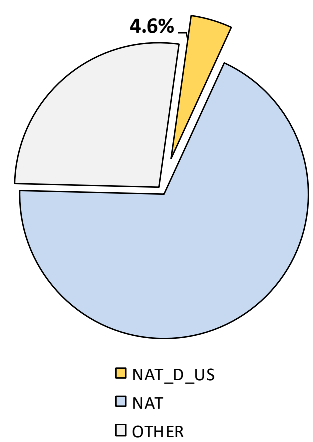
STRATUM: D_US



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	1.1	1.7	0.03	0.06	0.08
30	2.0	11.6	13.7	0.07	0.39	0.46
40	4.9	38.1	43.0	0.12	0.95	1.07
50	10.7	71.0	81.7	0.21	1.42	1.63
60	20.1	101.1	121.2	0.34	1.68	2.02
70	32.9	124.9	157.9	0.47	1.78	2.26
80	47.4	142.5	189.8	0.59	1.78	2.37
90	62.3	154.5	216.8	0.69	1.72	2.41
100	75.7	162.0	237.6	0.76	1.62	2.38
110	87.3	165.8	253.1	0.79	1.51	2.30
120	97.5	165.8	263.3	0.81	1.38	2.19
130	106.4	165.8	272.2	0.82	1.28	2.09
140	114.0	147.6	261.7	0.81	1.05	1.87
150	120.6	129.5	250.1	0.80	0.86	1.67
160	126.3	111.3	237.6	0.79	0.70	1.48
170	131.2	93.2	224.3	0.77	0.55	1.32
180	135.5	75.0	210.5	0.75	0.42	1.17
190	139.3	56.8	196.1	0.73	0.30	1.03
200	142.6	38.7	181.3	0.71	0.19	0.91
210	145.6	20.5	166.2	0.69	0.10	0.79
220	148.4	2.4	150.7	0.67	0.01	0.69
230	150.8	0.0	150.8	0.66	0.00	0.66
240	153.0	0.0	153.0	0.64	0.00	0.64
250	155.1	0.0	155.1	0.62	0.00	0.62
260	155.1	0.0	155.1	0.60	0.00	0.60

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	NAT_D_US	38,398	4.6%

Stratum % of the Active Landbase



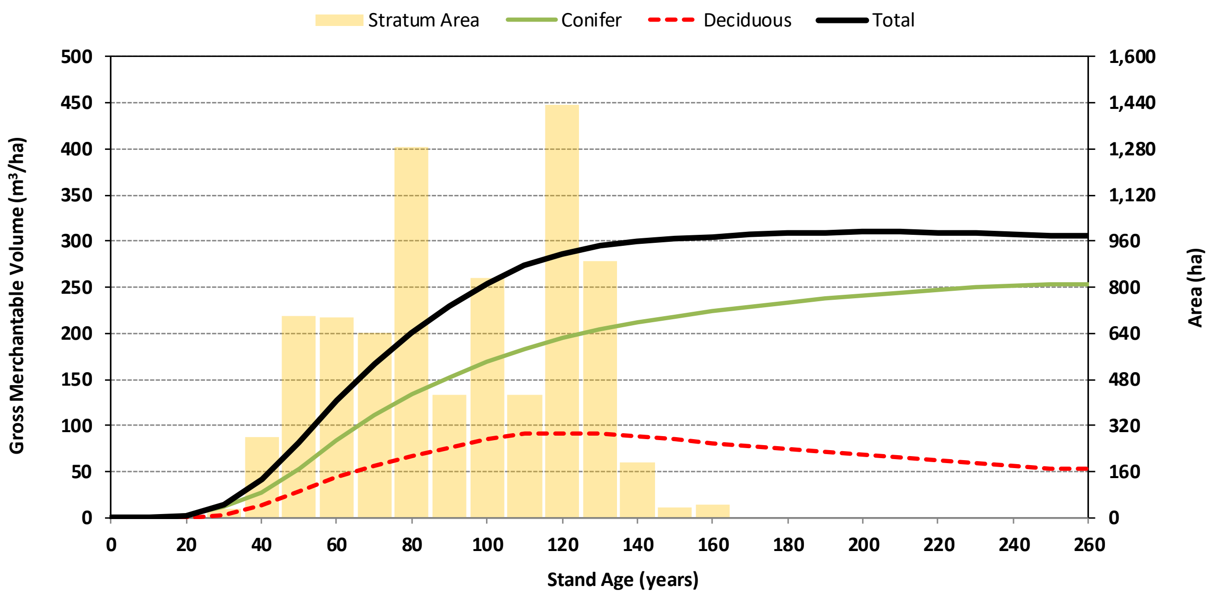
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	2,527,447	66
Deciduous	15/10/15/366/TL	5,551,490	145
Total		8,079,148	210

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

STRATUM: DC_PL

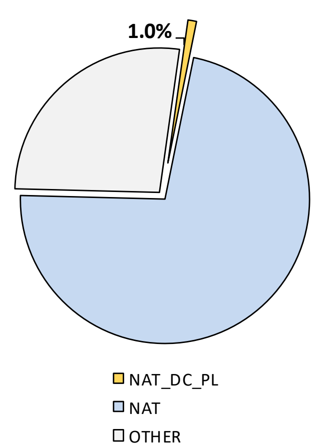


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	2.6	0.2	2.8	0.13	0.01	0.14
30	11.5	3.4	14.9	0.38	0.11	0.50
40	28.0	13.7	41.7	0.70	0.34	1.04
50	53.5	28.6	82.1	1.07	0.57	1.64
60	83.3	43.5	126.8	1.39	0.73	2.11
70	111.3	56.3	167.6	1.59	0.80	2.39
80	134.2	66.7	200.9	1.68	0.83	2.51
90	153.0	76.8	229.8	**1.70**	0.85	**2.55**
100	169.1	85.4	254.5	1.69	**0.85**	2.55
110	183.2	91.1	274.3	1.67	0.83	2.49
120	194.9	91.1	286.0	1.62	0.76	2.38
130	204.3	91.1	295.4	1.57	0.70	2.27
140	211.8	87.9	299.7	1.51	0.63	2.14
150	218.0	84.7	302.7	1.45	0.56	2.02
160	223.6	81.4	305.0	1.40	0.51	1.91
170	228.7	78.2	307.0	1.35	0.46	1.81
180	233.5	75.0	308.5	1.30	0.42	1.71
190	237.7	71.8	309.4	1.25	0.38	1.63
200	241.3	68.6	309.9	1.21	0.34	1.55
210	244.5	65.4	309.9	1.16	0.31	1.48
220	247.3	62.1	309.4	1.12	0.28	1.41
230	249.6	58.9	308.6	1.09	0.26	1.34
240	251.6	55.7	307.3	1.05	0.23	1.28
250	253.3	52.5	305.8	1.01	0.21	1.22
260	253.3	52.5	305.8	0.97	0.20	1.18

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_DC_PL**	**7,943**	**1.0%**

Stratum % of the Active Landbase



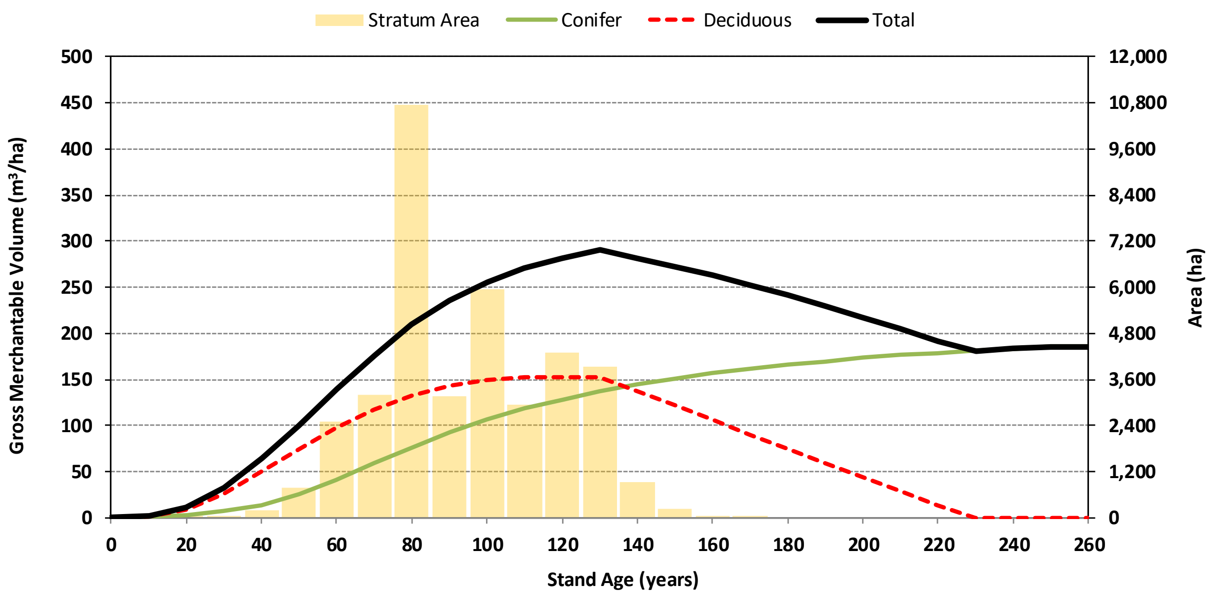
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	1,154,693	145
Deciduous	15/10/15/366/TL	555,477	70
Total		1,710,386	215

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

NATURAL STANDS

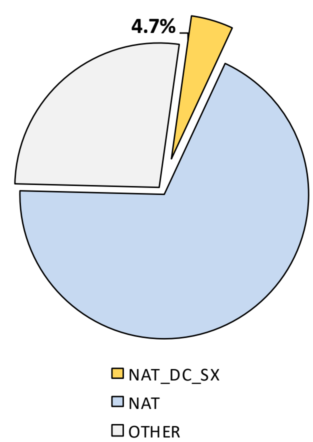
STRATUM: DC_SX



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.6	1.1	1.7	0.06	0.11	0.17
20	2.6	8.3	10.8	0.13	0.41	0.54
30	6.6	25.9	32.5	0.22	0.86	1.08
40	13.8	50.3	64.2	0.35	1.26	1.60
50	25.2	75.1	100.3	0.50	1.50	2.01
60	40.7	98.2	138.9	0.68	1.64	2.32
70	58.7	117.8	176.5	0.84	**1.68**	2.52
80	76.3	132.8	209.1	0.95	1.66	2.61
90	92.3	143.1	235.4	1.03	1.59	**2.62**
100	106.0	149.5	255.5	1.06	1.49	2.56
110	118.1	152.4	270.6	**1.07**	1.39	2.46
120	128.6	152.4	281.0	1.07	1.27	2.34
130	137.5	152.4	289.9	1.06	1.17	2.23
140	145.1	136.9	282.0	1.04	0.98	2.01
150	151.6	121.4	273.0	1.01	0.81	1.82
160	157.2	106.0	263.1	0.98	0.66	1.64
170	162.0	90.5	252.5	0.95	0.53	1.49
180	166.2	75.0	241.2	0.92	0.42	1.34
190	169.9	59.5	229.5	0.89	0.31	1.21
200	173.3	44.0	217.3	0.87	0.22	1.09
210	176.2	28.6	204.8	0.84	0.14	0.98
220	178.9	13.1	192.0	0.81	0.06	0.87
230	181.3	0.0	181.3	0.79	0.00	0.79
240	183.5	0.0	183.5	0.76	0.00	0.76
250	185.5	0.0	185.5	0.74	0.00	0.74
260	185.5	0.0	185.5	0.71	0.00	0.71

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	NAT	607,222	73.2%
Stratum	**NAT_DC_SX**	**39,042**	**4.7%**

Stratum % of the Active Landbase

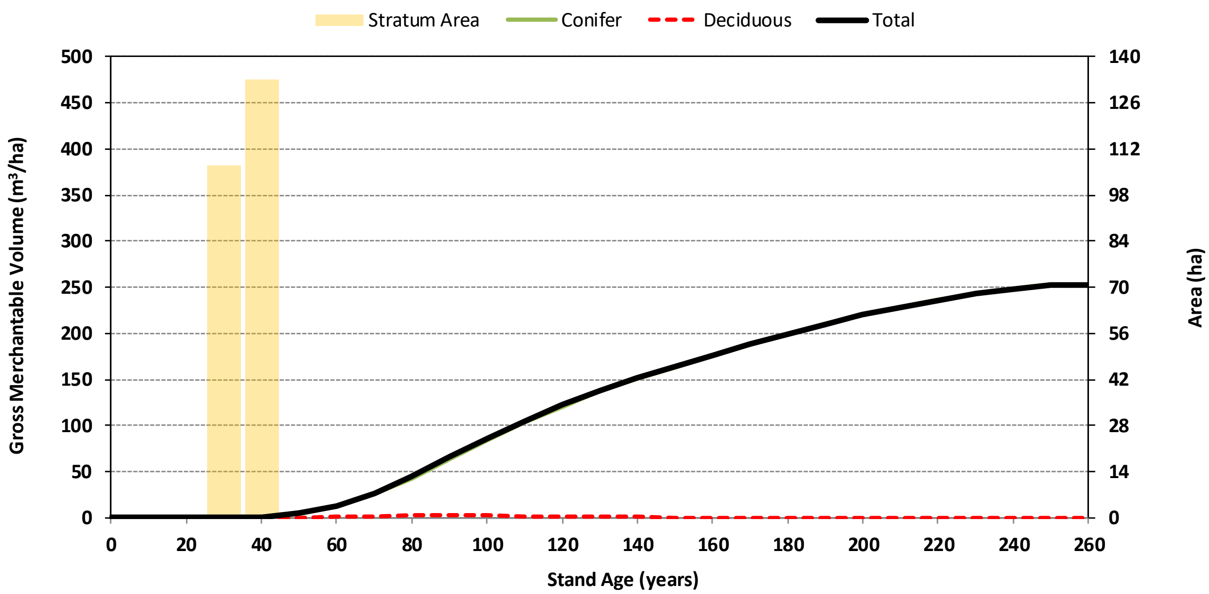


FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	3,678,450	94
Deciduous	15/10/15/366/TL	5,331,843	137
Total		9,010,524	231

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

Appendix V – Pre-1991 Managed Stand Yield Curves

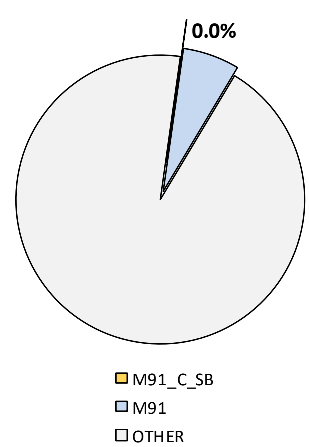
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	PRE-1991 CUTBLOCKS STRATUM: C_SB



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.0	0.0	0.00	0.00	0.00
30	0.0	0.0	0.0	0.00	0.00	0.00
40	0.9	0.0	0.9	0.02	0.00	0.02
50	4.3	0.2	4.5	0.09	0.00	0.09
60	12.1	0.8	12.9	0.20	0.01	0.21
70	25.5	1.5	27.0	0.36	0.02	0.39
80	43.2	2.2	45.4	0.54	0.03	0.57
90	63.4	2.5	65.9	0.70	0.03	0.73
100	83.9	2.4	86.3	0.84	0.02	0.86
110	103.4	1.7	105.1	0.94	0.02	0.96
120	121.1	1.2	122.3	1.01	0.01	1.02
130	136.8	1.0	137.9	1.05	0.01	1.06
140	150.9	0.8	151.7	1.08	0.01	1.08
150	163.8	0.5	164.3	1.09	0.00	1.10
160	176.1	0.2	176.3	1.10	0.00	1.10
170	188.0	0.1	188.1	1.11	0.00	1.11
180	199.6	0.0	199.6	1.11	0.00	1.11
190	210.4	0.0	210.4	1.11	0.00	1.11
200	220.2	0.0	220.2	1.10	0.00	1.10
210	228.8	0.0	228.8	1.09	0.00	1.09
220	236.2	0.0	236.2	1.07	0.00	1.07
230	242.6	0.0	242.6	1.05	0.00	1.05
240	248.2	0.0	248.2	1.03	0.00	1.03
250	253.0	0.0	253.0	1.01	0.00	1.01
260	253.0	0.0	253.0	0.97	0.00	0.97

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	M91_C_SB	240	0.0%

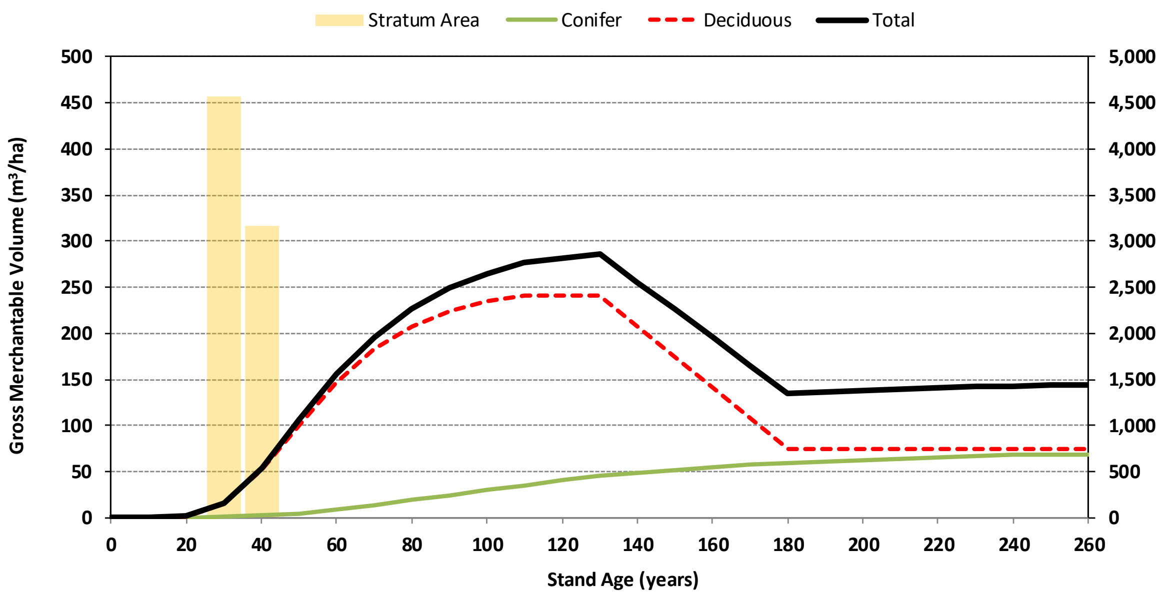
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	123	1
Deciduous	15/10/15/366/TL	3	0
Total		126	1

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	PRE-1991 CUTBLOCKS STRATUM: D_AB

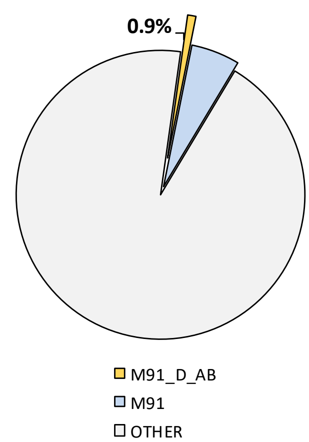


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	1.6	1.7	0.01	0.08	0.09
30	0.7	15.6	16.3	0.02	0.52	0.54
40	2.3	52.0	54.2	0.06	1.30	1.36
50	5.0	101.0	106.0	0.10	2.02	2.12
60	8.9	147.1	156.0	0.15	2.45	2.60
70	13.8	182.9	196.7	0.20	2.61	2.81
80	19.0	207.8	226.8	0.24	2.60	2.83
90	24.4	224.3	248.7	0.27	2.49	2.76
100	30.0	234.6	264.6	0.30	2.35	2.65
110	35.6	240.6	276.2	0.32	2.19	2.51
120	40.6	240.6	281.2	0.34	2.01	2.34
130	44.9	240.6	285.5	0.35	1.85	2.20
140	48.6	207.5	256.2	0.35	1.48	1.83
150	51.9	174.4	226.3	0.35	1.16	1.51
160	54.7	141.3	196.0	0.34	0.88	1.22
170	57.2	108.1	165.3	0.34	0.64	0.97
180	59.3	75.0	134.3	0.33	0.42	0.75
190	61.2	75.0	136.2	0.32	0.39	0.72
200	62.9	75.0	137.9	0.31	0.38	0.69
210	64.4	75.0	139.4	0.31	0.36	0.66
220	65.8	75.0	140.8	0.30	0.34	0.64
230	67.0	75.0	142.0	0.29	0.33	0.62
240	68.2	75.0	143.2	0.28	0.31	0.60
250	69.2	75.0	144.2	0.28	0.30	0.58
260	69.2	75.0	144.2	0.27	0.29	0.55

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_D_AB**	**7,747**	**0.9%**

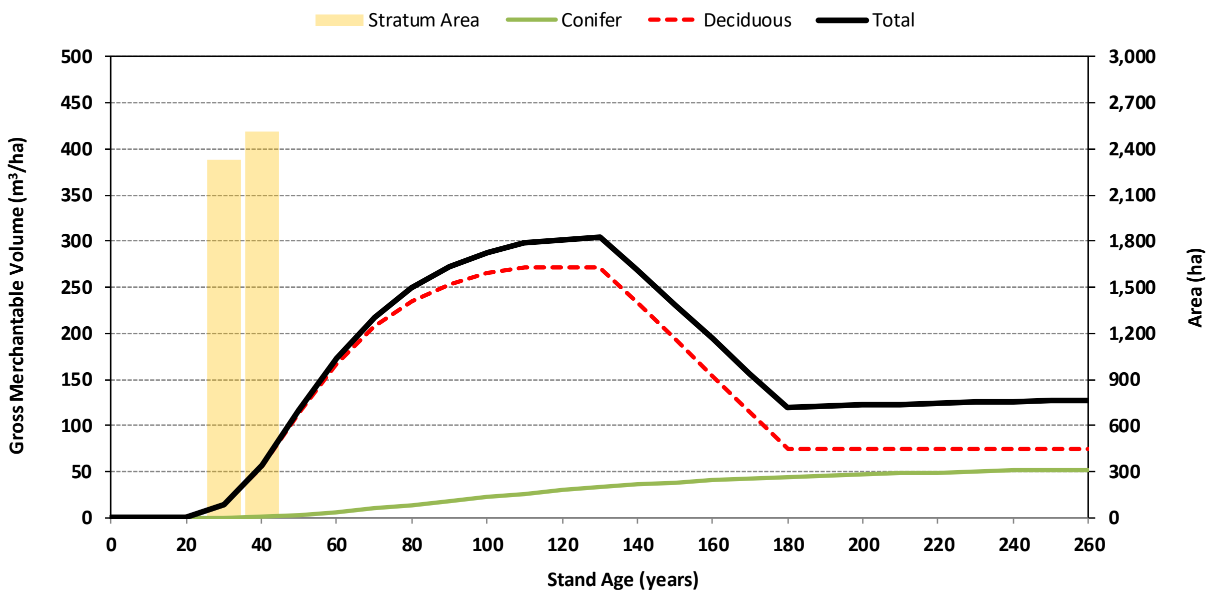
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	10,291	1
Deciduous	15/10/15/366/TL	236,101	30
Total		246,423	32

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

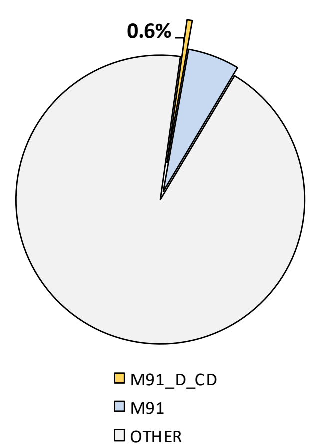
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	PRE-1991 CUTBLOCKS STRATUM: D_CD



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.8	0.9	0.00	0.04	0.04
30	0.4	13.6	13.9	0.01	0.45	0.46
40	1.5	55.2	56.7	0.04	1.38	1.42
50	3.5	113.6	117.1	0.07	2.27	2.34
60	6.5	166.9	173.4	0.11	2.78	2.89
70	10.1	207.0	217.1	0.14	**2.96**	3.10
80	14.2	234.9	249.1	0.18	2.94	**3.11**
90	18.4	253.6	271.9	0.20	2.82	3.02
100	22.3	265.4	287.7	0.22	2.65	2.88
110	26.1	272.2	298.3	0.24	2.47	2.71
120	29.6	272.2	301.8	0.25	2.27	2.52
130	32.9	272.2	305.1	0.25	2.09	2.35
140	35.8	232.8	268.6	0.26	1.66	1.92
150	38.4	193.3	231.7	**0.26**	1.29	1.54
160	40.6	153.9	194.5	0.25	0.96	1.22
170	42.5	114.4	157.0	0.25	0.67	0.92
180	44.2	75.0	119.2	0.25	0.42	0.66
190	45.7	75.0	120.7	0.24	0.39	0.64
200	47.0	75.0	122.0	0.23	0.38	0.61
210	48.1	75.0	123.1	0.23	0.36	0.59
220	49.1	75.0	124.1	0.22	0.34	0.56
230	50.1	75.0	125.1	0.22	0.33	0.54
240	50.9	75.0	125.9	0.21	0.31	0.52
250	51.7	75.0	126.7	0.21	0.30	0.51
260	51.7	75.0	126.7	0.20	0.29	0.49

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_D_CD**	**4,844**	**0.6%**

Stratum % of the Active Landbase



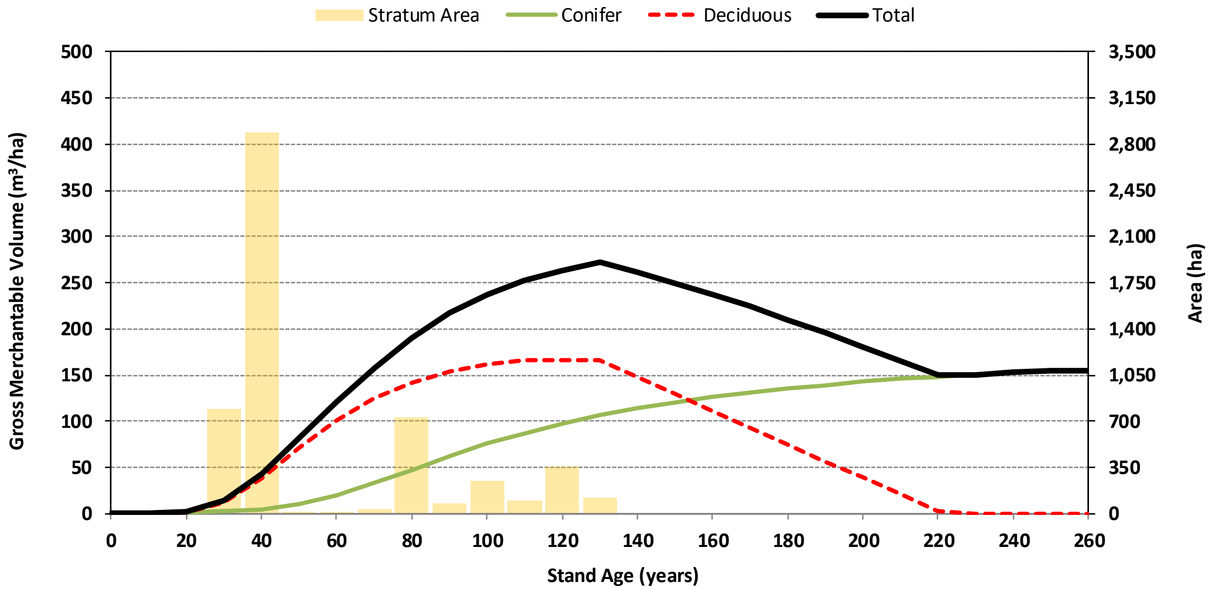
FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	4,462	1
Deciduous	15/10/15/366/TL	170,564	35
Total		175,062	36

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

PRE-1991 CUTBLOCKS

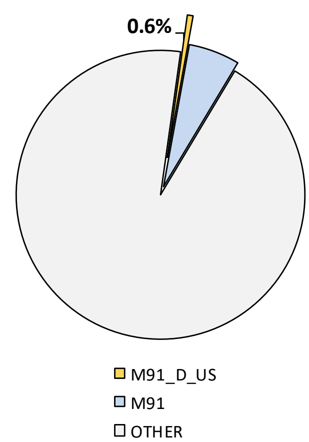
STRATUM: D_US



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	1.1	1.7	0.03	0.06	0.08
30	2.0	11.6	13.7	0.07	0.39	0.46
40	4.9	38.1	43.0	0.12	0.95	1.07
50	10.7	71.0	81.7	0.21	1.42	1.63
60	20.1	101.1	121.2	0.34	1.68	2.02
70	32.9	124.9	157.9	0.47	**1.78**	2.26
80	47.4	142.5	189.8	0.59	1.78	2.37
90	62.3	154.5	216.8	0.69	1.72	**2.41**
100	75.7	162.0	237.6	0.76	1.62	2.38
110	87.3	165.8	253.1	0.79	1.51	2.30
120	97.5	165.8	263.3	0.81	1.38	2.19
130	106.4	165.8	272.2	**0.82**	1.28	2.09
140	114.0	147.6	261.7	0.81	1.05	1.87
150	120.6	129.5	250.1	0.80	0.86	1.67
160	126.3	111.3	237.6	0.79	0.70	1.48
170	131.2	93.2	224.3	0.77	0.55	1.32
180	135.5	75.0	210.5	0.75	0.42	1.17
190	139.3	56.8	196.1	0.73	0.30	1.03
200	142.6	38.7	181.3	0.71	0.19	0.91
210	145.6	20.5	166.2	0.69	0.10	0.79
220	148.4	2.4	150.7	0.67	0.01	0.69
230	150.8	0.0	150.8	0.66	0.00	0.66
240	153.0	0.0	153.0	0.64	0.00	0.64
250	155.1	0.0	155.1	0.62	0.00	0.62
260	155.1	0.0	155.1	0.60	0.00	0.60

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_D_US**	**5,366**	**0.6%**

Stratum % of the Active Landbase



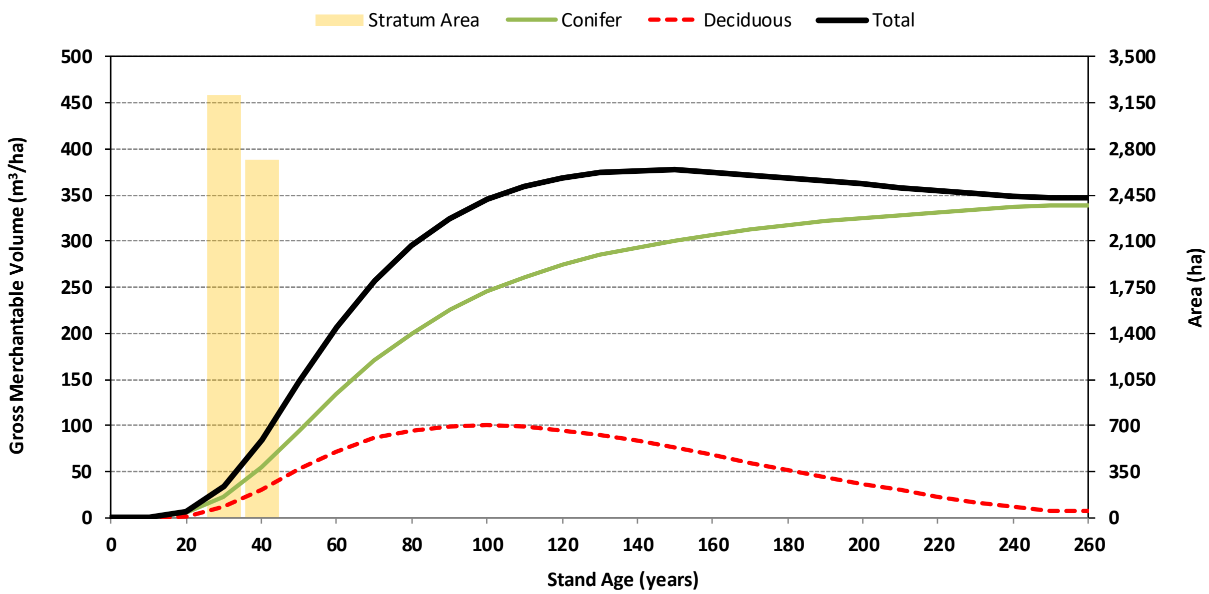
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	131,363	24
Deciduous	15/10/15/366/TL	376,693	70
Total		508,151	95

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

PRE-1991 CUTBLOCKS

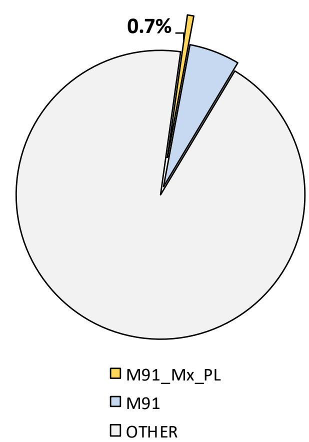
STRATUM: Mx_PL



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.1	0.1	0.2	0.01	0.01	0.02
20	5.1	1.6	6.7	0.26	0.08	0.34
30	22.5	11.4	33.9	0.75	0.38	1.13
40	54.4	30.7	85.1	1.36	0.77	2.13
50	94.5	52.9	147.4	1.89	1.06	2.95
60	134.3	72.1	206.4	2.24	1.20	3.44
70	170.1	86.3	256.5	2.43	1.23	3.66
80	200.4	95.1	295.5	2.50	1.19	3.69
90	225.1	99.3	324.5	2.50	1.10	3.61
100	245.1	100.2	345.2	2.45	1.00	3.45
110	261.1	98.5	359.6	2.37	0.90	3.27
120	274.0	94.9	368.9	2.28	0.79	3.07
130	284.6	89.8	374.4	2.19	0.69	2.88
140	293.4	83.4	376.9	2.10	0.60	2.69
150	300.9	76.1	377.0	2.01	0.51	2.51
160	307.2	68.0	375.2	1.92	0.42	2.34
170	312.7	59.1	371.8	1.84	0.35	2.19
180	317.5	51.3	368.7	1.76	0.28	2.05
190	321.7	43.9	365.6	1.69	0.23	1.92
200	325.4	36.8	362.2	1.63	0.18	1.81
210	328.8	29.7	358.5	1.57	0.14	1.71
220	331.7	22.8	354.5	1.51	0.10	1.61
230	334.4	17.2	351.6	1.45	0.07	1.53
240	336.8	12.6	349.4	1.40	0.05	1.46
250	339.0	7.7	346.7	1.36	0.03	1.39
260	339.0	7.7	346.7	1.30	0.03	1.33

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_Mx_PL**	**5,929**	**0.7%**

Stratum % of the Active Landbase



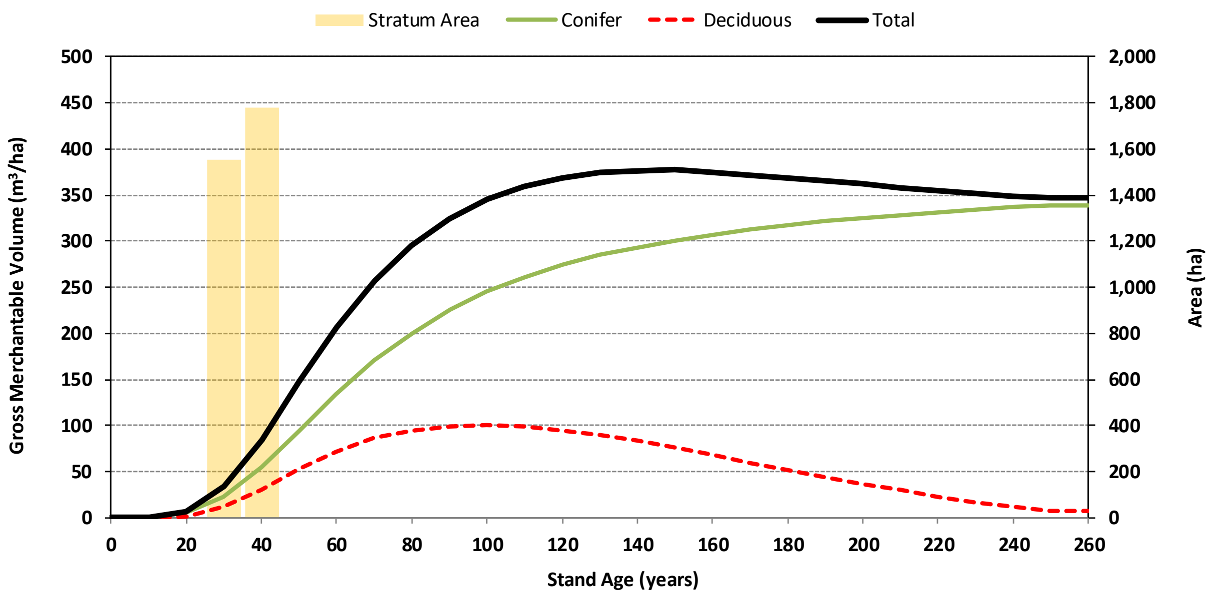
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	219,740	37
Deciduous	15/10/15/366/TL	120,111	20
Total		339,908	57

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

PRE-1991 CUTBLOCKS

STRATUM: Mx_SX

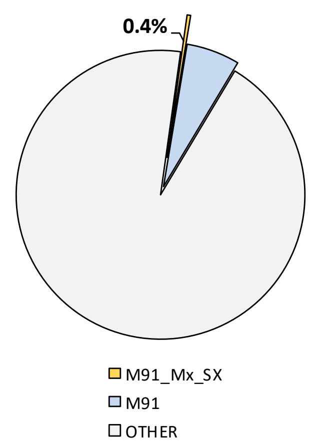


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.1	0.1	0.2	0.01	0.01	0.02
20	5.1	1.6	6.7	0.26	0.08	0.34
30	22.5	11.4	33.9	0.75	0.38	1.13
40	54.4	30.7	85.1	1.36	0.77	2.13
50	94.5	52.9	147.4	1.89	1.06	2.95
60	134.3	72.1	206.4	2.24	1.20	3.44
70	170.1	86.3	256.5	2.43	1.23	3.66
80	200.4	95.1	295.5	2.50	1.19	3.69
90	225.1	99.3	324.5	2.50	1.10	3.61
100	245.1	100.2	345.2	2.45	1.00	3.45
110	261.1	98.5	359.6	2.37	0.90	3.27
120	274.0	94.9	368.9	2.28	0.79	3.07
130	284.6	89.8	374.4	2.19	0.69	2.88
140	293.4	83.4	376.9	2.10	0.60	2.69
150	300.9	76.1	377.0	2.01	0.51	2.51
160	307.2	68.0	375.2	1.92	0.42	2.34
170	312.7	59.1	371.8	1.84	0.35	2.19
180	317.5	51.3	368.7	1.76	0.28	2.05
190	321.7	43.9	365.6	1.69	0.23	1.92
200	325.4	36.8	362.2	1.63	0.18	1.81
210	328.8	29.7	358.5	1.57	0.14	1.71
220	331.7	22.8	354.5	1.51	0.10	1.61
230	334.4	17.2	351.6	1.45	0.07	1.53
240	336.8	12.6	349.4	1.40	0.05	1.46
250	339.0	7.7	346.7	1.36	0.03	1.39
260	339.0	7.7	346.7	1.30	0.03	1.33

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_Mx_SX**	**3,331**	**0.4%**

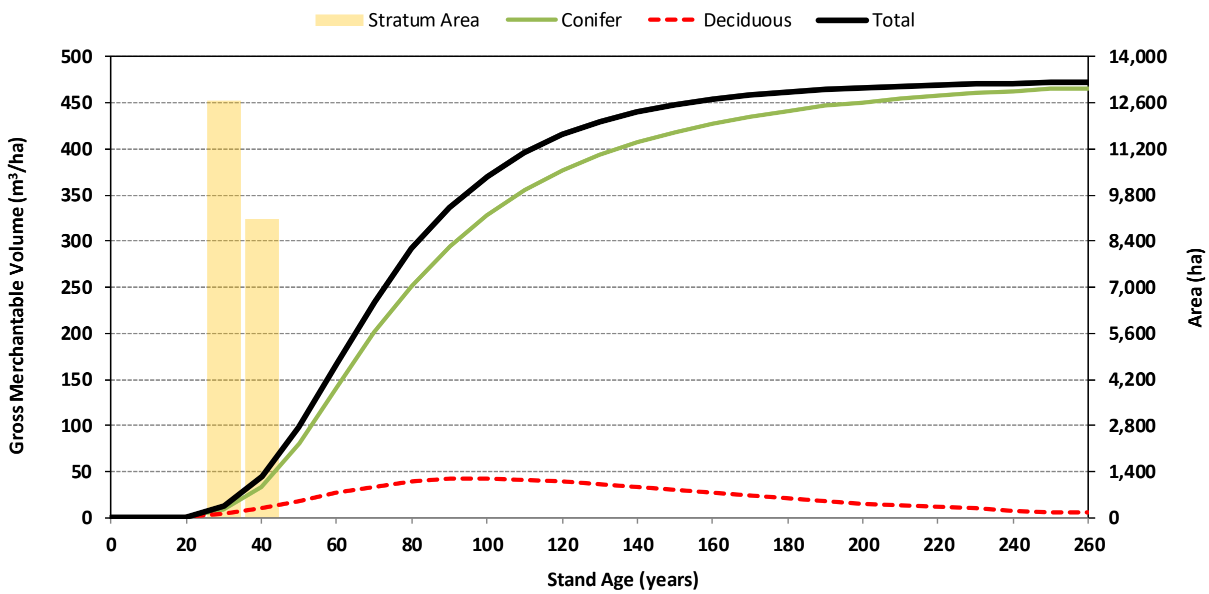
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	131,490	39
Deciduous	15/10/15/366/TL	72,351	22
Total		203,902	61

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

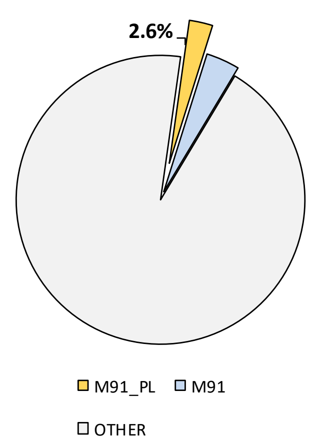
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	PRE-1991 CUTBLOCKS STRATUM: PL



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.6	0.5	1.1	0.03	0.03	0.06
30	8.3	4.3	12.7	0.28	0.14	0.42
40	33.5	10.6	44.1	0.84	0.27	1.10
50	80.0	18.1	98.1	1.60	0.36	1.96
60	140.9	26.5	167.4	2.35	0.44	2.79
70	200.8	34.0	234.8	2.87	0.49	3.35
80	252.3	39.2	291.4	3.15	**0.49**	3.64
90	294.2	41.9	336.1	3.27	0.47	**3.73**
100	328.0	42.5	370.5	**3.28**	0.42	3.70
110	354.9	41.4	396.4	3.23	0.38	3.60
120	376.4	39.2	415.6	3.14	0.33	3.46
130	393.6	36.3	429.9	3.03	0.28	3.31
140	407.3	33.3	440.6	2.91	0.24	3.15
150	418.4	29.9	448.3	2.79	0.20	2.99
160	427.5	26.9	454.3	2.67	0.17	2.84
170	434.9	23.9	458.8	2.56	0.14	2.70
180	441.2	20.6	461.8	2.45	0.11	2.57
190	446.4	18.0	464.4	2.35	0.09	2.44
200	450.9	15.7	466.6	2.25	0.08	2.33
210	454.7	13.6	468.2	2.17	0.06	2.23
220	457.9	11.7	469.6	2.08	0.05	2.13
230	460.7	9.8	470.5	2.00	0.04	2.05
240	463.1	8.0	471.1	1.93	0.03	1.96
250	465.1	6.6	471.7	1.86	0.03	1.89
260	465.1	6.6	471.7	1.79	0.03	1.81

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_PL**	**21,779**	**2.6%**

Stratum % of the Active Landbase



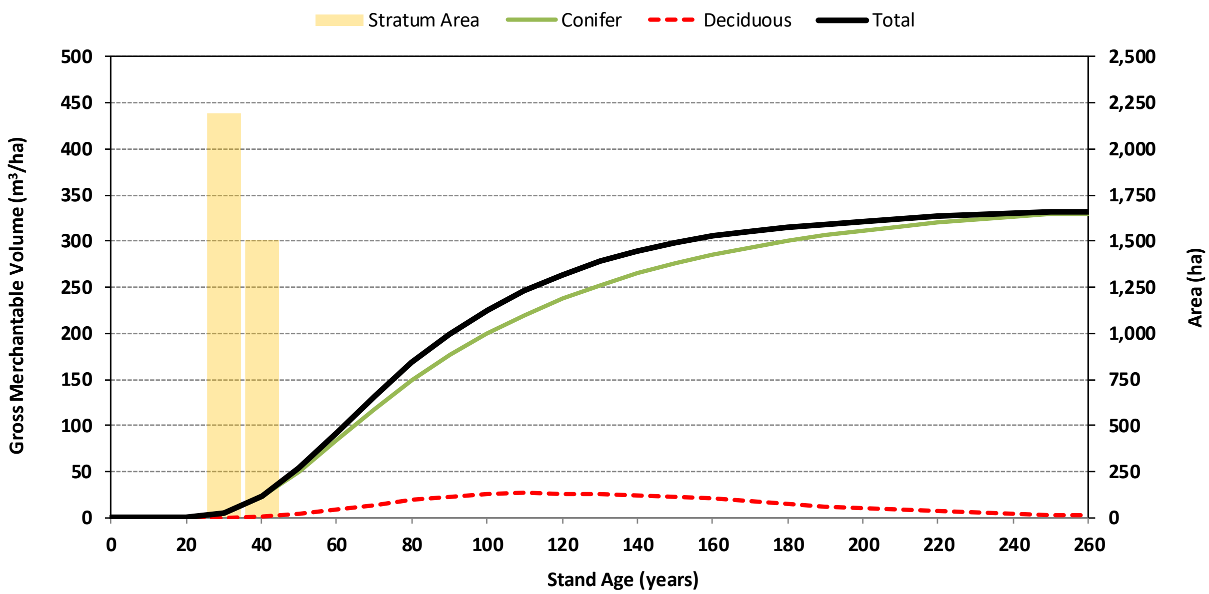
FMA Baseline Utilization		Standing Timber m3	m3/ha
Conifer	15/10/15/366/TL	410,001	19
Deciduous	15/10/15/366/TL	151,335	7
Total		561,361	26

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

PRE-1991 CUTBLOCKS

STRATUM: SW

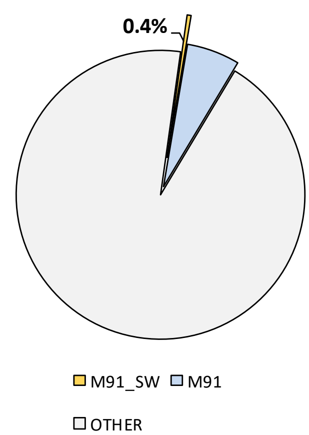


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.01	0.00	0.01
30	4.4	0.1	4.4	0.15	0.00	0.15
40	22.5	0.8	23.3	0.56	0.02	0.58
50	50.6	3.6	54.1	1.01	0.07	1.08
60	83.8	8.2	92.0	1.40	0.14	1.53
70	117.4	13.9	131.4	1.68	0.20	1.88
80	148.7	19.2	167.9	1.86	0.24	2.10
90	176.3	23.1	199.3	1.96	**0.26**	2.21
100	199.9	25.4	225.3	2.00	0.25	**2.25**
110	220.1	26.5	246.6	**2.00**	0.24	2.24
120	237.4	26.4	263.8	1.98	0.22	2.20
130	252.2	25.5	277.7	1.94	0.20	2.14
140	264.9	24.2	289.1	1.89	0.17	2.06
150	275.8	22.5	298.3	1.84	0.15	1.99
160	285.2	20.4	305.6	1.78	0.13	1.91
170	293.3	18.0	311.3	1.73	0.11	1.83
180	300.2	15.2	315.4	1.67	0.08	1.75
190	306.2	12.2	318.4	1.61	0.06	1.68
200	311.4	10.3	321.7	1.56	0.05	1.61
210	316.0	8.2	324.2	1.50	0.04	1.54
220	319.9	6.9	326.8	1.45	0.03	1.49
230	323.5	5.7	329.1	1.41	0.02	1.43
240	326.6	4.4	331.0	1.36	0.02	1.38
250	329.4	3.1	332.4	1.32	0.01	1.33
260	329.4	3.1	332.4	1.27	0.01	1.28

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	M91	52,934	6.4%
Stratum	**M91_SW**	**3,699**	**0.4%**

Stratum % of the Active Landbase



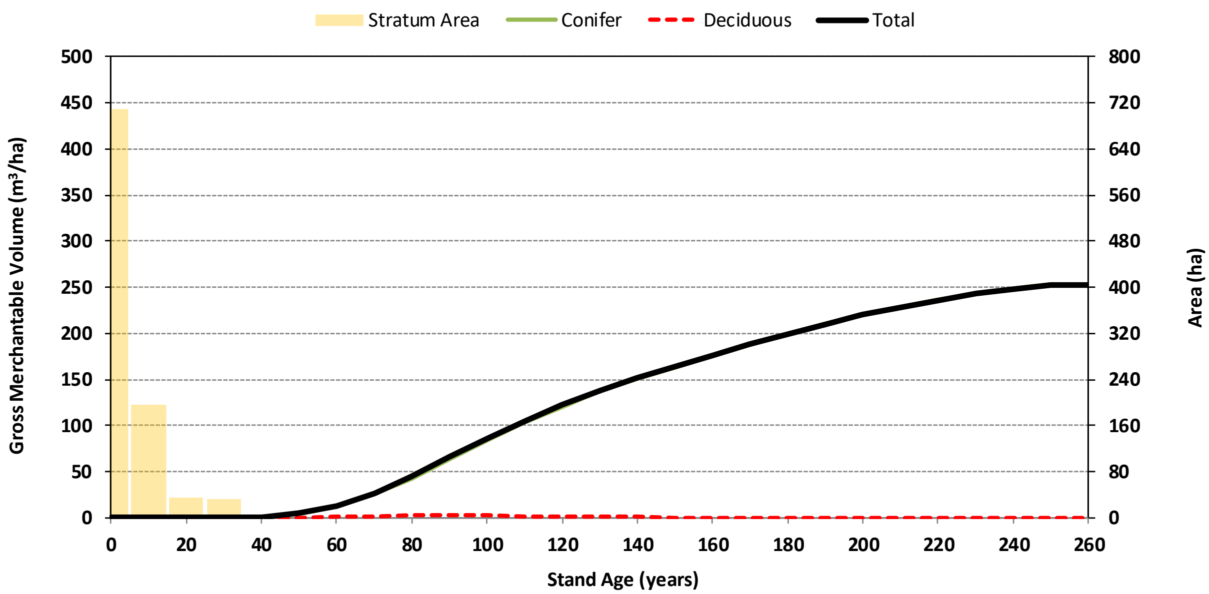
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	43,446	12
Deciduous	15/10/15/366/TL	1,313	0
Total		44,772	12

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

Appendix VI – Post-1991 Managed Stand Yield Curves

BASIC SILVICULTURE YIELD CURVES

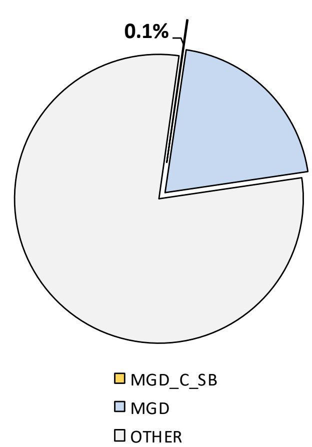
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	POST-1991 MANAGED STANDS STRATUM: C_SB



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.0	0.0	0.00	0.00	0.00
30	0.0	0.0	0.0	0.00	0.00	0.00
40	0.9	0.0	0.9	0.02	0.00	0.02
50	4.3	0.2	4.5	0.09	0.00	0.09
60	12.1	0.8	12.9	0.20	0.01	0.21
70	25.5	1.5	27.0	0.36	0.02	0.39
80	43.2	2.2	45.4	0.54	0.03	0.57
90	63.4	2.5	65.9	0.70	0.03	0.73
100	83.9	2.4	86.3	0.84	0.02	0.86
110	103.4	1.7	105.1	0.94	0.02	0.96
120	121.1	1.2	122.3	1.01	0.01	1.02
130	136.8	1.0	137.9	1.05	0.01	1.06
140	150.9	0.8	151.7	1.08	0.01	1.08
150	163.8	0.5	164.3	1.09	0.00	1.10
160	176.1	0.2	176.3	1.10	0.00	1.10
170	188.0	0.1	188.1	1.11	0.00	1.11
180	199.6	0.0	199.6	1.11	0.00	1.11
190	210.4	0.0	210.4	1.11	0.00	1.11
200	220.2	0.0	220.2	1.10	0.00	1.10
210	228.8	0.0	228.8	1.09	0.00	1.09
220	236.2	0.0	236.2	1.07	0.00	1.07
230	242.6	0.0	242.6	1.05	0.00	1.05
240	248.2	0.0	248.2	1.03	0.00	1.03
250	253.0	0.0	253.0	1.01	0.00	1.01
260	253.0	0.0	253.0	0.97	0.00	0.97

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_C_SB**	**972**	**0.1%**

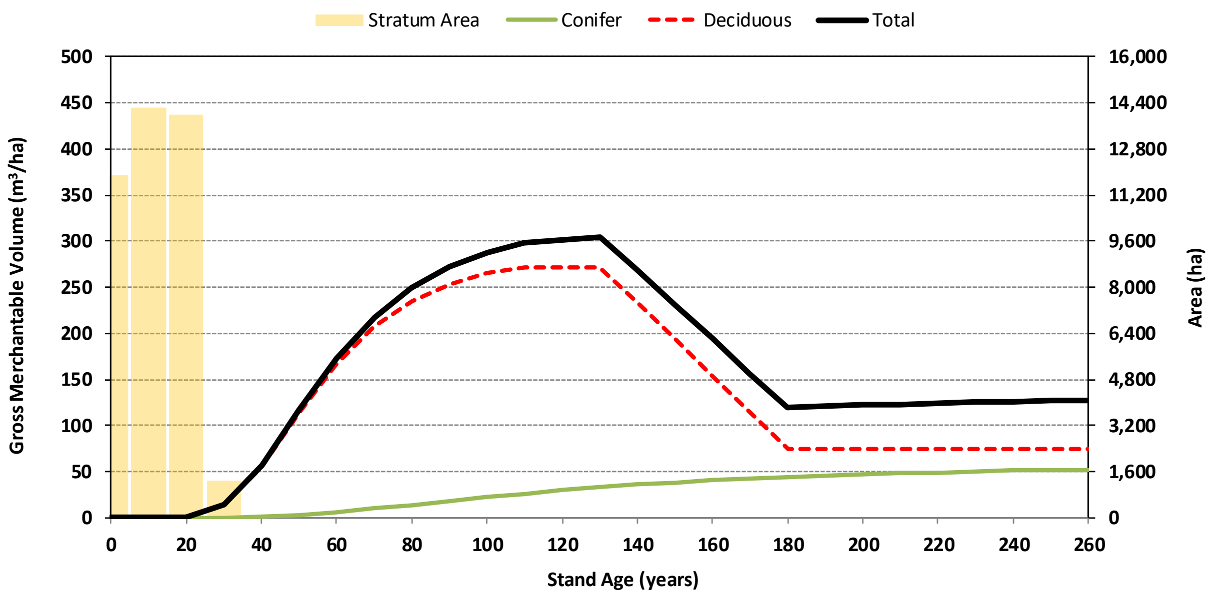
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	1	0
Deciduous	15/10/15/366/TL	0	0
Total		1	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

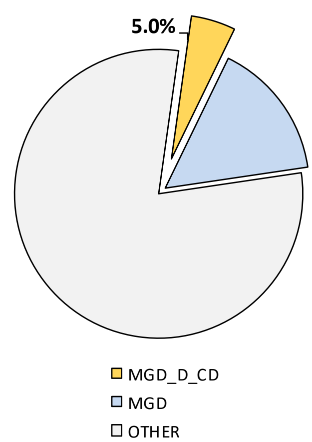
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	POST-1991 MANAGED STANDS STRATUM: D_CD



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.8	0.9	0.00	0.04	0.04
30	0.4	13.6	13.9	0.01	0.45	0.46
40	1.5	55.2	56.7	0.04	1.38	1.42
50	3.5	113.6	117.1	0.07	2.27	2.34
60	6.5	166.9	173.4	0.11	2.78	2.89
70	10.1	207.0	217.1	0.14	2.96	3.10
80	14.2	234.9	249.1	0.18	2.94	3.11
90	18.4	253.6	271.9	0.20	2.82	3.02
100	22.3	265.4	287.7	0.22	2.65	2.88
110	26.1	272.2	298.3	0.24	2.47	2.71
120	29.6	272.2	301.8	0.25	2.27	2.52
130	32.9	272.2	305.1	0.25	2.09	2.35
140	35.8	232.8	268.6	0.26	1.66	1.92
150	38.4	193.3	231.7	0.26	1.29	1.54
160	40.6	153.9	194.5	0.25	0.96	1.22
170	42.5	114.4	157.0	0.25	0.67	0.92
180	44.2	75.0	119.2	0.25	0.42	0.66
190	45.7	75.0	120.7	0.24	0.39	0.64
200	47.0	75.0	122.0	0.23	0.38	0.61
210	48.1	75.0	123.1	0.23	0.36	0.59
220	49.1	75.0	124.1	0.22	0.34	0.56
230	50.1	75.0	125.1	0.22	0.33	0.54
240	50.9	75.0	125.9	0.21	0.31	0.52
250	51.7	75.0	126.7	0.21	0.30	0.51
260	51.7	75.0	126.7	0.20	0.29	0.49

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_D_CD**	**41,393**	**5.0%**

Stratum % of the Active Landbase



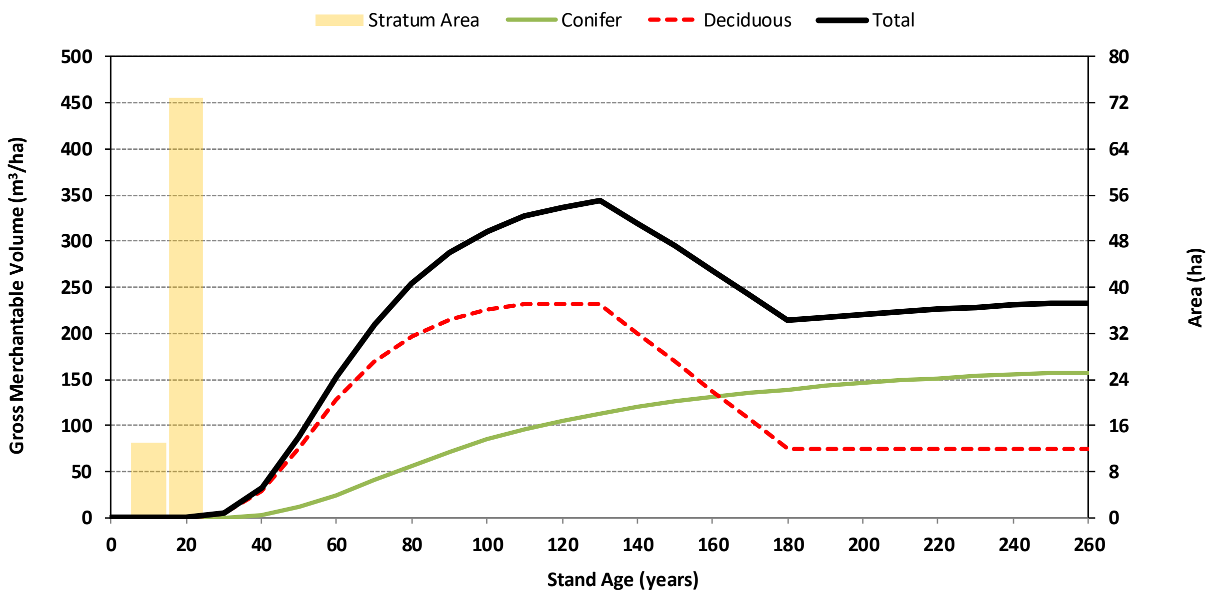
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	870	0
Deciduous	15/10/15/366/TL	29,079	1
Total		29,950	1

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: Hw

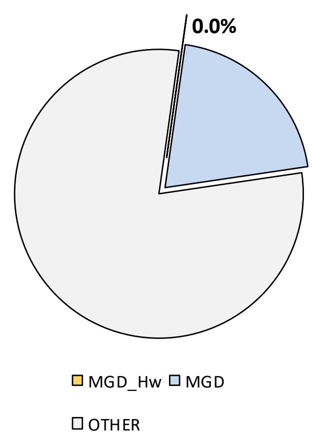


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.0	0.2	0.2	0.00	0.01	0.01
30	0.5	4.8	5.3	0.02	0.16	0.18
40	3.4	29.2	32.6	0.09	0.73	0.82
50	11.5	76.8	88.2	0.23	1.54	1.76
60	24.7	128.0	152.7	0.41	2.13	2.54
70	40.7	168.5	209.3	0.58	2.41	2.99
80	57.0	196.8	253.8	0.71	**2.46**	3.17
90	71.9	215.2	287.1	0.80	2.39	**3.19**
100	84.9	226.2	311.1	0.85	2.26	3.11
110	95.9	231.5	327.4	0.87	2.10	2.98
120	105.3	231.5	336.8	**0.88**	1.93	2.81
130	113.2	231.5	344.7	0.87	1.78	2.65
140	120.0	200.2	320.2	0.86	1.43	2.29
150	125.8	168.9	294.7	0.84	1.13	1.96
160	130.9	137.6	268.5	0.82	0.86	1.68
170	135.3	106.3	241.6	0.80	0.63	1.42
180	139.2	75.0	214.2	0.77	0.42	1.19
190	142.7	75.0	217.7	0.75	0.39	1.15
200	145.8	75.0	220.8	0.73	0.38	1.10
210	148.6	75.0	223.6	0.71	0.36	1.06
220	151.2	75.0	226.2	0.69	0.34	1.03
230	153.5	75.0	228.5	0.67	0.33	0.99
240	155.6	75.0	230.6	0.65	0.31	0.96
250	157.4	75.0	232.4	0.63	0.30	0.93
260	157.4	75.0	232.4	0.61	0.29	0.89

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	MGD_Hw	86	0.0%

Stratum % of the Active Landbase

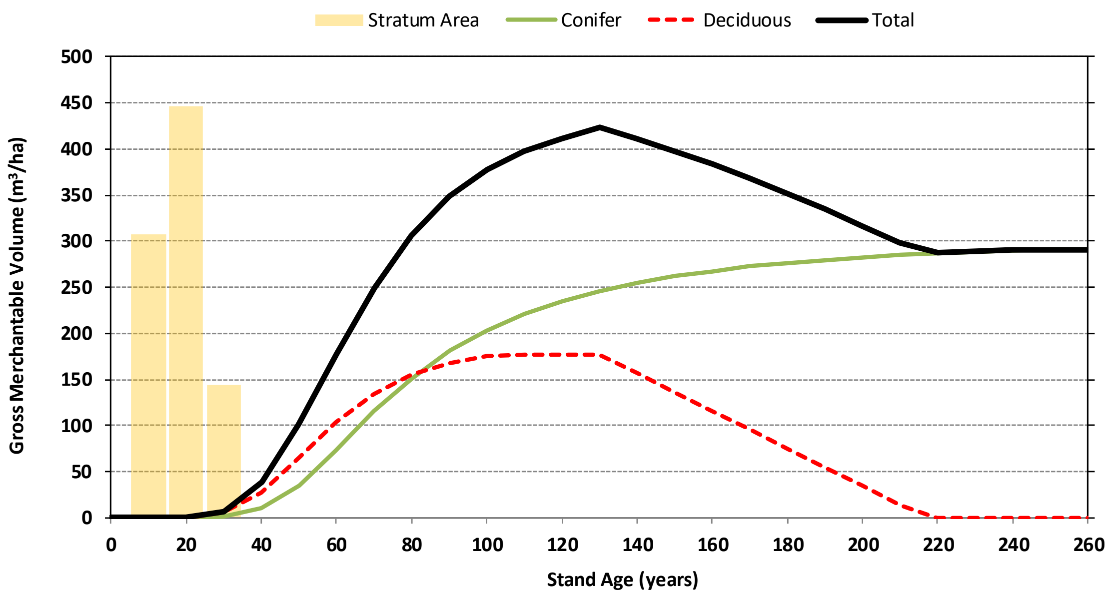


FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	1	0
Deciduous	15/10/15/366/TL	12	0
Total		14	0

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

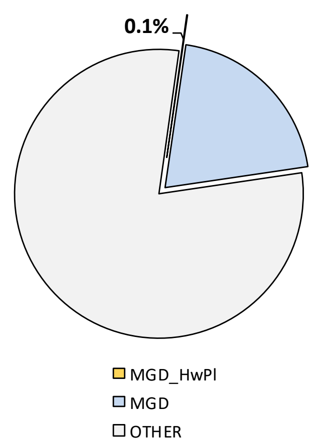
STRATUM: HwPl



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.2	0.3	0.00	0.01	0.01
30	1.8	5.2	7.0	0.06	0.17	0.23
40	11.1	27.8	38.9	0.28	0.70	0.97
50	35.3	66.1	101.4	0.71	1.32	2.03
60	73.7	104.3	178.0	1.23	1.74	2.97
70	115.4	134.1	249.5	1.65	1.92	3.56
80	151.7	154.8	306.5	1.90	**1.94**	3.83
90	180.7	167.8	348.5	2.01	1.86	**3.87**
100	203.4	174.7	378.1	**2.03**	1.75	3.78
110	221.1	176.9	397.9	2.01	1.61	3.62
120	234.9	176.9	411.8	1.96	1.47	3.43
130	245.9	176.9	422.8	1.89	1.36	3.25
140	254.7	156.5	411.2	1.82	1.12	2.94
150	261.9	136.1	398.0	1.75	0.91	2.65
160	267.7	115.7	383.5	1.67	0.72	2.40
170	272.6	95.4	367.9	1.60	0.56	2.16
180	276.6	75.0	351.6	1.54	0.42	1.95
190	280.0	54.6	334.6	1.47	0.29	1.76
200	282.8	34.3	317.0	1.41	0.17	1.59
210	285.1	13.9	299.0	1.36	0.07	1.42
220	287.0	0.0	287.0	1.30	0.00	1.30
230	288.6	0.0	288.6	1.25	0.00	1.25
240	289.9	0.0	289.9	1.21	0.00	1.21
250	291.0	0.0	291.0	1.16	0.00	1.16
260	291.0	0.0	291.0	1.12	0.00	1.12

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_HwPl**	**719**	**0.1%**

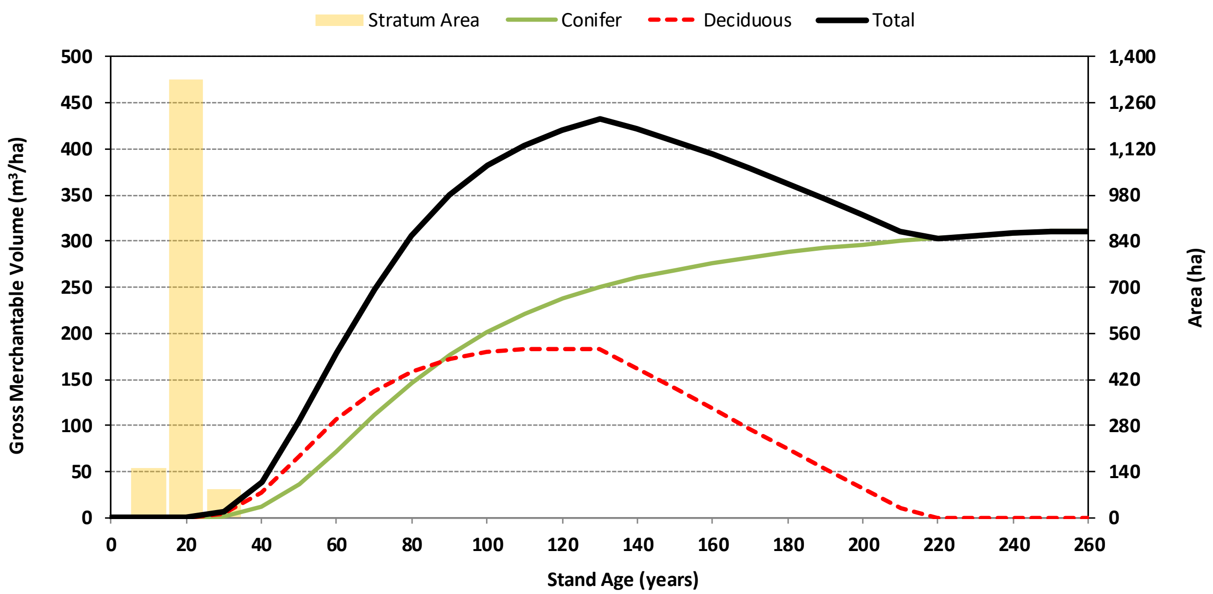
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	231	0
Deciduous	15/10/15/366/TL	673	1
Total		906	1

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

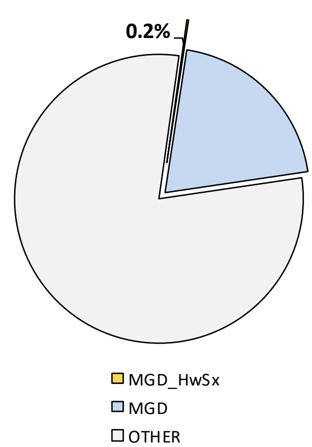
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	POST-1991 MANAGED STANDS STRATUM: HwSx



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.2	0.2	0.00	0.01	0.01
30	1.8	4.3	6.1	0.06	0.14	0.20
40	12.3	26.5	38.8	0.31	0.66	0.97
50	37.1	66.6	103.7	0.74	1.33	2.07
60	72.3	106.5	178.7	1.20	1.77	2.98
70	110.5	137.4	247.9	1.58	1.96	3.54
80	146.3	158.9	305.2	1.83	**1.99**	3.82
90	176.9	172.6	349.5	1.97	1.92	**3.88**
100	201.7	180.1	381.9	**2.02**	1.80	3.82
110	221.6	182.7	404.4	2.01	1.66	3.68
120	237.5	182.7	420.2	1.98	1.52	3.50
130	250.2	182.7	432.9	1.92	1.41	3.33
140	260.6	161.2	421.8	1.86	1.15	3.01
150	269.2	139.6	408.8	1.79	0.93	2.73
160	276.3	118.1	394.4	1.73	0.74	2.47
170	282.4	96.6	379.0	1.66	0.57	2.23
180	287.7	75.0	362.7	1.60	0.42	2.02
190	292.3	53.5	345.7	1.54	0.28	1.82
200	296.3	31.9	328.2	1.48	0.16	1.64
210	299.8	10.4	310.2	1.43	0.05	1.48
220	303.0	0.0	303.0	1.38	0.00	1.38
230	305.8	0.0	305.8	1.33	0.00	1.33
240	308.3	0.0	308.3	1.28	0.00	1.28
250	310.5	0.0	310.5	1.24	0.00	1.24
260	310.5	0.0	310.5	1.19	0.00	1.19

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_HwSx**	**1,566**	**0.2%**

Stratum % of the Active Landbase



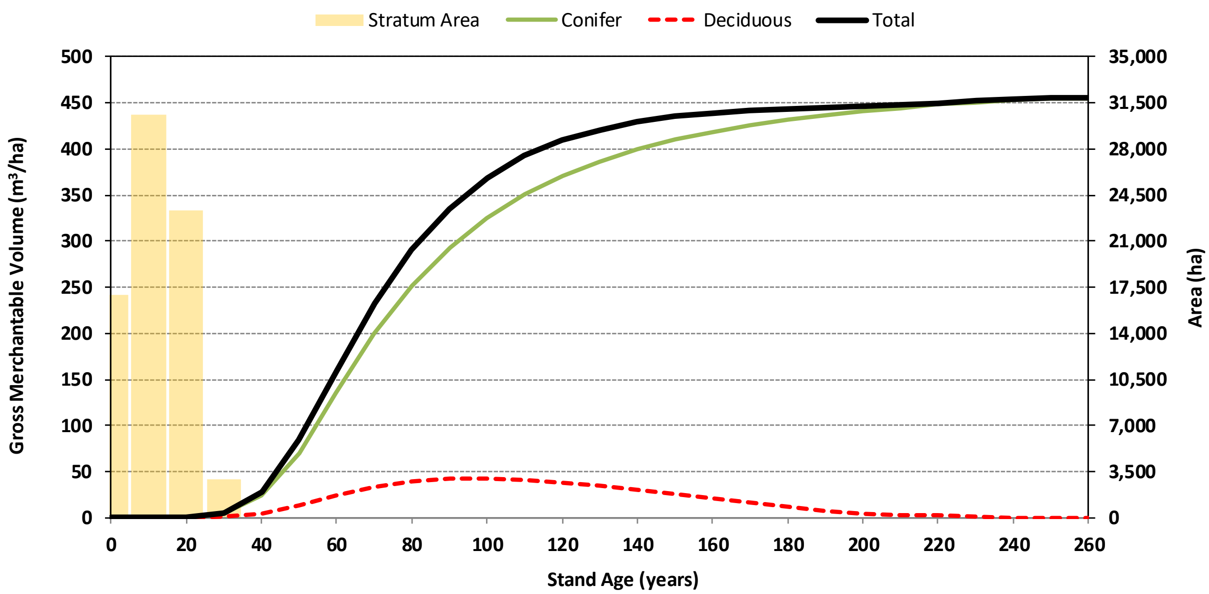
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	229	0
Deciduous	15/10/15/366/TL	569	0
Total		798	1

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

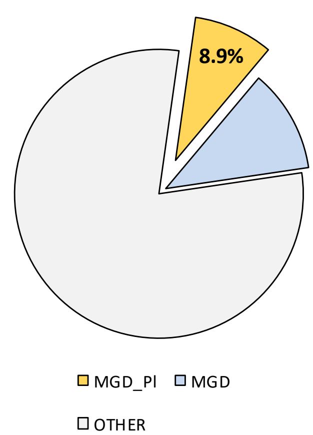
STRATUM: Pl



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.2	0.01	0.00	0.01
30	3.8	0.7	4.6	0.13	0.02	0.15
40	23.6	4.8	28.4	0.59	0.12	0.71
50	70.7	13.5	84.2	1.41	0.27	1.68
60	135.7	24.0	159.7	2.26	0.40	2.66
70	199.1	33.0	232.1	2.84	0.47	3.32
80	251.8	39.1	290.9	3.15	0.49	3.64
90	293.3	42.2	335.5	3.26	0.47	3.73
100	325.6	42.8	368.5	3.26	0.43	3.68
110	350.9	41.5	392.4	3.19	0.38	3.57
120	370.8	38.6	409.4	3.09	0.32	3.41
130	386.6	34.6	421.2	2.97	0.27	3.24
140	399.4	30.0	429.4	2.85	0.21	3.07
150	409.8	25.3	435.1	2.73	0.17	2.90
160	418.4	20.6	439.0	2.62	0.13	2.74
170	425.6	16.1	441.7	2.50	0.09	2.60
180	431.6	11.6	443.2	2.40	0.06	2.46
190	436.7	7.6	444.4	2.30	0.04	2.34
200	441.1	4.9	446.0	2.21	0.02	2.23
210	444.8	3.5	448.3	2.12	0.02	2.13
220	448.0	2.3	450.2	2.04	0.01	2.05
230	450.7	1.3	452.0	1.96	0.01	1.97
240	453.0	0.4	453.4	1.89	0.00	1.89
250	454.9	0.0	454.9	1.82	0.00	1.82
260	454.9	0.0	454.9	1.75	0.00	1.75

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	MGD_Pl	73,864	8.9%

Stratum % of the Active Landbase



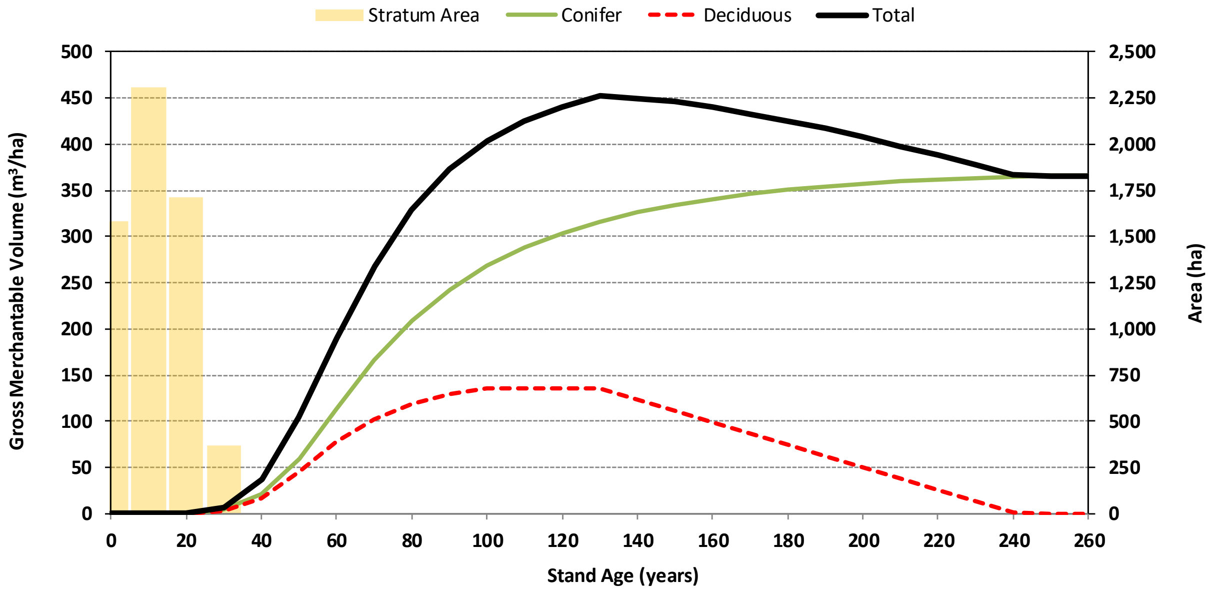
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	14,691	0
Deciduous	15/10/15/366/TL	2,638	0
Total		17,329	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

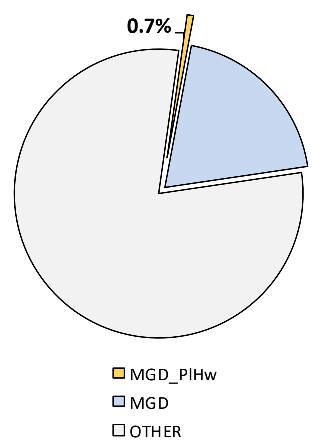
STRATUM: PlHw



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.2	0.1	0.3	0.01	0.00	0.02
30	4.0	2.5	6.5	0.13	0.08	0.22
40	20.7	16.6	37.3	0.52	0.42	0.93
50	59.1	45.5	104.6	1.18	0.91	2.09
60	112.8	76.9	189.7	1.88	1.28	3.16
70	165.6	102.0	267.6	2.37	1.46	3.82
80	209.1	119.2	328.3	2.61	**1.49**	4.10
90	242.7	129.7	372.4	**2.70**	1.44	**4.14**
100	268.6	134.9	403.5	2.69	1.35	4.03
110	288.5	136.0	424.5	2.62	1.24	3.86
120	304.1	136.0	440.1	2.53	1.13	3.67
130	316.4	136.0	452.4	2.43	1.05	3.48
140	326.3	123.8	450.0	2.33	0.88	3.21
150	334.2	111.6	445.8	2.23	0.74	2.97
160	340.7	99.4	440.0	2.13	0.62	2.75
170	346.0	87.2	433.2	2.04	0.51	2.55
180	350.4	75.0	425.4	1.95	0.42	2.36
190	354.1	62.8	416.9	1.86	0.33	2.19
200	357.1	50.6	407.7	1.79	0.25	2.04
210	359.7	38.4	398.1	1.71	0.18	1.90
220	361.8	26.2	388.0	1.64	0.12	1.76
230	363.5	14.0	377.5	1.58	0.06	1.64
240	364.9	1.9	366.7	1.52	0.01	1.53
250	366.0	0.0	366.0	1.46	0.00	1.46
260	366.0	0.0	366.0	1.41	0.00	1.41

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_PlHw**	**5,974**	**0.7%**

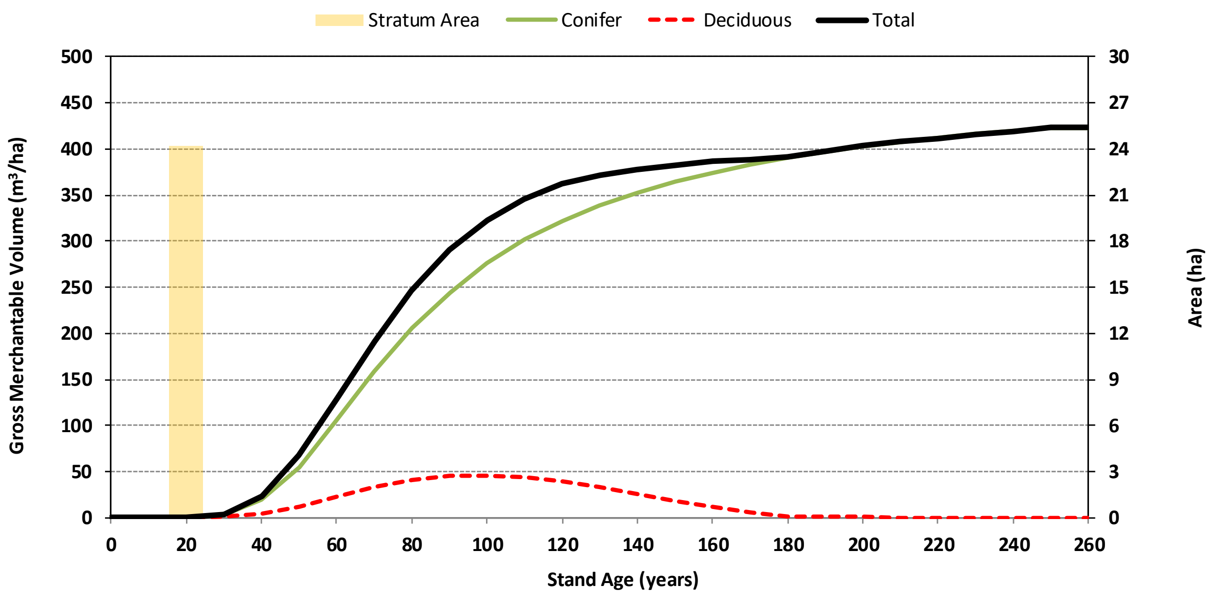
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	1,847	0
Deciduous	15/10/15/366/TL	1,056	0
Total		2,903	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	POST-1991 MANAGED STANDS STRATUM: Sb

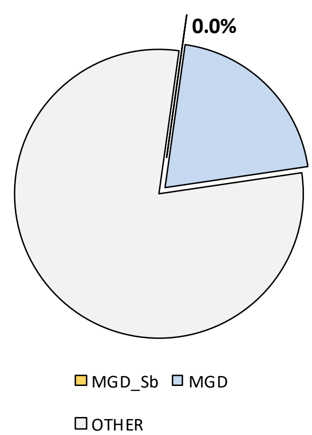


Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.00	0.00	0.00
30	3.0	0.6	3.6	0.10	0.02	0.12
40	19.4	3.9	23.4	0.49	0.10	0.58
50	55.2	12.0	67.3	1.10	0.24	1.35
60	105.3	23.1	128.4	1.75	0.39	2.14
70	158.3	33.6	191.9	2.26	0.48	2.74
80	205.6	41.2	246.8	2.57	**0.51**	3.08
90	244.8	45.2	290.1	2.72	0.50	3.22
100	276.5	45.9	322.5	**2.77**	0.46	**3.22**
110	302.0	43.9	345.8	2.75	0.40	3.14
120	322.5	39.4	361.9	2.69	0.33	3.02
130	339.2	32.9	372.1	2.61	0.25	2.86
140	353.0	25.1	378.1	2.52	0.18	2.70
150	364.5	17.6	382.2	2.43	0.12	2.55
160	374.3	12.2	386.5	2.34	0.08	2.42
170	382.8	6.2	389.0	2.25	0.04	2.29
180	390.1	1.4	391.5	2.17	0.01	2.17
190	396.5	1.1	397.6	2.09	0.01	2.09
200	402.2	0.8	403.0	2.01	0.00	2.02
210	407.3	0.5	407.8	1.94	0.00	1.94
220	411.9	0.2	412.0	1.87	0.00	1.87
230	416.0	0.0	416.0	1.81	0.00	1.81
240	419.6	0.0	419.6	1.75	0.00	1.75
250	422.9	0.0	422.9	1.69	0.00	1.69
260	422.9	0.0	422.9	1.63	0.00	1.63

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_Sb**	**24**	**0.0%**

Stratum % of the Active Landbase



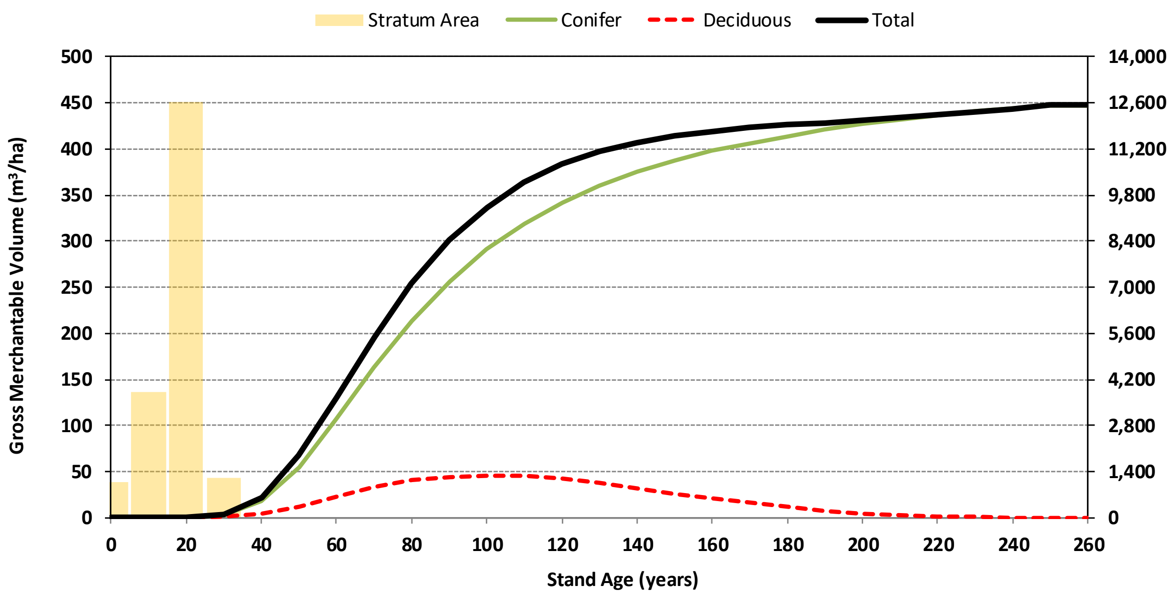
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	2	0
Deciduous	15/10/15/366/TL	0	0
Total		2	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: Sw

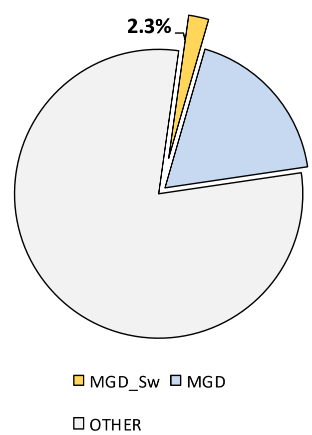


Stand Age	Gross Merchantable Volume (m^3/ha) Conifer	Deciduous	Total	Mean Annual Increment (m^3/ha/year) Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.00	0.00	0.00
30	2.6	0.6	3.2	0.09	0.02	0.11
40	18.2	4.2	22.4	0.46	0.10	0.56
50	54.9	12.4	67.3	1.10	0.25	1.35
60	106.9	23.2	130.1	1.78	0.39	2.17
70	162.4	33.1	195.6	2.32	0.47	2.79
80	213.2	40.4	253.5	2.66	**0.50**	3.17
90	256.0	44.6	300.6	2.84	0.50	3.34
100	290.9	46.1	337.0	**2.91**	0.46	**3.37**
110	319.1	45.2	364.2	2.90	0.41	3.31
120	341.7	42.3	384.0	2.85	0.35	3.20
130	360.0	37.9	397.9	2.77	0.29	3.06
140	375.0	32.3	407.3	2.68	0.23	2.91
150	387.4	26.4	413.8	2.58	0.18	2.76
160	397.9	21.4	419.2	2.49	0.13	2.62
170	406.7	16.4	423.1	2.39	0.10	2.49
180	414.3	11.5	425.8	2.30	0.06	2.37
190	421.0	7.7	428.6	2.22	0.04	2.26
200	426.8	4.7	431.5	2.13	0.02	2.16
210	431.9	2.8	434.6	2.06	0.01	2.07
220	436.4	1.5	437.9	1.98	0.01	1.99
230	440.4	0.5	441.0	1.91	0.00	1.92
240	444.0	0.0	444.0	1.85	0.00	1.85
250	447.2	0.0	447.2	1.79	0.00	1.79
260	447.2	0.0	447.2	1.72	0.00	1.72

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_Sw**	**18,715**	**2.3%**

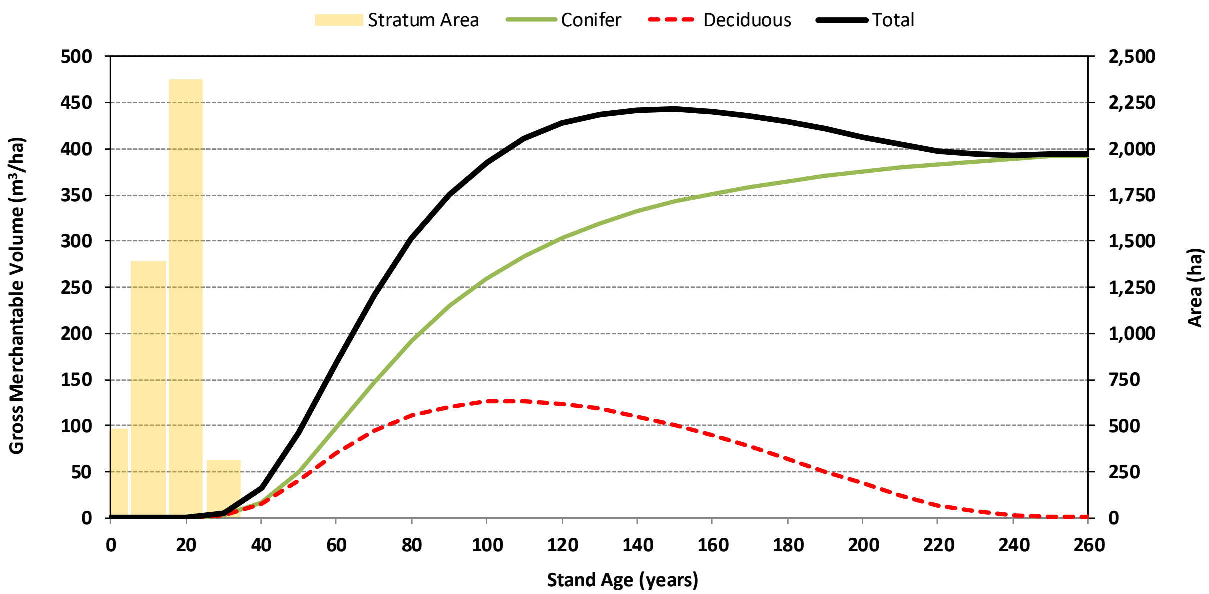
Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber m3	m3/ha
Conifer	15/10/15/366/TL	3,841	0
Deciduous	15/10/15/366/TL	987	0
Total		4,828	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

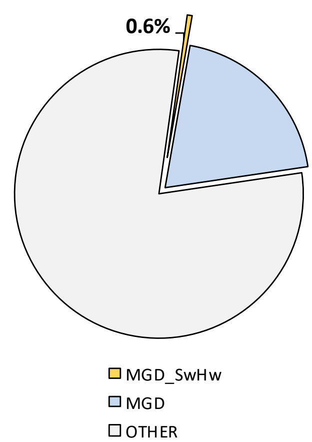
WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS FMA # 6900016 YIELD CURVES	POST-1991 MANAGED STANDS STRATUM: SwHw



Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.1	0.2	0.00	0.00	0.01
30	2.3	2.4	4.7	0.08	0.08	0.16
40	16.8	15.3	32.1	0.42	0.38	0.80
50	50.8	41.4	92.2	1.02	0.83	1.84
60	97.6	70.5	168.2	1.63	1.18	2.80
70	147.1	94.3	241.4	2.10	1.35	3.45
80	191.9	110.9	302.8	2.40	1.39	3.79
90	229.6	121.0	350.6	2.55	1.34	3.90
100	260.1	125.8	385.9	2.60	1.26	3.86
110	284.4	126.5	410.9	2.59	1.15	3.74
120	303.8	123.7	427.5	2.53	1.03	3.56
130	319.4	118.2	437.6	2.46	0.91	3.37
140	332.1	110.4	442.5	2.37	0.79	3.16
150	342.6	100.6	443.2	2.28	0.67	2.95
160	351.4	89.4	440.7	2.20	0.56	2.75
170	358.8	77.0	435.7	2.11	0.45	2.56
180	365.1	64.1	429.2	2.03	0.36	2.38
190	370.6	50.9	421.5	1.95	0.27	2.22
200	375.4	37.6	413.0	1.88	0.19	2.07
210	379.7	24.9	404.6	1.81	0.12	1.93
220	383.4	14.1	397.5	1.74	0.06	1.81
230	386.8	7.2	394.0	1.68	0.03	1.71
240	389.9	3.1	393.1	1.62	0.01	1.64
250	392.7	1.5	394.2	1.57	0.01	1.58
260	392.7	1.5	394.2	1.51	0.01	1.52

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_SwHw**	**4,565**	**0.6%**

Stratum % of the Active Landbase



FMA Baseline Utilization		Standing Timber	
		m3	m3/ha
Conifer	15/10/15/366/TL	906	0
Deciduous	15/10/15/366/TL	956	0
Total		1,862	0

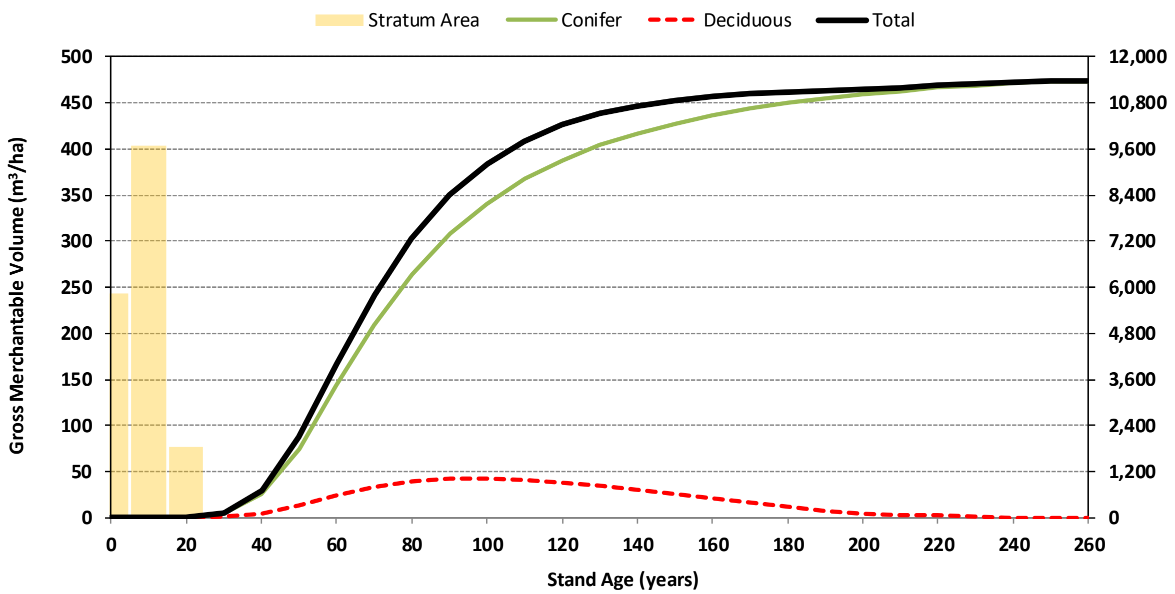
Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

GENETIC (TREE IMPROVEMENT) YIELD CURVES

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: PL_G147p1



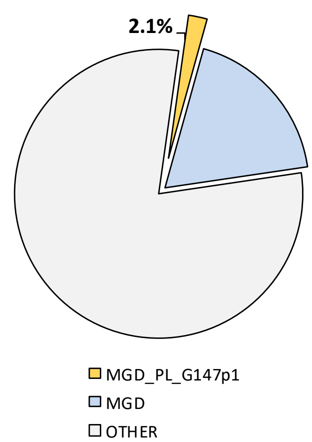
Stand Age	Gross Merchantable Volume (m^3/ha)			Mean Annual Increment (m^3/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.2	0.0	0.2	0.01	0.00	0.01
30	4.1	0.7	4.8	0.14	0.02	0.16
40	25.0	4.8	29.7	0.62	0.12	0.74
50	74.6	13.5	88.2	1.49	0.27	1.76
60	143.0	24.0	167.0	2.38	0.40	2.78
70	209.4	33.0	242.4	2.99	0.47	3.46
80	264.3	39.1	303.4	3.30	0.49	3.79
90	307.5	42.2	349.7	3.42	0.47	3.89
100	340.9	42.8	383.8	3.41	0.43	3.84
110	367.0	41.5	408.5	3.34	0.38	3.71
120	387.5	38.6	426.1	3.23	0.32	3.55
130	403.8	34.6	438.4	3.11	0.27	3.37
140	416.9	30.0	446.9	2.98	0.21	3.19
150	427.6	25.3	452.8	2.85	0.17	3.02
160	436.4	20.6	456.9	2.73	0.13	2.86
170	443.7	16.1	459.8	2.61	0.09	2.70
180	449.8	11.6	461.4	2.50	0.06	2.56
190	455.0	7.6	462.6	2.39	0.04	2.43
200	459.4	4.9	464.3	2.30	0.02	2.32
210	463.1	3.5	466.6	2.21	0.02	2.22
220	466.3	2.3	468.6	2.12	0.01	2.13
230	469.0	1.3	470.3	2.04	0.01	2.04
240	471.3	0.4	471.7	1.96	0.00	1.97
250	473.2	0.0	473.2	1.89	0.00	1.89
260	473.2	0.0	473.2	1.82	0.00	1.82

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_PL_G147p1**	**17,398**	**2.1%**

Stratum % of the Active Landbase

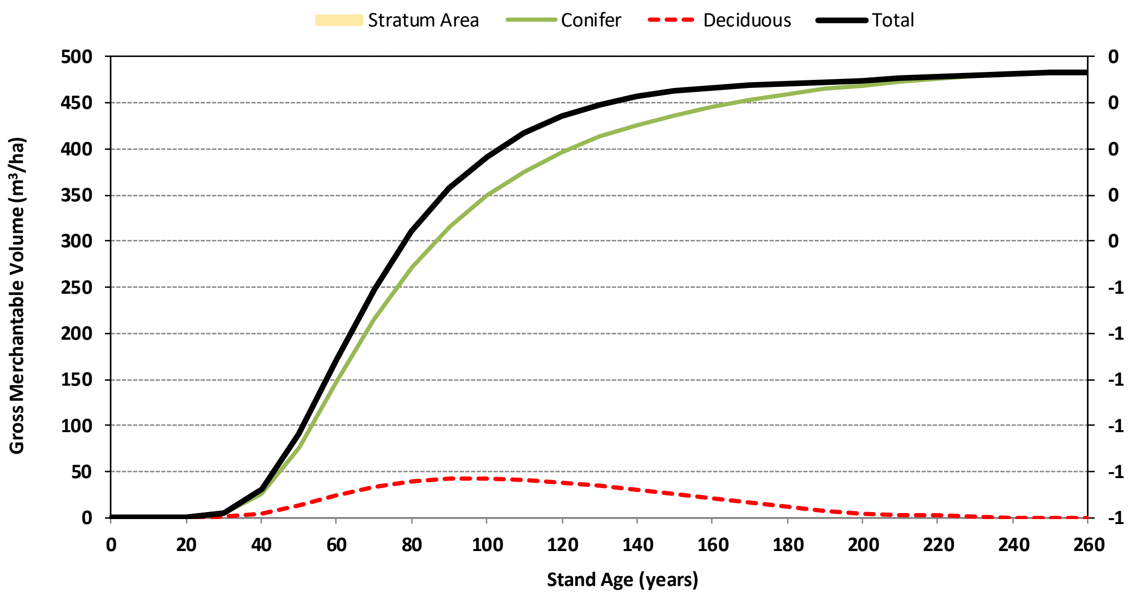


FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	297	0
Deciduous	15/10/15/366/TL	37	0
Total		334	0

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

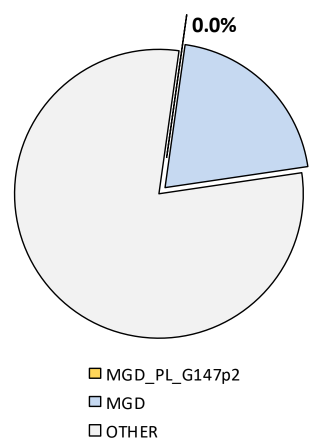
STRATUM: PL_G147p2



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.2	0.0	0.2	0.01	0.00	0.01
30	4.2	0.7	4.9	0.14	0.02	0.16
40	25.7	4.8	30.5	0.64	0.12	0.76
50	76.8	13.5	90.3	1.54	0.27	1.81
60	146.9	24.0	170.9	2.45	0.40	2.85
70	215.0	33.0	248.0	3.07	0.47	3.54
80	271.1	39.1	310.2	3.39	**0.49**	3.88
90	315.1	42.2	357.3	**3.50**	0.47	**3.97**
100	349.2	42.8	392.1	3.49	0.43	3.92
110	375.8	41.5	417.2	3.42	0.38	3.79
120	396.6	38.6	435.2	3.30	0.32	3.63
130	413.1	34.6	447.7	3.18	0.27	3.44
140	426.4	30.0	456.4	3.05	0.21	3.26
150	437.2	25.3	462.5	2.91	0.17	3.08
160	446.1	20.6	466.7	2.79	0.13	2.92
170	453.5	16.1	469.6	2.67	0.09	2.76
180	459.7	11.6	471.3	2.55	0.06	2.62
190	464.9	7.6	472.5	2.45	0.04	2.49
200	469.3	4.9	474.2	2.35	0.02	2.37
210	473.1	3.5	476.6	2.25	0.02	2.27
220	476.3	2.3	478.5	2.16	0.01	2.18
230	479.0	1.3	480.3	2.08	0.01	2.09
240	481.2	0.4	481.7	2.01	0.00	2.01
250	483.1	0.0	483.1	1.93	0.00	1.93
260	483.1	0.0	483.1	1.86	0.00	1.86

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_PL_G147p2**	**0**	**0.0%**

Stratum % of the Active Landbase



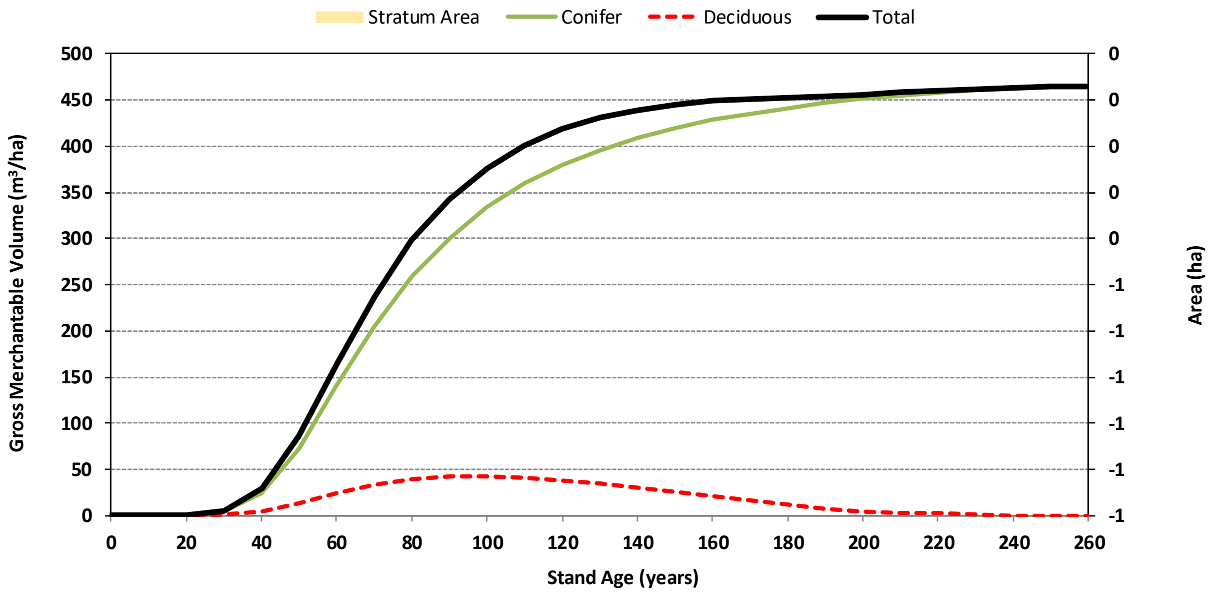
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	0	0
Deciduous	15/10/15/366/TL	0	0
Total		0	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: PL_G303

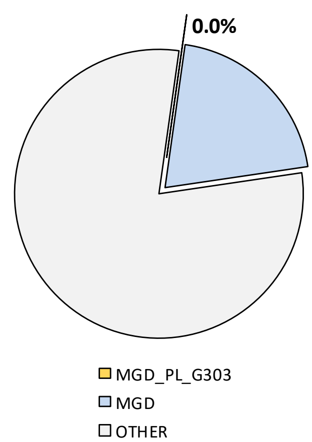


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.2	0.0	0.2	0.01	0.00	0.01
30	4.0	0.7	4.7	0.13	0.02	0.16
40	24.4	4.8	29.1	0.61	0.12	0.73
50	72.9	13.5	86.4	1.46	0.27	1.73
60	139.6	24.0	163.7	2.33	0.40	2.73
70	204.7	33.0	237.7	2.92	0.47	3.40
80	258.6	39.1	297.7	3.23	**0.49**	3.72
90	301.0	42.2	343.2	**3.34**	0.47	**3.81**
100	334.0	42.8	376.8	3.34	0.43	3.77
110	359.7	41.5	401.2	3.27	0.38	3.65
120	379.9	38.6	418.5	3.17	0.32	3.49
130	396.0	34.6	430.6	3.05	0.27	3.31
140	408.9	30.0	438.9	2.92	0.21	3.13
150	419.5	25.3	444.8	2.80	0.17	2.97
160	428.2	20.6	448.8	2.68	0.13	2.80
170	435.4	16.1	451.5	2.56	0.09	2.66
180	441.5	11.6	453.1	2.45	0.06	2.52
190	446.7	7.6	454.3	2.35	0.04	2.39
200	451.0	4.9	456.0	2.26	0.02	2.28
210	454.8	3.5	458.3	2.17	0.02	2.18
220	458.0	2.3	460.2	2.08	0.01	2.09
230	460.7	1.3	462.0	2.00	0.01	2.01
240	463.0	0.4	463.4	1.93	0.00	1.93
250	464.9	0.0	464.9	1.86	0.00	1.86
260	464.9	0.0	464.9	1.79	0.00	1.79

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_PL_G303**	**0**	**0.0%**

Stratum % of the Active Landbase



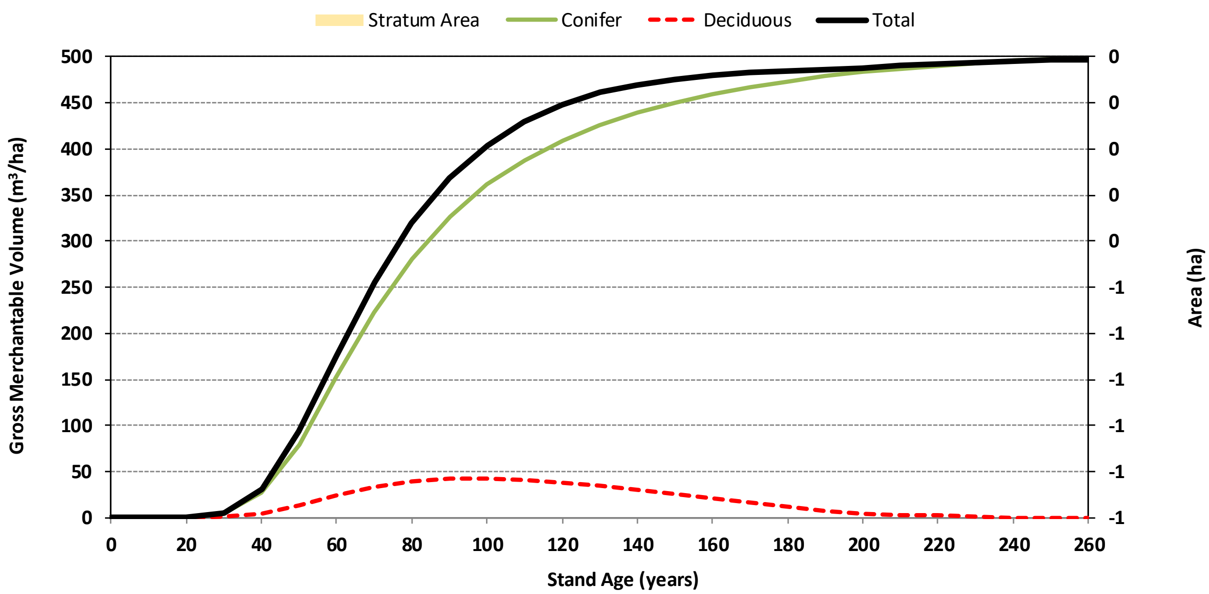
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	0	0
Deciduous	15/10/15/366/TL	0	0
Total		0	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

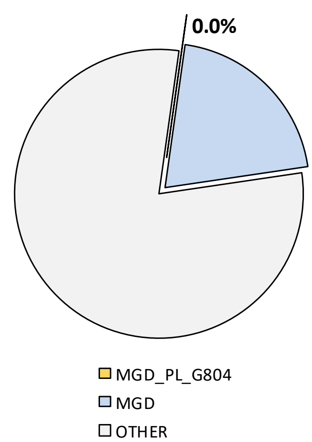
STRATUM: PL_G804



Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.2	0.0	0.2	0.01	0.00	0.01
30	4.4	0.7	5.1	0.15	0.02	0.17
40	26.8	4.8	31.6	0.67	0.12	0.79
50	79.8	13.5	93.3	1.60	0.27	1.87
60	152.5	24.0	176.5	2.54	0.40	2.94
70	222.9	33.0	255.9	3.18	0.47	3.66
80	280.8	39.1	319.9	3.51	0.49	4.00
90	326.1	42.2	368.3	3.62	0.47	4.09
100	361.0	42.8	403.9	3.61	0.43	4.04
110	388.2	41.5	429.7	3.53	0.38	3.91
120	409.5	38.6	448.1	3.41	0.32	3.73
130	426.4	34.6	461.0	3.28	0.27	3.55
140	439.9	30.0	469.9	3.14	0.21	3.36
150	450.9	25.3	476.2	3.01	0.17	3.17
160	460.0	20.6	480.5	2.87	0.13	3.00
170	467.5	16.1	483.5	2.75	0.09	2.84
180	473.7	11.6	485.3	2.63	0.06	2.70
190	479.0	7.6	486.7	2.52	0.04	2.56
200	483.5	4.9	488.4	2.42	0.02	2.44
210	487.2	3.5	490.8	2.32	0.02	2.34
220	490.4	2.3	492.7	2.23	0.01	2.24
230	493.1	1.3	494.5	2.14	0.01	2.15
240	495.4	0.4	495.8	2.06	0.00	2.07
250	497.3	0.0	497.3	1.99	0.00	1.99
260	497.3	0.0	497.3	1.91	0.00	1.91

Area Distribution			
Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	MGD_PL_G804	0	0.0%

Stratum % of the Active Landbase



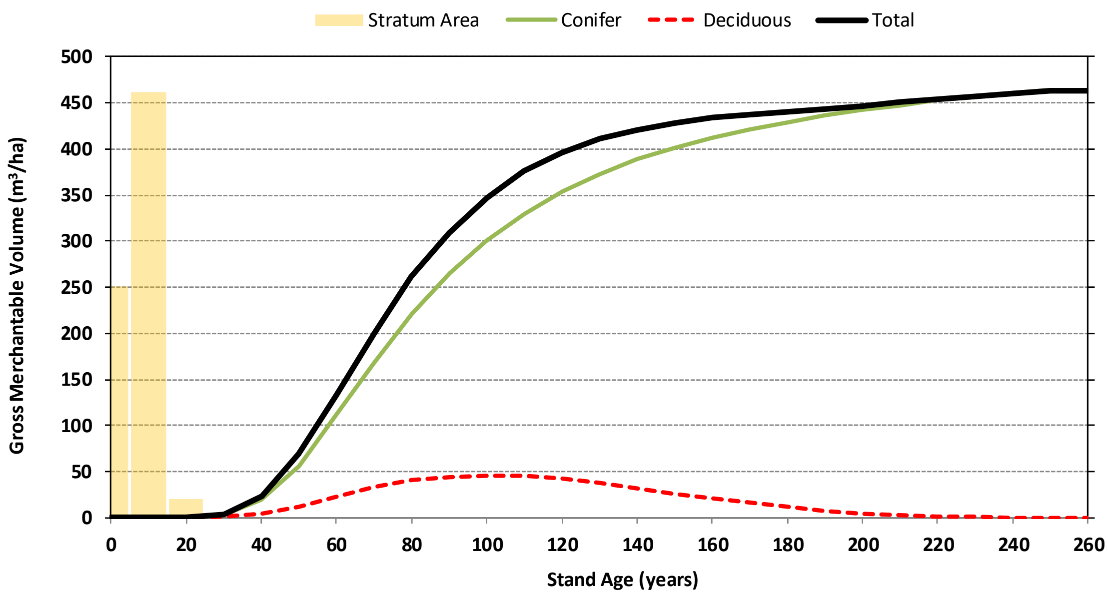
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	0	0
Deciduous	15/10/15/366/TL	0	0
Total		0	0

Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: SW_G351p1

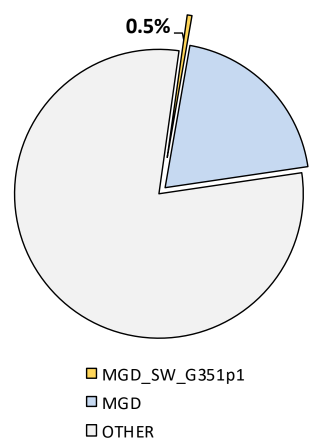


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.00	0.00	0.00
30	2.7	0.6	3.3	0.09	0.02	0.11
40	18.9	4.2	23.0	0.47	0.10	0.58
50	56.9	12.4	69.3	1.14	0.25	1.39
60	110.6	23.2	133.8	1.84	0.39	2.23
70	168.1	33.1	201.2	2.40	0.47	2.87
80	220.6	40.4	261.0	2.76	0.50	3.26
90	264.9	44.6	309.6	2.94	0.50	3.44
100	301.1	46.1	347.2	3.01	0.46	3.47
110	330.3	45.2	375.5	3.00	0.41	3.41
120	353.8	42.3	396.1	2.95	0.35	3.30
130	372.9	37.9	410.7	2.87	0.29	3.16
140	388.4	32.3	420.7	2.77	0.23	3.01
150	401.4	26.4	427.8	2.68	0.18	2.85
160	412.2	21.4	433.6	2.58	0.13	2.71
170	421.5	16.4	437.8	2.48	0.10	2.58
180	429.5	11.5	440.9	2.39	0.06	2.45
190	436.4	7.7	444.0	2.30	0.04	2.34
200	442.4	4.7	447.1	2.21	0.02	2.24
210	447.8	2.8	450.6	2.13	0.01	2.15
220	452.6	1.5	454.0	2.06	0.01	2.06
230	456.8	0.5	457.3	1.99	0.00	1.99
240	460.6	0.0	460.6	1.92	0.00	1.92
250	463.9	0.0	463.9	1.86	0.00	1.86
260	463.9	0.0	463.9	1.78	0.00	1.78

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	MGD_SW_G351p1	4,402	0.5%

Stratum % of the Active Landbase



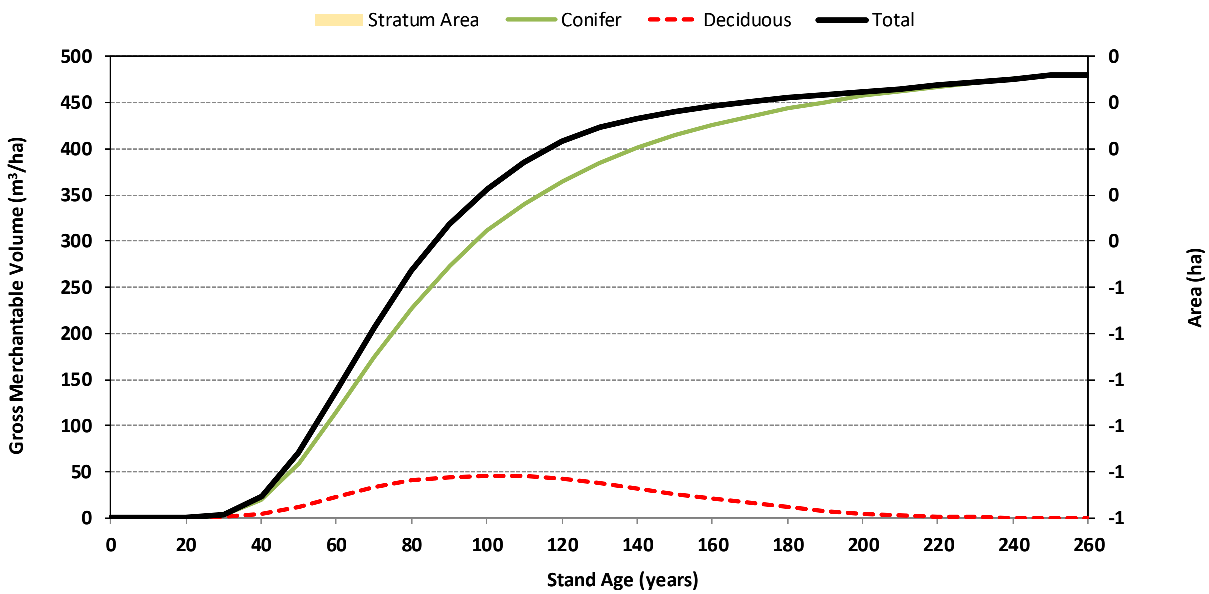
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	8	0
Deciduous	15/10/15/366/TL	3	0
Total		10	0

Note: Peak MAIs are highlighted in yellow.
Standing timber volumes are approximate.

WEYERHAEUSER GRANDE PRAIRIE TIMBERLANDS
FMA # 6900016
YIELD CURVES

POST-1991 MANAGED STANDS

STRATUM: SW_G351p2

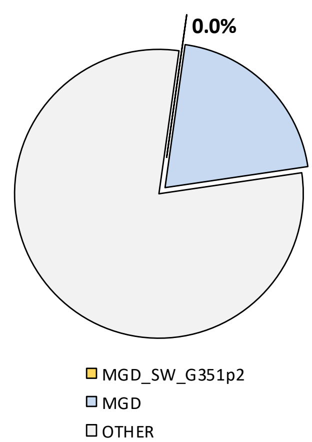


Stand Age	Gross Merchantable Volume (m³/ha)			Mean Annual Increment (m³/ha/year)		
	Conifer	Deciduous	Total	Conifer	Deciduous	Total
0	0.0	0.0	0.0	0.00	0.00	0.00
10	0.0	0.0	0.0	0.00	0.00	0.00
20	0.1	0.0	0.1	0.00	0.00	0.00
30	2.7	0.6	3.3	0.09	0.02	0.11
40	19.5	4.2	23.6	0.49	0.10	0.59
50	58.7	12.4	71.1	1.17	0.25	1.42
60	114.1	23.2	137.3	1.90	0.39	2.29
70	173.4	33.1	206.5	2.48	0.47	2.95
80	227.5	40.4	267.9	2.84	**0.50**	3.35
90	273.3	44.6	318.0	3.04	0.50	3.53
100	310.7	46.1	356.8	**3.11**	0.46	**3.57**
110	340.9	45.2	386.1	3.10	0.41	3.51
120	365.2	42.3	407.5	3.04	0.35	3.40
130	384.9	37.9	422.8	2.96	0.29	3.25
140	401.1	32.3	433.3	2.86	0.23	3.10
150	414.5	26.4	440.9	2.76	0.18	2.94
160	425.7	21.4	447.1	2.66	0.13	2.79
170	435.3	16.4	451.7	2.56	0.10	2.66
180	443.6	11.5	455.1	2.46	0.06	2.53
190	450.8	7.7	458.5	2.37	0.04	2.41
200	457.1	4.7	461.9	2.29	0.02	2.31
210	462.7	2.8	465.5	2.20	0.01	2.22
220	467.7	1.5	469.2	2.13	0.01	2.13
230	472.1	0.5	472.7	2.05	0.00	2.06
240	476.1	0.0	476.1	1.98	0.00	1.98
250	479.6	0.0	479.6	1.92	0.00	1.92
260	479.6	0.0	479.6	1.84	0.00	1.84

Area Distribution

Landbase Category		(ha)	(%)
Active Landbase		*829,835*	
LB Type	MGD	169,678	20.4%
Stratum	**MGD_SW_G351p2**	**0**	**0.0%**

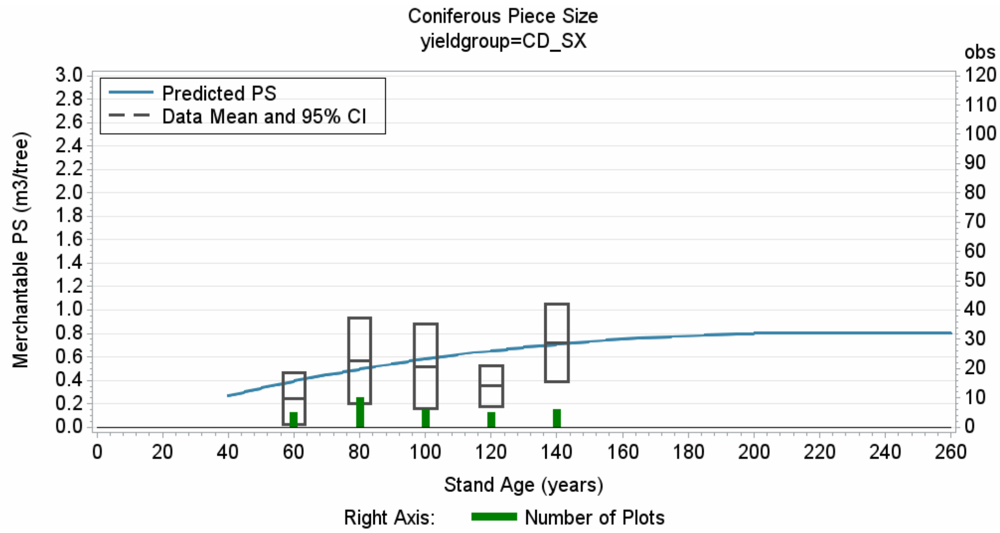
Stratum % of the Active Landbase

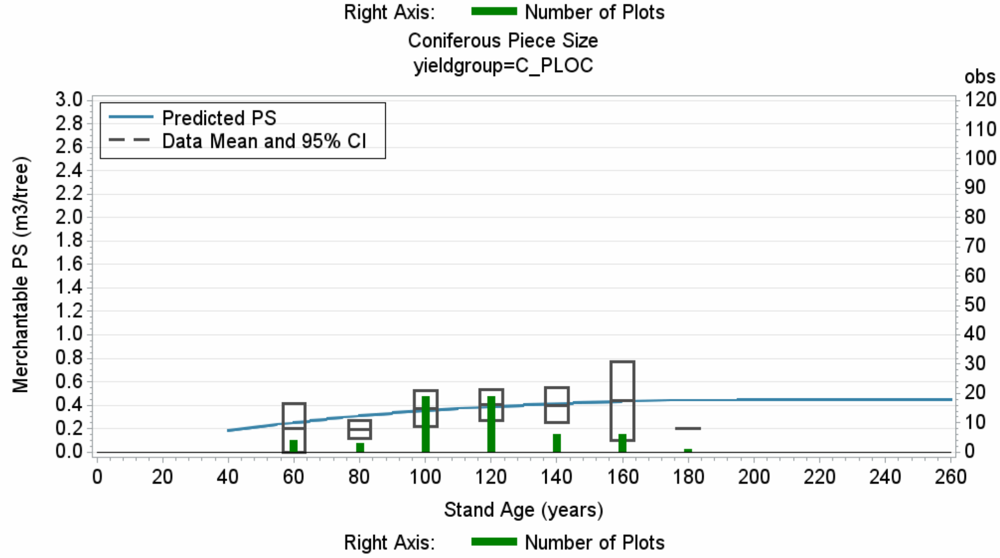


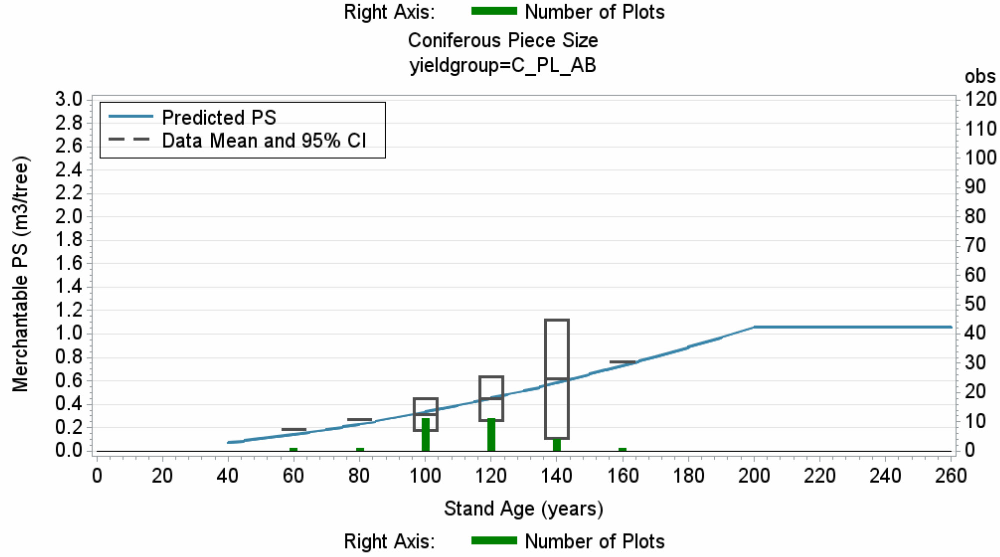
FMA Baseline Utilization		Standing Timber m3	Standing Timber m3/ha
Conifer	15/10/15/366/TL	0	0
Deciduous	15/10/15/366/TL	0	0
Total		0	0

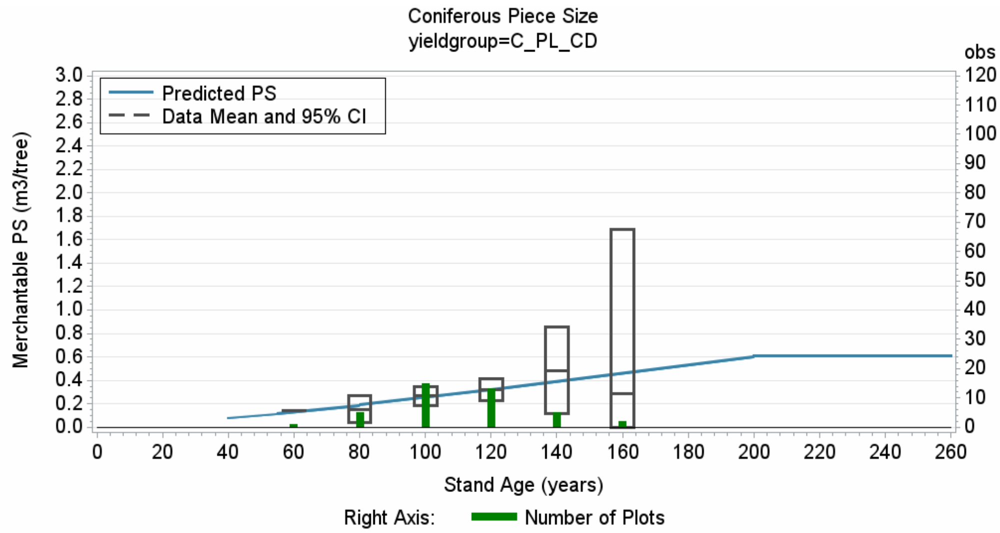
Note: *Peak MAIs are highlighted in yellow.*
Standing timber volumes are approximate.

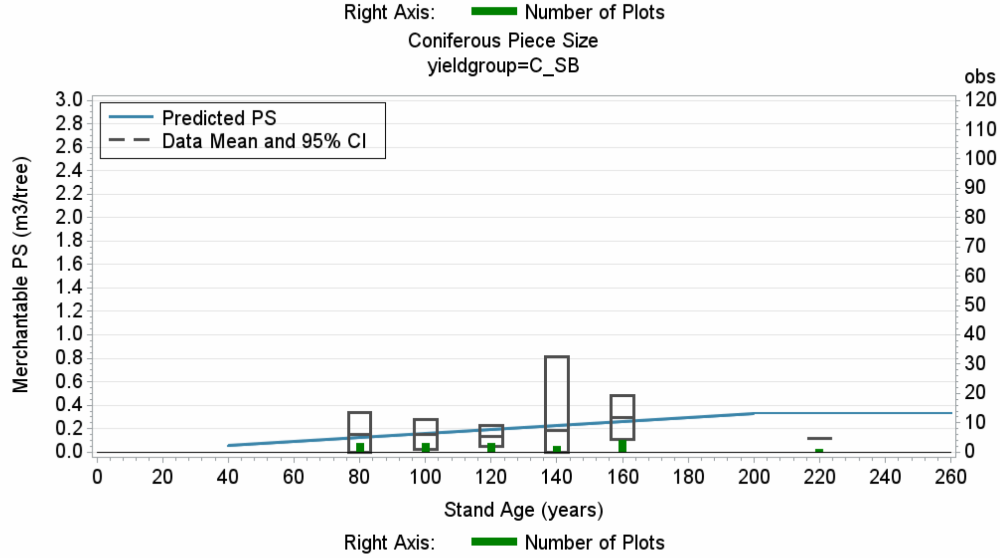
Appendix VII – Natural Stand Piece Size Curves

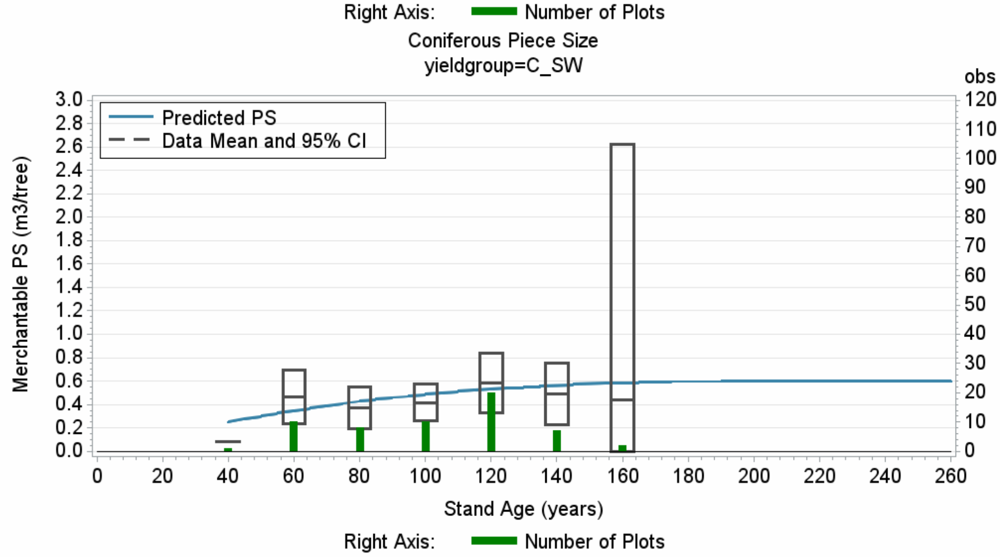

Coniferous Piece Size
yieldgroup=CD_SX
Predicted PS
Data Mean and 95% CI
Merchantable PS (m3/tree)
obs
Stand Age (years)
Right Axis: Number of Plots


Coniferous Piece Size
yieldgroup=C_PLOC
Predicted PS
Data Mean and 95% CI
Merchantable PS (m3/tree)
obs
Stand Age (years)
Right Axis: Number of Plots


Coniferous Piece Size
yieldgroup=C_PL_AB
Predicted PS
Data Mean and 95% CI
Merchantable PS (m3/tree)
obs
Stand Age (years)
Right Axis: Number of Plots


Coniferous Piece Size
yieldgroup=C_PL_CD
obs
Predicted PS
Data Mean and 95% CI
Merchantable PS (m3/tree)
Stand Age (years)
Right Axis:
Number of Plots


Coniferous Piece Size
yieldgroup=C_SB
obs
Predicted PS
Data Mean and 95% CI
Merchantable PS (m3/tree)
Stand Age (years)
Right Axis:
Number of Plots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Stand Age (years)
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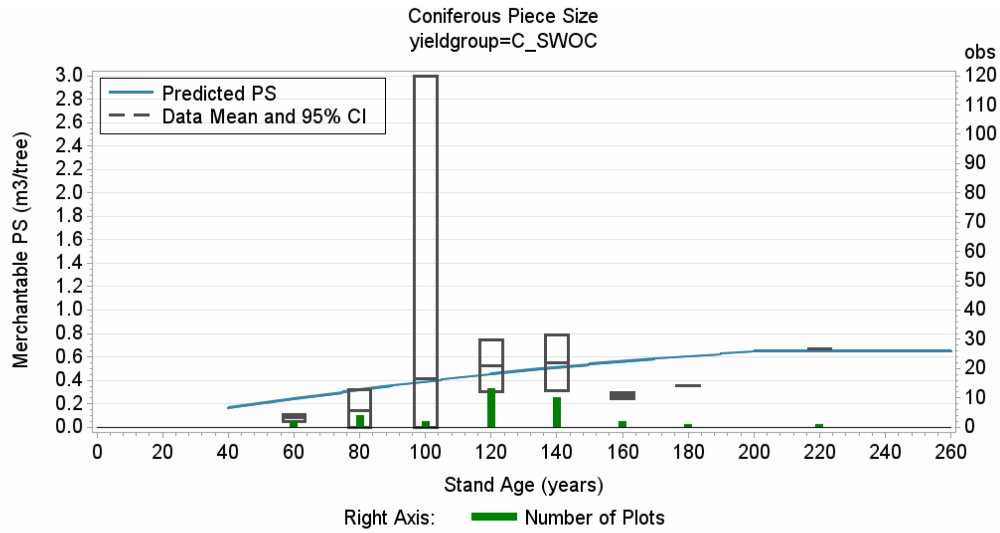
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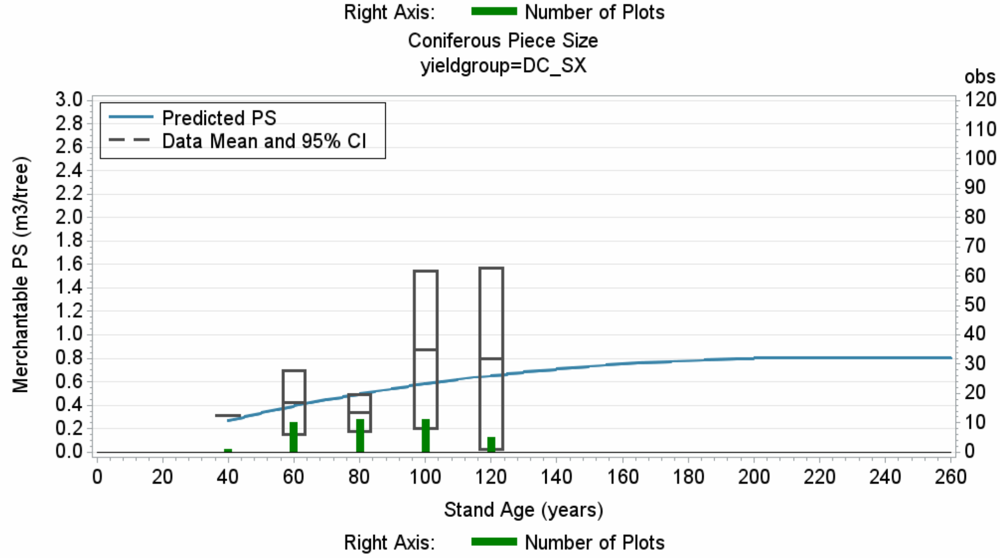
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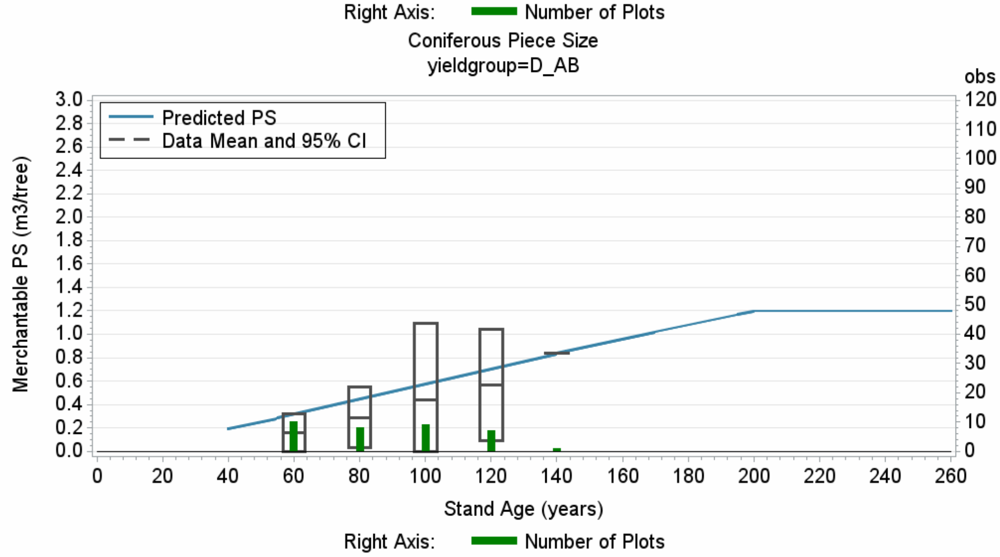
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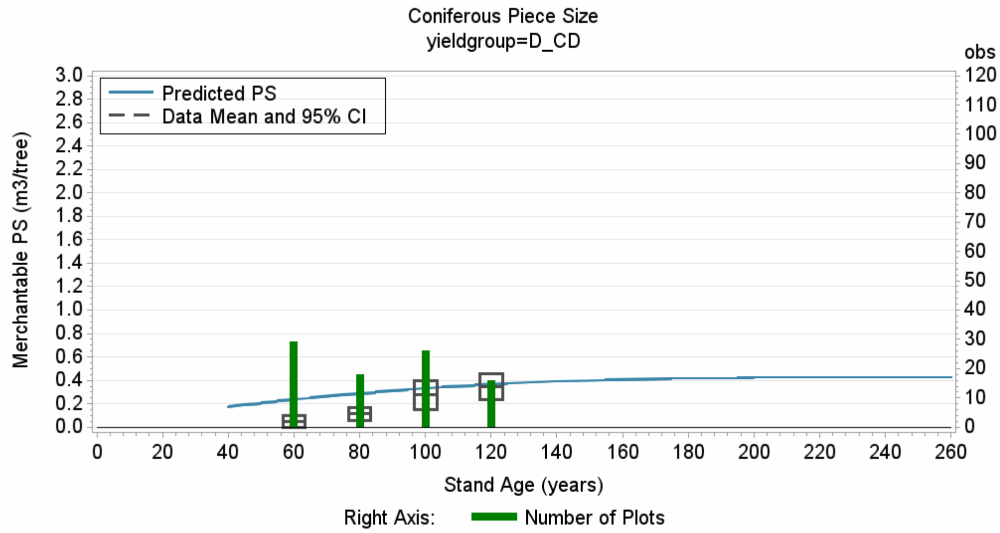
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Stand Age (years)
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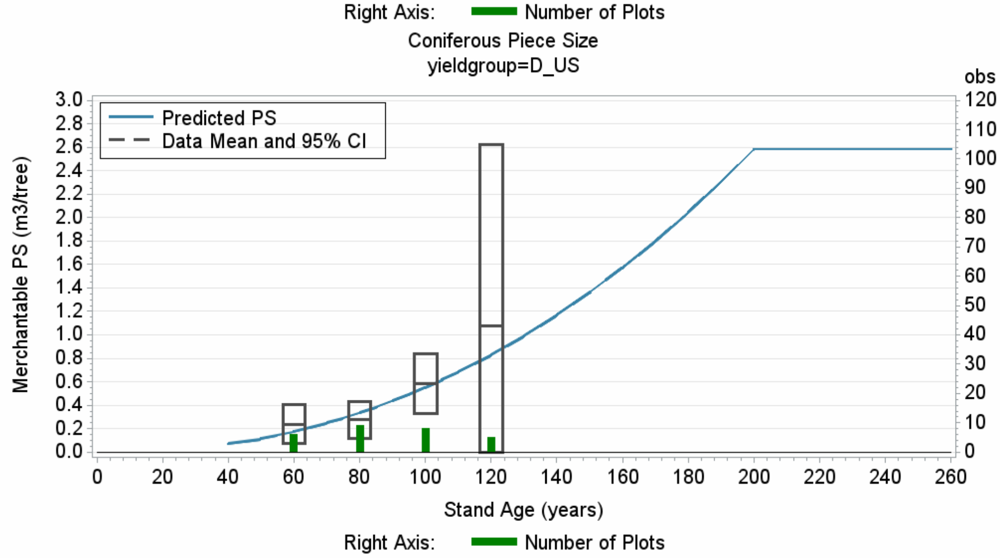
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Stand Age (years)
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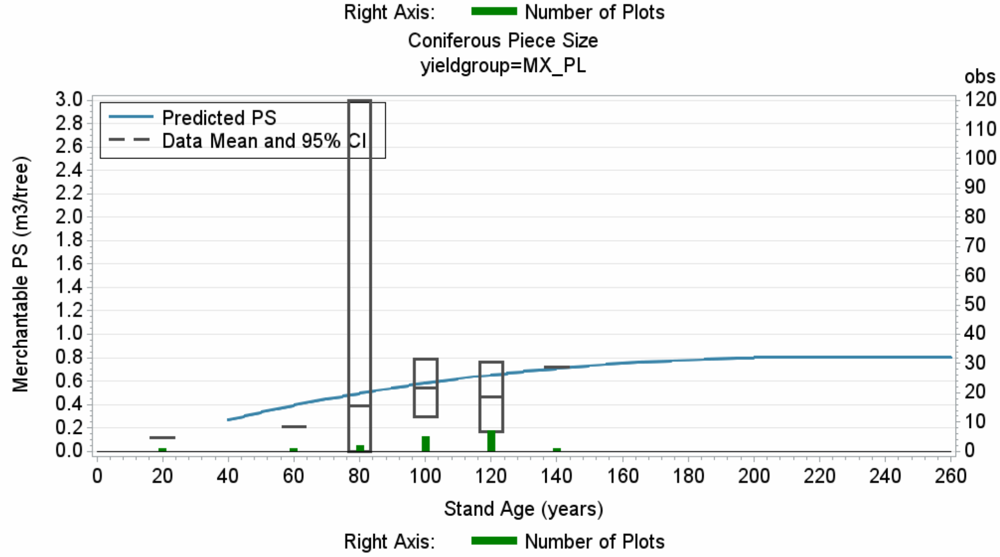
Number of Plots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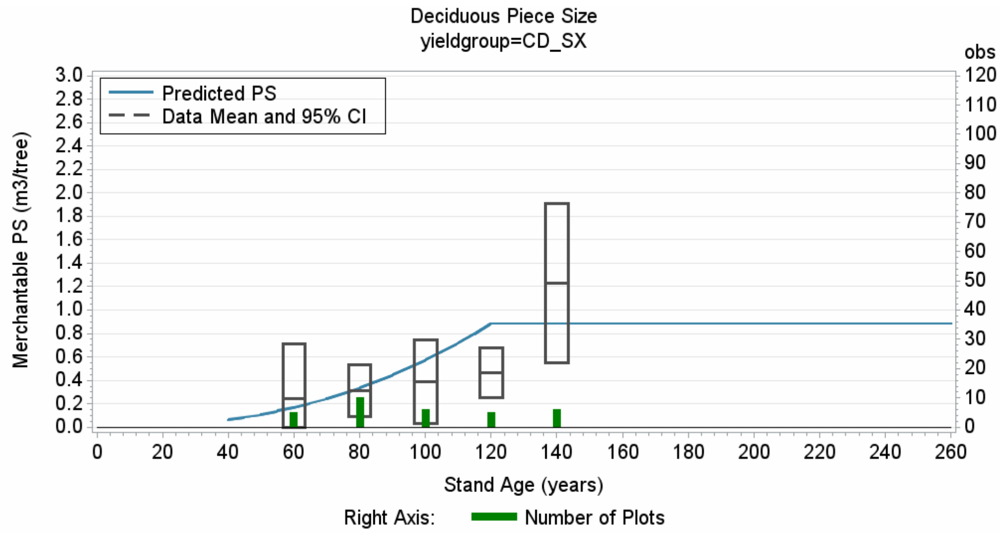
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Merchantable PS (m3/tree)
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Stand Age (years)
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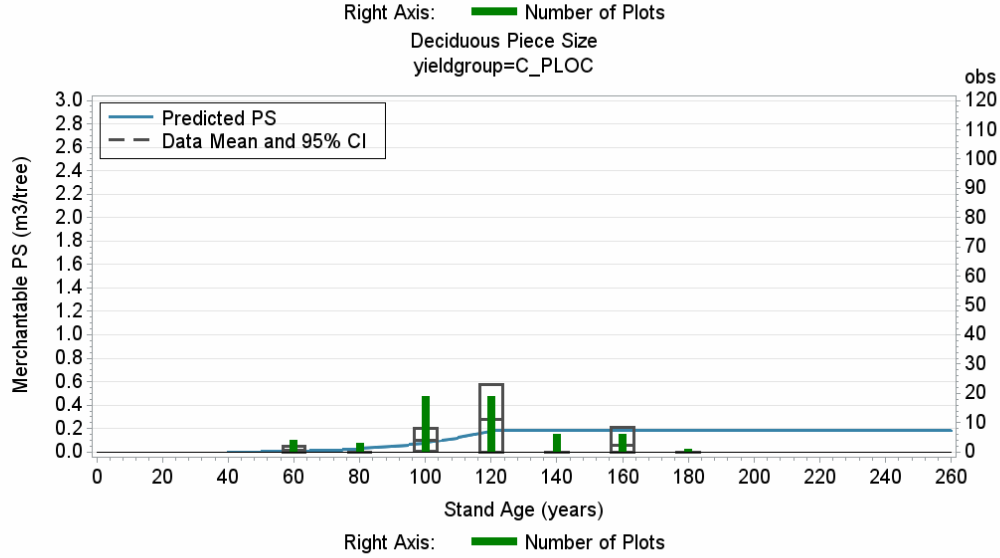
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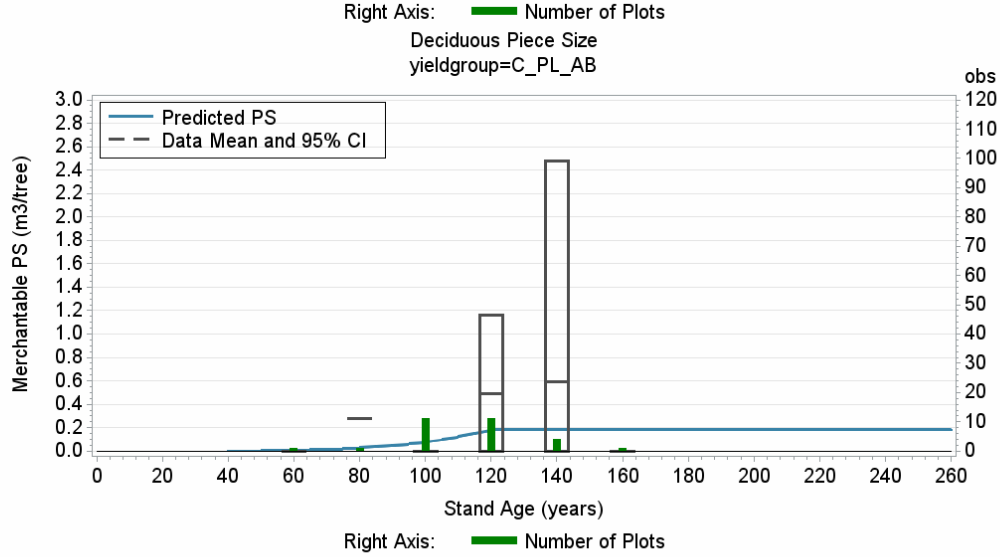
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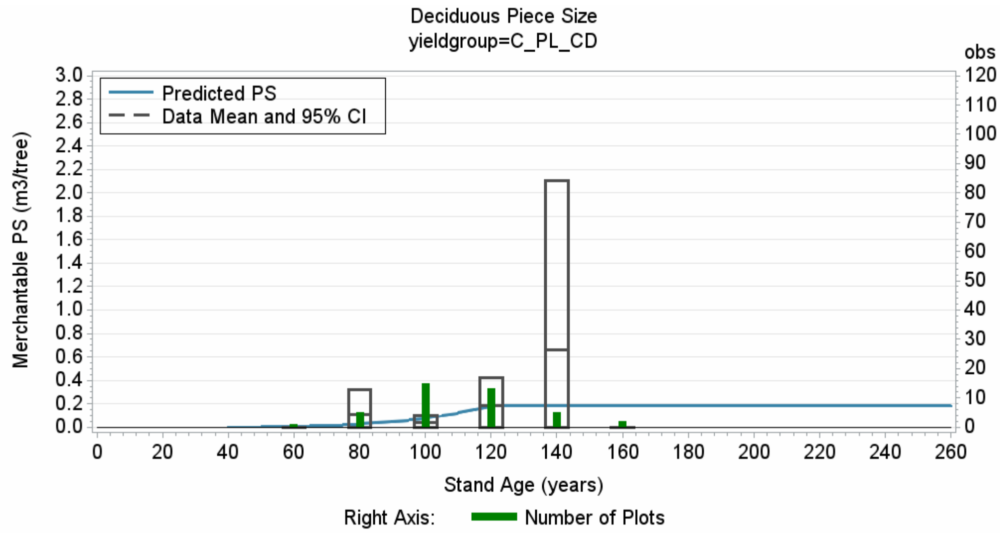
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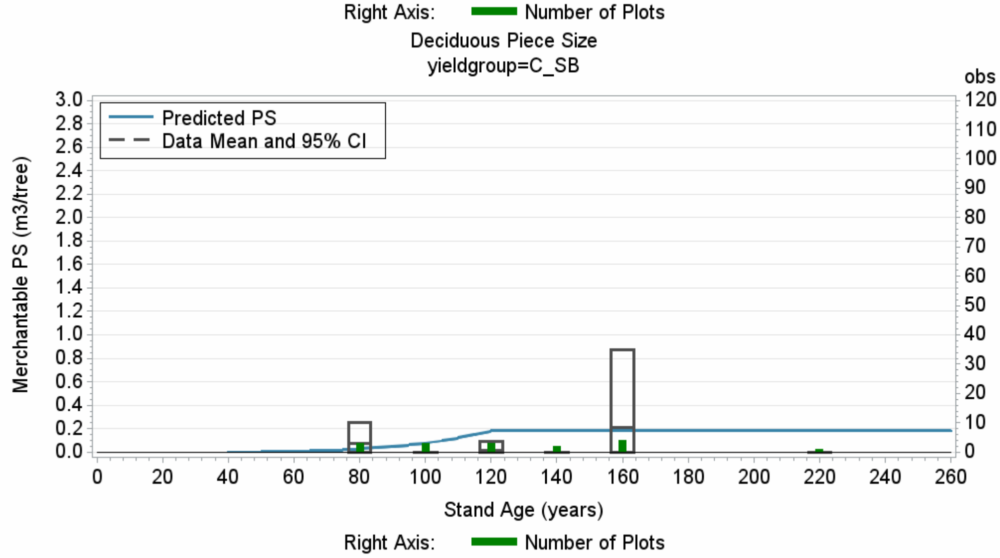
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)
Right Axis: Number of Plots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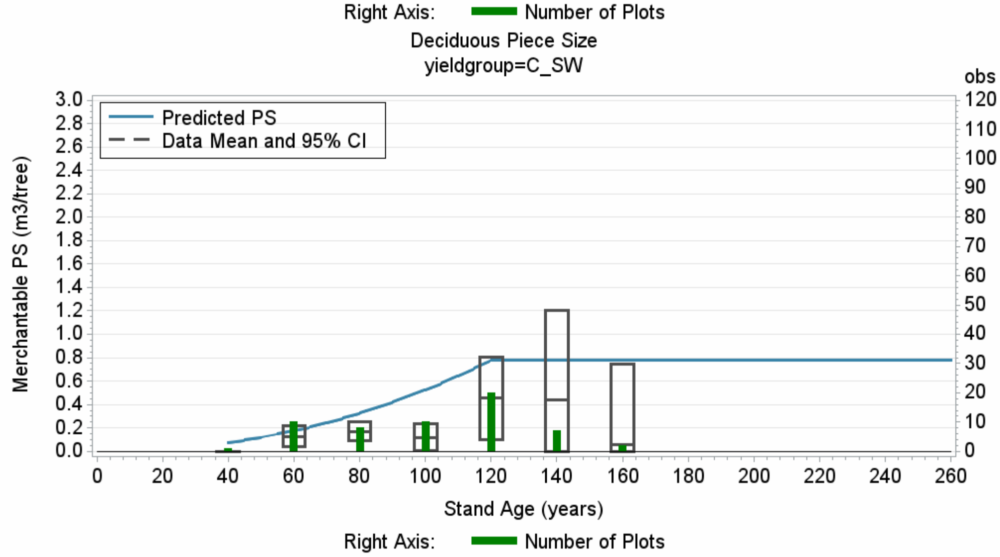
120 110 100 90 80 70 60 50 40 30 20 10 0
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)
Right Axis: Number of Plots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Data Mean and 95% CI
Merchantable PS (m3/tree)
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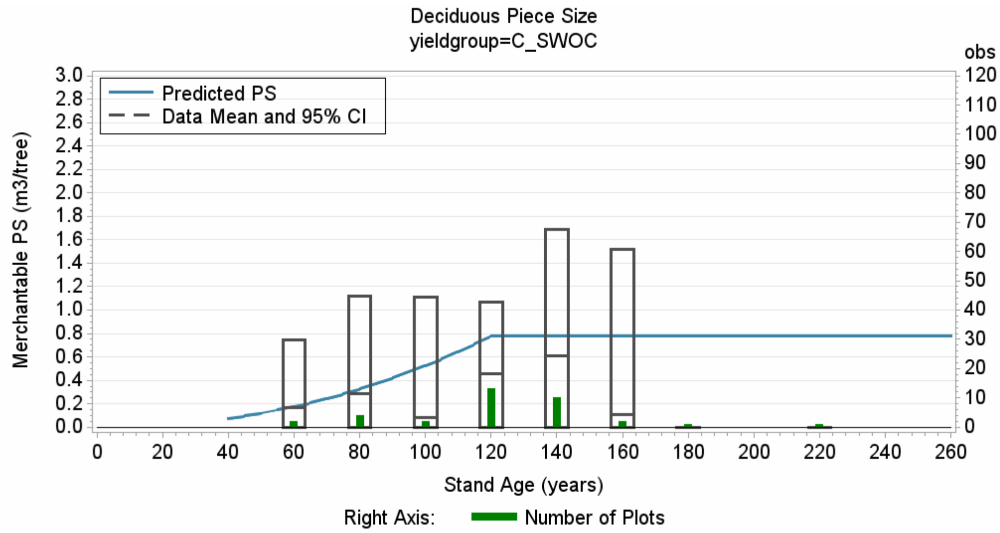
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Stand Age (years)
Right Axis: Number of Plots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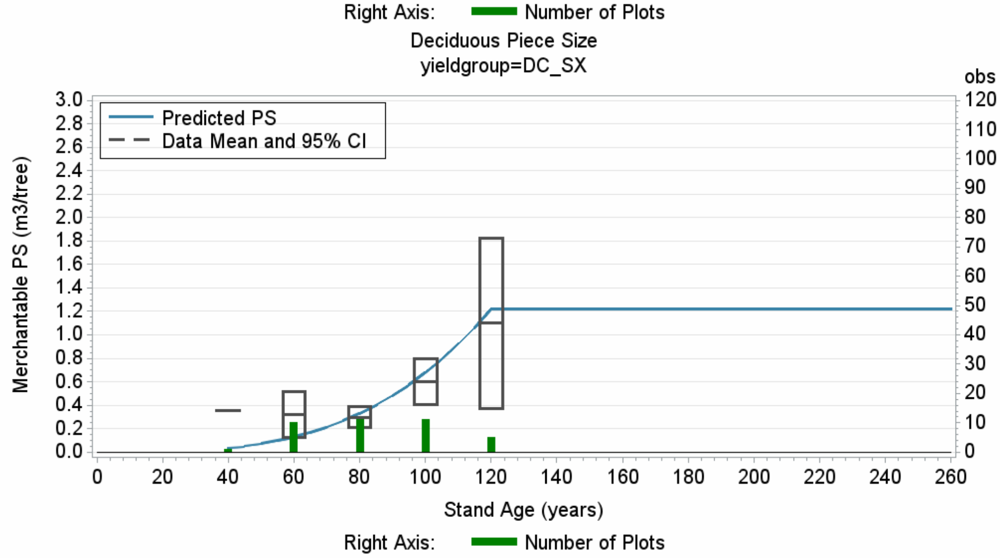
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Data Mean and 95% CI
Merchantable PS (m3/tree)
Stand Age (years)
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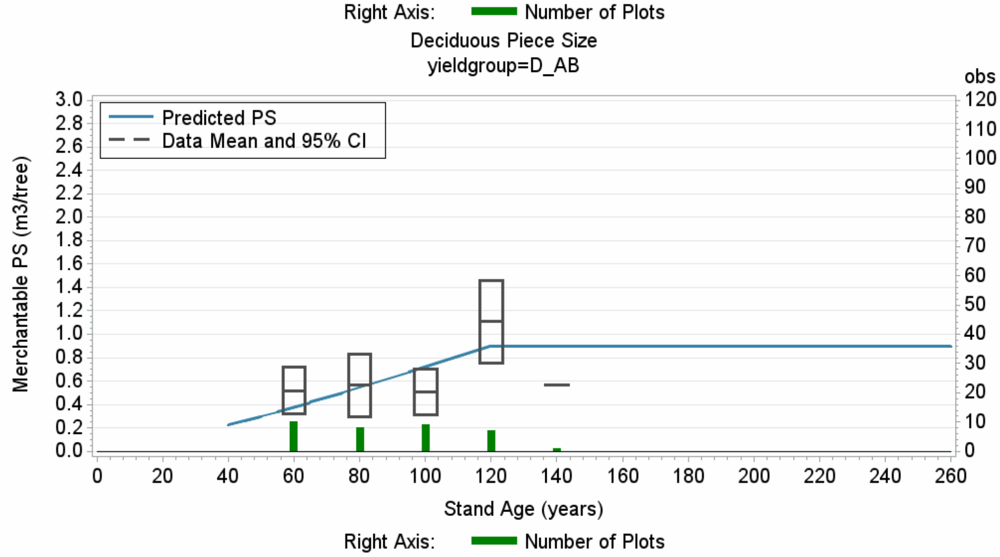
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Merchantable PS (m3/tree)
Stand Age (years)
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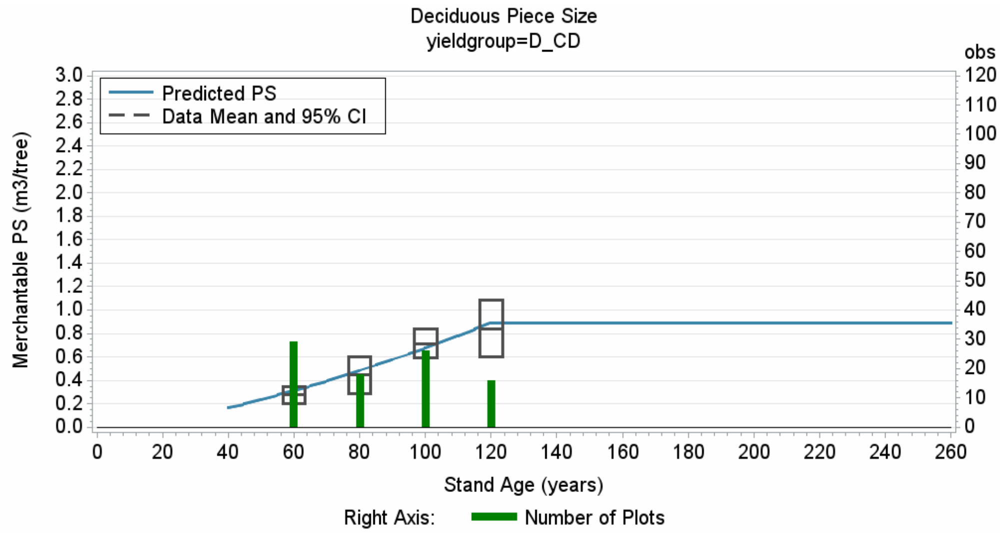
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Stand Age (years)
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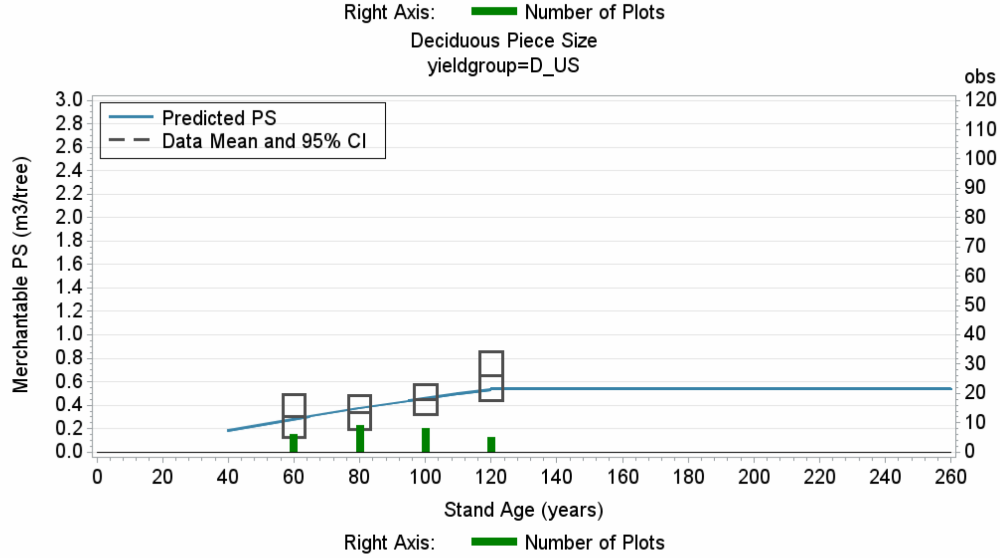
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Stand Age (years)
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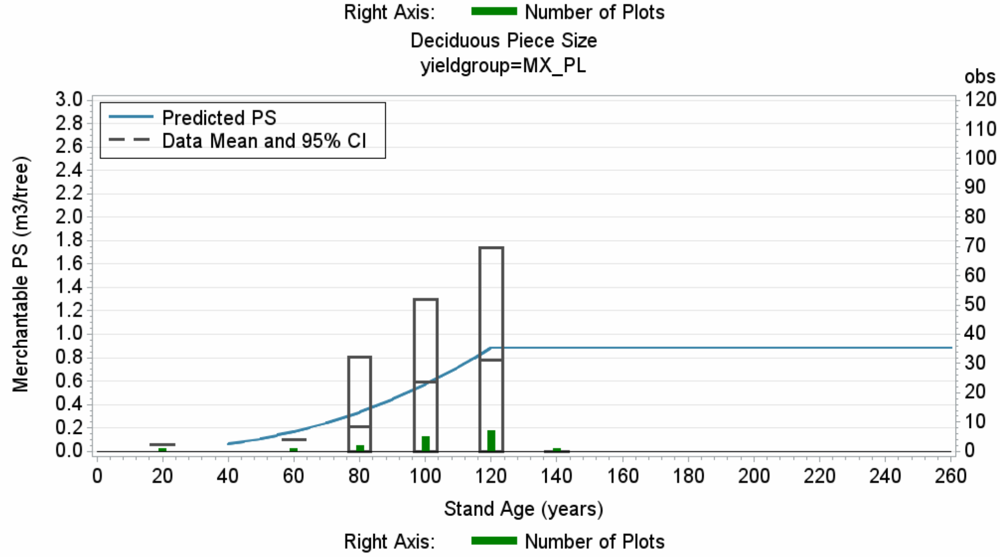
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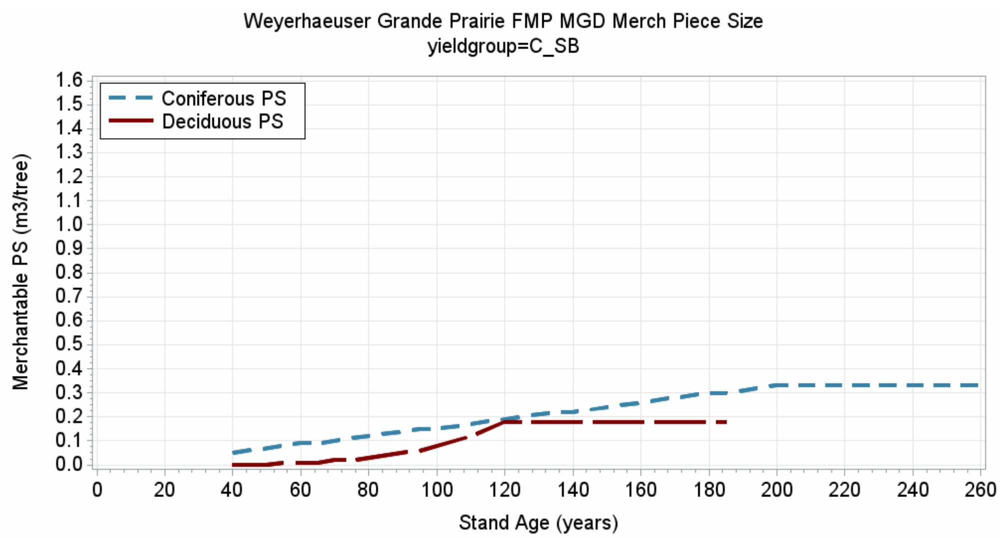
Data Mean and 95% CI
Merchantable PS (m3/tree)
Stand Age (years)
Right Axis:
Number of Plots

Appendix VIII – Post-1991 Managed Stand Piece Size Curves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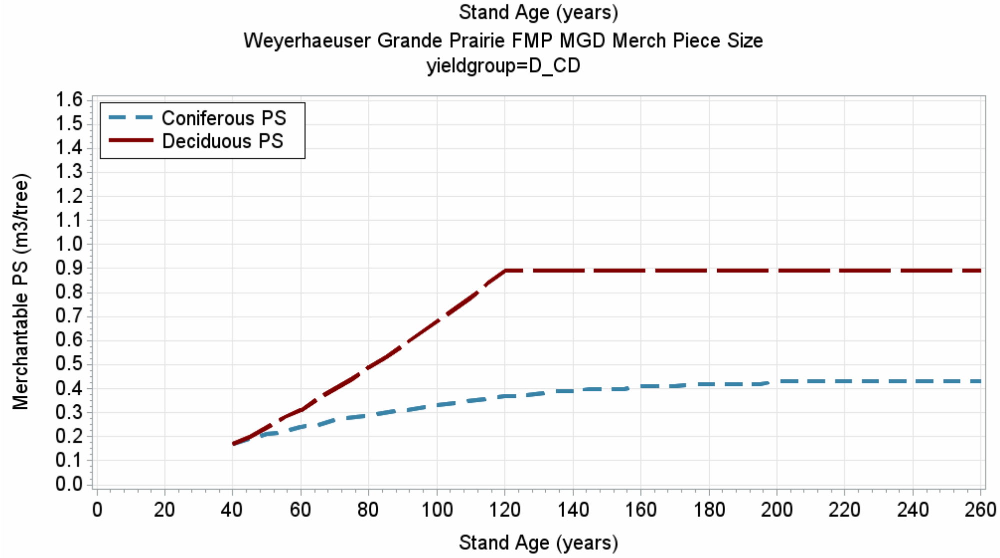
Deciduous PS
Merchantable PS (m3/tree)
Stand Age (years)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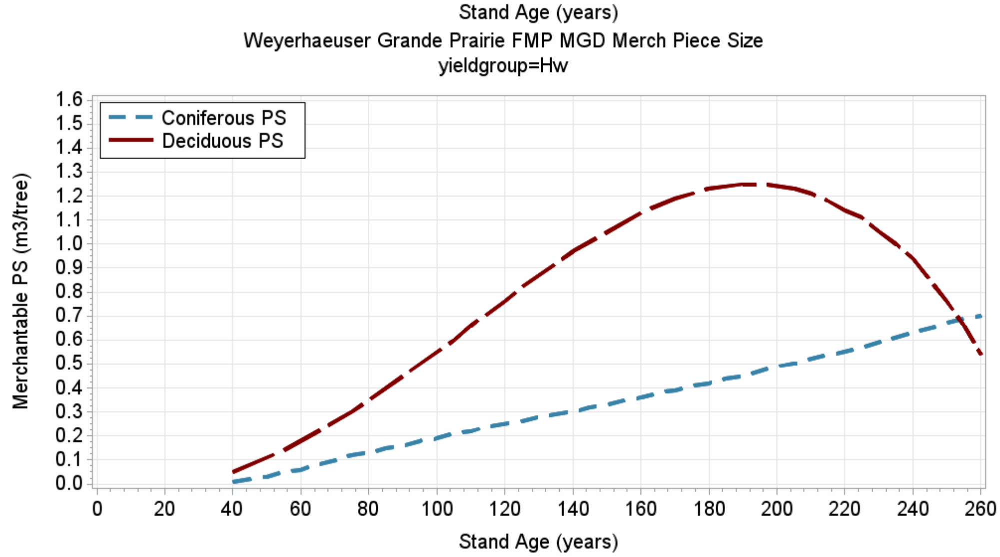
Stand Age (years)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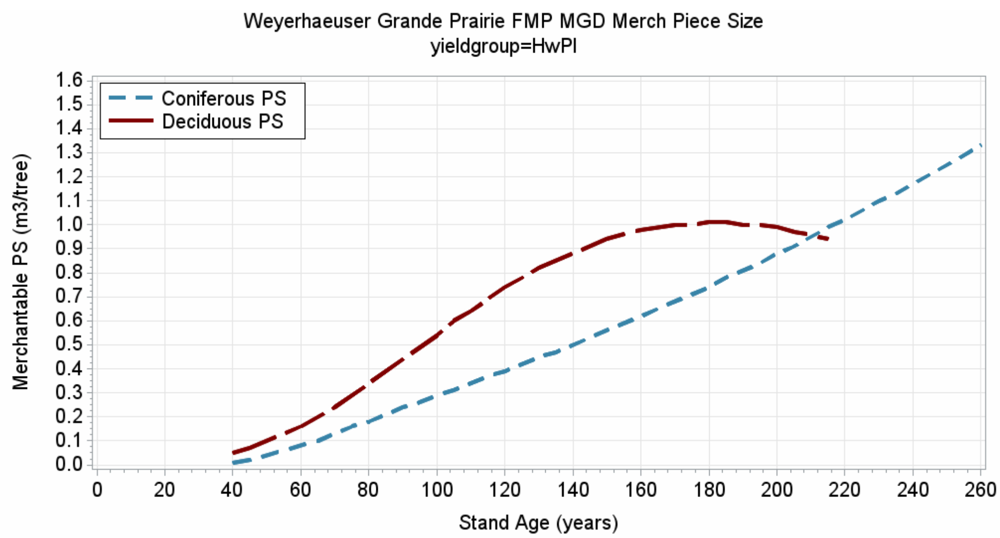
Stand Age (years)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Deciduous PS
Merchantable PS (m3/tree)
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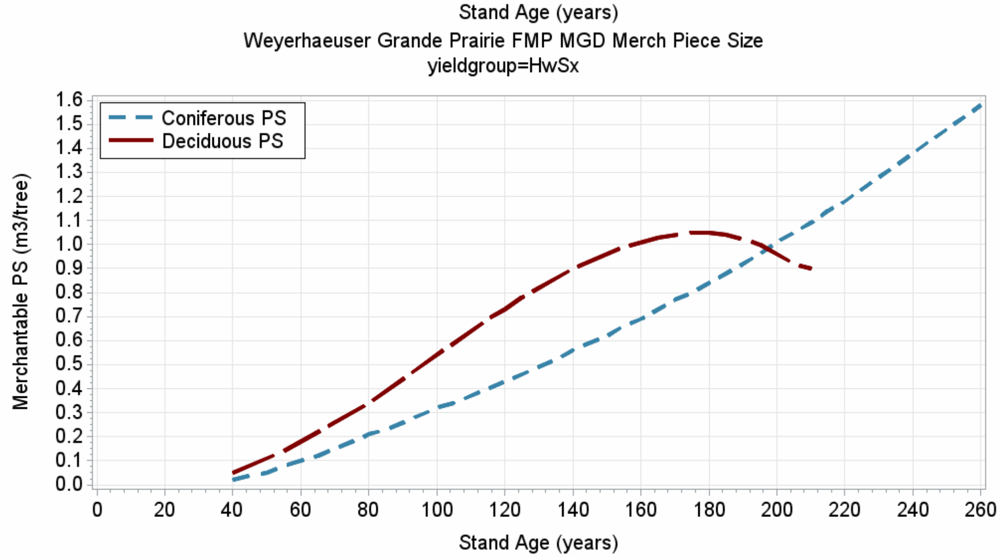
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Deciduous PS
Merchantable PS (m3/tree)
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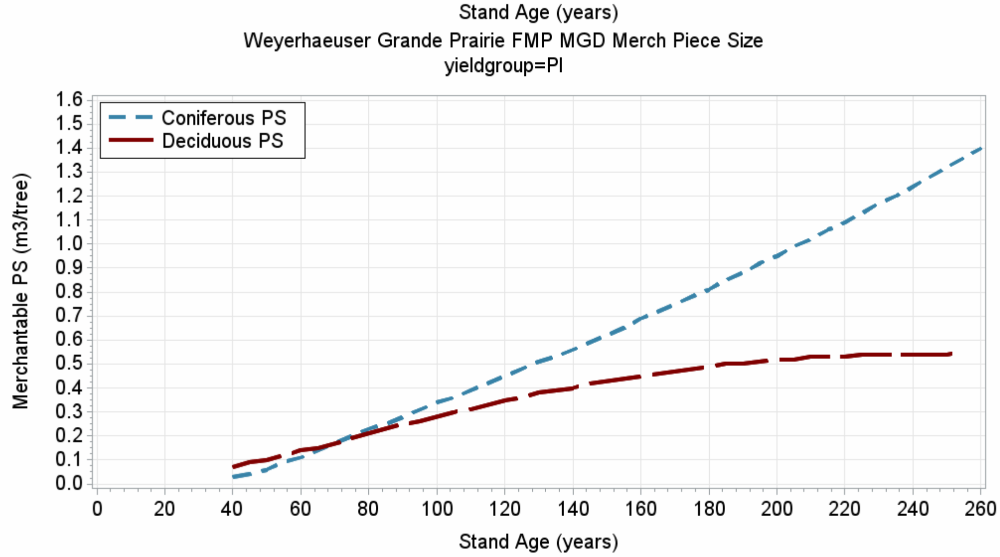
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Deciduous PS
Merchantable PS (m3/tree)
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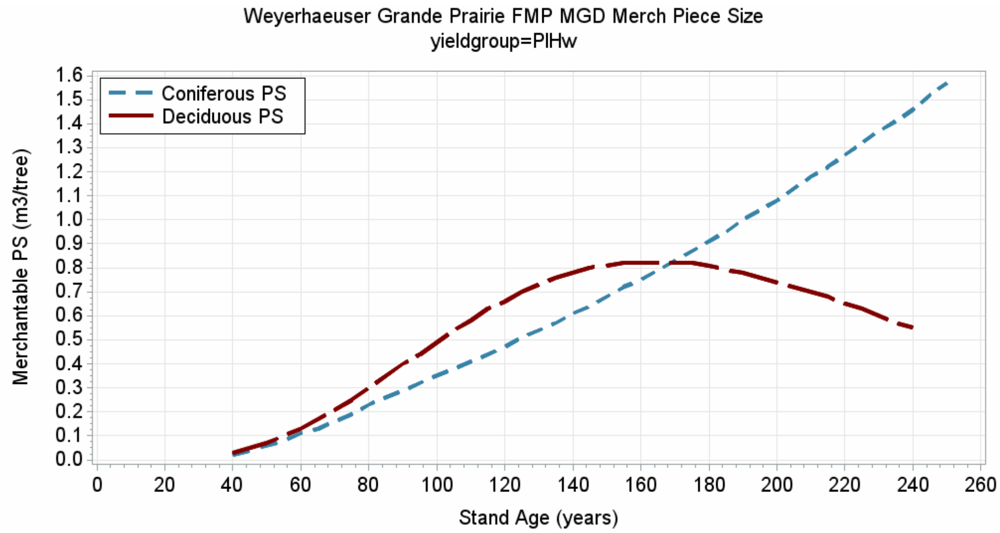
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Deciduous PS
Merchantable PS (m3/tree)
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40
60
80
100
120
140
160
180
200
220
240
260
0.0
0.1
0.2
0.3
0.4
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0.8
0.9
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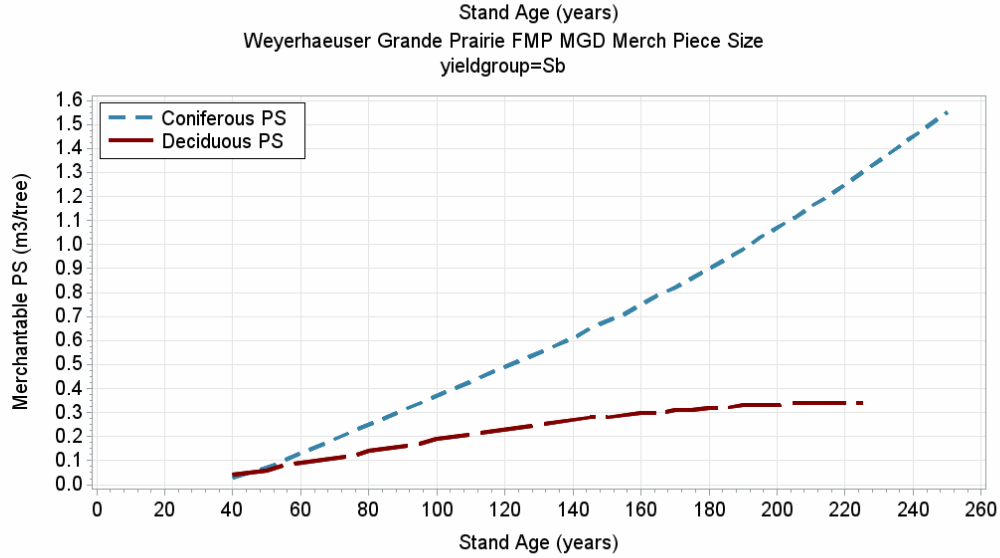
1.1
1.2
1.3
1.4
1.5
1.6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Deciduous PS
Merchantable PS (m3/tree)
Stand Age (years)
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40
60
80
100
120
140
160
180
200
220
240
260
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0.1
0.2
0.3
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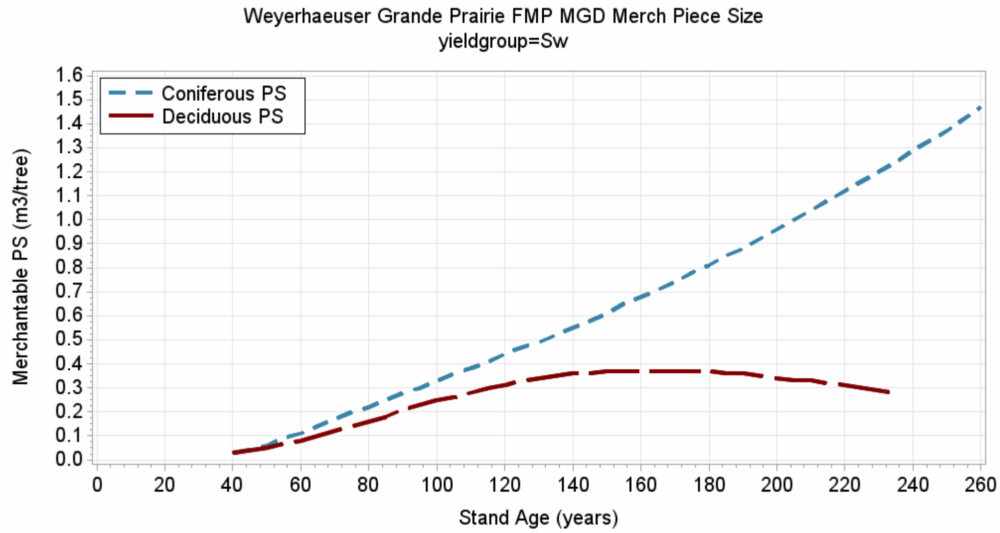
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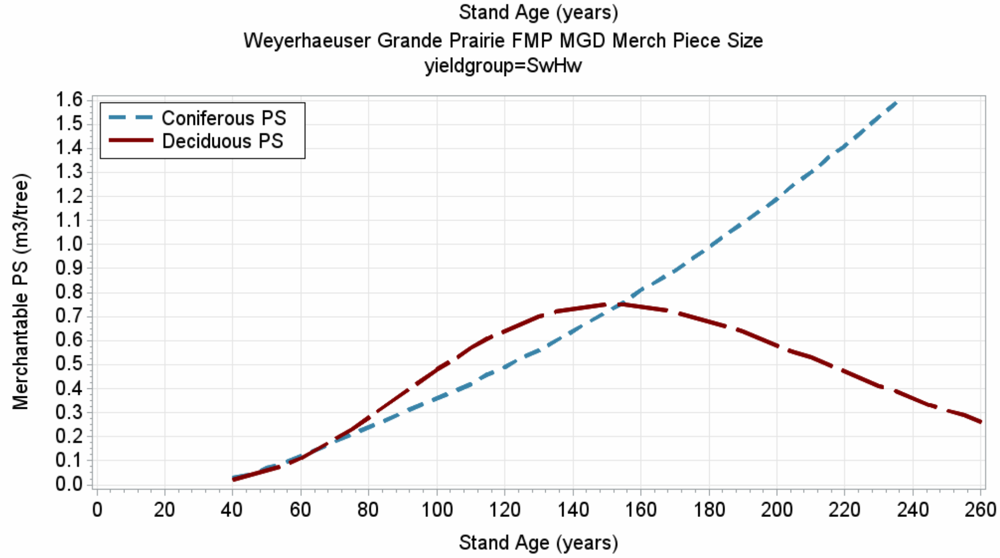
Stand Age (years)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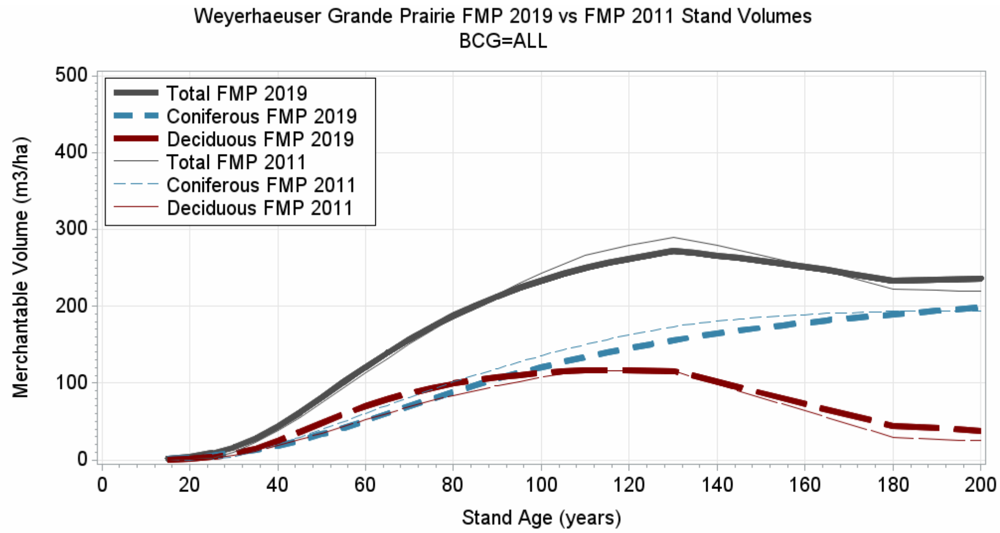
Deciduous PS
Merchantable PS (m3/tree)
Stand Age (years)

Appendix IX – Yield Comparison to FMP 2011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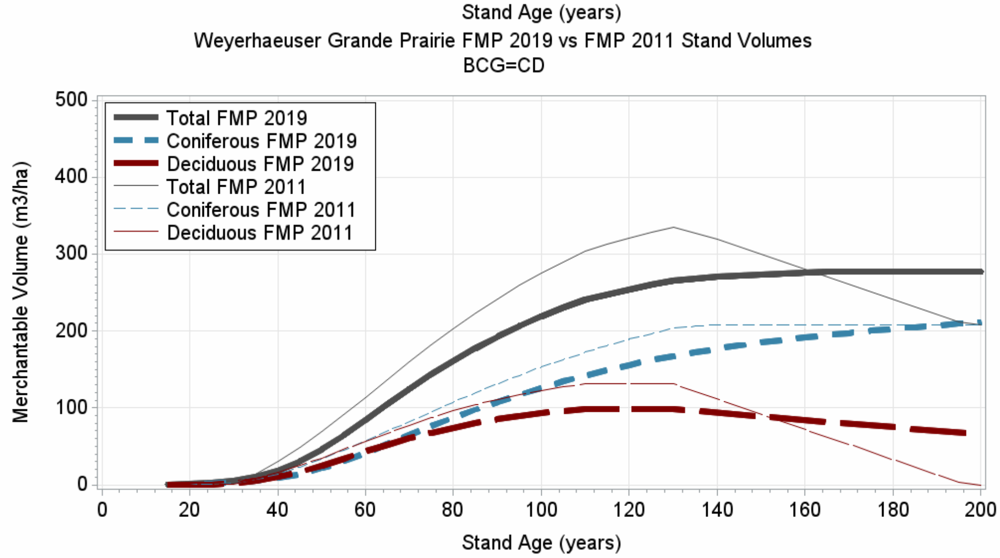
BCG=ALL
Total FMP 2019
Coniferous FMP 2019
Deciduous FMP 2019
Total FMP 2011
Coniferous FMP 2011
Deciduous FMP 2011
Merchantable Volume (m3/ha)
Stand Age (years)
0
100
200
300
400
500
0
20
40
60
80
100
120
140
160
180
200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BCG=CD
Total FMP 2019
Coniferous FMP 2019
Deciduous FMP 2019
Total FMP 2011
Coniferous FMP 2011
Deciduous FMP 2011
Merchantable Volume (m3/ha)
Stand Age (years)
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300
400
500
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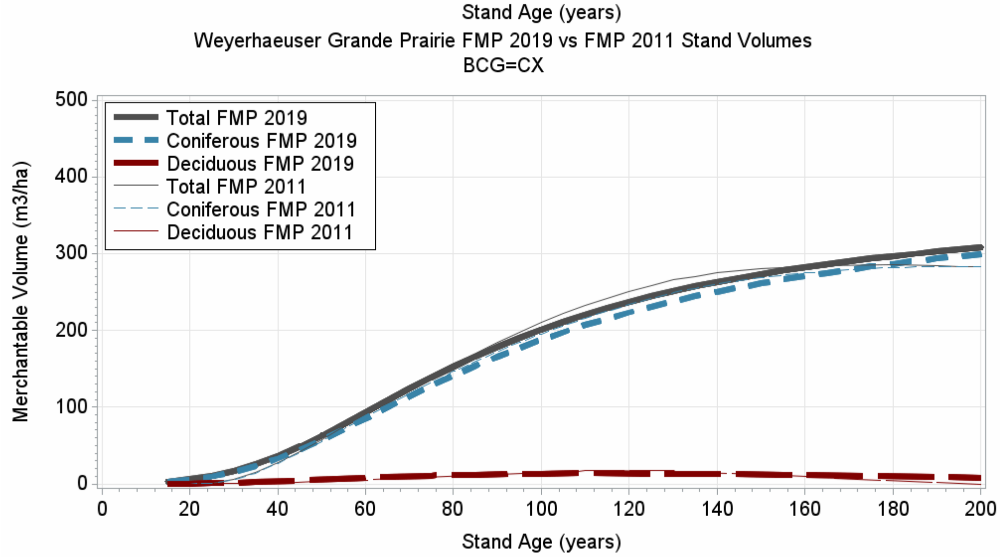
20
40
60
80
100
120
140
160
180
200


Weyerhaeuser Grande Prairie FMP 2019 vs FMP 2011 Stand Volumes
BCG=CX
Total FMP 2019
Coniferous FMP 2019
Deciduous FMP 2019
Total FMP 2011
Coniferous FMP 2011
Deciduous FMP 2011
Merchantable Volume (m3/ha)
Stand Age (years)
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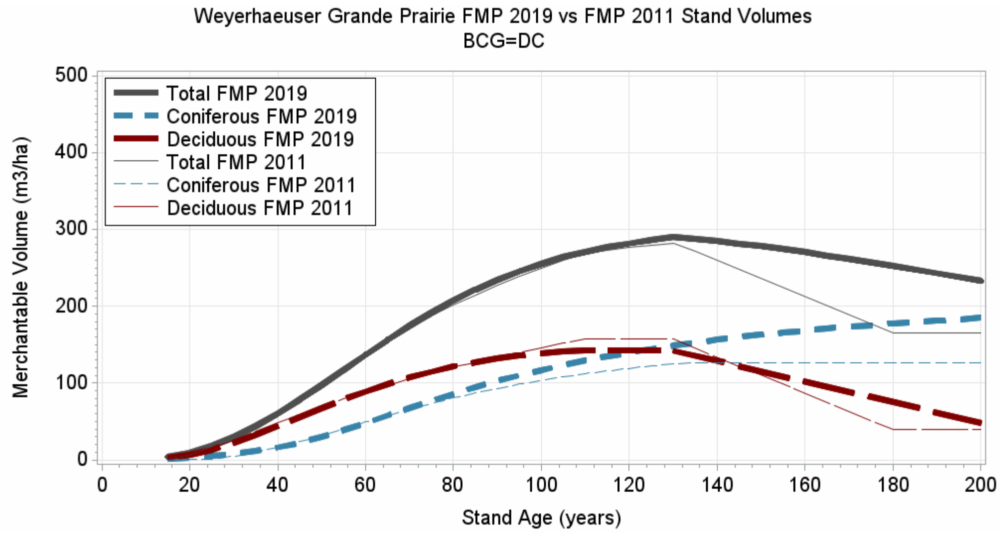
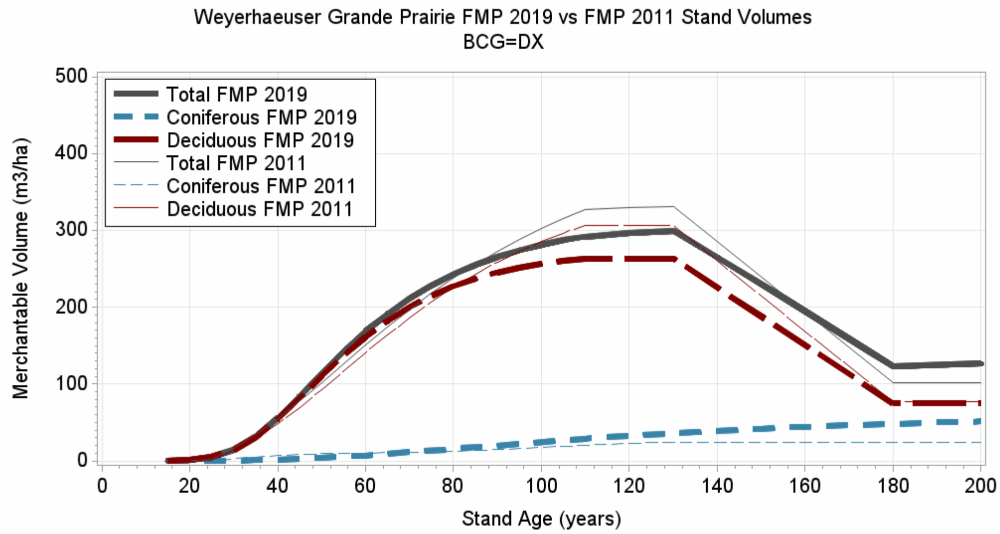
100
200
300
400
500
0
20
40
60
80
100
120
140
160
180
200





Weyerhaeuser Contact:
Traci Carter, *RPFT*
Strategic Planning Forester
Weyerhaeuser, Grande Prairie Timberlands
Tel: (780) 539-8940
Email: Traci.Carter@weyerhaeuser.com

Document Version: 20190520_WeyGP_GY_Report.docx

Weyerhaeuser

Indigenous Consultation Process

2019-2029
Forest Management Plan

Weyerhaeuser Company Limited
Grande Prairie Alberta Timberlands
FMA#6900016

Version: November 15, 2017

Table of Contents

1. Introduction

Weyerhaeuser Grande Prairie has developed an Indigenous Consultation Plan that articulates the overall process we will use to fulfill the aspects of consultation required by the Province specific to the 2019 Forest Management Plan for Forest Management Agreement #6900016.

1.1. Indigenous Consultation Policies & Guidelines

The Government of Alberta's (GoA) current First Nations consultation policy, *The Government of Alberta's Policy on Consultation with First Nations on Land and Natural Resource Management*, was approved by cabinet on August 16, 2013. In the fall of 2015, *The Government of Alberta's Policy on Consultation with Métis Settlements on Land and Natural Resource Management* was approved by cabinet and it was released to the public on April 4, 2016.[1] Both policies aim to address potential adverse impacts to First Nation Treaty rights and traditional uses and Métis Settlements members' harvesting or traditional use activities due to land and natural resource management through a meaningful consultation process.

The *Government of Alberta's Guidelines on Consultation with First Nations (2014) and Métis Settlements (2016) on Land and Natural Resource Management* outline procedures to carry out the Province's recognized duty to consult with First Nations and Métis Settlements regarding land management and resource development policies, legislation and regulatory decisions. These Guidelines also allow for the Province to delegate aspects of that consultation to industry and provide direction to industry regarding its role in the consultation process with respect to specific forest management plans. [1]

The Government of Alberta's Proponent Guide to First Nations and Métis Settlements Consultation Procedures (June 2016) is a guide aimed at providing additional details on the administrative steps, submission standards, and requirements of the consultation process.[2]

2. Proposed Project

The Forest Management Plan is a technical document describing forest management objectives, strategies and commitments over a planning horizon of 200 years. It identifies intended methods of harvesting, reforesting, and managing timber resources within the defined area of responsibility.

Forest Management Plans are renewed at least every ten years and incorporate knowledge from research, new policy and legislative changes and ongoing review of performance. FMP's contain details of where, when and how trees are harvested and managed for sustainability and are approved by the Government of Alberta, with input from the public and other stakeholders, as well as Indigenous groups. The ten year term for this project will be 2019-2029.

[1] Alberta; Indigenous Relations; Indigenous Consultation Policy and Guidelines

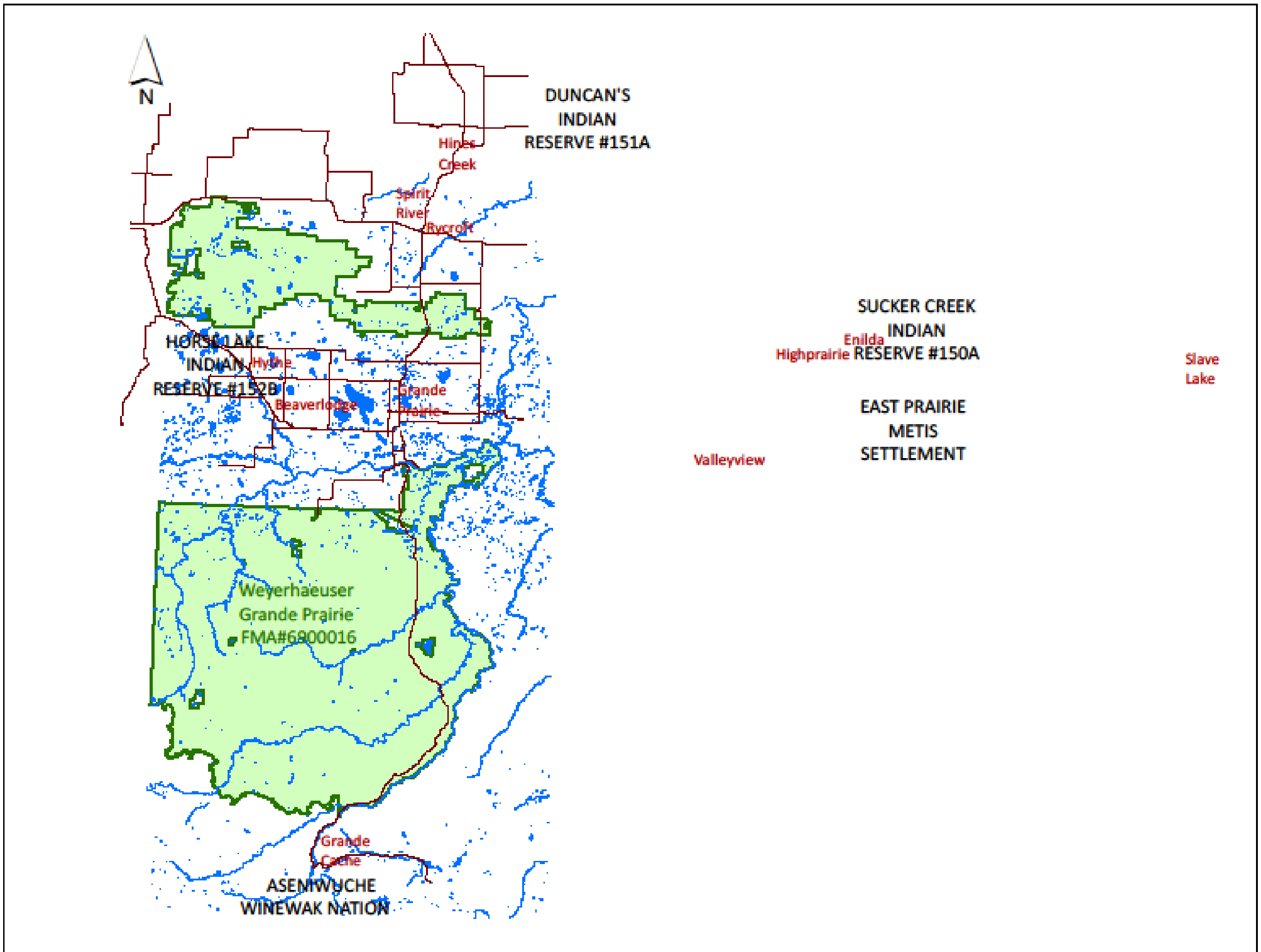
[2] Alberta; Indigenous Relations; Proponent Guide

3. Pre-Consultation Assessment

A Pre-Consultation Assessment was requested by Weyerhaeuser on May 4, 2017 and the response was received on June 26, 2017. The assigned First Nations Consultation Number is FNC201703622. This assessment details the requirement for Weyerhaeuser to consult with the following Indigenous groups at Level 3 Extensive Consultation:

- Aseniwuche Winewak Nation
- Duncan's First Nation
- East Prairie Métis Settlement
- Horse Lake First Nation
- Sucker Creek First Nation

Figure 1: FMA#6900016 in relation to First Nations Communities and Métis Settlements



Weyerhaeuser

4. Contact

The Primary contact for Weyerhaeuser in regards to this consultation plan and project will be:

Name:	Traci Carter, RPFT
Position:	Strategic Planning, Grande Prairie Timberlands
Proponent:	**Weyerhaeuser Company Limited**
Address:	Postal Bag 1020, Grande Prairie, Alberta, T8V3A9
Office Phone:	780-539-8940
Email:	traci.carter@weyerhaeuser.com

5. Potential Short and Long Term Impacts

Weyerhaeuser recognizes that timberlands operations have the potential to impact First Nation Treaty rights and traditional uses and Métis Settlements members' harvesting or traditional use activities. It is our goal to minimize any adverse impact to Treaty rights, traditional use activities and the use of traditional sites. If the First Nations or Metis Settlements provide site specific concerns about how the proposed project may adversely impact Treaty rights or traditional uses or harvesting and traditional use activities, respectively, then reasonable attempts to avoid and/or mitigate those potential impacts will be undertaken with indication of such to the GoA.

These known sites may include, but are not limited to, some of the following:

- historic trails
- campsites
- hunting, gathering, trapping areas
- fishing waters
- ceremonial and spiritual sites
- grave sites
- gathering areas

Potential impacts may include the following:

- temporary disruption of travel on historic trails
- temporary disruption of camping activities due to operations
- temporary displacement of game during periods of increased operational activities
- temporal disruption within gathering areas until vegetation communities re-establish post-harvest
- temporary disruption of use of ceremonial or spiritual sites during periods where noise may be a deterrent for use

Consultation with First Nations and Métis Settlements is a primary step to be able to achieve that goal. This Indigenous Consultation Plan will ensure that First Nations or Métis with the potential to be impacted Weyerhaeuser's activities have the opportunity to provide input into the development of the FMP.

As part of the consultation process Weyerhaeuser will strive to learn from the Indigenous groups that are being impacted, and to use this knowledge in preparing the preferred forest management strategies that will be embodied within the FMP. The Company expects that additions to the lists above will likely occur as the consultation process takes place with each First Nation or Métis Settlement.

6. Schedule of Consultation for FMP documents

Weyerhaeuser will share plain language documents, as described by GoA consultation timelines, with affected First Nation or Métis Settlement. The milestones at which consultation will occur include:

<u>INITIAL NOTIFICATION – Q4 2017</u>

- Provide a brief history of Weyerhaeuser in Grande Prairie and of the FMA
- Provide a map to illustrate the location of the FMP area of interest in relation to traditional use areas and communities
- Description of the FMP planning process; including magnitude, scope and duration
- Identify the importance of a designated contact and effective methods of communication
- Describe what stage the FMP process is at as well as a proposed schedule for development of the FMP documents that will be consulted
- Explain why their feedback is important, ways it will be solicited and incorporated
- Describe how concerns will be recorded, reported to the Province and brought into the FMP
- Potential Supporting Documents: Terms of Reference; Landscape Assessment; description of the previous preferred management strategies, VOIT Template

<u>20 YR SPATIAL HARVEST SEQUENCE (SHS) and Values, Objectives, Indicators and Targets (VOITS) – Q3 2018</u>

- Description of the SHS process and how non-timber values play a role
- Overview of previous spatial footprint and a definition of the SHS including timeline
- Describe what stage the SHS process is at
- A map(s) of appropriate scale and level of detail to show the 20-year SHS
- A map(s) of appropriate scale to illustrates the 20-year SHS in relation traditional use areas
- Provide clear wording that Weyerhaeuser is looking for written specific concerns regarding the SHS and what mitigation efforts may look like
- Draft VOITS
- Potential Supporting Documents: maps of various scales, maps showing the SHS in relation to non-timber values

<u>FINAL SUBMISSION – Q3-Q4 2018</u>

- This is the final opportunity for input into the FMP
- A copy of the FMP document and supporting appendices as submitted for review
  - Preferred Management Strategies & final VOITS
- Identification of potential short and long-term adverse impacts of the FMP (as known)
- A summary of previous comments & concerns and how they have been addressed and/ or incorporated into the plan
- Clear wording that Weyerhaeuser is looking for written specific concerns regarding the entire FMP and how it may impact their Treaty Rights and Traditional Uses

7. General Conduct and Delivery Methods

Weyerhaeuser will act in good faith in all aspects of the consultation process. This includes the following standard behaviours:

- In all communication, use suitable language and terminology. Avoid the over use of acronyms and technical terms.
- Take reasonable measures to explore issues and/ or concerns and respond in a timely manner.
- Consider options to avoid, minimize or mitigate impacts to First Nations' Treaty rights and traditional uses or Métis Settlement members' harvesting and traditional use activities as identified.
- Provide timely updates of any changes to the FMP development.

Weyerhaeuser will initially contact each First Nation or Métis Settlement through registered mail or other prescribed methods via the designated official contact on the Indigenous Consultation Contacts listing (http://indigenous.alberta.ca/576.cfm). All subsequent communication with that First Nation or Métis Settlement will be done by prescribed methods at the identified significant milestones. In the event communications are undertaken with other members of the Indigenous group, this will be provided also to the designated contacts in order to maintain a single window approach.

Weyerhaeuser will use the following delivery methods to provide information to First Nations and Métis Settlements:

- Registered mail with tracking number results and/ or signature
- Email showing all attached .pdf files combined with delivery receipt notification
- Electronic Submission/ Portal with proof of delivery (varies with each portal)
- In person visits with sign-in
- Open Houses or Community Presentations with sign in

8. Indigenous Consultation Input Tracking and Reporting

Weyerhaeuser will use *The Government of Alberta's First Nations Consultation Log* [3] to track consultation activities, communication and responses with each First Nation and Métis Settlement. A representation of this standard log is illustrated in Table 1.

Logs will be separate for each community and will maintain a running summary format.

Table 1: Indigenous Relations Record of Consultation Log

Date	First Nation or Métis Settlement Representative(s) (including names of individuals with whom consultation was undertaken)	Method of Contact	Included in Supporting Docs	Purpose of contact (brief details or key points of communication, including proponent representative's name)	Issues and Concerns Raised or Identified by First Nation or Métis Settlement	Details on how concerns were addressed (including avoidance or mitigation measures)	Outcomes/ Comments

[3] Indigenous Alberta; documents; ROC_Log

Weyerhaeuser will record all comments as they arise during the Indigenous consultation process. All comments received will be reviewed with the Planning Development Team, and will be addressed in the FMP (i.e.: mitigation efforts) where appropriate.

Where required, Weyerhaeuser will use a separate process to capture specific concerns raised during consultation. How these specific concerns are captured is illustrated in Table 2. These tables will also be separate for each community and will maintain a running summary format.

Table 2: Indigenous Relations Specific Concern and Response Table4

Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Métis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed (including avoidance or mitigation measures)	Outcomes/ Comments

9. Reporting to the Province on Progress of the Consultation

Beginning with the initial communication/ information package, Record of Consultation (ROC) Logs will be sent bi-monthly to Alberta Agriculture and Forestry and to each First Nation or Metis Settlement being consulted with.

Prior to requesting an Adequacy Assessment, Weyerhaeuser will send Record of Consultation Logs to First Nations and Métis Settlements to review. ROC logs will be sent with an explanation of the intent for review as well as the expected timeline.

[4] Indigenous Alberta; documents; Specific Concern Form

Appendix 1: Glossary of Terms

The following glossary includes topics and terms that may be found in the plain language documents that will be used at each milestone.

Alberta Vegetation Inventory (AVI)	An inventory of vegetation and forest stands including non-vegetated areas.
Annual allowable cut (AAC)	The volume of timber that can be harvested under sustained-yield management in any one year, as stipulated in the pertinent approved forest management plan. In Alberta it is the quadrant cut divided by the number of years in that quadrant, usually five.
Annual Operating Plan (AOP)	A plan prepared and submitted by the forest operator each year, which provides the authorization to harvest. An AOP is a requirement of the Timber Management Regulation. (See section B 1.4)
Biological diversity (biodiversity)	The variety, distribution and abundance of different plants, animals and microorganisms, the ecological functions and processes they perform, and the genetic diversity they contain at local, regional or landscape levels of analysis.
Buffer	The buffer is an area of forest land that reduces the impacts of adjacent activities on the critical area. The size and composition of the buffer zone depends on its intended function. The objective of the buffer zone is to provide added protection for the core reserve area.
Commercial timber permit (CTP)	A timber disposition issued under Section 22 of the Forests Act authorizing the permittee to harvest public timber.
Compartment or Cost Zone	A subsection of an FMA for which operational plans are developed.
Constraints	The restriction, limiting, or regulation of an activity, quality or state of being to a predetermined or prescribed course of action or inaction.
Culmination age	The age at which the stand, for the stated diameter limit and utilization standard, achieves its maximum average rate of volume production (the Mean Annual Increment, or MAI is maximized.
Deciduous timber allocation (DTA)	A quota of deciduous timber.
Desired Future Forest	A spatially explicit projected range of conditions of the forest landscape 100+ years into the future. The range of forest conditions defines the goal towards which forest management will be directed.
Detailed forest management plan (DFMP)	A long-term plan used to outline higher-level management objectives, sustainability and timber production assumptions for a Forest Management Agreement (FMA).
Disturbance patterns	The spatial and temporal arrangement of disturbances.
Embedded operators	Includes quota holders, permittees and other industrial operators with dispositions located within a Forest Management Agreement Area.
Even-aged stands	A stand of trees in which the age differences among trees are small, usually less than 10 to 20 years, or 30% of the rotation age in stands more than 100 years old. Even-aged stands result from disturbances occurring at one point in time, such as wildfires.
FireSmart Community Zone	A standard 10 km radius around the community extending from the Wildland Urban Interface Zone. A unique data set will be gathered for this zone for community protection planning to provide a fundamental linkage between FireSmart Communities and FireSmart Landscapes.
Forest Health	A condition of the forest; a forest is considered healthy if it can sustain itself to meet the specific forest land management objectives of today or in the future.
Forest Management Agreement (FMA)	A contract between the province of Alberta and the FMA holder whereby the province provides an area-based Crown timber supply. The FMA gives the FMA holder the right to access Crown fibre. In return, the FMA holder commits to forest management responsibilities, which may change from time to time.

Forest Management Plan (FMP)	Generic term for Preliminary Forest Management Plans, Detailed Forest Management Plans, Forest Management Unit Plans, General Development Plans, Annual Operating Plans.
Forest Management Unit (FMU)	An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the *Forests Act*.
Genetic Diversity	The genetic variability within a population or a species; the number and relative abundance of alleles.
Grazing disposition	An authorization issued by Alberta for the purpose of domestic livestock grazing on public land (i.e., lease, license or permit).

Ground Rules	Standards for operational planning and field practices that must be measurable and auditable and based forest management plan objectives.
Historical resource	Any work of nature or man that is primarily of value for its paleontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest, including, but not limited to, the structure or object and its surrounding site.
Harvest area aesthetics	Overall quality of operations in respect to the real or imagined effect on visual quality and/or the environment within a particular harvest area.
Harvest Level	A volume or area of timber determined through timber supply analysis available for harvest on an annual sustainable basis within a DFA. A harvest level is not necessarily an AAC.
Interior forest conditions	The environmental conditions typical of the central or interior part of a habitat patch.
Landscape	A landscape (or LMU) is a heterogeneous area in which the pattern of the mosaic of local ecosystems or land uses is repeated in similar form throughout kilometres wide area.
Landscape fire assessment	Information on the effects of fire which may be used to influence forest management strategies and tactics over a landscape.
Mean Annual Increment	**T**he average annual increase in volume of individual trees or stands up to the specified point in time.
Model	An idealized representation of reality developed to describe, analyse or understand the behaviour of some aspect of this reality.
Permanent reserve	An area permanently excluded from harvesting in the DFMP.
Permanent sample plots (PSP)	A fixed or variable area plot established for (forest) sampling and measurement purposes, and designed for remeasurement.
Planning Horizon	The length of time over which a series of defined management actions occur. For the purposes of modeling, usually equivalent to two full rotations.
Quota	The timber quota is a share of the allowable cut of coniferous timber within a forest management unit.
Regulated Forestry Professional	A Registered Professional Forester (RPF) or a Registered Professional Forest Technologist (RFPT).
Rotation	The period of years required to establish and grow even-aged timber crops to a specified condition of maturity.
Sensitivity Analysis	An analytical procedure in which the value of one or more parameters is varied; the changes that this produces are analysed in a series of iterative evaluations.
Seral stages	A stage in succession. A series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age.
Silviculture	The theory and practice of controlling the establishment, composition, health, structure and growth of forests in order to achieve specified management objectives.
Sustainable forest management (SMF)	Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations.
Timber disposition	Licenses and permits that allow forest operators to harvest from Crown lands.
Timber supply analysis (TSA)	Calculations/computer models with built-in assumptions regarding forest growth patterns, used to determine the annual allowable cut (AAC).
Values at risk	A listing of values which may be at risk of being reduced by wildfire. In order to complete a spatial "priority" evaluation, information regarding values is required.
Visual Resource Management	A standardized process of identifying and assessing visual values to ensure that proposed industrial developments in visually sensitive areas of Alberta, are planned and developed in a consistent manner.
Yield Curve	Graphical representation of a yield table.

Appendix 2: Initial Notification; Plain Language Information Package

Weyerhaeuser

Cover Letter

Grande Prairie Timberlands
Postal Bag 1020
8 Miles South on Resources Road
Grande Prairie, Alberta, T8V3A9

December 1, 2017 **FNC201703622**

Consultation contact name (as identified on Aboriginal Consultation Office's website).
First Nation
Address
Address

Dear consultation contact name:

Re: Weyerhaeuser Grande Prairie Forest Management Plan

Alberta Agriculture and Forestry has directed Weyerhaeuser Grande Prairie to consult with you on our proposed Forest Management Plan. This project has been assessed as requiring Level 3-Extensive Consultation based on the long term in duration (more than 10 years), the size and scale or complexity and the potential for extensive environmental impacts.

Weyerhaeuser is currently in the process of developing a new Detailed Forest Management Plan (the Plan) covering our Forest Management Area.

Activity #	Activity Type	Area	Applicable Act	Regulatory Body
FNC201703622	Forest Management Plan	Forest Management Area #6900016	Forest Act	Agriculture and Forestry

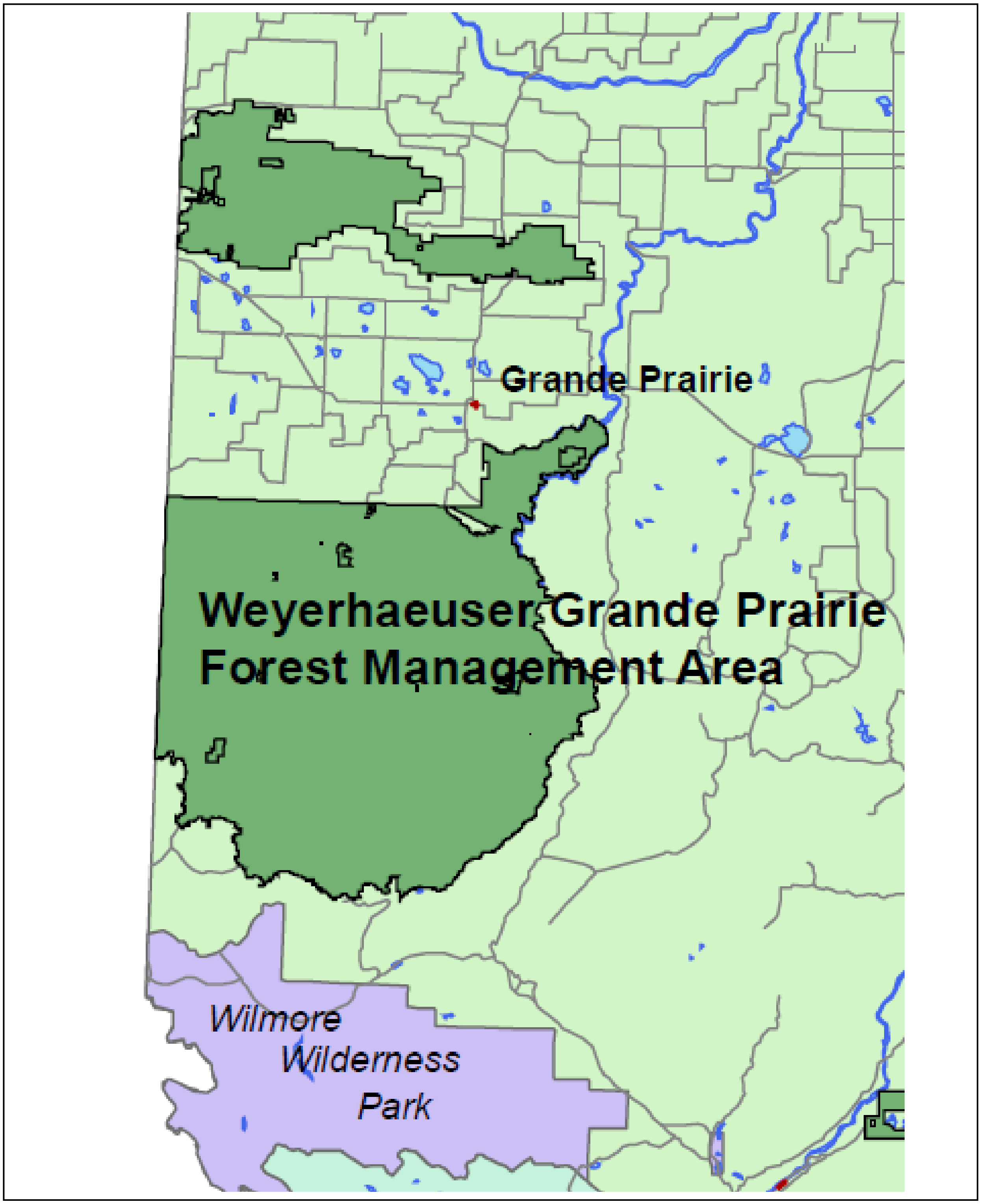
This letter is an invitation for your community to learn more about this, and to have the opportunity for input and direction to the Plan. The linking of our forest management planning process with innovative suggestions from your community will enable a meaningful engagement process to take place.

The Forest Management Plan is a long term look at the entire Area that sets forth what forest management strategies will be deployed by timber operators, and what impacts those strategies may have on all forest resources.

The Plan will:

- Establish forest management objectives, and describe how they will be met and monitored;
- Provide how Weyerhaeuser and other timber operators will meet the Government of Alberta's requirements for the Area;
- Contain a variety of information and analyses of forest resources, and;
- Respond to input from a variety of stakeholders

Map: Forest Management Agreement #6900016 Area



Engaging your community

Forest management activities include timber harvesting, reforestation, road construction and forest protection, all of which is integrated with other natural resources management and protection. These activities over the long term on large landscapes may have impacts on the (AWN: traditional uses; HLFN/DFN/SCFN: Treaty rights and traditional uses; EPMS: harvesting or traditional use activities) of your community.

We feel that this is an excellent opportunity for Weyerhaeuser to better understand potential impacts to your (Nation/First Nation/Metis Settlement), and what can be accommodated in the Forest Management Plan to address those impacts. The attached Information Package outlines the magnitude, scope and duration of the planning process. This is the initial information exchange opportunity. Several others will occur as illustrated under Significant Milestones in the attached document.

We will be working on the Plan over the next year or so, and would like to connect with a representative of your community to find out more about your level of interest on this opportunity, and how we might best engage your community if you so desire. We are prepared to meet with your community or consultation representative at your convenience to discuss this opportunity further if you wish.

Please let us know whether this plan may adversely impact your (AWN: traditional uses; HLFN/DFN/SCFN: Treaty rights and traditional uses; EPMS: harvesting or traditional use activities) in the area before December 29, 2017. If you state that there are potential impacts, please specify the site-specific concerns your (Nation/First Nation/Metis Settlement) may have and their location.

Weyerhaeuser will record all discussions on the standard Alberta Record of Consultation Log, which will be shared with your community.

If you wish to meet to discuss this plan further, please contact Traci Carter at traci.carter@weyerhaeuser.com to arrange a meeting at your earliest convenience.

Sincerely,

Traci Carter, RPFT
Strategic Planning Forester
Grande Prairie Timberlands
Weyerhaeuser Company Limited

Attachment: Initial Information Package

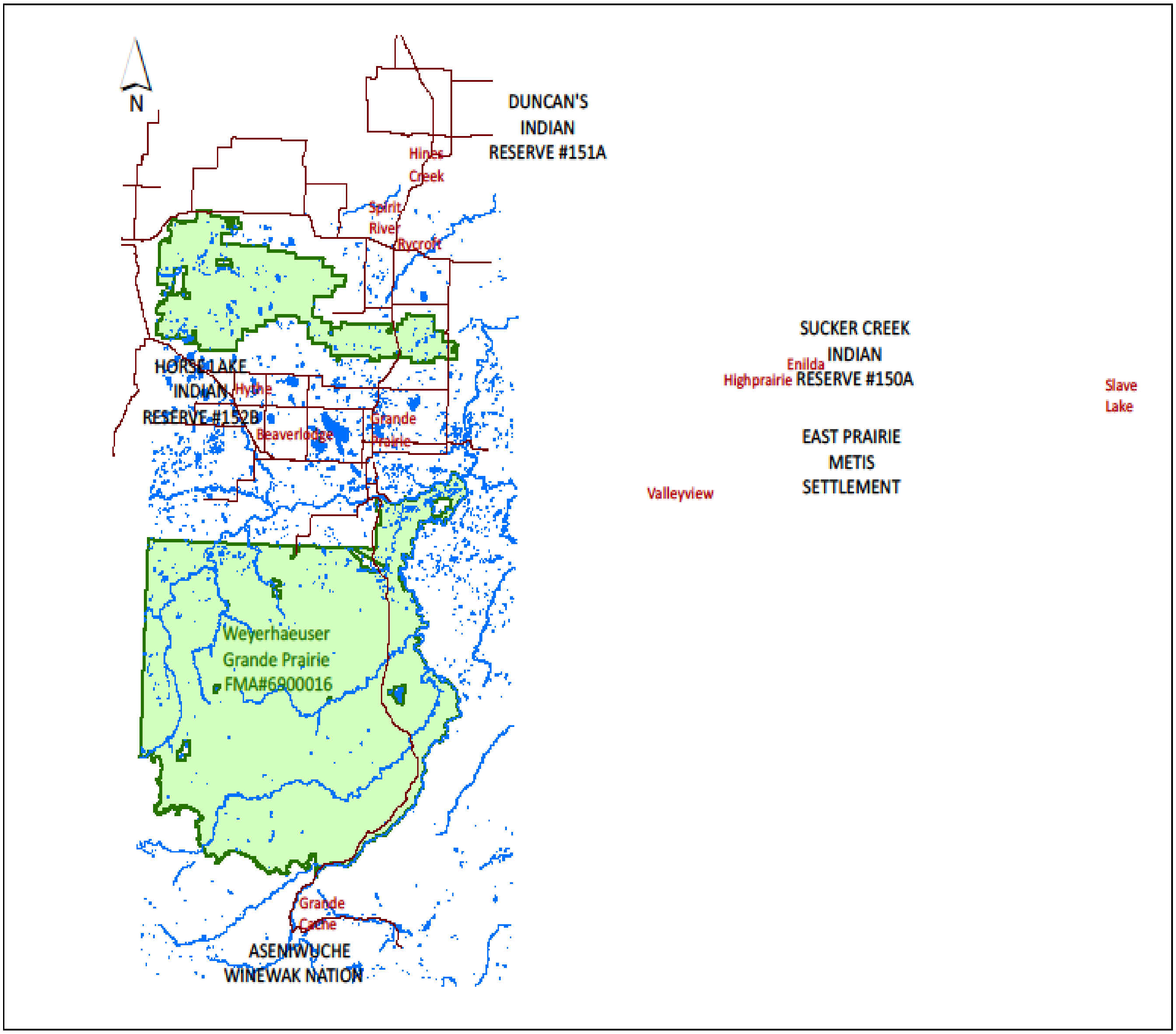
Weyerhaeuser

PROJECT:	Plain language Information Package for Consultation on the 2019-2029 Forest Management Plan	Weyerhaeuser
BY:	Weyerhaeuser Company Limited, Grande Prairie	Grande Prairie Timberlands Postal Bag 1020 Grande Prairie, AB, T8V3A9
AREA:	FMA#6900016	
FNC#:	FNC201703622	

Pre-Consultation Assessment

A Pre-Consultation Assessment was requested by Weyerhaeuser on May 4, 2017 and the response was received on June 26, 2017. The assigned FNC# is FNC201703622. This assessment details the requirement for Weyerhaeuser to consult with the *INSERT FIRST NATION NAME* at Level 3 Extensive Consultation.

FMA#6900016 in relation to First Nations Communities and Métis Settlements



Weyerhaeuser

Introduction to Weyerhaeuser

History and Facilities

In 1992 Weyerhaeuser expanded its presence in Alberta by acquiring the pulp mill and sawmill as well as the Forest Management Agreement (FMA) in Grande Prairie from Proctor & Gamble. In 2003, Weyerhaeuser grew its operations to include a cogeneration plant which captures waste steam to produce electricity. To illustrate the impact, this plant is capable of producing enough electricity to power 1/3 of the homes in Grande Prairie. In 2016 Weyerhaeuser sold the pulp mill and cogeneration plant to International Paper but retained the sawmill and the Forest Management Agreement and Area.

Forest Management Agreement

Weyerhaeuser Grande Prairie operates under Forest Management Agreement #6900016 which originated in 1969 and was most recently renewed in 2008 and is valid for 20 years. As an FMA holder, Weyerhaeuser must sustainably manage the forest resource on a long term basis and ensure that reclamation and reforestation activities are carried out. Weyerhaeuser has the responsibility to consider a broad range of forest values and social, economic and environmental factors such as watersheds and wildlife habitat. Public and Indigenous consultation is an integral part of the planning process.

Forest Management Area

The Forest Management Area is divided into two disjointed spatial locations, the smaller “Saddle Hills” area to the north of Grande Prairie and the larger “main block” portion south of Grande Prairie.

The FMA area serves as the main wood supply for Weyerhaeuser’s Grande Prairie Lumber business and International Paper’s pulp facility. Additionally, Norbord Inc. and Tolko Industries Ltd. are embedded Quota holders and there is a Community Timber Permit Program (CTPP) active in the FMA Area. Oilfield developments are extensive across the area, and continue to have a major impact on the managed land base.

Third Party Certification

Weyerhaeuser is certified to three Sustainable Forestry Initiative (SFI) Standards including Forest Management, Certified Sourcing and Chain of Custody. These initiatives provide key environmental support to allow us to practice sustainable forestry, reduce pollution, conserve natural resources and energy and improve environmental performance.

Contact Information

As this is the initial contact from Weyerhaeuser regarding this project, we have chosen registered mail. We request that *INSERT FIRST NATION NAME* establish a designated official contact for this project.

The Primary contact for Weyerhaeuser in regards to this consultation plan and project will be:

Name:	**Traci Carter, RPFT**
Position:	Strategic Planning, Grande Prairie Timberlands
Proponent:	Weyerhaeuser Company Limited, Grande Prairie Timberlands
Address:	Postal Bag 1020, Grande Prairie, Alberta, T8V3A9
Office Phone:	780-539-8940
Email:	traci.carter@weyerhaeuser.com

Weyerhaeuser

Proposed Project: Forest Management Plan 2019-2029

The Forest Management Plan (FMP) is a technical document describing forest management objectives, strategies and commitments over a planning horizon of 200 years. It identifies intended methods of harvesting, reforesting, and managing timber resources within the defined area of responsibility.

Forest Management Plans are renewed at least every ten years and incorporate knowledge from research, new policy and legislative changes and ongoing review of performance. FMP's contain details of where, when and how trees are harvested and managed for sustainability and are approved by the Government of Alberta, with input from Indigenous groups, the public and other stakeholders.

The targeted ten year term for this project will be 2019-2029.

Potential Short and Long Term Impacts

Weyerhaeuser recognizes that timberlands operations have the potential to impact (AWN: traditional uses; HLFN/DFN/SCFN: Treaty rights and traditional uses; EPMS: harvesting or traditional use activities).

These known sites may include, but are not limited to, some of the following:

- historic trails
- campsites
- hunting, gathering, trapping areas
- fishing waters
- ceremonial and spiritual sites
- grave sites
- gathering areas

Potential impacts may include the following:

- temporary disruption of travel on historic trails
- temporary disruption of camping activities due to operations
- temporary displacement of game during periods of increased operational activities
- temporal disruption within gathering areas until vegetation communities re-establish post-harvest
- temporary disruption of use of ceremonial or spiritual sites during periods where noise may be a deterrent for use

It is our goal to minimize any adverse impact to (AWN: traditional uses; HLFN/DFN/SCFN: Treaty rights and traditional uses; EPMS: harvesting or traditional use activities) through productive consultation activities and a healthy two-way relationship with *INSERT FIRST NATION NAME*.

Difference from Annual Consultation Activities

Over the 12-16 months Weyerhaeuser will be providing *INSERT FIRST NATION NAME* with information on how Forest Management Plans are developed with consideration to timber values and non-timber values such as watersheds, recreation as well as fish and wildlife. These plans include the details of where, when and how trees on our forest management area are harvested and reforested and the impacts of these activities over 200 years. We are seeking your input into these strategies in order to understand and minimize impact to your (AWN: traditional uses; HLFN/DFN/SCFN: Treaty rights and traditional uses; EPMS: harvesting or traditional use activities).

Weyerhaeuser

The Annual Operating Plan (AOP) is developed from the Forest Management Plan and consultation happens each year. It is focused on gathering feedback from *INSERT FIRST NATION NAME* on the potential impacts of harvesting and silviculture activities from a smaller and more focused scope. The annual consultation will include the specific nature and location of activities expected to occur over a 1-3 year period. This will include specific stands that have been selected for harvest or silviculture treatments, the road plans as well as anticipated camp or staging area locations. This consultation activity allows *INSERT FIRST NATION NAME* the ability to bring forth any site specific impacts or concerns they have, while still being informed and able to provide input to the larger planning process.

The Forest Management Plan consultation activities we are referring to in this project does not in any way replace or take away from the Annual Operating Plan (AOP) consultation that occurs each year. By completing both of these consultation activities allows us to hear more complete feedback on concerns and address those concerns in the appropriate process, so that feedback is built into both the planning and execution stages.

Significant Milestones

It is important to Weyerhaeuser that *INSERT FIRST NATION NAME* has the opportunity to provide input into the development of the FMP at significant milestones. At each milestone, Weyerhaeuser will be seeking written specific concerns regarding the provided information as well as what mitigation efforts may look like.

CURRENT ACTIVITIES

Weyerhaeuser's current Forest Management Plan was approved in 2011 and is valid until 2021. The overall management strategy in 2011 was to address the threat of Mountain Pine Beetle. Due to concentrated efforts by Weyerhaeuser and by the Province, the amount of susceptible pine has largely been removed from the operable landscape. We have recently completed a new inventory of the FMA in order to understand current and future fibre supply. We have chosen to renew this plan early so that we can adjust preferred management strategies to reflect the current state of the forest management area and to ensure that harvest levels are sustainable.

Unless otherwise requested by you, consultation will occur at the following milestones:

INITIAL NOTIFICATION- Q4 2017

This is the initial contact from Weyerhaeuser to inform you about the project in order to establish a contact within your consultation office. Within this information package we have included:

- a brief history of Weyerhaeuser in Grande Prairie and of the forest management area
- a map that illustrates the location of the FMP area of interest in relation to traditional use areas and communities
- a description of the FMP planning process; including magnitude, scope and duration
- the differences between this project and the annual consultation already occurring
- the methods of communication and document tracking that should be expected
- why Weyerhaeuser considered your feedback important as well as ways it will be solicited and incorporated into the FMP

<u>20 YR SPATIAL HARVEST SEQUENCE (SHS)[5] and Values, Objectives, Indicators and Targets (VOITS) – Q3 2018</u>
At this point we will have incorporated the Timber Value information as well as a large part of the Non-Timber Value[6] information and will be able to produce the first draft of where on the landscape our anticipated footprint will be. We will present an information package including:

- a description of the SHS process, what stage the process is at and how non-timber values play a role
- an overview of our previous footprint in relation to the proposed sequence including timeline
- map(s) of appropriate scale and level of detail to show the 20-year SHS in relation traditional use areas
- An introduction to Values, Objectives, Indicators and Targets including what they are and how they are implemented

<u>FINAL SUBMISSION – Q3-Q4 2018</u>
This is the final opportunity for input into the Forest Management Plan before it is submitted to the Province for approval. It is our desire that by this point in the planning process Weyerhaeuser and *INSERT FIRST NATION NAME* will have had several opportunities for meaningful dialogue. We will present a copy of the FMP document and supporting appendices as well as:

- a summary of identified potential short and long-term adverse impacts of the FMP (as known)
- a summary of previous comments & concerns
- a summary of mitigative strategies implemented

Communication

Future communication with *INSERT FIRST NATION NAME* will be done at least at the identified significant milestones. Weyerhaeuser prefers to provide information in a face-to-face setting, but failing that we will use the following delivery methods to provide information:

- Registered mail with tracking number results and/ or signature
- Email showing all attached .pdf files combined with delivery receipt notification
- Electronic Submission/ Portal with proof of delivery

In the event communications and/ or presentation are requested by other members of *INSERT FIRST NATION NAME*, Weyerhaeuser will flow communication through your designated contact in order to maintain a single window approach. Examples of these types of information sharing events could include:

- In person visits
- Open Houses or Community Presentations
- Field Tours

Mitigation

When *INSERT FIRST NATION NAME* provide site specific concerns regarding this project, reasonable attempts to avoid and/or mitigate those potential impacts will be undertaken by Weyerhaeuser. An important step in developing forest management strategies for this plan is to learn from the Indigenous groups that are being impacted, and to use incorporate this knowledge into our forest management strategies.

Weyerhaeuser does not mean to imply that the potential significant sites, potential impacts or significant milestones listed in this document are a complete and exhaustive list. We expect that additions will likely occur as the consultation process takes place with *INSERT FIRST NATION NAME*.

[5] Spatial Harvest Sequence or SHS is a spatial description (map) of where we anticipate to harvest over the next 20 years
[6] Values are identified as either Timber or Non-Timber. Timber Values only consider harvest ability of a stand. Non-Timber Values consider the value of the forest as a whole.

Consultation Input Tracking, Sharing and Reporting

Weyerhaeuser will use *The Government of Alberta's First Nations Consultation Log* [7] to track consultation activities, communication and responses with each First Nation and Métis Settlement.
Where required, Weyerhaeuser will use a separate process to capture specific concerns raised during consultation.

Weyerhaeuser will record all comments as they arise during the Indigenous consultation process. All comments received will be reviewed with the Planning Development Team, and will be addressed in the FMP where appropriate.

Record of Consultation

Record of Consultation (ROC) Logs as well as the Specific Concerns Table will be sent bi-monthly to *INSERT FIRST NATION NAME* and to Alberta Agriculture and Forestry.

Prior to requesting an Adequacy Assessment, Weyerhaeuser will send Record of Consultation Logs as well as the Specific Concerns Table to *INSERT FIRST NATION NAME* to review with an explanation of the intent for review as well as the expected timeline.

Glossary of Terms

The following glossary includes some of the technical topics and terms that may be found in the presentations, documents and/ or maps that will be shared at each milestone. At any point in the process we encourage you to ask for clarification if a term or acronym is unfamiliar.

Alberta Vegetation Inventory (AVI)	An inventory of vegetation and forest stands including non-vegetated areas.
Annual allowable cut (AAC)	The volume of timber that can be harvested under sustained-yield management in any one year, as stipulated in the pertinent approved forest management plan. In Alberta it is the quadrant cut divided by the number of years in that quadrant, usually five.
Annual Operating Plan (AOP)	A plan prepared and submitted by the forest operator each year, which provides the authorization to harvest. An AOP is a requirement of the Timber Management Regulation. (See section B 1.4)
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Buffer	The buffer is an area of forest land that reduces the impacts of adjacent activities on the critical area. The size and composition of the buffer zone depends on its intended function. The objective of the buffer zone is to provide added protection for the core reserve area.
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Compartment or Cost Zone	A subsection of an FMA for which operational plans are developed.
Constraints	The restriction, limiting, or regulation of an activity, quality or state of being to a predetermined or prescribed course of action or inaction.
Culmination age	The age at which the stand, for the stated diameter limit and utilization standard, achieves its maximum average rate of volume production (the Mean Annual Increment, or MAI is maximized.
Deciduous timber allocation (DTA)	A quota of deciduous timber.
Desired Future Forest	A spatially explicit projected range of conditions of the forest landscape 100+ years into the future. The range of forest conditions defines the goal towards which forest management will be directed.

[7] Indigenous Alberta; documents

Detailed forest management plan (DFMP)	A long-term plan used to outline higher-level management objectives, sustainability and timber production assumptions for a Forest Management Agreement (FMA).
Disturbance patterns	The spatial and temporal arrangement of disturbances.
Embedded operators	Includes quota holders, permittees and other industrial operators with dispositions located within a Forest Management Agreement Area.
Even-aged stands	A stand of trees in which the age differences among trees are small, usually less than 10 to 20 years, or 30% of the rotation age in stands more than 100 years old. Even-aged stands result from disturbances occurring at one point in time, such as wildfires.
FireSmart Community Zone	A standard 10 km radius around the community extending from the Wildland Urban Interface Zone. A unique data set will be gathered for this zone for community protection planning to provide a fundamental linkage between FireSmart Communities and FireSmart Landscapes.
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Forest Management Agreement (FMA)	A contract between the province of Alberta and the FMA holder whereby the province provides an area-based Crown timber supply. The FMA gives the FMA holder the right to access Crown fibre. In return, the FMA holder commits to forest management responsibilities, which may change from time to time.
Forest Management Plan (FMP)	Generic term for Preliminary Forest Management Plans, Detailed Forest Management Plans, Forest Management Unit Plans, General Development Plans, Annual Operating Plans.
Forest Management Unit (FMU)	An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the *Forests Act*.
Genetic Diversity	The genetic variability within a population or a species; the number and relative abundance of alleles.
Grazing disposition	An authorization issued by Alberta for the purpose of domestic livestock grazing on public land (i.e., lease, license or permit).
Ground Rules	Standards for operational planning and field practices that must be measurable and auditable and based forest management plan objectives.
Historical resource	Any work of nature or man that is primarily of value for its paleontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest, including, but not limited to, the structure or object and its surrounding site.
Harvest area aesthetics	Overall quality of operations in respect to the real or imagined effect on visual quality and/or the environment within a particular harvest area.
Harvest Level	A volume or area of timber determined through timber supply analysis available for harvest on an annual sustainable basis within a DFA. A harvest level is not necessarily an AAC.
Interior forest conditions	The environmental conditions typical of the central or interior part of a habitat patch.
Landscape	A landscape (or LMU) is a heterogeneous area in which the pattern of the mosaic of local ecosystems or land uses is repeated in similar form throughout kilometres wide area.
Landscape fire assessment	Information on the effects of fire which may be used to influence forest management strategies and tactics over a landscape.
Mean Annual Increment	**T**he average annual increase in volume of individual trees or stands up to the specified point in time.
Model	An idealized representation of reality developed to describe, analyse or understand the behaviour of some aspect of this reality.
Permanent reserve	An area permanently excluded from harvesting in the DFMP.
Permanent sample plots (PSP)	A fixed or variable area plot established for (forest) sampling and measurement purposes, and designed for remeasurement.
Planning Horizon	The length of time over which a series of defined management actions occur. For the purposes of modeling, usually equivalent to two full rotations.
Quota	The timber quota is a share of the allowable cut of coniferous timber within a forest management unit.
Regulated Forestry Professional	A Registered Professional Forester (RPF) or a Registered Professional Forest Technologist (RFPT).

Rotation	The period of years required to establish and grow even-aged timber crops to a specified condition of maturity.
Sensitivity Analysis	An analytical procedure in which the value of one or more parameters is varied; the changes that this produces are analysed in a series of iterative evaluations.
Seral stages	A stage in succession. A series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age.
Silviculture	The theory and practice of controlling the establishment, composition, health, structure and growth of forests in order to achieve specified management objectives.
Sustainable forest management (SMF)	Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations.
Timber disposition	Licenses and permits that allow forest operators to harvest from Crown lands.
Timber supply analysis (TSA)	Calculations/computer models with built-in assumptions regarding forest growth patterns, used to determine the annual allowable cut (AAC).
Values at risk	A listing of values which may be at risk of being reduced by wildfire. In order to complete a spatial “priority” evaluation, information regarding values is required.
Visual Resource Management	A standardized process of identifying and assessing visual values to ensure that proposed industrial developments in visually sensitive areas of Alberta, are planned and developed in a consistent manner.
Yield Curve	Graphical representation of a yield table.

ANNEX 8: VOIT TABLE

<table>
<tr><th colspan="10">CCFM Criterion 1. Biological Diversity</th></tr>
<tr><th colspan="10">CSA SFM Element 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)</th></tr>
<tr><th>Value</th><th>Objective</th><th>Indicator</th><th>Target[1]</th><th>Means to Identify Target[2]</th><th>Legal / Policy Requirements</th><th>Means of achieving Objective and Target</th><th>Monitoring and Measurement</th><th>Reporting</th><th>Acceptable Variance</th><th>Response</th></tr>
<tr>
<td>1.1.1 Landscape scale biodiversity</td>
<td>1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages[3]</td>
<td>Area of old + very old, Mature and young forest for the DFA[4] by cover class.[5]

Very old= >180
Old= 120-179
Mature= 80-119
Immature= 20-79
Young= 0-19</td>
<td>Over the 200-year planning horizon;

a) Contributing land base will target greater than the below listed % of old + very old forest, greater than the below listed % mature forest and less than the below listed % of young forest.
<table>
<tr><th>Cover Class</th><th>Old + very old (> than)</th><th>Mature (> than)</th><th>Young (< than)</th></tr>
<tr><td>Cx-Pl</td><td>16.5</td><td>2.5</td><td>35.0</td></tr>
<tr><td>Cx-Sw</td><td>7.5</td><td>2.0</td><td>37.0</td></tr>
<tr><td>Cx-other</td><td>15.0</td><td>1.5</td><td>46.0</td></tr>
<tr><td>MW</td><td>3.5</td><td>1.5</td><td>46.5</td></tr>
<tr><td>Dx</td><td>3.5</td><td>1.5</td><td>38.5</td></tr>
</table>
b) Classified land base will target greater than the below listed % of old + very old forest, greater than the below listed % mature forest and less than the below listed % of young forest.
<table>
<tr><th>Cover Class</th><th>Old + very old (> than)</th><th>Mature (> than)</th><th>Young (< than)</th></tr>
<tr><td>Cx-Pl</td><td>18.0</td><td>4.0</td><td>31.0</td></tr>
<tr><td>Cx-Sw</td><td>26.0</td><td>3.5</td><td>27.5</td></tr>
<tr><td>Cx-other</td><td>35.5</td><td>1.0</td><td>9.0</td></tr>
<tr><td>MW</td><td>13.5</td><td>3.0</td><td>40.0</td></tr>
<tr><td>Dx</td><td>3.5</td><td>2.5</td><td>31.5</td></tr>
</table>
</td>
<td>Targets and seral stage definitions will be based on sound science, ecological considerations, wildlife zones, disturbance regimes, social values and Indigenous Traditional Knowledge.

Target will ensure representation of natural range of ecosystem attributes (e.g. Productivity class)</td>
<td>Planning Standard</td>
<td>Spatial Harvest Sequence (SHS)</td>
<td>Periodic updates to forest inventory</td>
<td>FMP: Tables of indicators (values and targets) at 0, 10, 20, 100 and 200 years.

Maps of indicators at 0, 10 and 50 years

Performance:
10 year - Stewardship Report [Compare time 0 of previous FMP to Classified Landbase (CLB) of new FMP]</td>
<td>Area (ha) of old + very old forests by cover class will be between 90% and 100% of target areas.

Area of young + mature forest by cover class will not exceed 110% of target area</td>
<td>Adjust strategies in subsequent Forest Management Plan (FMP)</td>
</tr>
</table>

[1] Targets identified, including measurable variables have been determined by the FMP planning process and the PDT.
[2] Strategies identified to identify and achieve objectives and targets have been determined by the FMP planning process and the PDT.
[3] Seral stages are as defined in the “Biodiversity Assessments” (Draft May 9, 2016) document provided by GoA (PDT-005) Very old= >180; Old= 120-179; Mature= 80-119; Immature= 20-79; Young= 0-19
[4] Unless otherwise noted, the subunit for all indicators will be the Defined Forest Area (DFA)- decided at PDT-005
[5] Cover class is as defined in the “Biodiversity Assessments” (Draft May 9, 2016) document provided by GoA (PDT-005); Cx-Pl; Cx-Sw; Cx-other; MW; Dx

Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation	a) Range of patch[6] sizes by DFA for young seral stands.	a) A distribution of harvest area sizes that will result in a patch size pattern over the 200-year planning horizon approximating patterns created by natural disturbances. Young Seral Patch Targets[7]: 0-5ha: < 5% 6-19ha: < 20% 20-99ha: < 50% 100-250ha: > 15% >250ha: > 10%	Targets will be based on sound science, ecological considerations, wildlife zones, disturbance regimes, social values and Indigenous Traditional Knowledge.	Planning Standard	Spatial Harvest Sequence	Periodic updates to forest inventory	**FMP:** Tables and maps of indicators by DFA at 0, 10, and 50 years (or end of first rotation). **Performance:** 10 year - Stewardship Report (Compare time 0 of previous FMP to CLB of new FMP)	At the end of the 10- year FMP term a) The target distribution is achieved; or demonstrated progress to achieving target in one rotation where the pattern has deviated significantly from the target	Adjust strategies in subsequent FMP
		b) Area of old (>120 yrs) interior forest[8] by DFA.	c) Area of old interior forest will not be less than 10% over the next 200 years.	Targets will be based on sound science, ecological considerations, wildlife zones, disturbance regimes, social values and Indigenous Traditional Knowledge.	Planning Standard	Spatial Harvest Sequence	Periodic updates to forest inventory	**FMP:** Tables and maps of indicators by DFA at 0, 10, and 50 years (or end of first rotation). **Performance:** 10 year - Stewardship Report (Compare time 0 of previous FMP to CLB of new FMP)	At the end of the 10- year FMP term b) Target is achieved for at least 80% of the planning period with variance not exceeding 20% below target	Adjust strategies in subsequent FMP

[6] A patch is defined as a stand of forest in the same seral stage and not split by a linear feature greater than 8m wide.
[7] Patches <5ha was separated out to understand slivers. 5 ha is the minimum block size.
[8] Interior forest is a forested area greater than 100 hectares in size located beyond edge effect buffer zone along a forest edge and not split by a linear feature greater than 8m wide.
7a) Edge effect buffer zone: 60 m where adjacent area is non-forested or less than 40 years old; 30 m where adjacent forest stand is >= 40 years and less than mature forest; 0 m where adjacent stand is mature forest.
7b) Forest edge: any of the following: a) a linear disruption in forest cover greater than 8m in width, or, b) the line along which forest seral stage class changes.

Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	1.1.1.3 Maintain biodiversity by minimizing access	a) Permanent all-weather road density by DFA	Less than 0.6m/km^2 of permanent all-weather forestry road (DLO).[9]	Targets will be based on sound science, ecological considerations, wildlife zones, disturbance regimes, social values and Indigenous Traditional Knowledge.	Planning Standard	Utilize a strategy that coordinates spatial/temporal sequencing of harvest, road closures and decommissioning. (SHS and long-term corridor access plan)	Periodic updates to forest inventory	**FMP:** Table and Map of existing and proposed permanent all-weather forestry roads (DLO + LOC) at time 0. **Performance:** Stewardship Report	A variance not exceedin g +/-20% should be achieved	Adjust strategies in subsequent FMP
		b) Seasonal / temporary forestry road length by DFA	b) All seasonal/ temporary roads closed within three (3) years of construction	Analysis of status of seasonal/ temporary forestry roads on the DFA.	Planning Standard	Road construction, maintenance and reclamation activities	Road plan (Operating Ground Rule) OGR 11.2	**Performance**: Stewardship Reports summarizing all seasonal/ temporary roads open longer than three (3) years with description of mitigation efforts.	none	Adjust strategies in subsequent AOPs
	1.1.1.4 Maintain plant communities uncommon in DFA or province	Area or occurrence of each uncommon plant community/ unique area within DFA	100% of identified uncommon plant communities/ unique areas will be maintained. This will include culturally valued plant species identified during layout and/ or Indigenous consultation.	GIS analysis, AVI, ecosite phases, ACIMS plant community classification and tracking list, Indigenous Traditional Knowledge. Identify occurrence of uncommon plant communities/ unique areas	Planning Standard	Spatial planning of harvest and road construction, OGR	Periodic updates to forest inventory	**FMP:** Table and map(s) displaying known locations of uncommon plant communities/ unique areas. **Performance:** Stewardship Reports summarizing new sites identified.	none	Adjust strategies in subsequent AOPs and FMP.

[9] Targets are set by forestry roads (DLO). Reporting is done for all roads (DLO + LOC) (PDT006)

Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events	a) Areas of unsalvaged burned forest b) Areas of unsalvaged blowdown	On the contributing landbase: a) Fires <1,000ha: Follow FMP structure retention strategy consistent with normal harvesting practices. Fires >1,000ha: retain unburned (green) wind firm areas between 0-10ha. b) In areas of significant (>100ha) blowdown, greater than 10% will be left unsalvaged. Blowdown in mature spruce stands will be assessed for forest health considerations (Spruce Beetle) as part of the salvage plan.	a) Targets based on "Fire Salvage Planning and Operations - Directive No. 2007-01" Ensure consistency with FireSmart objectives b) Targets are to be based on sound science, ecological considerations, disturbance regimes, social values and Indigenous Traditional Knowledge.	"Fire Salvage Planning and Operations - Directive No. 2007 - 01" Planning Standard	Salvage planning	Periodic updates to forest inventory; ground surveys, post-harvest assessments	**FMP:** Table and map of natural disturbance hectares within the last 10 years. **Performance:** Stewardship Reports by natural disturbance type fires > 1,000ha, fires < 1,000ha; blowdown >100ha); salvaged and unsalvaged and total area disturbed (ha).	At the end of the 10- year FMP term the target is achieved or exceeded	Adjust strategies in subsequent AOPs
	1.1.1.6 Retain ecological values and functions associated with riparian zones	Compliance with OGR	Zero non-compliance penalties assessed regarding riparian zones.	OGR	Federal Fisheries Act, Water Act	Planning, TSA, OGR	Organization reports, air photo interpretation, ground surveys, post-harvest assessments or other existing compliance monitoring systems	**Performance:** Stewardship Reports summarizing non-compliance penalties assessed regarding riparian zones.	No variance	Immediate remedial action and / or administrative penalty

Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1.1.2 Local/stand scale biodiversity	1.1.2.1 Retain stand level structure	a) % area / volume / stems residual structure (both living and dead), within a harvest area, representative of the status (live / dead), sizes, and species of the overstorey trees by subunit.	a) 4% of the harvest area comprised of a combination of single stems, clumps, and islands will be left as stand level structure. **Note**: A wide range in variability in stand level retention is desired providing the target level is achieved by the contributing landbase.	Wildlife zones, roadside vegetation screens, recreational values, aesthetics, Indigenous Traditional Knowledge, ACIMS, Alberta Biodiversity Monitoring Institute (ABMI) and Fisheries and Wildlife Management Information System (FWMIS)	Occupational Health and Safety Act, Forest and Prairie Protection Act	Implement residual structure retention strategies and OGRs	Cutblock delineation as per the Spatial Data Directive.	**Performance:** Stewardship Reports summary of performance.	At the end of the 10- year FMP term the target is achieved or exceeded	Adjust strategies in subsequent FMP
		b) Percentage of harvested area by DFA with downed woody debris[10] equivalent to preharvest conditions	b) All harvest areas have downed woody debris retained on site (exception is piled and burned roadside and forwarding slash)	Based on sound ecological science.	Planning Standard	Minimize the amount of woody debris removed from harvest areas.	Pre-harvest ocular estimates and post-harvest silviculture prescriptions	**Performance** Stewardship Reports summary of performance.	none	Adjust strategies in subsequent FMPs
	1.1.2.2 Maintain integrity of sensitive sites	Sensitive sites (e.g. mineral licks, major game trails) by DFA	Protect and report on all identified sites.	Local knowledge, Indigenous Traditional Knowledge, FHPs, ACIMS, ABMI	Planning Standard	Organization developed standards for sensitive site protection, OGRs 7.7.4	Forest Harvest Plans	**Performance:** Stewardship Reports summarizing performance.	None	Adjust strategies in subsequent AOPs and FHPs
	1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings	Forestry water crossings in compliance with Code of Practice for Water Course Crossings within the DFA.	Zero non-compliance assessments for the Code of Practice of OGR's for water course crossings.	Code of Practice for Water Course Crossings: Sections 7, 9 and Schedule 2	Code of Practice for Water Course Crossings	Road construction, maintenance and reclamation activities	Road plan OGR 11.2	**Performance:** Stewardship Reports: number of crossings by type that received a non-compliance assessment.	None	Act immediately to eliminate problems and adjust strategies in subsequent FHPs

[10] Downed woody debris: wood lying at an angle of less than 45 degrees from the ground and having a diameter greater than 7.5 cm.

CSA SFM Element 1.2 Species Diversity: Conserve species diversity by ensuring that habitats for the native species found in the DFA are maintained throughout time										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
1.2.1 Viable populations of identified plant and animal species	1.2.1.1 Maintain habitat for identified high value species (i.e., economically valuable, socially valuable, species at risk, species of management concern)	a) Number of hectares of primary and secondary habitat from the fRI Grizzly Bear habitat state model, as measured at time 0 (May 1, 2017) by DFA; b) Percent change in the Barred owl potential breeding pairs and Resource Selection Function (RSF) value from May 1, 2017 by DFA; c) Percent change in American marten habitat suitability index from May 1, 2017 by DFA; d) Percent change in relative abundance value of five songbird species (Canada Warbler, Black-throated Warbler, Brown Creeper, Ovenbird and Varied Thrush from May 1, 2017 by DFA; and e) Cold water fish species: Using Equivalent Clearcut Areas (ECA) as a surrogate to predict and mitigate potential impacts of harvesting to cold water fish species habitat.	a) Maintain or increase the number of hectares of primary and secondary habitat from the fRI Grizzly Bear habitat state model, as measured at time 0; b) Maximum 15% reduction in the breeding pairs indicator over the 200-year planning horizon and maximum 15% reduction in the RSF indicators over the 200-year planning horizon; c) Maximum 15% reduction in the indicator over the 200-year planning horizon; d) Maximum 15% reduction in the indicator over the 200-year planning horizon; and e) ECA target in bull trout watersheds (i.e. watershed that have adult density scores FSI≥1) is ≤30%. No watersheds should have an ECA that exceeds 50%. In watersheds that are identified as sensitive (i.e. presence of Class A or B water as per the CoP) ECA will be <30%. In watersheds that have an ECA >30% in time 0 then ECA values must demonstrate a continuous downward trend or not exceed 35% in years 0-20.	Habitat models (provided by the Government of Alberta (GoA)). Based on sound science, ecological considerations, wildlife zones, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) list, provincially listed species, ABMI, ACIMS, Recovery plans, government priorities, public consultation, habitat suitability analysis, literature review, observation data, local and Indigenous Traditional Knowledge	Recovery plans for species at risk, Federal Species at Risk Act	Harvesting plans, road construction, OGR, planning and implementation, adherence to provincial wildlife guidelines Adhere to the Spatial Harvest Sequence	Periodic updates to forest inventory and habitat modelling	**FMP**: a) Table and maps of current (time zero) and future (10 and 20 years) landscape condition for Core and Secondary habitat zones, including the total hectares of secondary source, primary source, non-critical, secondary sink and primary sink habitat states within each Grizzly Bear Watershed Unit. b) Tables of breeding pairs and RSF at 0, 10, 20, 50, 100 and 200 years and maps of RSF value and breeding pairs at 0, 10, 20 and 50 years; c) Tables of habitat suitability at 0, 10, 20, 50, 100 and 200 years and maps of habitat suitability at 0, 10, 20 and 50 years; d) Tables of relative abundance at 0, 10, 20, 50, 100 and 200 years and maps of relative abundance at 0, 10, 20 and 50 years; and e) Document effort made to modify SHS sequence to reduce ECA in FMP development. Tables and maps of current (time zero) and future (10, 20 years, etc.) watershed condition showing both increasing ECA and areas where ECAs are >30% at time zero decreasing over time. **Performance:** 10 year - Stewardship Report (Compare time 0 of previous FMP to CLB of new FMP)	At the end of the 10- year FMP term the target is achieved or exceeded <20% SHS variance	Adjust strategies in subsequent FMP

CSA SFM Element 1.3 Genetic Diversity: Conserve genetic diversity by maintaining the variation of genes within species										
Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1.3.1 Genetic integrity of natural tree populations	1.3.1.1 Retain "wild forest populations[11]" for each native tree species in each seed zone through establishment of in-situ reserves by Alberta and timber disposition holders	The appropriate Number and area (ha) of in-situ genetic conservation areas as directed by the FGRMS (2016).	To be managed by FMA holders (cooperators in Controlled Parentage Programs) in accordance with the Gene Conservation Plan for Native Trees of Alberta and assessments by Alberta on sufficiency of existing reserves to meet conservation requirements.	Direction and detail as per FGRMS (2016) Section 20.0 "In-Situ Gene Conservation", in consultation with the other associate FMA holders and GoA.	Standards regulated through Timber Management Regulation (TMR) 144.2(1), the FGRMS (2016) and GoA.	Field reconnaissance or survey to locate appropriate in-situ tree gene conservation reserves on the ground. Establish protective notation to identify in-situ tree gene conservation reserves in land standing records, and management plan to protect genetic resources.	Within each FMP planning and Stewardship Report, determine the status of all existing and planned in-situ reserves.	FMP: Table and map showing number and location of genetic conservation areas required in each seed zone and number provided in DFA, as agreed to by the CPP owners and GoA. Performance: Stewardship Reports showing status updates	At the end of the 10-year FMP term the target is achieved or exceeded.	GoA will direct any required amendments or adjustments to targets
	1.3.1.2 Retain wild[12] forest genetic resources through *ex-situ* conservation for species under CPP programs.	Number of provenances, families and clone in trials and clone banks; and seed in the seed archive.	Establish and maintain active ex-situ conservation program for species under CPP programs in cooperation with GOA and in accordance with FGRMS.	Adequacy of the ex-situ conservation program to capture a representative sample of wild tree genetic resources in ex-situ gene archives.	TMR 144.2(1) as directed by FGRMS (2016) and consultation with GoA	FGRMS (2016) and GoA/Industry Genetics Cooperatives Seed collections, clone banking and establishment of genetic lines in genetic trials.	Conservation activities identified in FMP as per FGRMS (2016)	FMP: Reporting of any existing genetic tests in the field as per ex situ requirements in FGRMS section 29, page 29. Performance: Stewardship Reports showing status updates.	No variance from targets as set by GoA is anticipated, but, adjustment to targets and objectives are allowable as more research and development bring new data and parameters forward	GoA will direct any required amendments or adjustments to targets

CSA SFM Element 1.4 Protected Areas: Respect protected areas identified through government processes										
Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1.4.1 Areas with minimal human disturbances within managed landscapes	1.4.1.1 Integrate trans boundary values and objectives into forest management	Stakeholder consultation	Ongoing consultation with relevant protected areas agencies when operations are adjacent to protected areas.	Forest Harvest Plans	Planning Standard	Operational Planning; Forest Harvest Plans	Documentation of consultation processes	Performance: Stewardship Reports. Summary of consultation activities with protected area agencies.	None	Adjust strategies in subsequent FMP

[11] Wild: genetic materials of native species originating from natural regeneration (FGRMS (2016)).
[12] Wild: genetic materials of native species originating from natural regeneration (FGRMS (2016)).

CCFM Criterion 2. Ecosystem Productivity										
CSA SFM Element 2.1 Ecosystem resilience										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
2.1.1 Reforested harvest areas	2.1.1.1 Reforest all harvested areas	Annual % of openings that: a) meet or exceed the Reforestation Standard of Alberta (RSA) establishment survey minimum stocking and species composition standards for the declared regenerated yield stratum; b) meet or exceed the RSA establishment survey minimum stocking and species composition standards for an alternate regenerated yield stratum; and c) do not achieve the RSA establishment survey minimum stocking and/or species composition standards for any regenerated yield strata and are re-treated within one year. Indicators a, b and c are to be reported separately	The sum of Indicators a, b and c = 100% of openings	Direction from Alberta	TMR 141.6(1) and 141.6(2); RSA	Implementation of silviculture strategies that ensure the target stocking and species composition is achieved for the opening	RSA establishment survey protocols	**Performance**: Annual ARIS reporting, Silviculture AOP, Stewardship Reports summarizing ARIS reports of A, B & C	None	Adjust silviculture strategies
2.1.1 Reforested harvest areas	2.1.1.2 Meet or exceed the C and D Mean Annual Increment (MAI) standard for the population of openings surveyed in each quadrant by the end of the 5th year of the FMP	Summed difference between target and actual C and D MAIs for openings surveyed in a five-year quadrant, as reported to ARIS	100% of target	Direction from Alberta	TMR 141.7(1) and 141.7(2); RSA	Implementation of silviculture strategies that ensure the target productivity is achieved for the population of openings	RSA performance survey protocols	**Performance**: **FMP**: MAI targets by yield group ARIS, AOP, Forest Management Branch, Stewardship Reports comparing RSA MAI results for C& D and forecasted targets by yield group.	Meet or exceed the target C and D MAI for the DFA	Adjust silviculture strategies

Value	Objective	Indicator	Target	Means to Identify Target	Legal / Policy Requirements	Means of achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
2.1.2 Maintenance of forest landbase	2.1.2.1 Recognize conversion of productive forest landbase to other uses	Amount of change in forest landbase	Report losses of forested landbase area	Forest inventory and land use data	Planning Standard	Monitor impacts and report losses to forested landbase	Periodic updates to forest inventory; GoA tracking of withdrawals and cancellations by FMA	**Performance**: Stewardship Reports of additions and deletions to the gross forest landbase	Report actual	Adjust net landbase projections in next TSA
	2.1.2.2 Recognize lands affected by insects, disease or natural events	Amount of area affected	Report the area (ha) affected by significant (>100ha) outbreaks, infestations, natural event (excluding fire)	GoA forest health surveys, forest inventory updates.	Planning Standard, Alberta Forest Health Strategy and Shared Roles and Responsibilities between GoA and the Forest Industry	Maintain up-to-date information	GoA Annual surveys, forest Inventory updates	**Performance**: Stewardship Reports summarizing impact of known events.	Report actuals	Event specific
2.1.3 Control invasive species	2.1.3.1 Control non- native plant species (weeds)	Invasive weed program	Suppression of invasive weeds.	Weed Management in Forestry Operations Directive 2001-06	Weed Management in Forestry Operations Directive 2001-06	Weed Management in Forestry Operations Directive 2001-06	Field surveys & observations	**Performance**: Stewardship Report summary of invasive weed control efforts	none	Suppression of invasive weeds.
CCFM Criterion 3. Soil and water										
CSA SFM Element 3.1 Soil quantity and quality										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
3.1.1 Soil productivity	3.1.1.1 Minimize impact of roading and bared areas in forest operations	Silviculture strategies include tactics to reforest temporary harvest roads.	Less than 5% road disturbance	Direction from Alberta	OGRs and Soils Guidelines	Planning and supervision of operations as per the silviculture strategy table.	Field inspection reports and audits	**Performance**: Final Clearance Inspection reporting, FOMP reporting, AOP, Stewardship Reports	None	Immediate remedial action to correct
	3.1.1.2 Minimize incidence of soil erosion and slumping	Incidence of soil erosion and slumping	Zero non-compliance assessments regarding soil erosion or slumping.	Direction from Alberta	OGRs and Soils Guidelines	Planning and supervision of operations and adherence to relevant OGRs	Field inspection reports and audits	**Performance**: Inspection reporting, Stewardship Reports summary of incidents of non-compliance	None	Immediate remedial action to correct

CSA SFM Element 3.2 Water quantity and quality										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
3.2.1 Water quantity	3.2.1.1 Limit impact of timber harvesting on water yield	Forecast impact of timber harvesting on water yield. Forecasted changes in water yields resulting from the approved SHS, as measured by Equivalent Clearcut Area (ECA)	ECA = <30%[13] (Equivalent Water yield = 15%) Zero Water Act penalties.	Equivalent Clearcut Area (ECA) water yield modelling	Water Act, Planning Standard	Follow the SHS.–FHP will identify mitigative actions for watersheds (30-49% ECA)	Spatial Harvest Sequence variance reporting.	**Performance**: Stewardship Report summarizing SHS variance and Water Act penalties	< 20 percent SHS variance	Adjust strategies in the next FMP
3.2.2 Effective riparian habitats	3.2.2.1 Minimize impact of operations in riparian areas	Riparian buffers maintained as outlined in OGRs	Zero non-compliance assessments regarding riparian buffers.	Direction from Alberta	OGRs	Planning and supervision of operations	Stewardship Reports, Block Monitoring reports and GoA FOMP reporting	**Performance**: FHP, Stewardship Report summary of non-compliance assessments for riparian buffers.	None	Immediate correction and / or administrative penalty
CCFM Criterion 5. Multiple Benefits to Society										
CSA SFM Element 5.1 Timber and non-timber benefits										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
5.1.1 Sustainable timber supplies	5.1.1.1 Establish appropriate AACs	Process described in Annex 1 is followed and standards are met	Complete compliance	Preferred Forest Management Strategies and Timber Supply Analysis form the Spatial Harvest Sequence (SHS).	Forests Act and TMR; Planning Standard	Implementation of planning standard.	Multiple means: Timber Production and Revenue System (TPRS), ARIS, AOPs, Stewardship Reports, filed inspection	**Performance**: 5 year - Stewardship Report (None) 10 year - Stewardship Report (Compare time 0 of previous FMP to CLB of new FMP)	Issue specific	Adjust AAC using most current and relevant information

[13] Watersheds along the boundary less than 500ha will not be assessed. GoA direction 04192018 email.

CSA SFM Element 5.2 Communities and Sustainability										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
5.2.1 Risk to communities and landscape values from wildfire is low.	5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability	a) Percentage reduction in Fire Behaviour Potential area (ha) within the FireSmart Community Zone b) Percentage reduction in Fire Behaviour Potential area (ha) across the DFA now and over the planning horizon	a) Reduce the area in the high, very high and extreme Fire Behaviour Potential rating within FireSmart Community Zones by 2,375 ha in decades 1 and 2. b) Reduce the area in the high, very high and extreme Fire Behaviour Potential rating across the DFA by 79,814 ha in decades 1 and 2.	Fire Behaviour Potential and Fuel Grid Assessment (Annex 3 Report Provided to FMA Holder) FMA Holder assessment of the SHS developed using recommendations from Annex 3 Report	Planning Standard	SHS, thinning, partial harvest techniques, prescribed burns, FireSmart Treatments	AOPs, Compartment Assessments	**FMP**: Maps Fire Behaviour Potential, Fuel Grid, Historical Wildfires and Natural Sub regions. **Performance**: Stewardship Reports - Report on actual harvested area a) and b)	Issue specific	Adjust harvest sequence
5.2.2 Provide opportunities to derive benefits and participate in use and management	5.2.2.1 Integrate other users and timber management activities	Extent of various uses	To be determined in the planning process	Consultation and co- operation	Legislation and policy	Implementation of plans	FHPs, Compartment Assessments	**Performance**: Stewardship Report summary of activities and outcomes	none	Adjust activities
5.2.3 Forest Productivity	5.2.3.1 Maintain Long Run Sustained Yield Average	Regenerated stand yield compared to natural stand yield	No net decrease from the natural stand strata yields	FMP, TSA	Planning Standard	Implementation of plans	Stewardship Report	**Performance**: TSA FMP: summary of LRSY 10 year - Stewardship Report (Compare time 0 of previous FMP to CLB of new FMP)	Report actual	Adjust strategies in the next FMP AAC using most current and relevant information

CCFM Criterion 6. Accepting society's responsibility for sustainable development										
CSA SFM Element 6.1 Aboriginal and treaty rights and aboriginal forest values										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
6.1.1 Compliance with government regulations and policies	6.1.1.1 Implement Indigenous Consultation Process	Meet Alberta's current expectations for Indigenous consultation	Consult at the community level with designated representatives of affected Indigenous communities	The Government of Alberta's Guidelines on Consultation with First Nations on Land and Natural Resource Management	Planning Standard	Implementation of Indigenous Consultation Process	Consultation logs	**Performance**: Stewardship Reports summary of Indigenous consultation activities.	None	Adjust activities
	6.1.1.2 Exercise of Treaty and Indigenous rights on the DFA.	First Nation and Metis gathering and cultural sites	Protect all site-specific traditional sites identified during any consultation process or shares by the First Nation or Metis Community.	First Nation and Metis Settlement Consultation	Alberta's First Nation and Metis Settlement Consultation guidelines	Implementation of Alberta's First Nation and Metis Settlement consultation requirements.	Consultation logs	Stewardship report (5year) summarizing a list of any disturbed sites.	None	Adjust strategy to reflect GoA direction.
	6.1.1.3	Maintain healthy First Nation and Metis community relationships	A) Increase company leadership awareness of Indigenous people within the communities in which we operate B) Increase the pool of indigenous candidates that meet the present & future workforce needs C) Support contract opportunities that are mutually beneficial D) Support Indigenous community initiatives and events	A) Indigenous Awareness training for leadership; TLU camps B) Support aboriginal hiring and recruitment events (Career Fairs, Open Houses) C) Engage in discussions that may lead to business opportunities with an Indigenous group D) Engage local Indigenous leaders outside of consultation; support/ participate in Indigenous community events.	Company policy for Building Mutually Beneficial Relationships with Indigenous communities	Relationship agreements, relationship meetings, meetings between industry and community leaders	Consultation logs; scorecards, meeting notes	**Performance**: Stewardship Report summary of activities and outcomes	None	Adjust activities
CSA SFM Element 6.2 Public participation and information for decision-making										
Value	**Objective**	**Indicator**	**Target**	**Means to Identify Target**	**Legal / Policy Requirements**	**Means of achieving Objective and Target**	**Monitoring and Measurement**	**Reporting**	**Acceptable Variance**	**Response**
6.2.1 Meaningful public participation is achieved	6.2.1.1 Implement Public Involvement Process	Opportunities provided for public input into the FMP, GDP and AOP.	Provide opportunities for public involvement into forest management plans and operational plans.	Public Involvement Process	Section 5 of CSA Z809-02 Planning Standard	Implementation of Public Involvement Process. Annual Open House; Annual stakeholder engagement	Documentation of activities	**Performance**: Stewardship Report summary of activities and outcomes	None	Adjust activities

Weyerhaeuser Forest Management Plan

Annex IX: Non-Timber Assessments for the Baseline Scenario #8109

AUTHOR: Jeremy Hachey, RPF

DATE: July 22, 2019

REVISION DATE: August 22, 2019

2019

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

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1. Introduction

This report summarizes the results of the Non-timber Assessments associated with the Baseline Timber Supply Analysis (TSA) Scenario #8109 (unaccelerated) conducted in support of the FMP process.

The Government of Alberta (GoA) provided a package of scripts and tools to assist Weyerhaeuser in undertaking a non-timber assessment for its 2019 Forest Management Plan (FMP). Values, Objectives, Indicators, and Targets (VOITS) were developed using these metrics as benchmarks to assess potential change over the Defined Forest Area (DFA).

The tools were provided to generate preliminary assessments for the following indicators:

- Old and Very Old Seral (Objective 1.1.1.1)
- Patch Size (Objective 1.1.1.2a)
- Old Interior (Objective 1.1.1.2b)
- Grizzly Bear (Objective 1.2.1.1a)
- Barred Owl (VOIT 1.2.1.1b)
- Marten (VOIT 1.2.1.1c)
- 5 Songbird Species (VOIT 1.2.1.1d):
    - Brown Creeper
    - Black-throated Green Warbler
    - Canada Warbler
    - Ovenbird; and
    - Varied Thrush
- Watersheds (VOIT 1.2.1.1e and VOIT 3.2.1.1)

Non-timber assessments can be applied as two ways: the snapshot and the Timber Supply Analysis (TSA) Integration approach.

The snapshot approach uses forest conditions at a given time period, either now or sometime in the future (e.g. after the 20-year SHS is complete), to assess the non-timber metrics given the forest conditions at that time. The intent is to quantify the relative change in non-timber metrics resulting from changes in forest conditions over the time between the two snapshots.

The Timber Supply Analysis (TSA) Integration approach uses age-dependant curves to integrate into the timber supply model. This allows change assessments to occur 'on-the-fly' during timber supply modeling. Also, because the timber supply model tracks these metrics as features, controls can be applied to features in the model so that model scheduler can influence harvest scheduling to ensure non-timber metrics are not unduly compromised.

Currently, the GoA tools only support the snapshot approach for the barred owl, whereas both the snapshot and TSA integration are available for pine marten, songbirds, and watershed assessment tools.

2. Approach / Methodology

2.1 *Seral Retention Targets (VOIT 1.1.1.1)*

Managing for landscape level biodiversity is achieved by retaining target amounts of seral representation by 5 distinct forest cover classes. Accounts and features were constructed in the forest estate model to dynamically keep track of the amount of classified and contributing forest in a young seral (<20 years) state, mature seral (80-120 years) as well as in an old (> 120 years) and very old (> 180 years) seral state for each of the five cover classes; Pine-dominated conifer (Cx-Pl), Spruce-dominated conifer (Cx-Sw), other-conifer dominated (Cx-Sb/Lt/Fd), mixedwood-dominated (MW), deciduous-dominated mixedwood (DC), and deciduous-dominated stands (Dx). Targets were set for both the contributing net landbase as well as the total classified forested landbase (Table 1).

Table 1 Active Seral Targets for Contributing and Classified Land Base by Cover Class and Seral Stage

Cover Class	Contributing			Classified		
	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)
Pine-dominated conifer (CxPl)	46	2.5	16.5	31	4	18
Spruce-dominated conifer (CxSw)	37	2	7.5	27.5	3.5	26
Other Conifer Dominated (Cx-Sb/Lt/Fd)	46	1.5	15	9	1	35.5
Mixedwood stands (MW)	46.5	1.5	3.5	40	3	13.5
Deciduous Dominated (DX)	38.5	1.5	3.5	31.5	2.5	3.5

2.2 *Patch Size (VOIT 1.1.1.2a)*

A patch is defined as a stand of forest in the same seral stage and not split by a linear feature greater than 8m wide. The Values, Objectives, Indicators and Targets (VOITs) table specified targets for 5 patch size classes (Table 2). To actively control patch size distribution in the TSA, a patch account was created in the Patchworks model for young seral class (<20 years old) using a topology distance of 8m.

Table 2 Young Seral Patch Size Targets

Patch Size Class	Target
0-5 ha	Maximum of 5%
6-19 ha	Maximum of 20%
20-99 ha	Maximum of 50%
100-250 ha	Minimum of 15%
>250 ha	Minimum of 10%

2.3 *Old Interior Forest (VOIT 1.1.1.2b)*

Interior forest is a forested area greater than 100 hectares in size located beyond edge effect buffer zone along a forest edge and not split by a linear feature greater than 8m wide. The edge effect buffer zone is 60m where adjacent is non-forested or <40 years old, 30 m where adjacent forest is >= 40 years and less than mature seral age definition (80 year), and 0 m where the adjacent forest is mature or older (>80 years). This metric is not dynamically kept of track within the timber supply model and is instead calculated post-scenario completion using a python script for the respective future time periods (0, 10, 20, and 50 years into the future).

2.4 *Grizzly Bear Habitat States (VOIT 1.2.1.1a)*

The FRI Grizzly Bear Research Program produced a package that included, among other models, the 2018 Habitat States Model. This model was used to generate current habitat metrics for Grizzly Bear within the G16 FMU. It is a combination of the Grizzly RSF and mortality risk models. Positive values generated are considered potential sources of primary and secondary habitat while negative values indicate potential sinks (i.e., areas where mortality risks are greater). A value of 0 indicates non-critical habitat.

The Area of Interest (AOI) was the area intersecting the Grizzly Bear zone and the DFA, and to ensure the appropriate coefficients were used the Grande Cache population was selected. Since the inventory surface available was current only to 2018, newer cutblocks were used to reflect harvesting since 2018 and a value of 1 years was then assigned in the Forecast Age dialogue to forecast crown closure attributes for regenerating cutblocks for the current snapshot. No other optional user inputs were used (i.e., New pipelines, new roads, reclaimed roads, and deletions).

For future scenarios, the spatial harvest sequence produced from the timber supply scenario were used as development inputs for future time periods (0, 10, and 20 years from 2019) and the respective start years were used as inputs (1, 11, 21 years for 2019, 2029, and 2039, respectively).

2.5 *Barred Owl (VOIT 1.1.2.1b)*

The Barred Owl Model is a Resource Selection Function (RSF) model based on the MSc Thesis[1] work done by Mike Russell. The habitat metric (value) produced by this model is proportional to the probability of use for a resource unit. Barred owl are more likely found in areas with higher values. The model requires 5 variables to determine the habitat suitability metric, as described below:

MODEL = Exp((0.442 * [UPSW]) - (.057 * [UPSW] * [UPSW]) + (0.408 * [HW]) - ([HW] * [HW] * 0.028) + (0.222 * Ln([ATOP] + 1)) + (0.152 * Ln([DISTOPEN] + 1)) - (0.104 * Ln([DISTOLD] + 1)) - 3.862)

Where:

- UPSW - Proportion of upland softwood within 150m (multi-stand)
- HW - Proportion of hardwood within 150m (multi-stand)
- ATOP - Area to perimeter ratio of all contiguous older stands (>30 years old)
- DISTOPEN – Euclidean distance to nearest patch <30 years old
- DISTOLD – Distance to nearest stand older than 89 years

[1] Russell, M.S. 2008. Habitat selection of barred owls (*Strix varia*) across multiple spatial scales in a boreal agricultural landscape in north-central Alberta. MSc Thesis. University of Alberta (Canada)

The GOA has not yet developed its approach for incorporating barred Owl RSF tracking into a timber supply model. The snapshot Barred Owl Model uses spatial analyst tools to create proximity metrics (Euclidian Distance) raster features to calculate the relative importance of habitat. These distance metrics cannot be easily calculated dynamically within a timber supply model. Thus, the only way to assess barred owl habitat changes over time is to conduct future 'snapshots' using an AVI that reflects projected growth and disturbances. The Foothills coefficients were used to run these future snapshots at 0, 10, 20, 50, 100, 150, and 200 years from now using age attribute tables produced by the timber supply model and linked to the original input planning file.

2.6 *American Marten (VOIT 1.1.2.1c)*

Marten Habitat Suitability Index is a numerical index that represents the capacity of a given habitat to support Marten; in this case, winter habitat (cover and foraging). Higher values mean that the habitat can support more Marten. The GoA has provided methodology (Appendix H of Non-Timber Assessments in Forest Management Planning) to assist in developing marten HSI curves to dynamically track and report habitat suitability indices directly in the forest estate model. The methodology requires age-height curves to be converted into marten HSI-age curves using the following formula:

$$HSI = S4 * \sqrt{S1 * S2 * S3}$$

Where:

S1 is a value between 0 and 1 assigned based on percent tree canopy closure

S2 is a value between 0 and 1 assigned based on percent spruce + fir in the tree canopy

S3 is a value between 0 and 1 assigned based on tree canopy height

S4 is a value between 0 and 1 assigned based on percent pine + spruce + fir in the tree canopy

These relationships are depicted graphically in Figure 1. HSI calculations result in values between 0 and 1 (inclusive) depending on the four variables above.

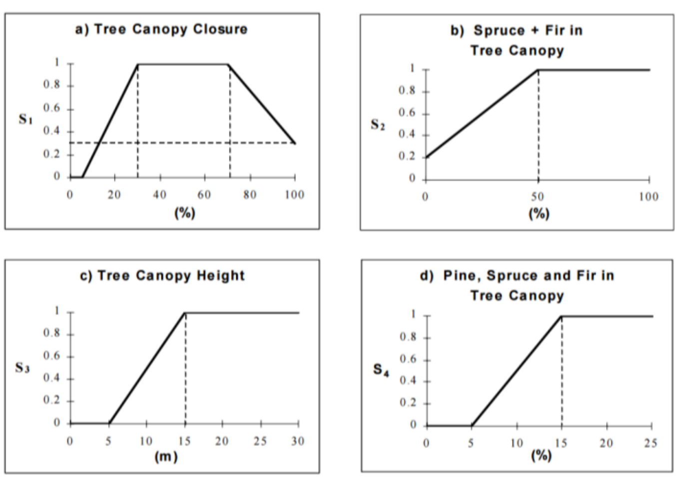


Figure 1 Relationships between habitat variables and HSI components in the marten model (from Takats et al. 1999[2])

[2] Takats, L, Stewart, R., Todd, M., Bonar, R., Beck, J., Beck, B., Quinlan, R., 1999. American Marten: Habitat Suitability Index Model v5. Edmonton, AB

2.7 *Songbirds (VOIT 1.1.2.1d)*

Resource Availability (RA) values for 5 songbird species commonly found in Alberta was integrated into the forest estate model: Canada Warbler, Brown Creeper, Black-Throated Green Warbler, Ovenbird, and Varied Thrush.

The GoA provided songbird RA – Age curves that were incorporated directly in the timber supply model. The curves were mapped to the company-specific yield curve strata (option 2 of step 3 of Appendix F in the document "Non-timber Assessments in Forest Management Planning"). To generate RA map snapshots that resemble the raster output from the provided snapshot tools, stand level RA values were normalized by the polygon areas.

2.8 *Watersheds / Fisheries (VOIT 1.1.2.1e / 3.2.1.1*

A watershed assessment is required under the ABFMPS in the timber supply analysis section (Section 5.9.13) and VOIT Objectives 1.1.2.1e and 3.2.1.1. The purpose of watershed assessment is to:

1. Determine the potential for water yield increases that would result from forest harvesting
2. Use Equivalent Clearcut Area (ECA) as a measure of disturbance and an indicator of potential water yield increase.
3. Constrain, using timber supply analysis, forestry operations to minimize the potential for adverse changes in water yields.

Provincial hydrologic recovery curves and coefficients developed by GoA were used to incorporate ECA curves into the model so that ECA could be tracked and controlled within the timber supply model. Current permanent anthropogenic disturbance outside the classified forest for each watershed was calculated and added to the ECA values reported by the model (which only contains classified forest).

3. Results

The following sections provide results of the Non-Timber elements specified in the final version of the VOITs table associated with the forecasted future condition of the Baseline Scenario #8109 (unaccelerated).

3.1 *Seral Retention (VOIT 1.1.1.1a) – Contributing*

3.1.1 Young (<20 years)

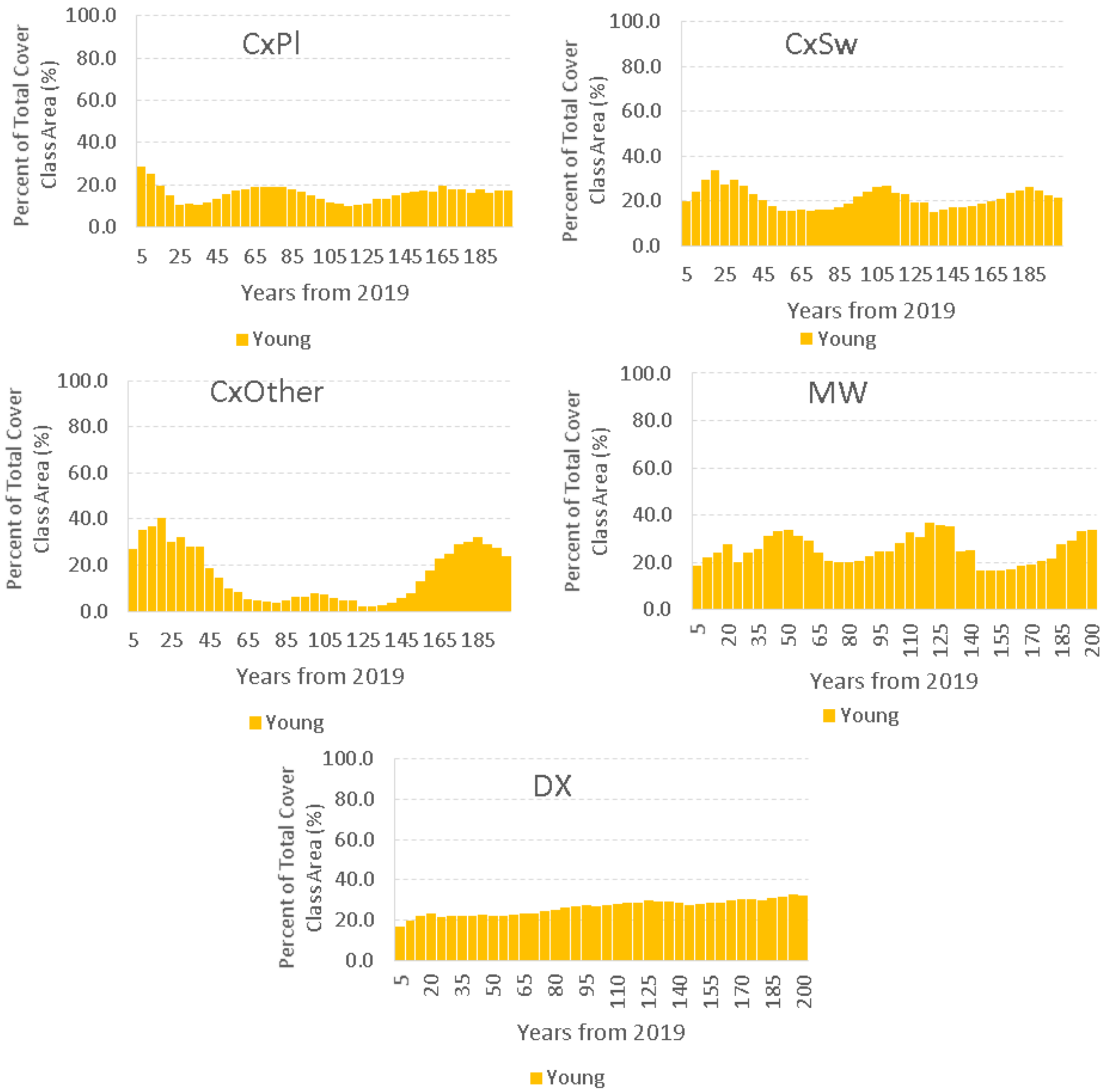


Figure 2 Young Seral on the DFA Contributing Land base by Cover Class

Table 3 Maximum proportion (%) of Young Seral by Cover Class on the Contributing Landbase

Cover Class	Maximum Young Proportion (%)	Target Maximum Proportion (%)
CxPl	29.6	46.0
CxSw	33.4	37.0
CxOther	40.7	46.0
MW	36.7	46.5
DX	32.7	38.5

3.1.2 Mature (80-120 years)

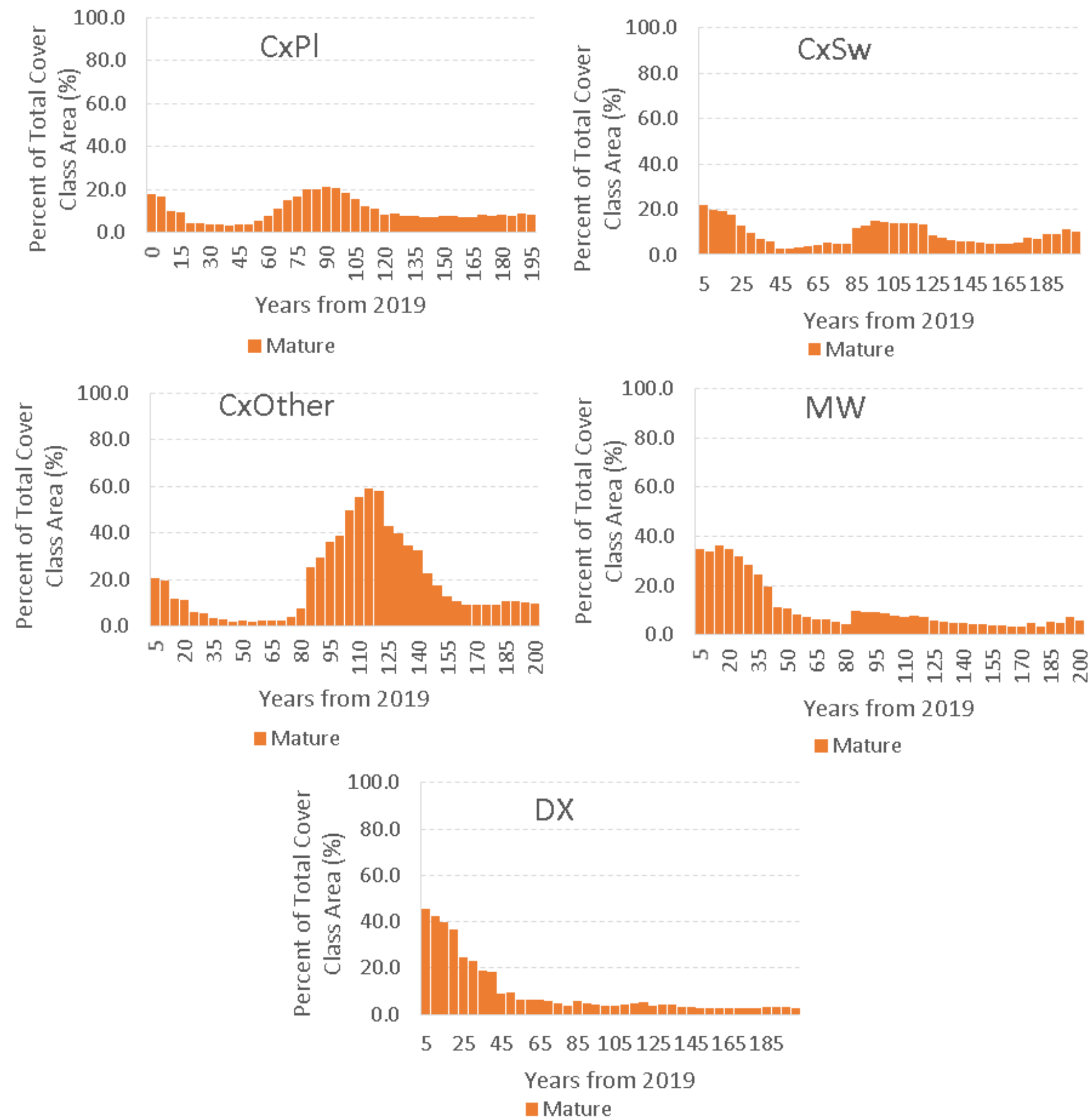


Figure 3 Mature Seral on the DFA Contributing Land base by Cover Class

Table 4 Minimum proportion (%) of Mature Seral by Cover Class on the Contributing Landbase

Cover Class	Minimum Mature Proportion (%)	Target Minimum Mature Proportion (%)
CxPl	3.2	2.5
CxSw	2.4	2.0
CxOther	2.0	1.5
MW	3.4	1.5
DX	2.5	1.5

3.1.3 Old+Very Old (>120 years)

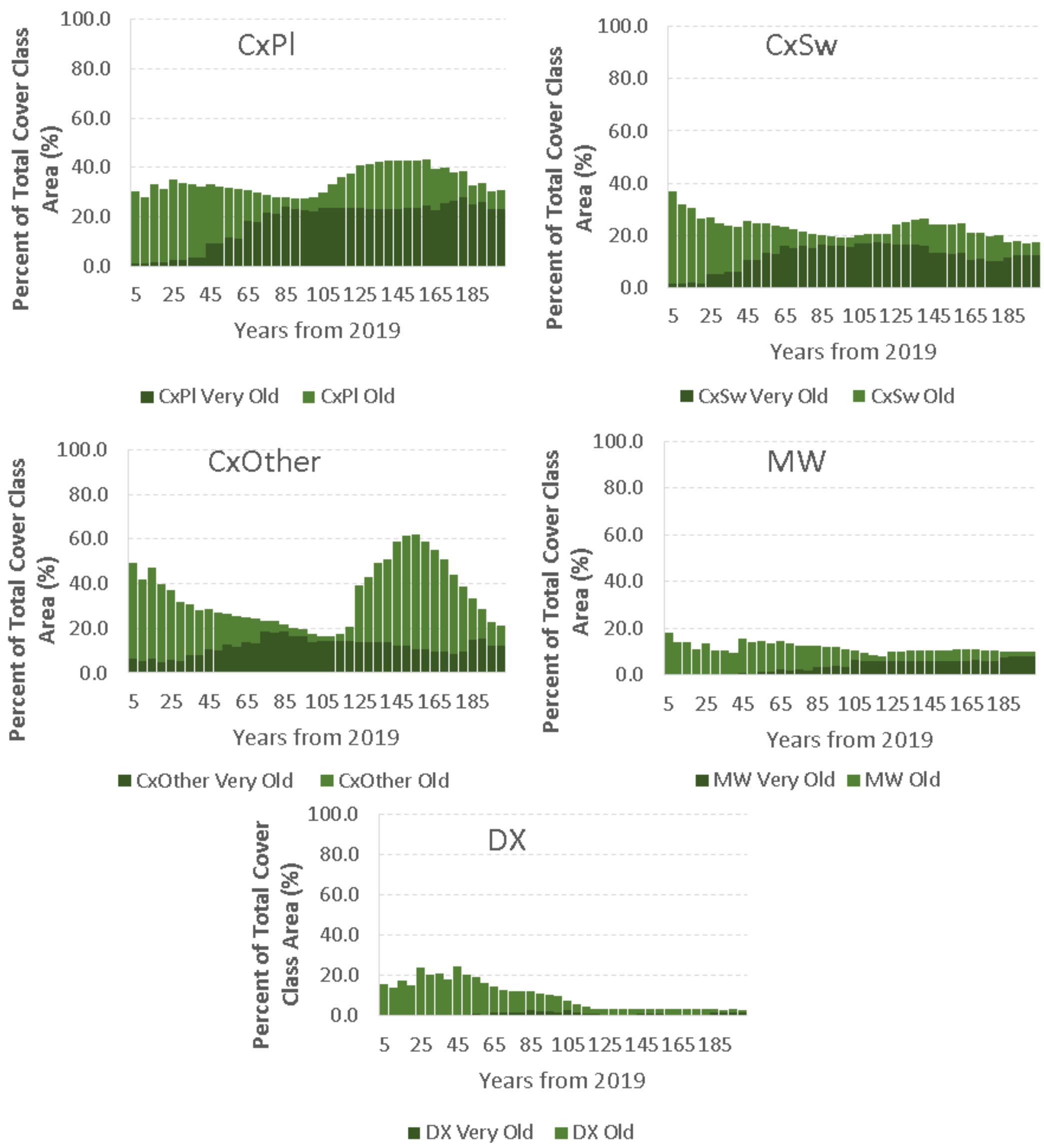


Figure 4 Old + Very Old Seral on the DFA Contributing Land base

Table 5 Minimum proportion of Old + Very Old by Cover Class on the FMA Contributing Landbase

Cover Class	Minimum Old+Very Old Proportion (%)	Target Minimum Old+Very Old Proportion (%)
CxPl	20.2	16.5
CxSw	17.1	7.5
CxOther	16.3	15
MW	8.1	3.5
DX	3.0	3.5

3.2 *Seral Retention (VOIT 1.1.1.1b) – Classified*

3.2.1 Young (<20 years)

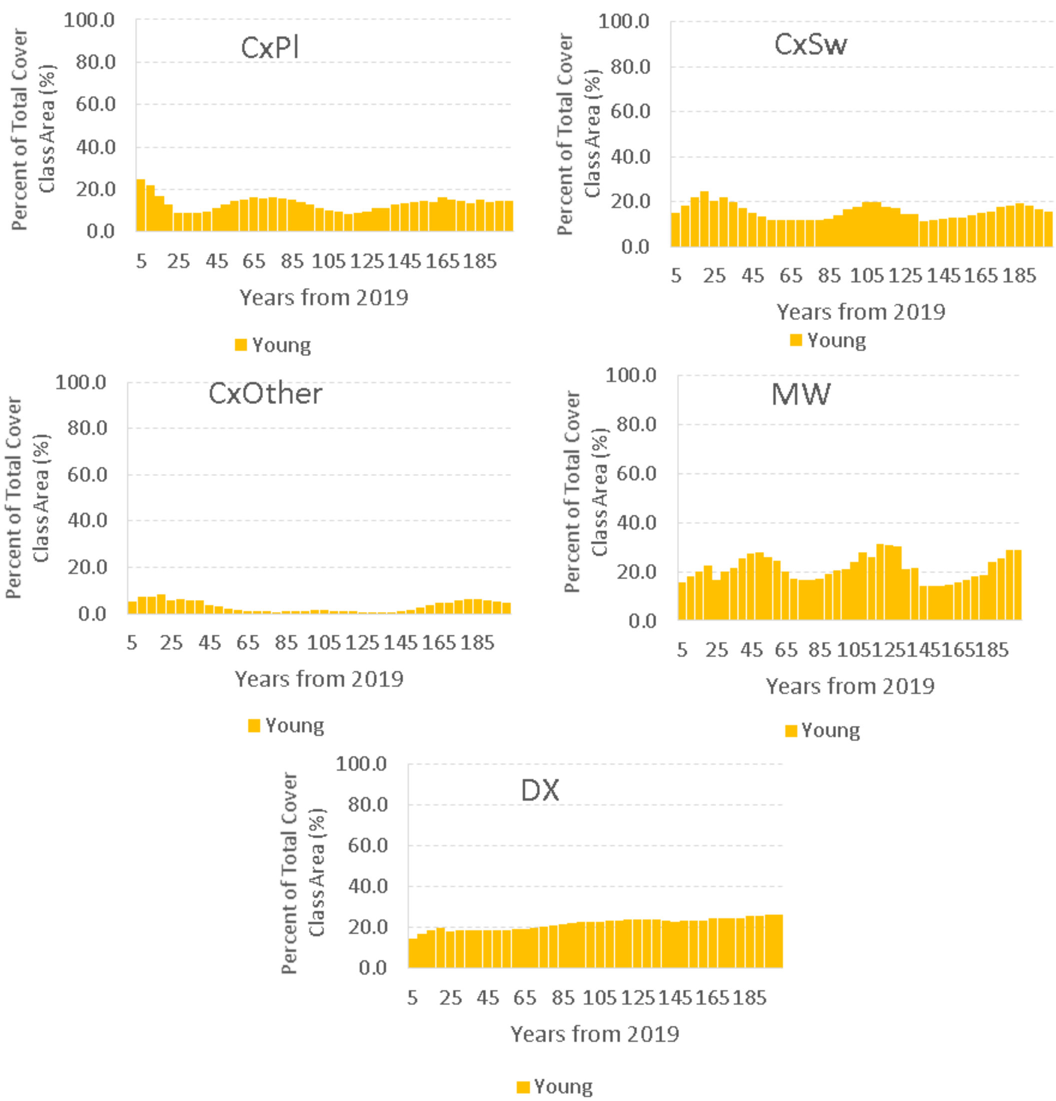


Figure 5 Young Seral on the DFA Classified Land base by Cover Class

Table 6 Maximum proportion (%) of Young Seral by Cover Class on the Classified Landbase

Cover Class	Maximum Young Proportion (%)	Target Maximum Proportion (%)
CxPl	26.2	31
CxSw	24.8	27.5
CxOther	8.1	9
MW	31.4	40
DX	26.5	31.5

3.2.2 Mature (80-120 years)

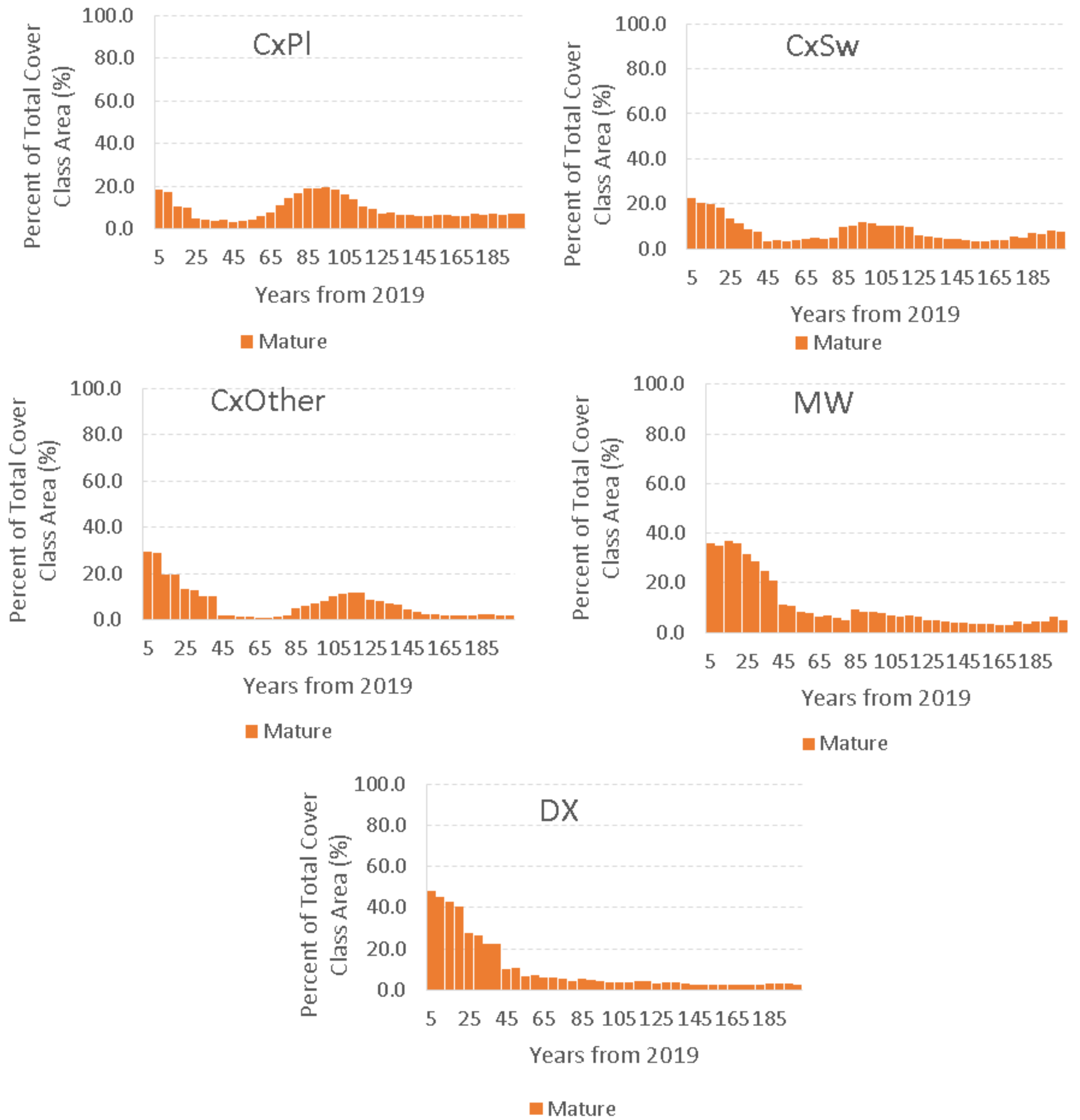


Figure 6 Mature Seral on the DFA Classified Land base by Cover Class

Table 7 Minimum proportion (%) of Mature Seral by Cover Class on the Classified Landbase

Cover Class	Minimum Mature Proportion (%)	Target Minimum Mature Proportion (%)
CxPl	3.3	4.0
CxSw	3.3	3.5
CxOther	0.9	1.0
MW	3.0	3.0
DX	2.5	2.5

3.2.3 Old+Very Old (>120 years)

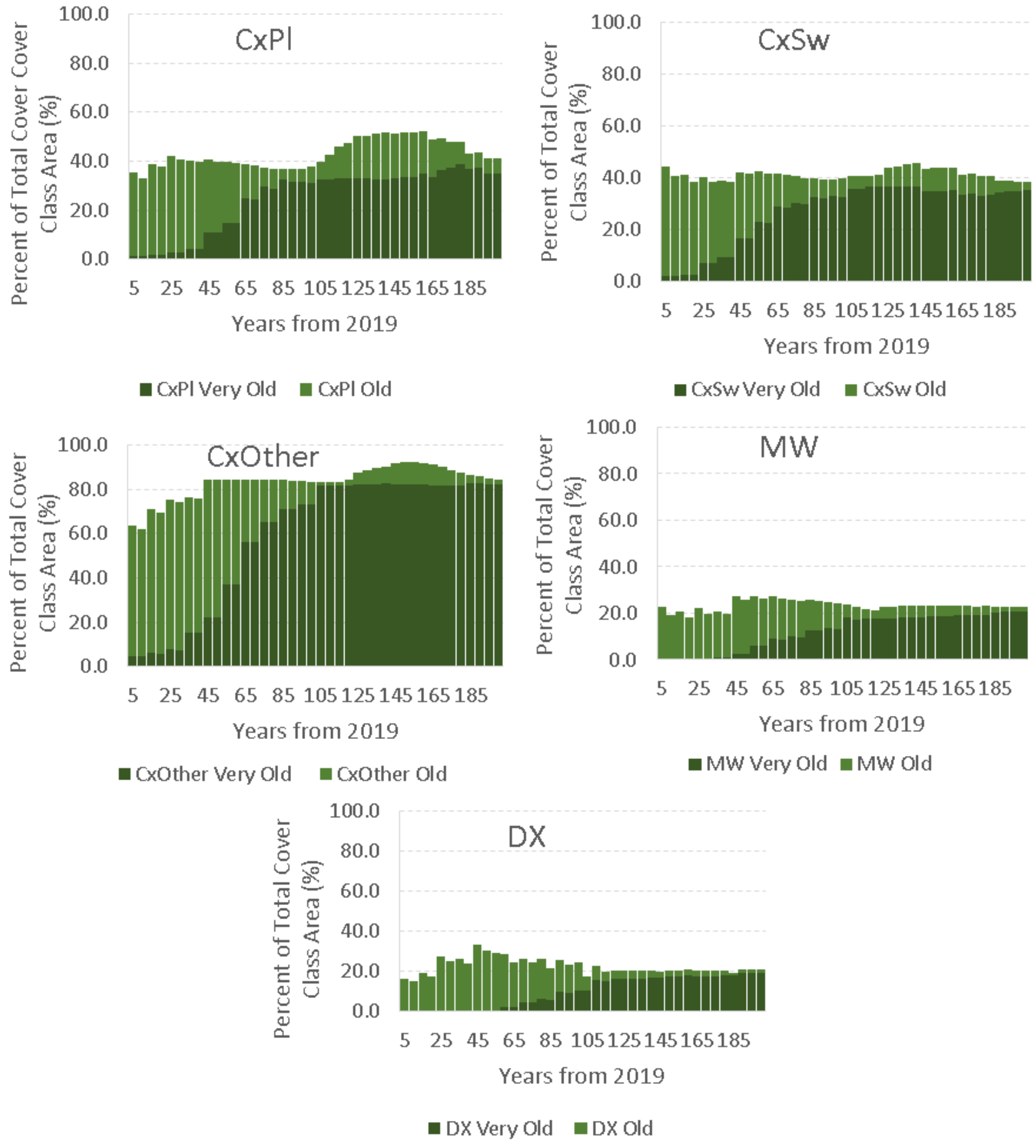


Figure 7 Old + Very Old Seral on the DFA Classified Land base

Table 8 Minimum proportion of Old + Very Old by Cover Class on the DFA Classified Forested Landbase

Cover Class	Minimum Old+Very Old Proportion (%)	Target Minimum Old+Very Old Proportion (%)
CxPl	22.4	18
CxSw	37.9	26
CxOther	44.0	35.5
MW	17.5	13.5
DX	7.0	3.5

3.3 *Patch Size (VOIT 1.1.1.2a)*

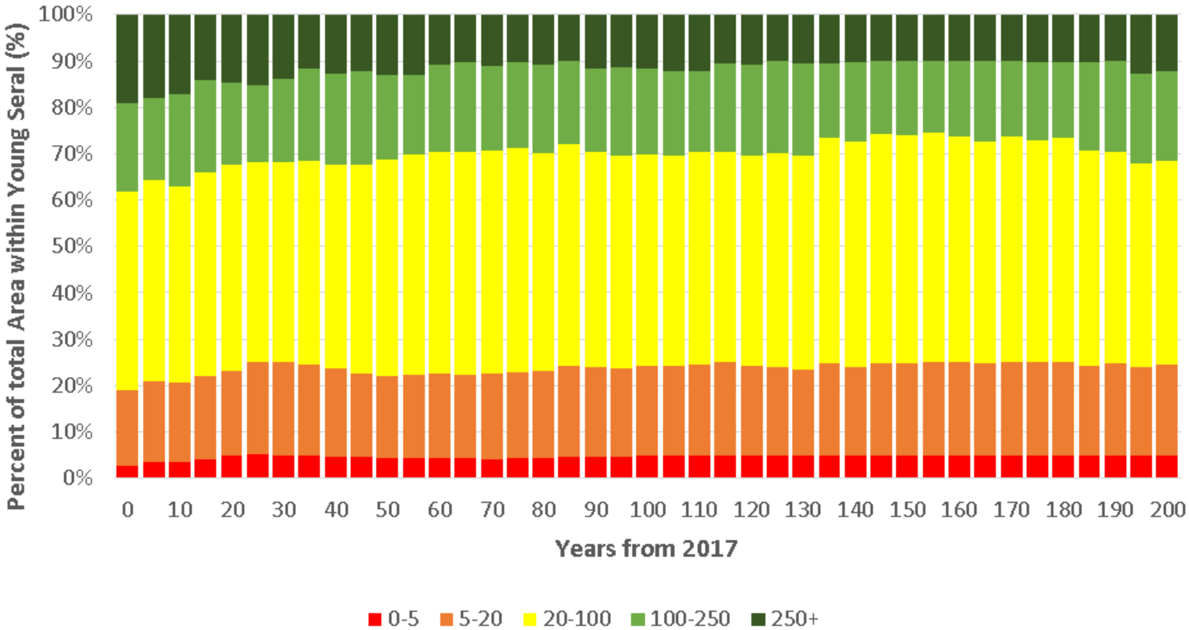


Figure 8 Young Seral (0-20 years old) Patch Size Distribution over time

3.3.1 **Current Snapshot**

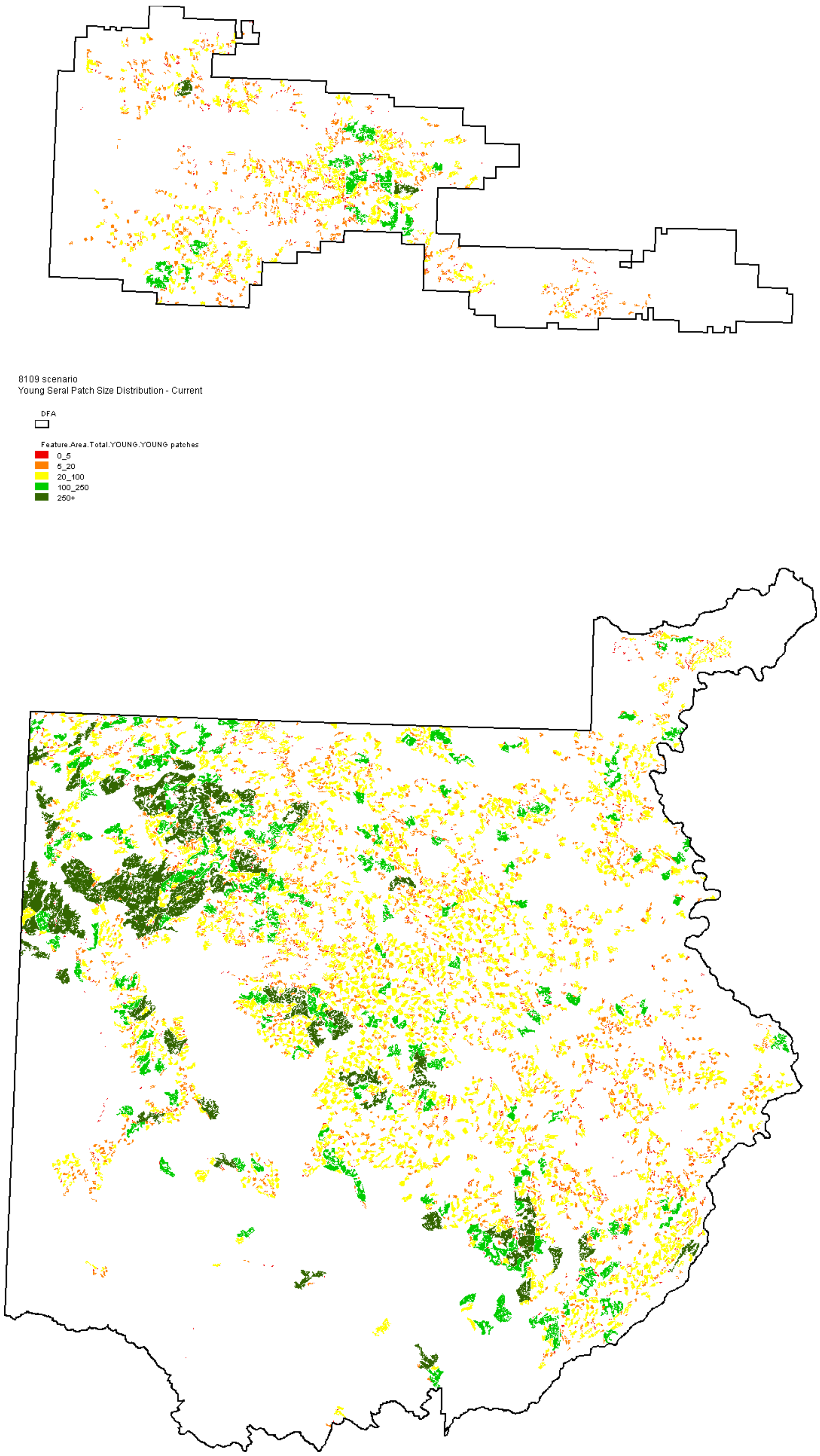


Figure 9 Young Seral Patch Size Distribution – Current

3.3.2 10-Year Snapshot

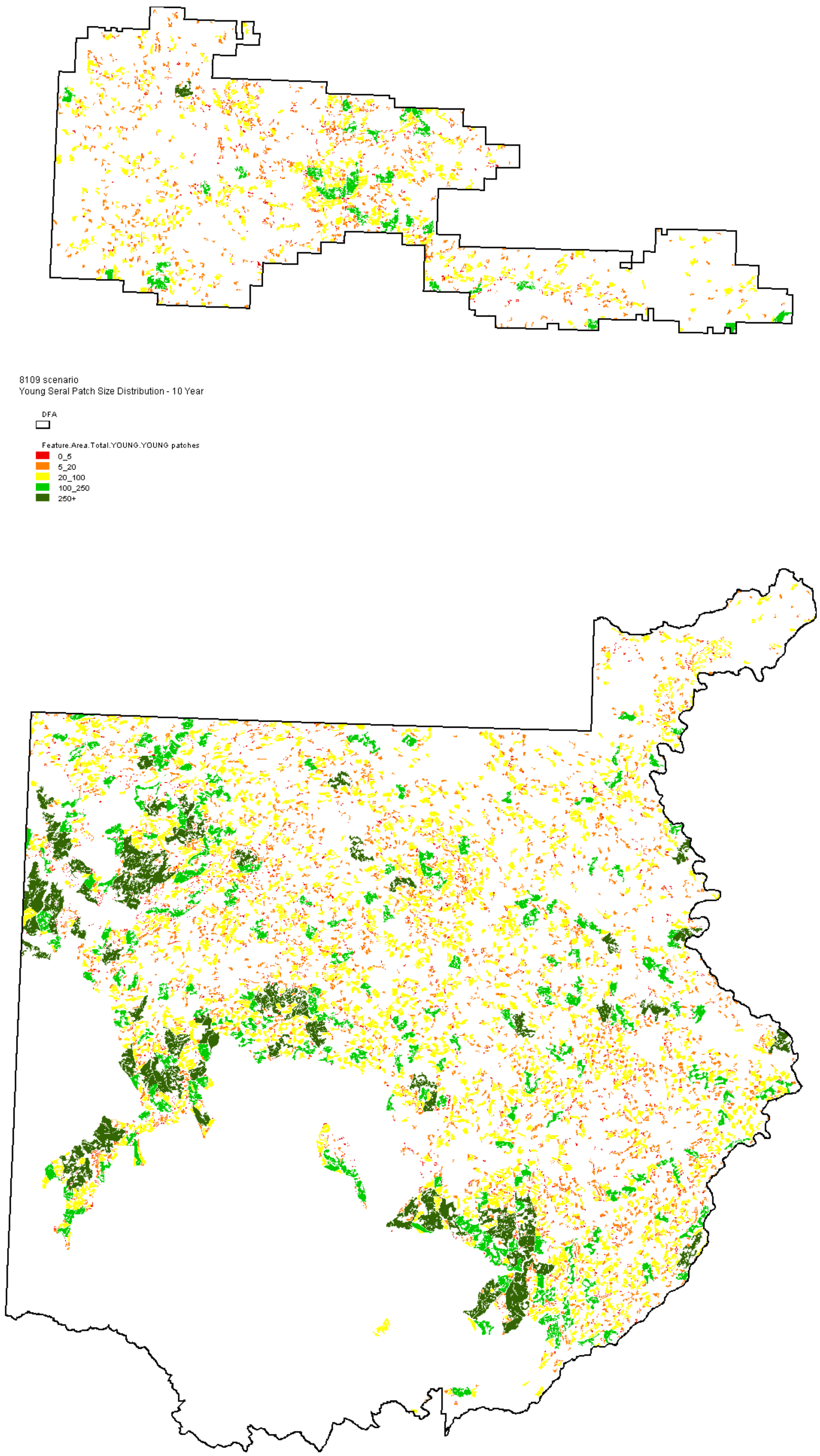


Figure 10 Young Seral Patch Size Distribution – 10-Year Snapshot

3.3.3 **50-Year Snapshot**

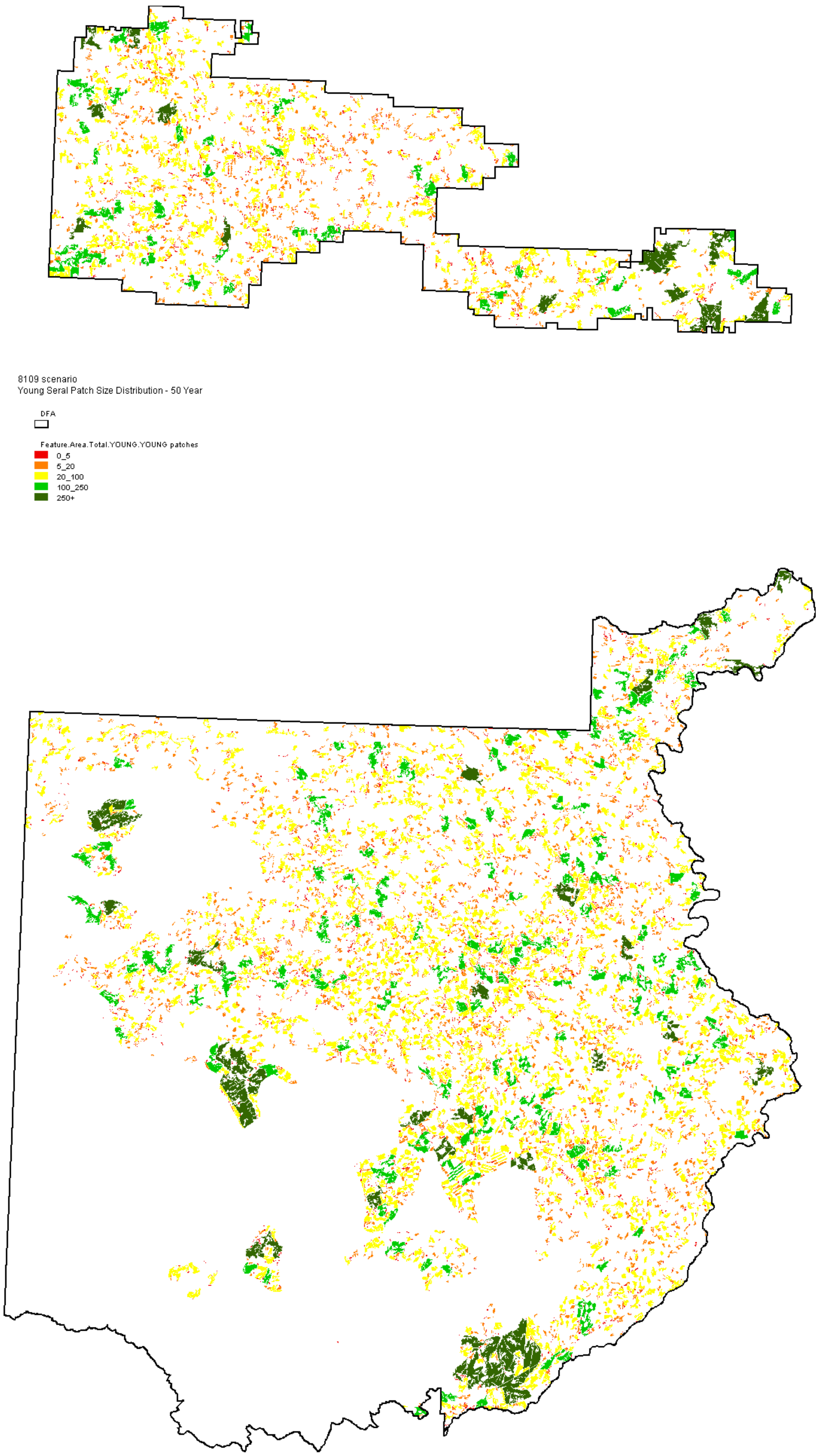


Figure 11 Young Seral Patch Size Distribution – 50-Year Snapshot

3.4 *Old Interior Forest (VOIT 1.1.1.2b)*

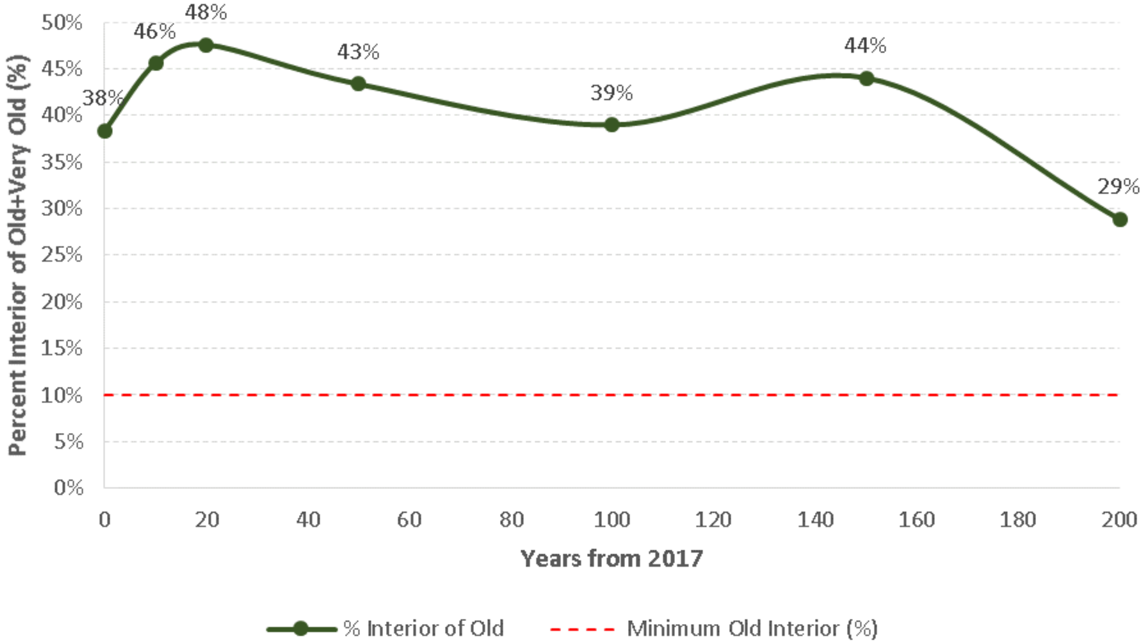


Figure 12 Old Interior forest area over the next 50 years

3.4.1 **Current Snapshot**

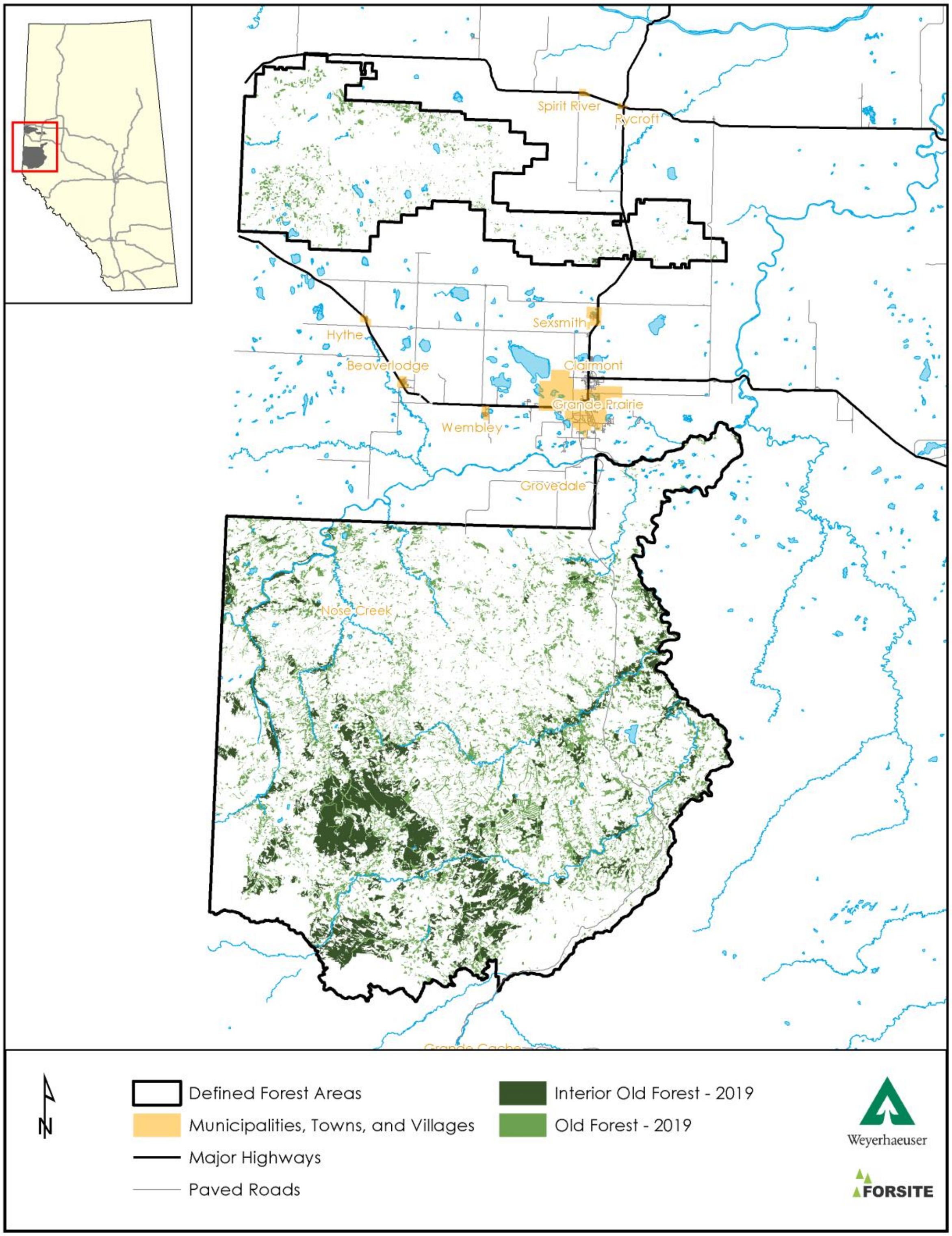


Figure 13 Current Distribution of Old Interior Forest

3.4.2 10-Year Snapshot

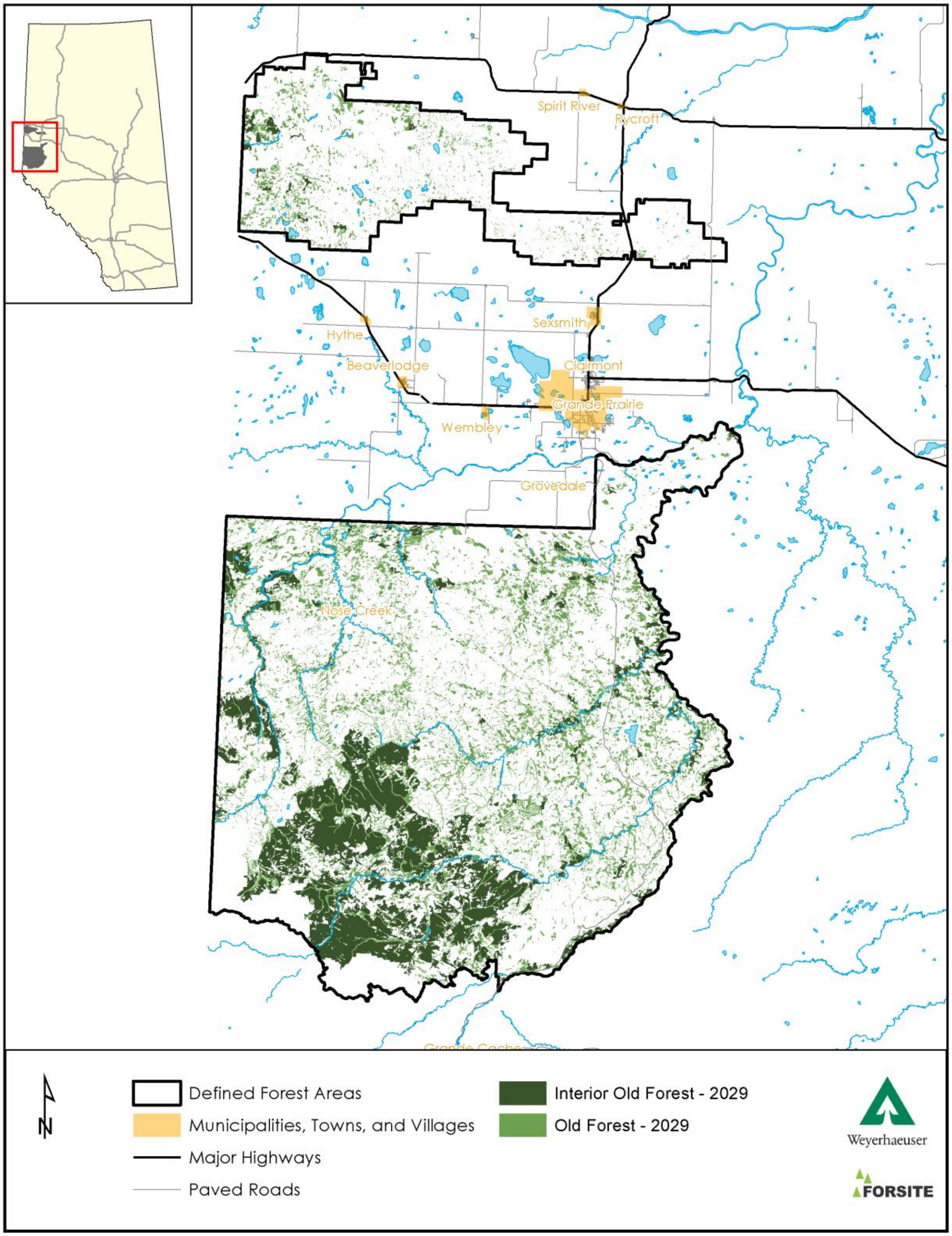


Figure 14 Forecasted Old Interior Forest in 2029

3.4.3 50-Year Snapshot

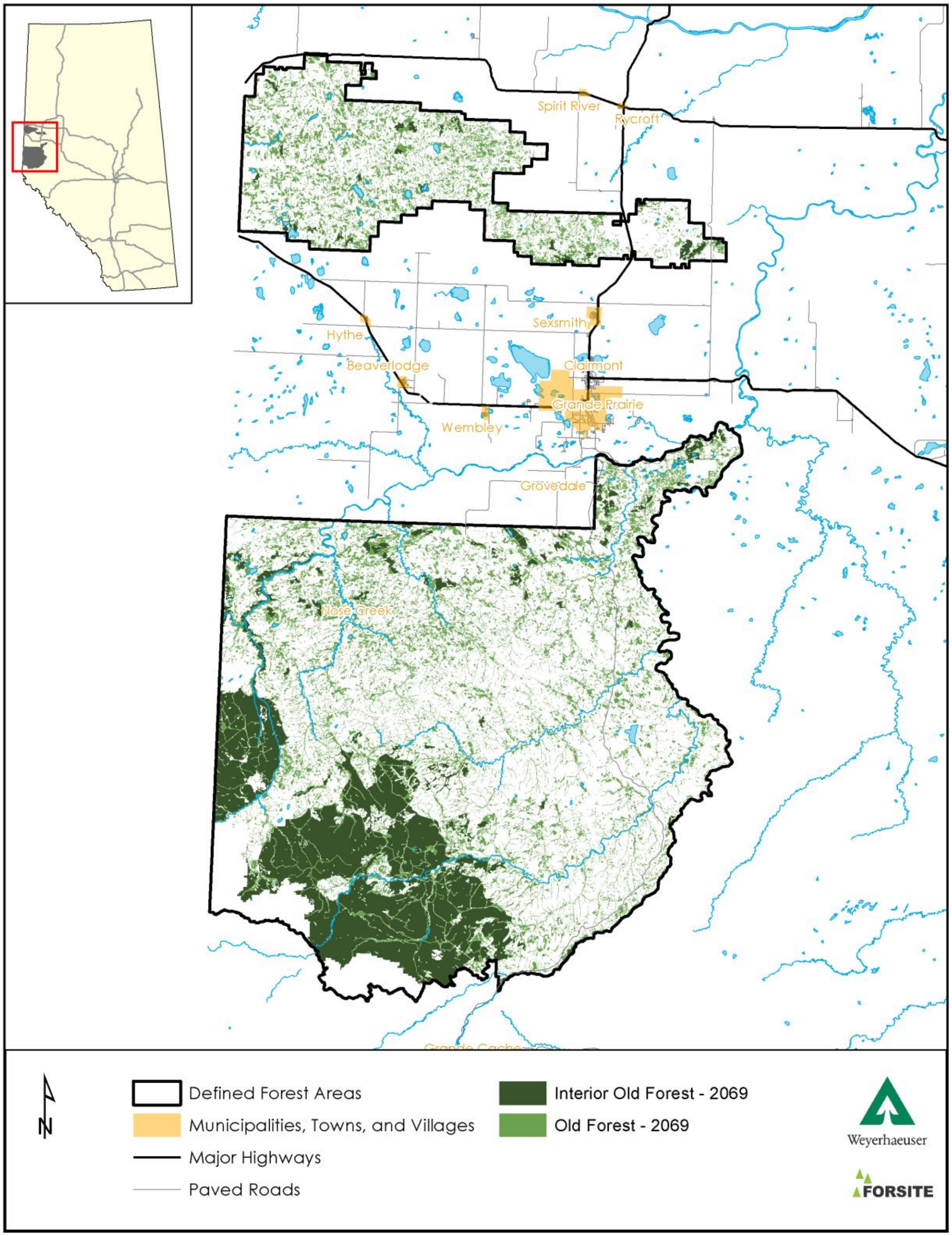
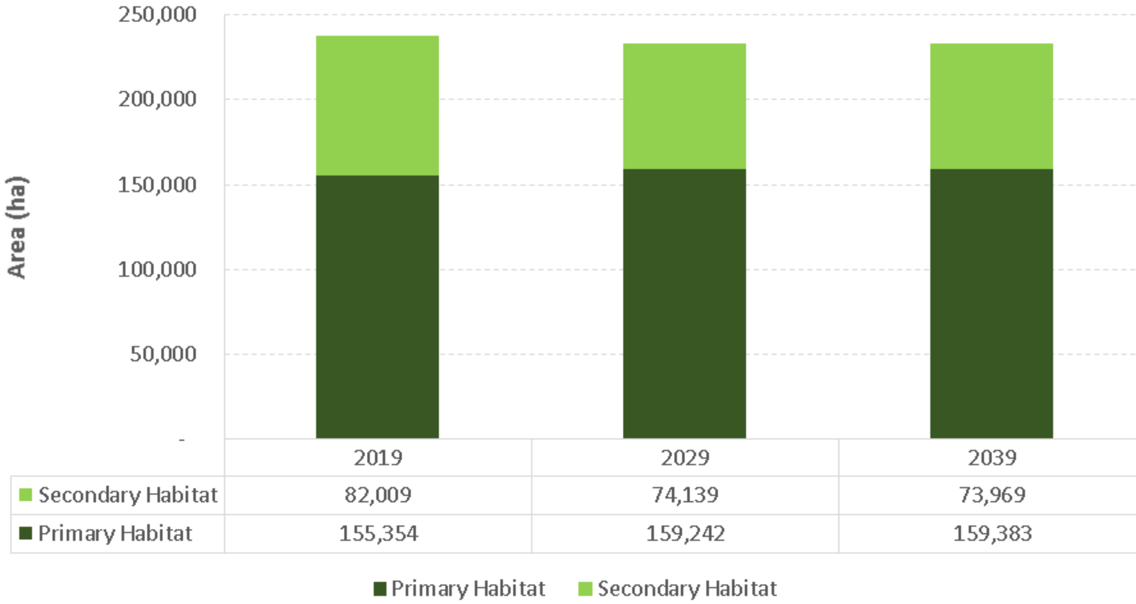


Figure 15 Forecasted Old Interior Forest in 2069

3.5 *Grizzly Bear Habitat States (VOIT 1.2.1.1a)*

A summary of the change in Primary and Secondary Grizzly Bear habitat states for FMU G16 is provided in Figure 16. Appendix I provides detailed reporting for each Grizzly Bear Watershed Unit, for FMA #6900016, and for FMU G16.



	2019	2029	2039
Secondary Habitat	82,009	74,139	73,969
Primary Habitat	155,354	159,242	159,383

Figure 16 Primary and Secondary Grizzly bear habitat in in 2019 and forecasted to 2029 and 2039

3.5.1 Current Snapshot

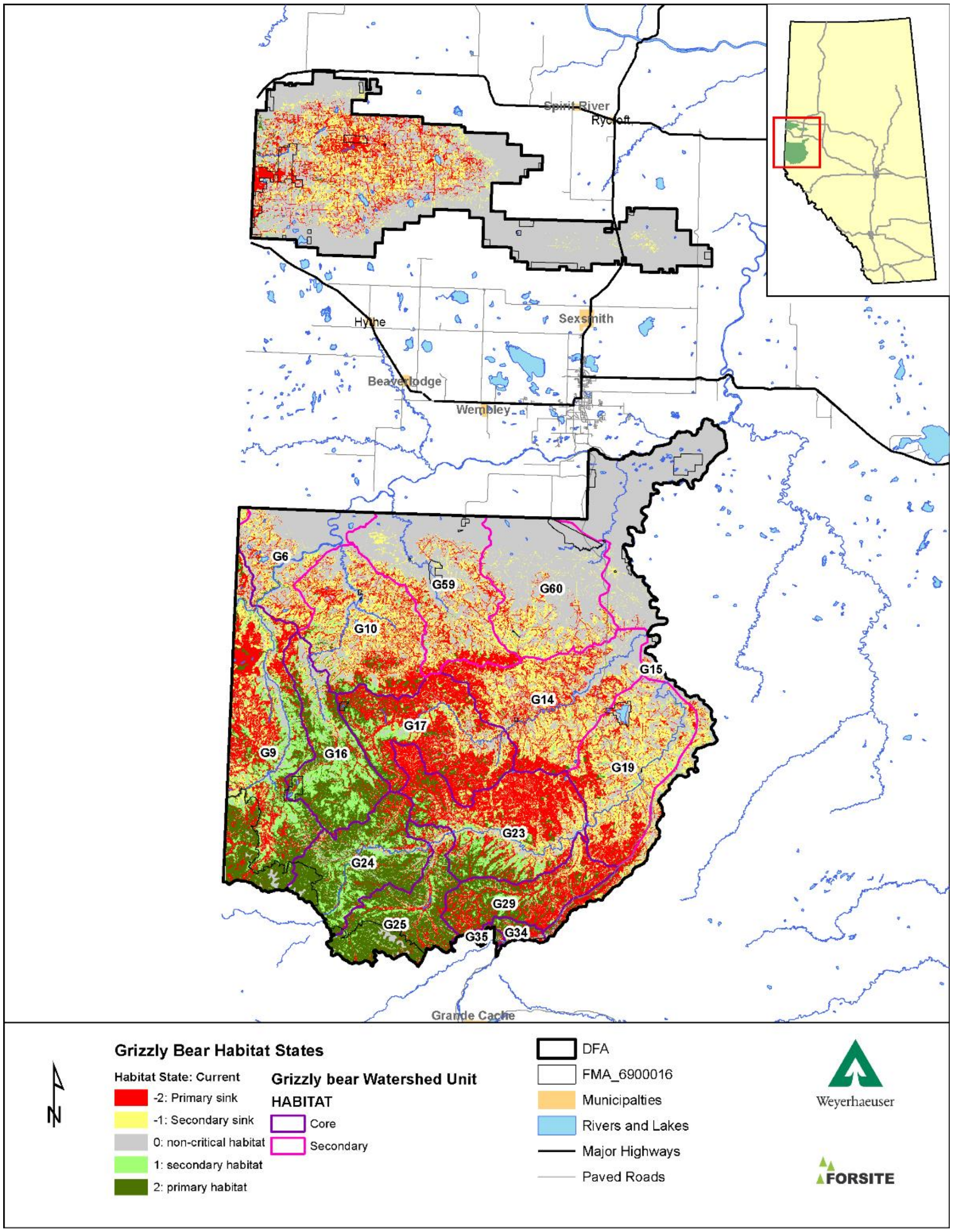


Figure 17 Grizzly Bear Habitat States - Current Snapshot

3.5.2 10-year Snapshot

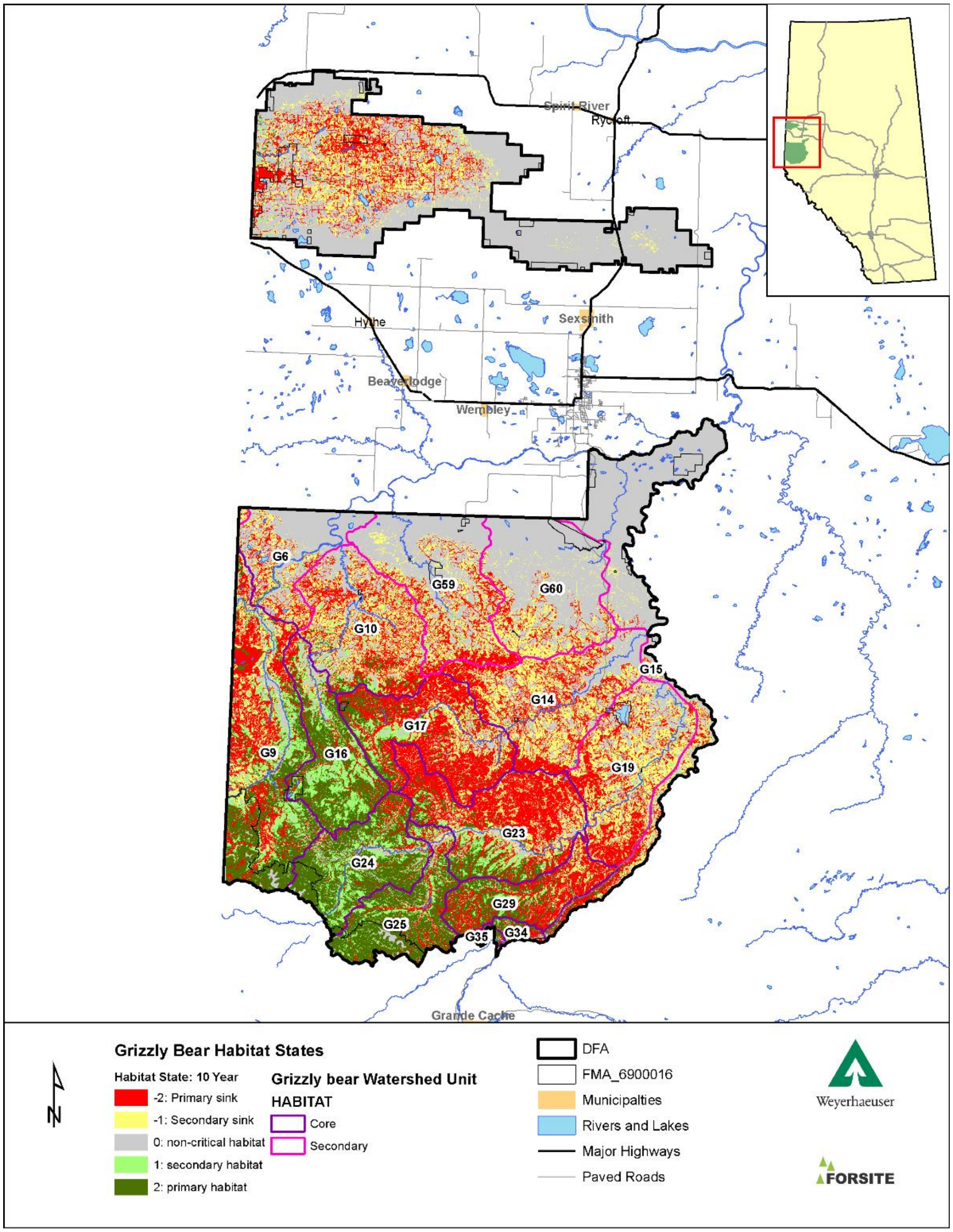


Figure 18 Grizzly Bear Habitat States - 10 years from now (2027)

3.5.3 20-year Snapshot

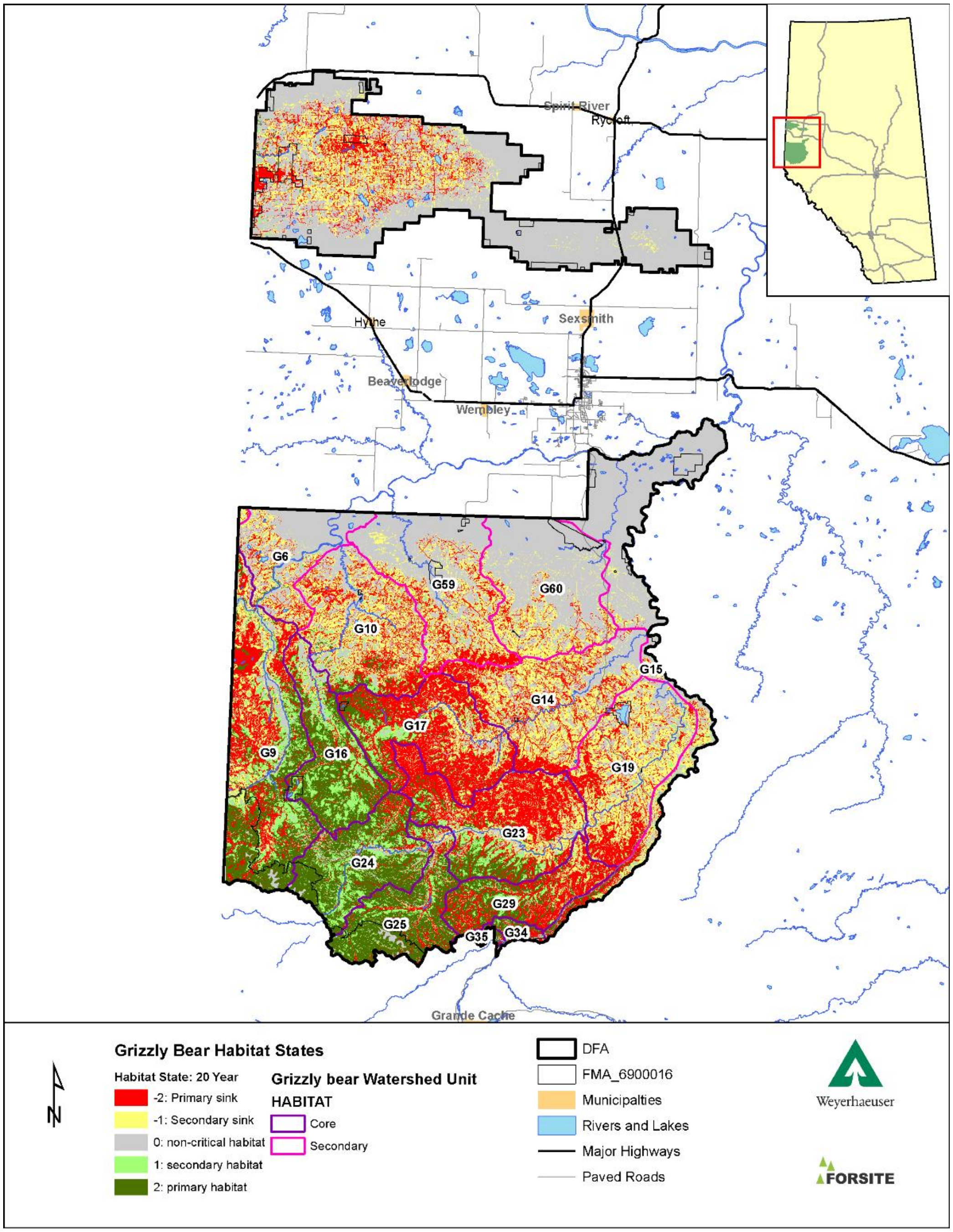


Figure 19 Grizzly Bear Habitat States - 20 years from now (2037)

3.6 *Barred Owl (VOIT 1.1.2.1b)*

3.6.1 Barred Owl RSF

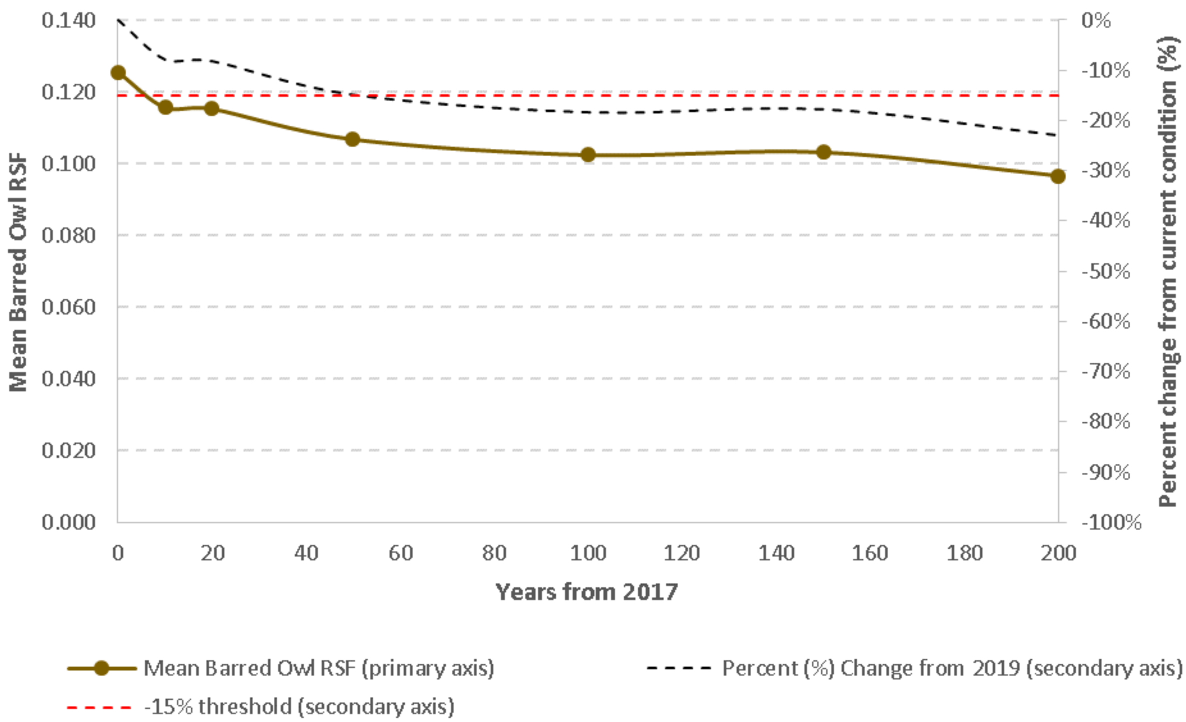


Figure 20 Barred Owl Resource Selection Function (RSF) at 0, 10, 20, 50, 100, 150, and 200 years from 2019

Table 9 Barred Owl Resource Selection Function (RSF) at 0, 10, 20, 50, 100, 150, and 200 years from 2019

Years from 2017	Mean Barred Owl RSF	±SD	Percent (%) Change from 2019
0	0.1255	0.1185	0.0%
10	0.1156	0.1111	-7.9%
20	0.1152	0.1131	-8.2%
50	0.1067	0.1021	-14.9%
100	0.1024	0.0948	-18.4%
150	0.1031	0.0926	-17.8%
200	0.0966	0.0893	-23.0%

3.6.1.1 Current Snapshot

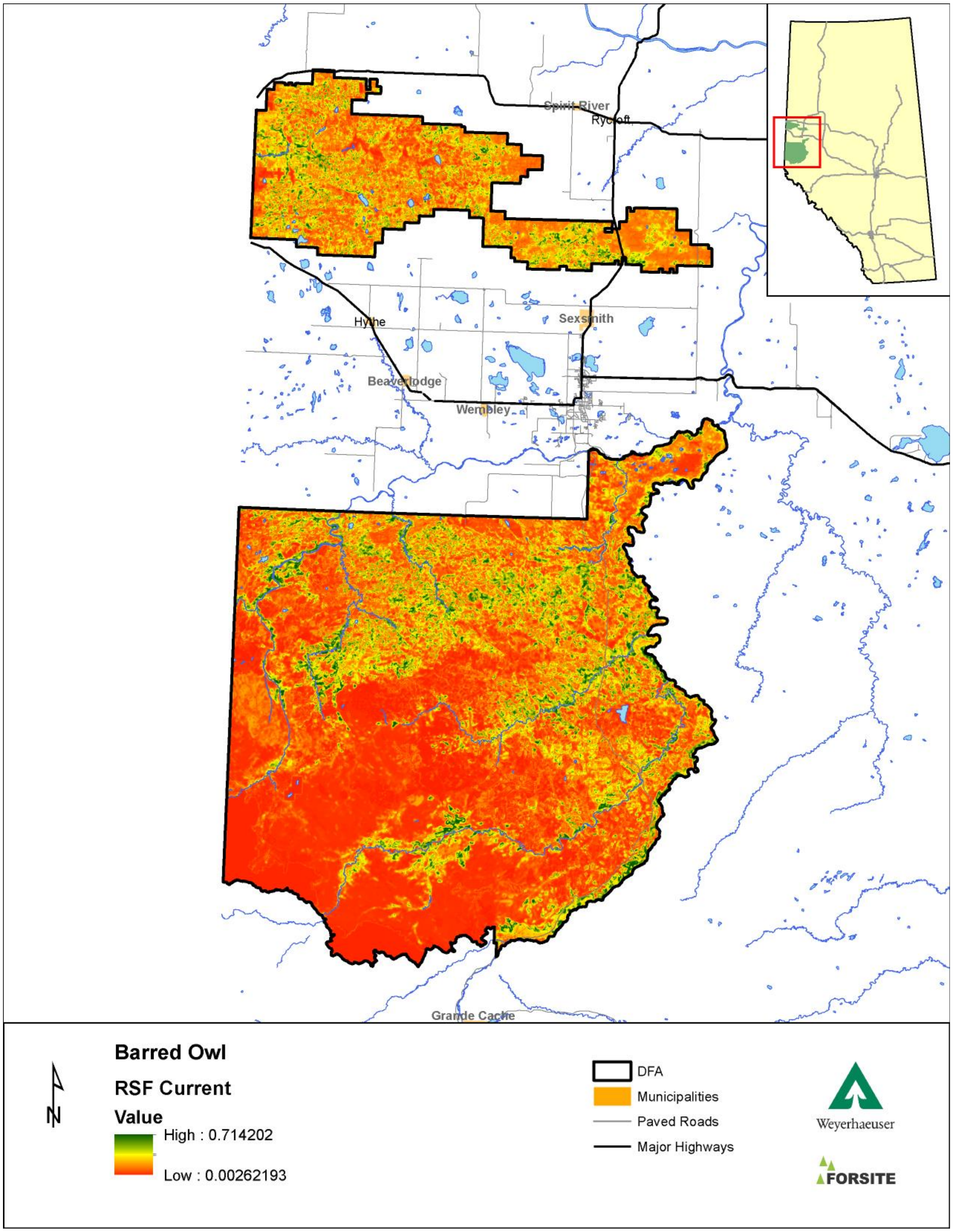


Figure 21 Current Habitat Suitability for Barred Owl (2019)

3.6.1.2 **10-year Snapshot**

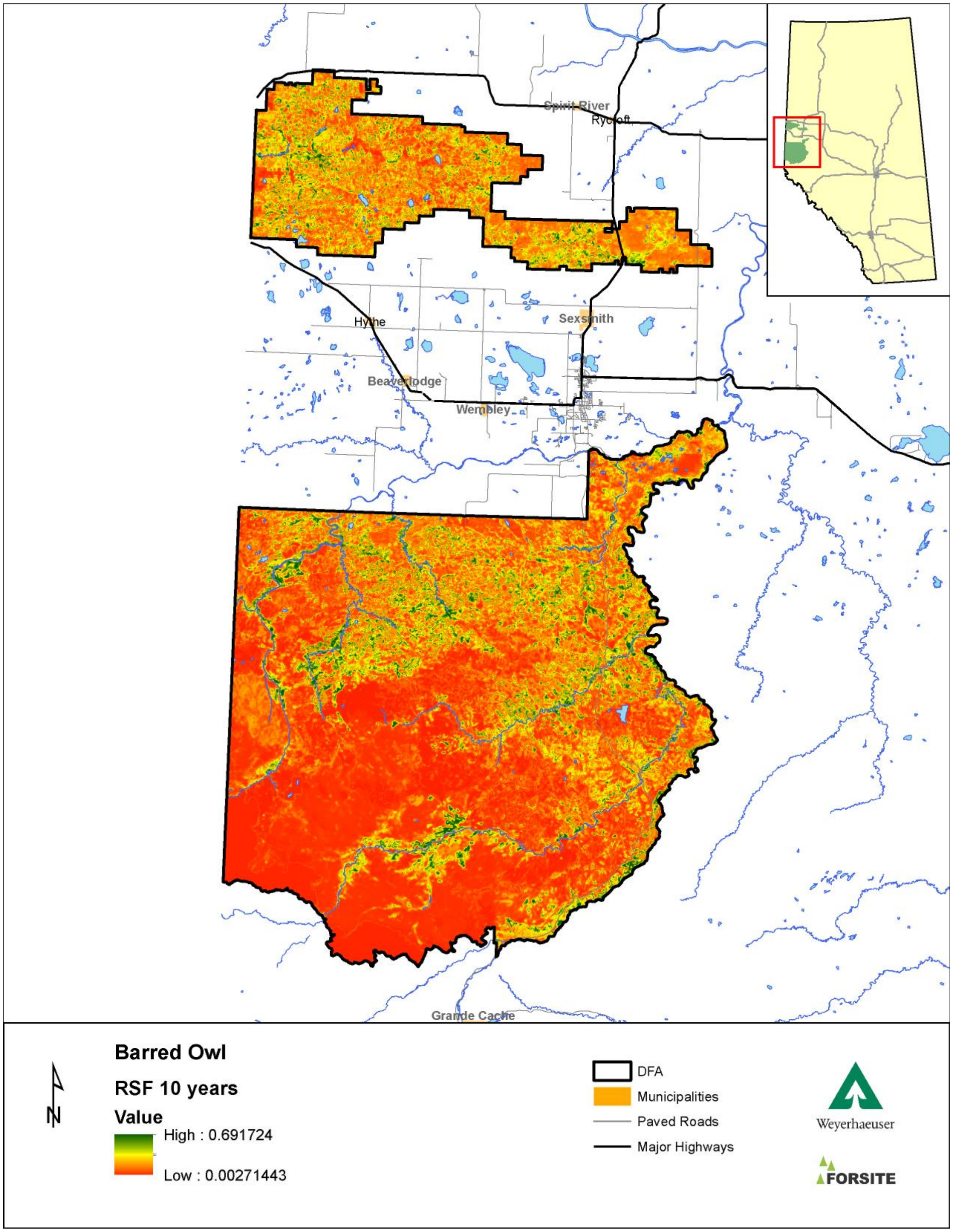


Figure 22 Forecasted Habitat Suitability for Barred Owl in 2027

3.6.1.3 **20-year Snapshot**

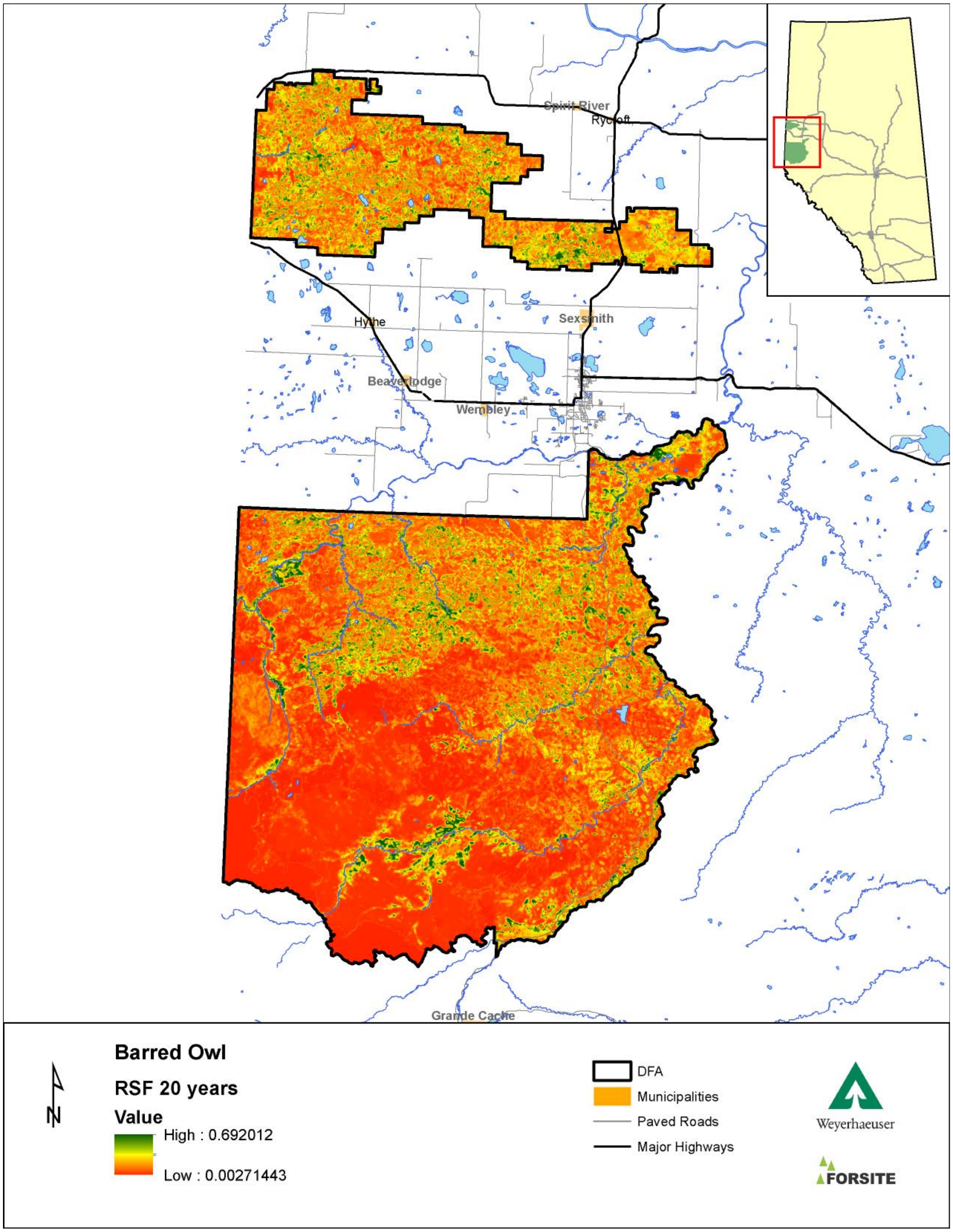


Figure 23 Forecasted Habitat Suitability for Barred Owl in 2037

3.6.1.4 **50-year Snapshot**

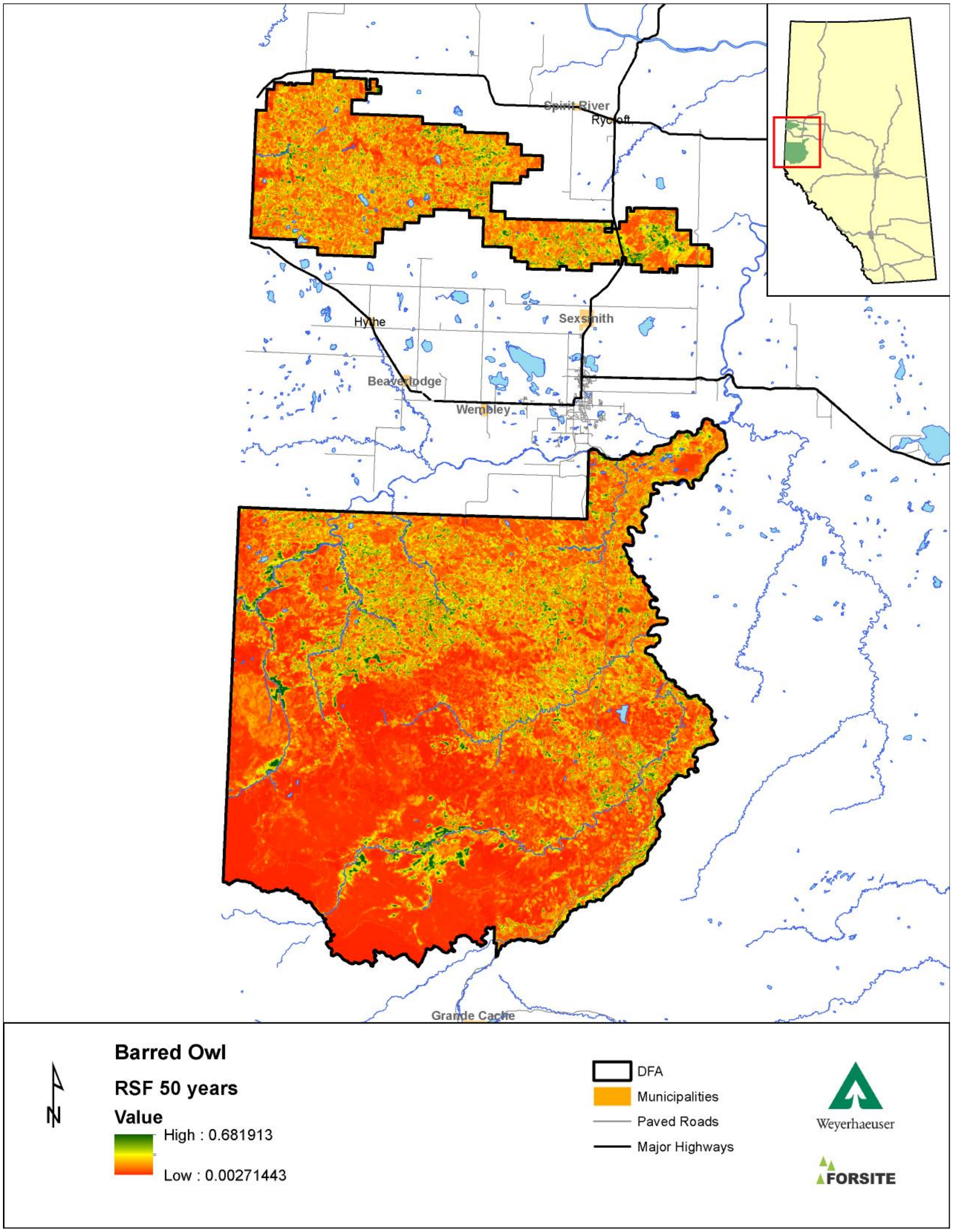


Figure 24 Forecasted Habitat Suitability for Barred Owl in 2067

3.6.2 Barred Owl Breed Pair

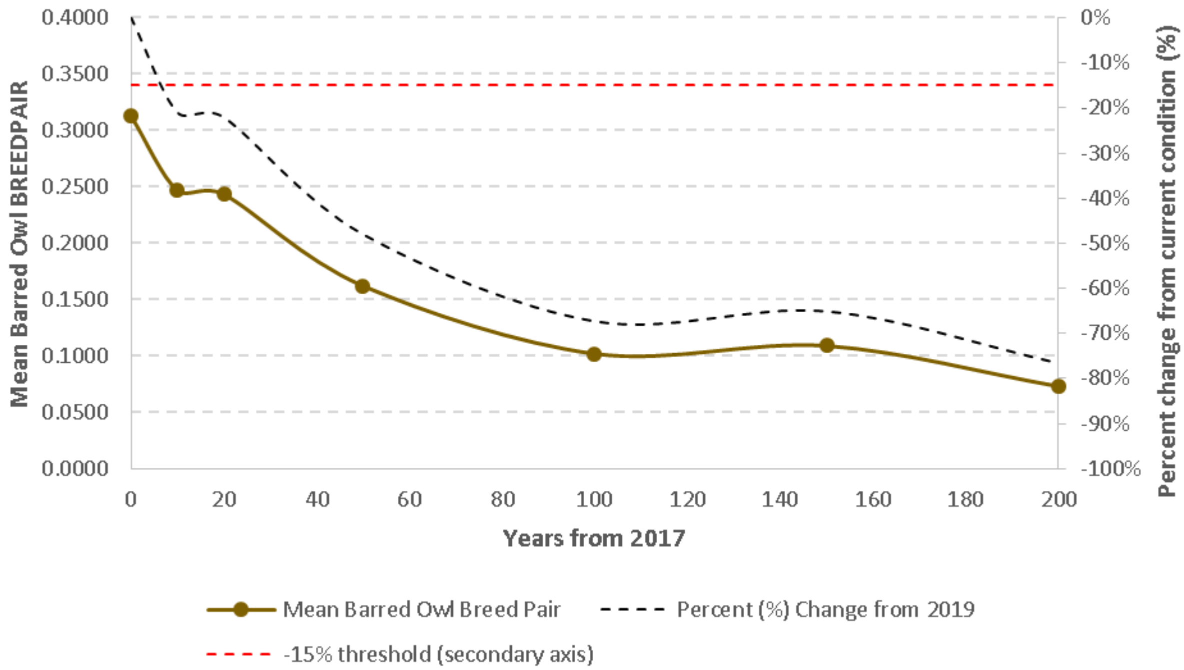


Figure 25 Mean Barred Owl Breed pair 0, 10, 20, 50, 100, 150, and 200 years from 2019

Table 10 Mean Barred Owl Breed pair 0, 10, 20, 50, 100, 150, and 200 years from 2019

Years from 2017	Mean Barred Owl Breed Pair	±SD	Percent (%) Change from 2019
0	0.3129	0.4637	0.0%
10	0.2468	0.4312	-21.1%
20	0.2433	0.4291	-22.2%
50	0.1622	0.3687	-48.1%
100	0.1020	0.3026	-67.4%
150	0.1089	0.3115	-65.2%
200	0.0730	0.2601	-76.7%

3.6.2.1 **Current Snapshot**

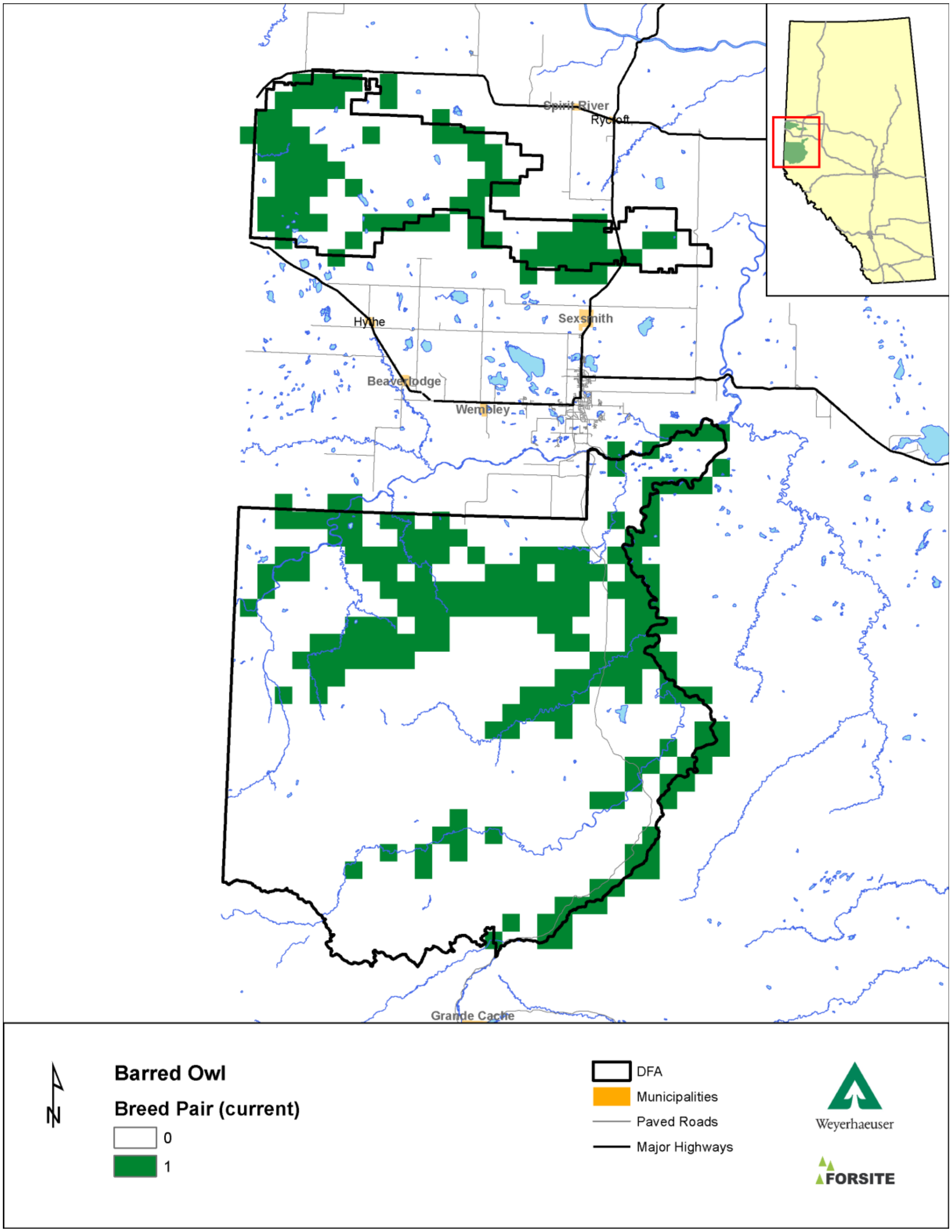


Figure 26 Barred Owl Breed Pair – Current

3.6.2.2 10-year Snapshot

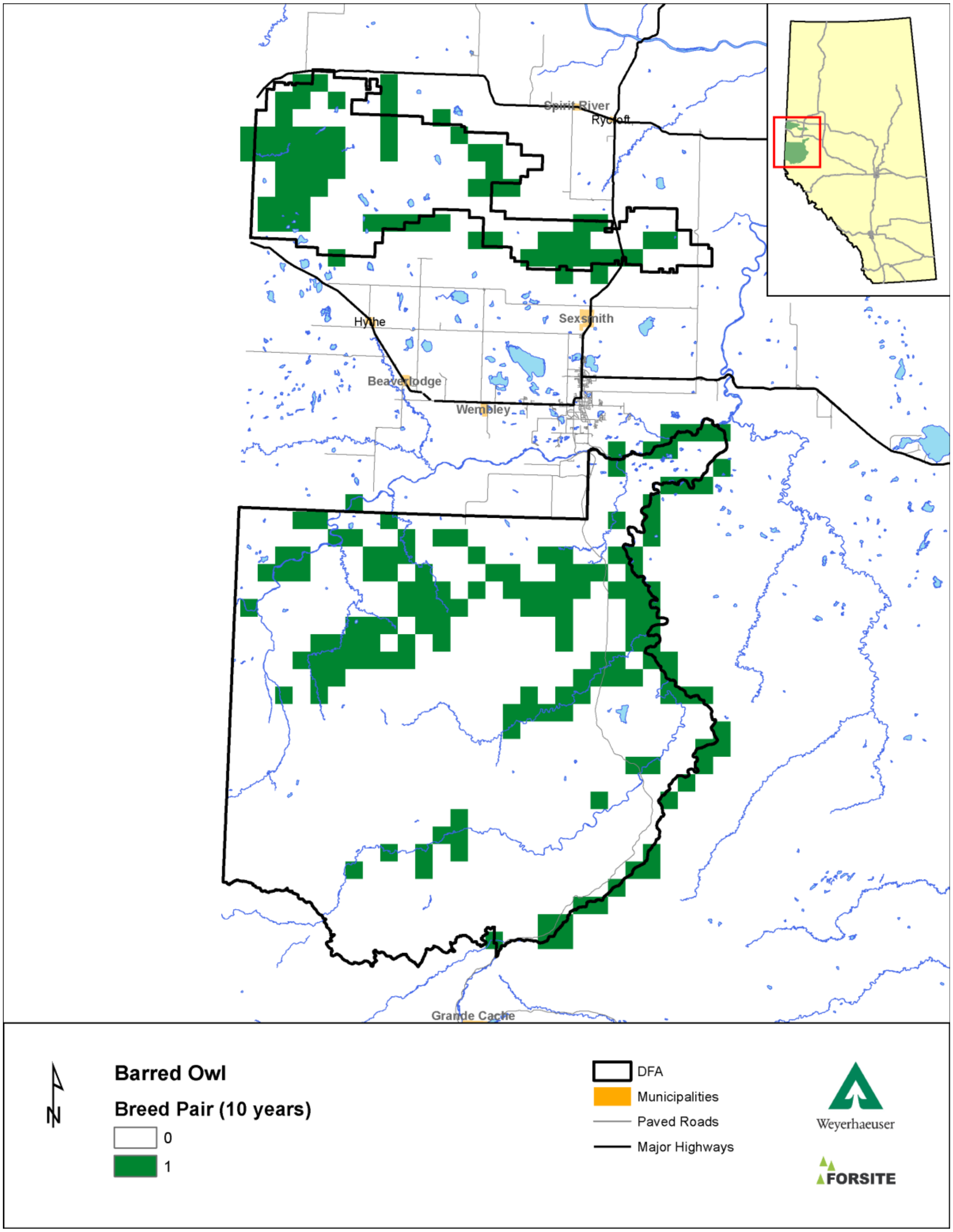


Figure 27 Barred Owl Breed Pair – 10 years

3.6.2.3 **20-year Snapshot**

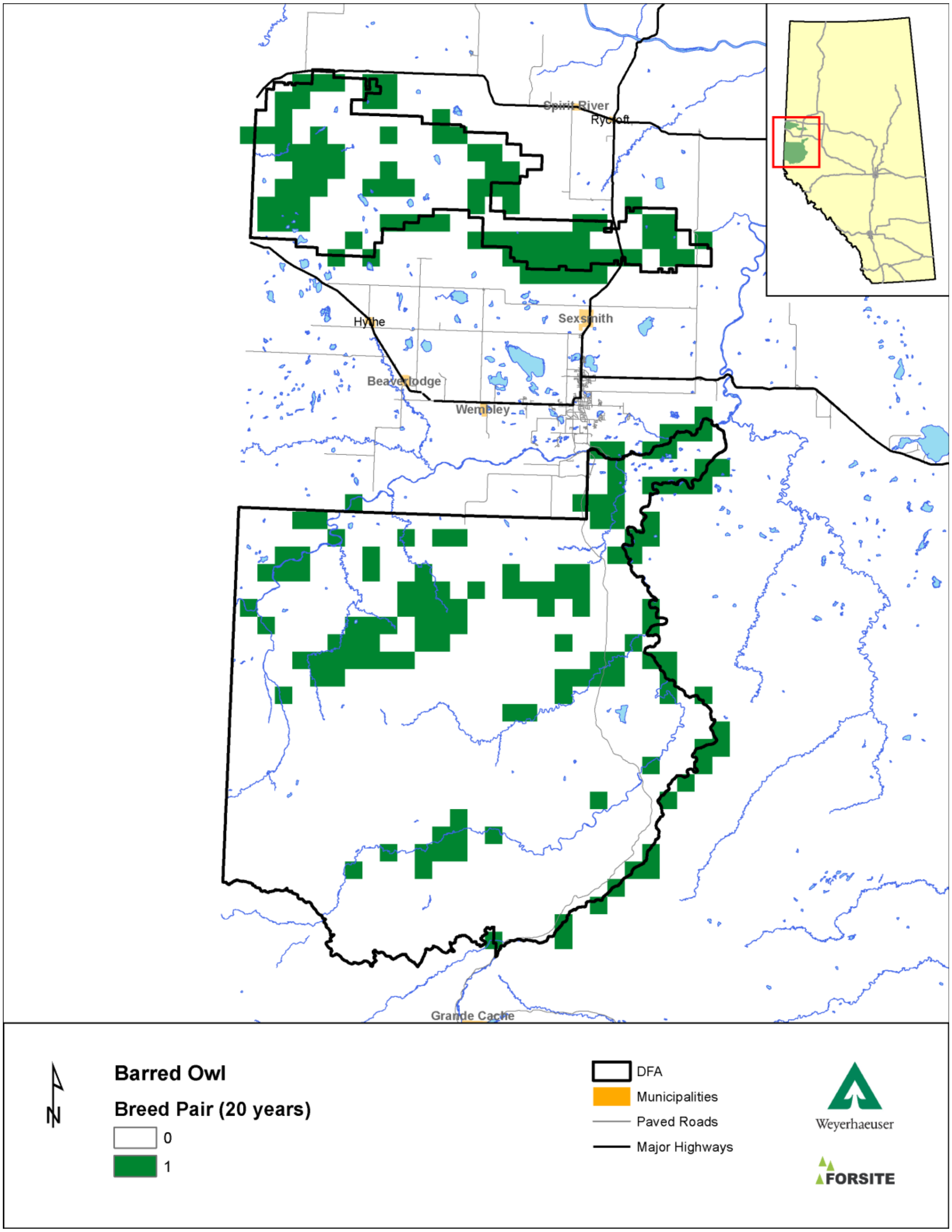


Figure 28 Barred Owl Breed Pair – 20 years

3.6.2.4 **50-year Snapshot**

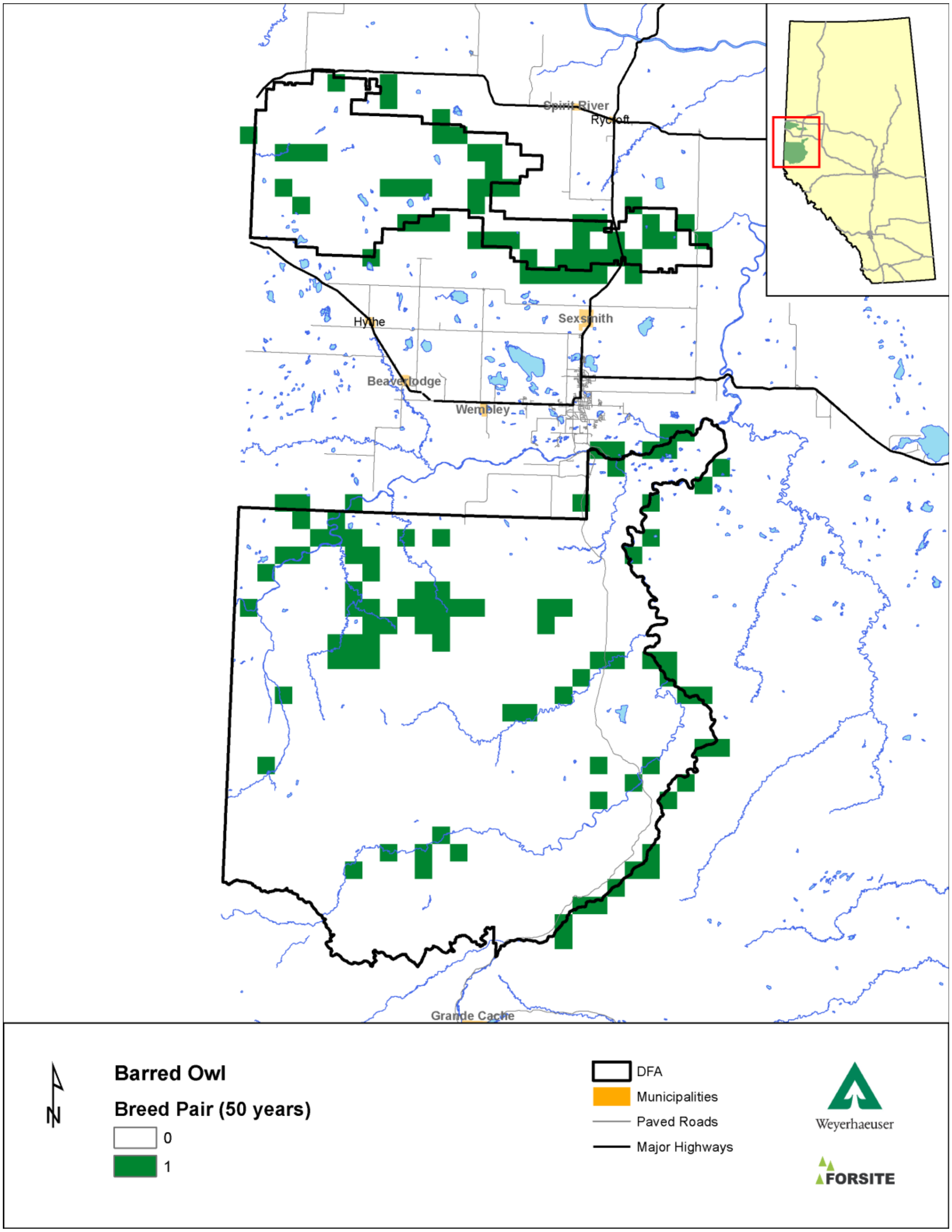


Figure 29 Barred Owl Breed Pair – 50 Year

3.7 *Marten (VOIT 1.1.2.1c)*

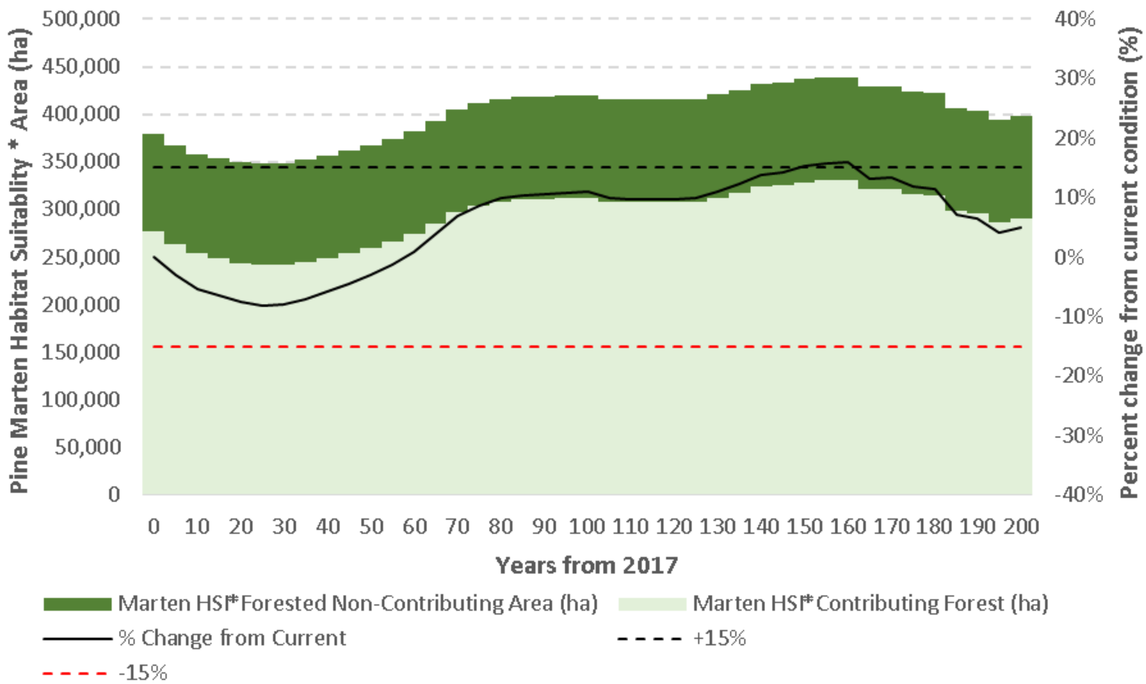


Figure 30 Change in Marten Habitat Suitability Index (HSI) *Area over a 200-year planning horizon

3.7.1 **Current Snapshot**

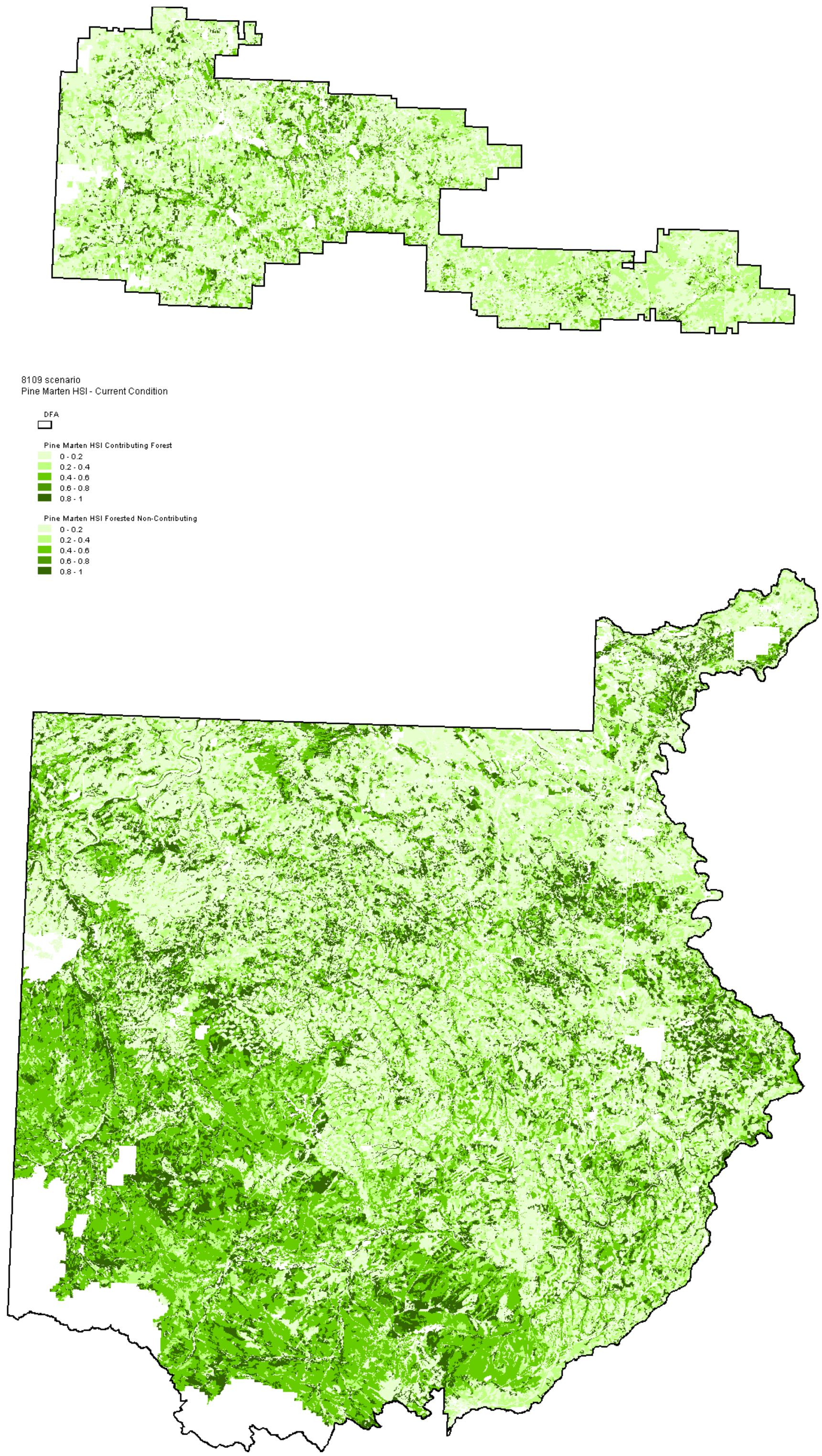


Figure 31 Current Habitat Suitability for Marten Habitat

3.7.2 10-year Snapshot

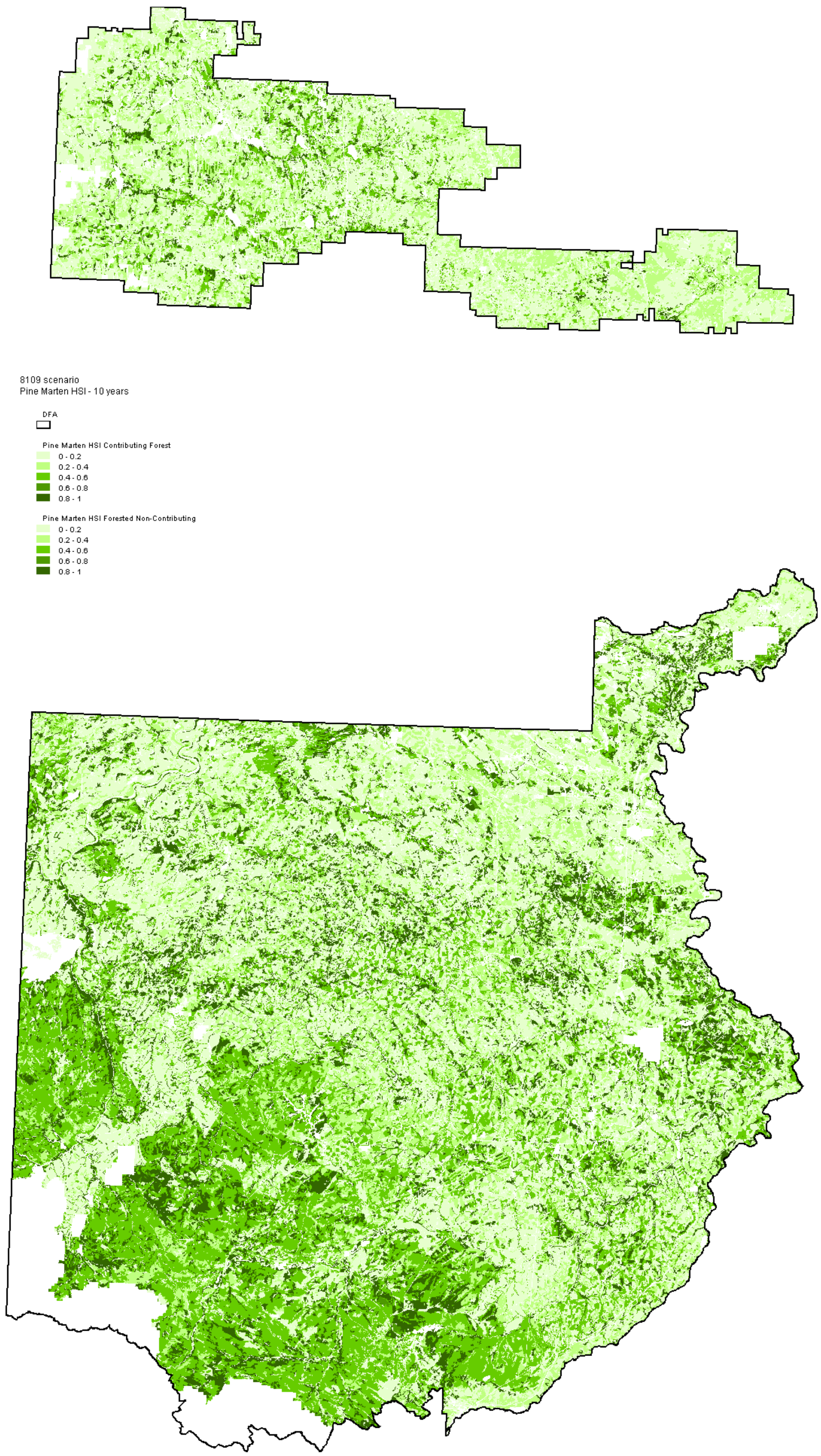


Figure 32 10-Year Habitat Suitability for Pine Marten

3.7.3 **20-year Snapshot**

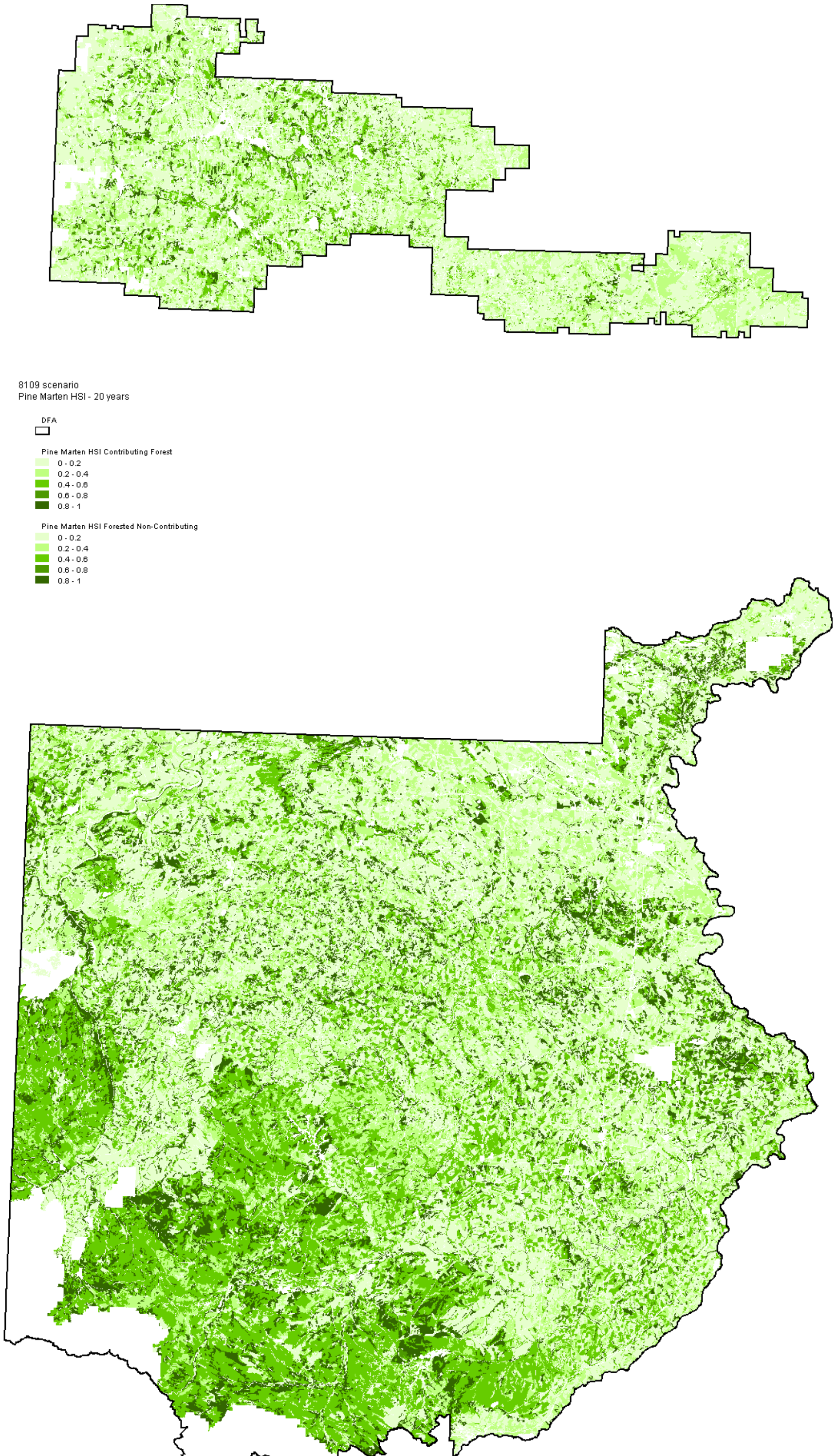


Figure 33 20-Year Habitat Suitability for Pine Marten

3.7.4 **50-year Snapshot**

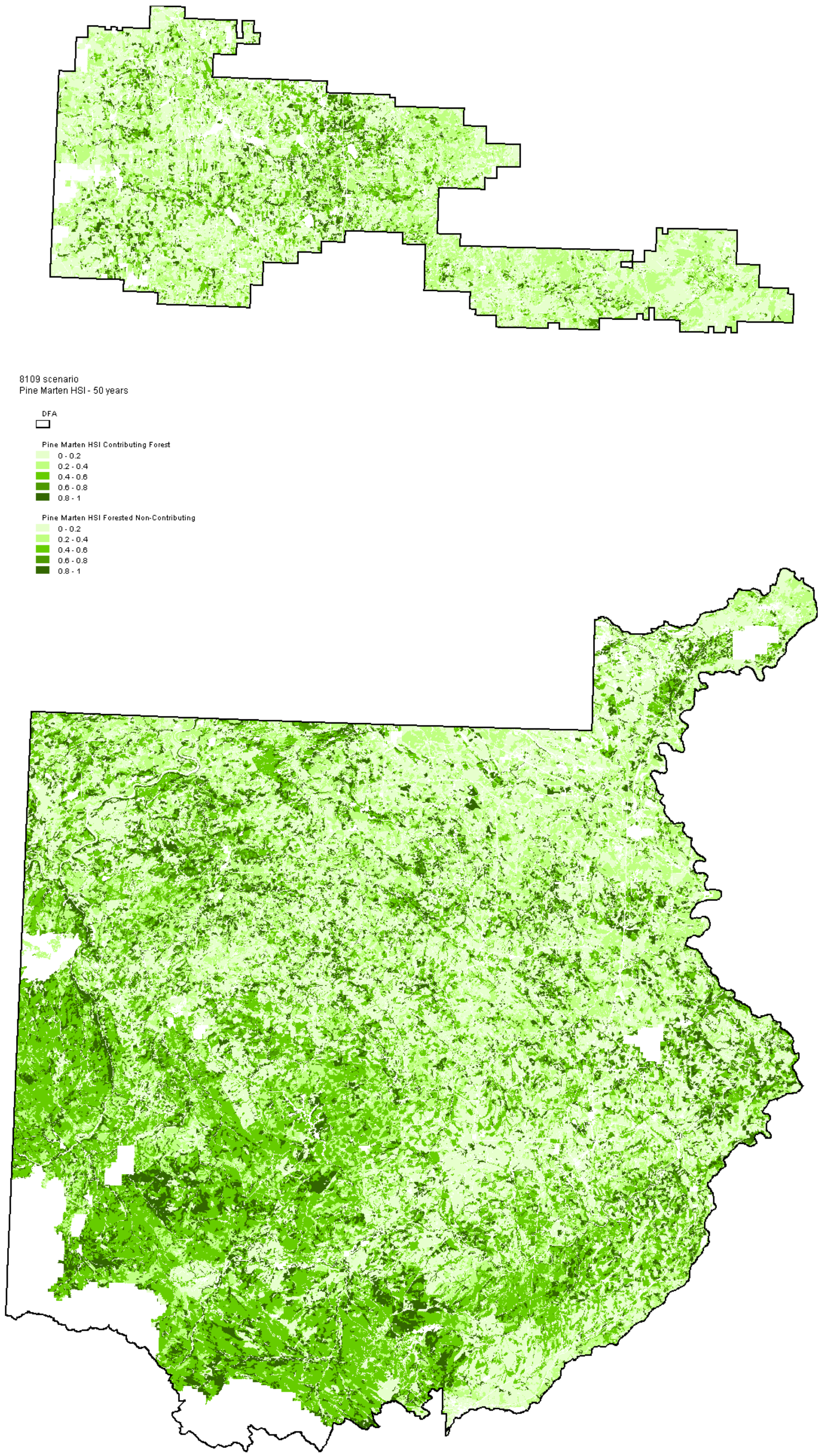


Figure 34 50-Year Habitat Suitability for Pine Marten

3.8 *Songbirds (VOIT 1.1.2.1d)*

3.8.1 Canada Warbler

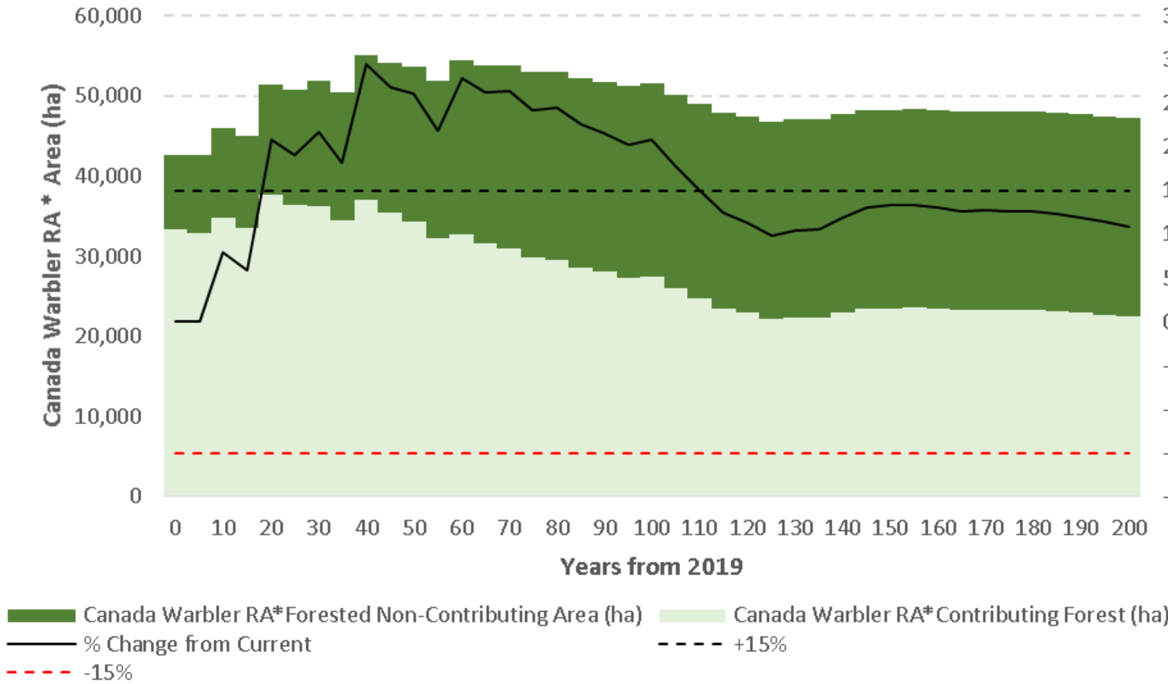


Figure 35 Canada Warbler relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.1.1 **Current Snapshot**

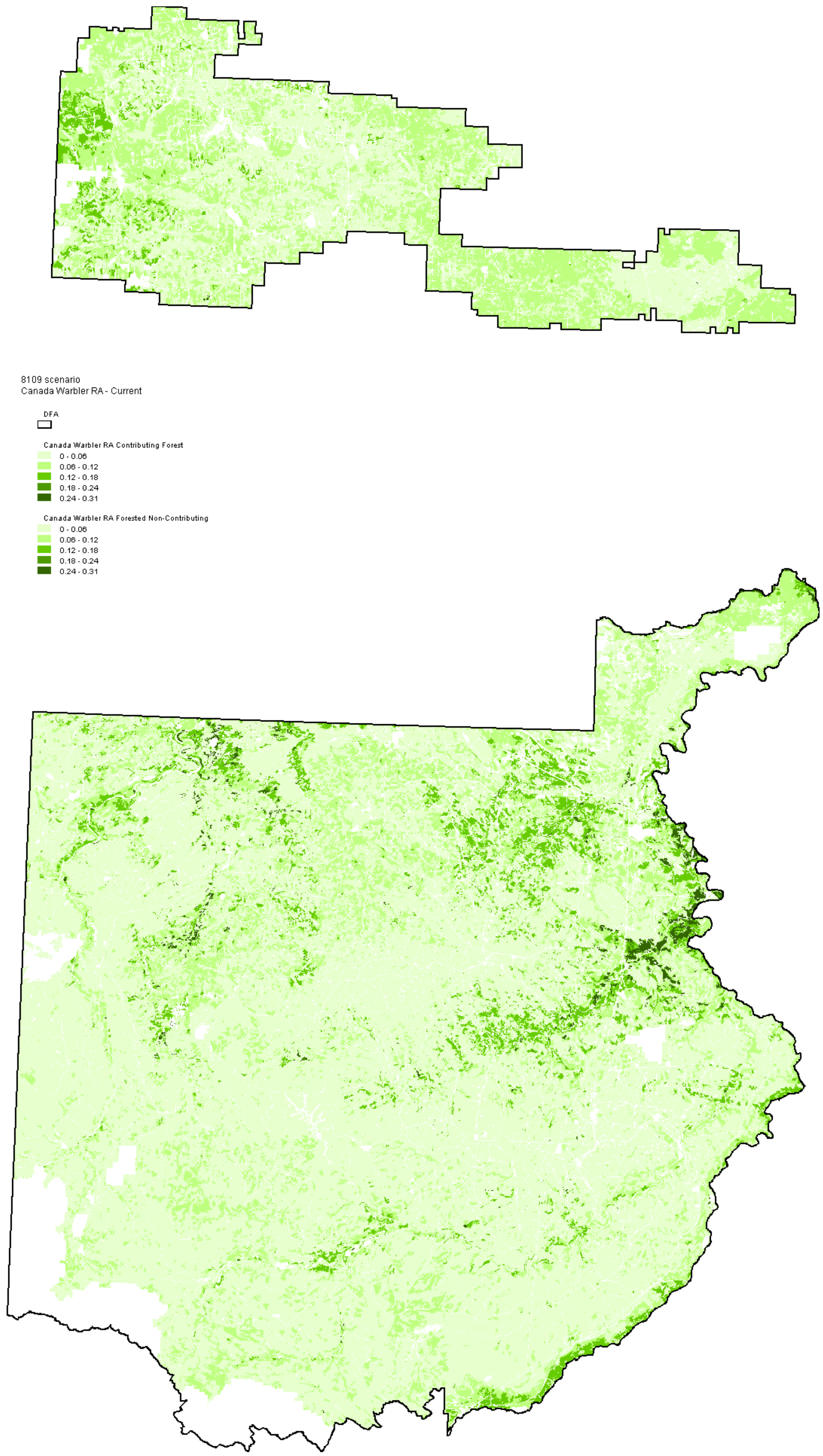


Figure 36 Current Canada Warbler Relative abundance (2017)

3.8.1.2 **10-year Snapshot**

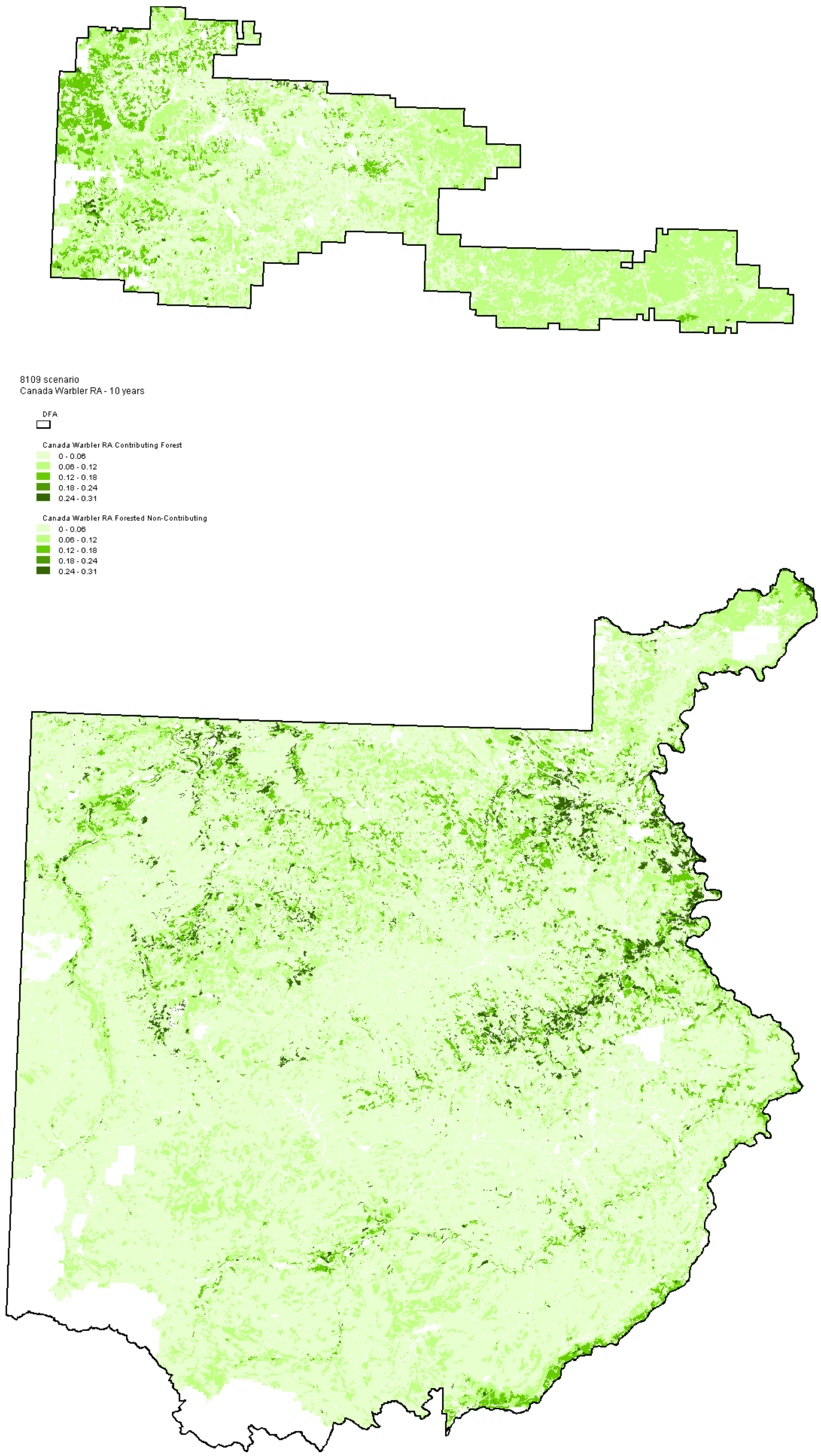


Figure 37 Canada Warbler Relative abundance - 10-Year snapshot

3.8.1.3 **20-year Snapshot**

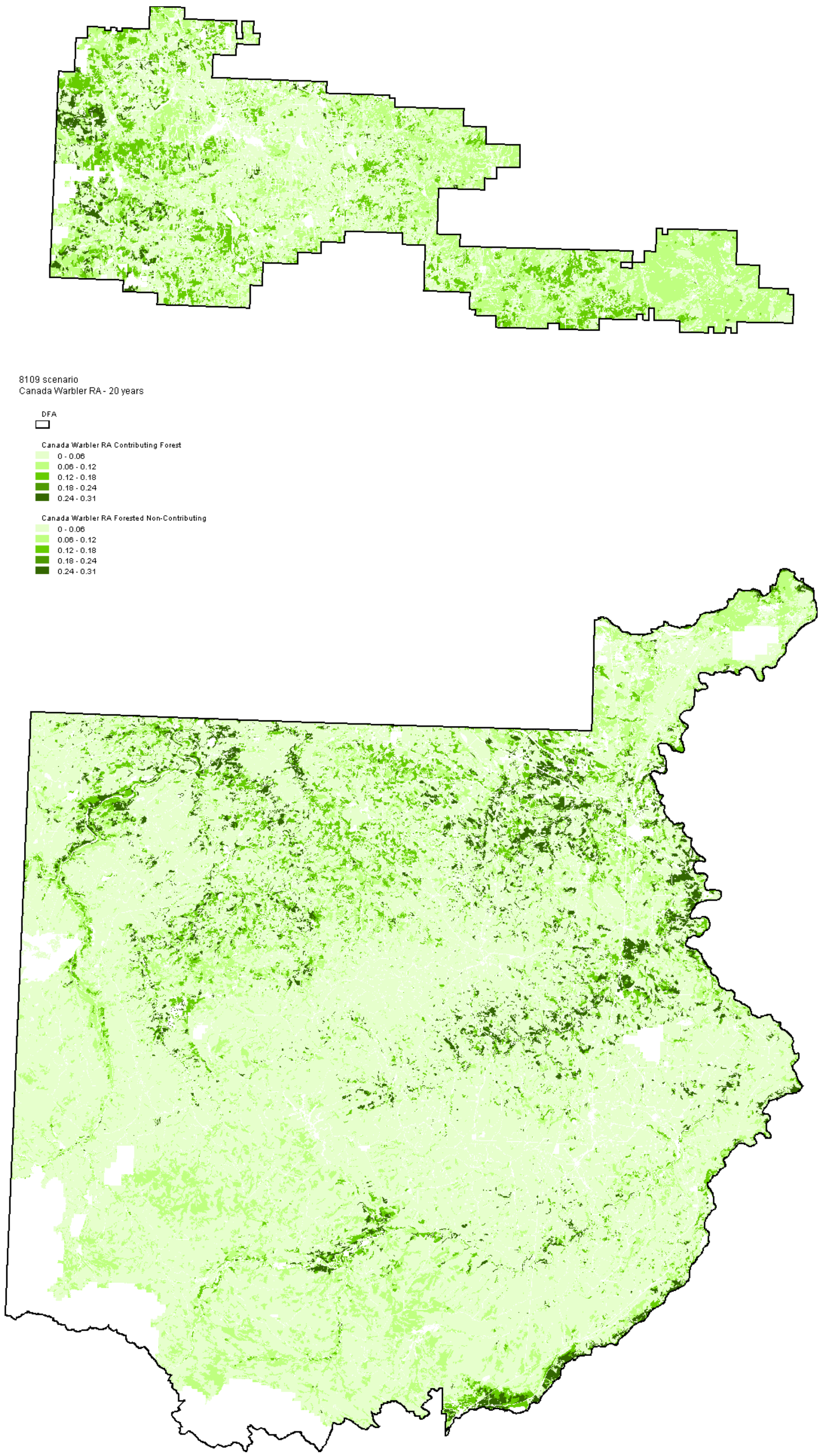


Figure 38 Canada Warbler Relative abundance - 20-Year snapshot

3.8.1.4 **50-year Snapshot**

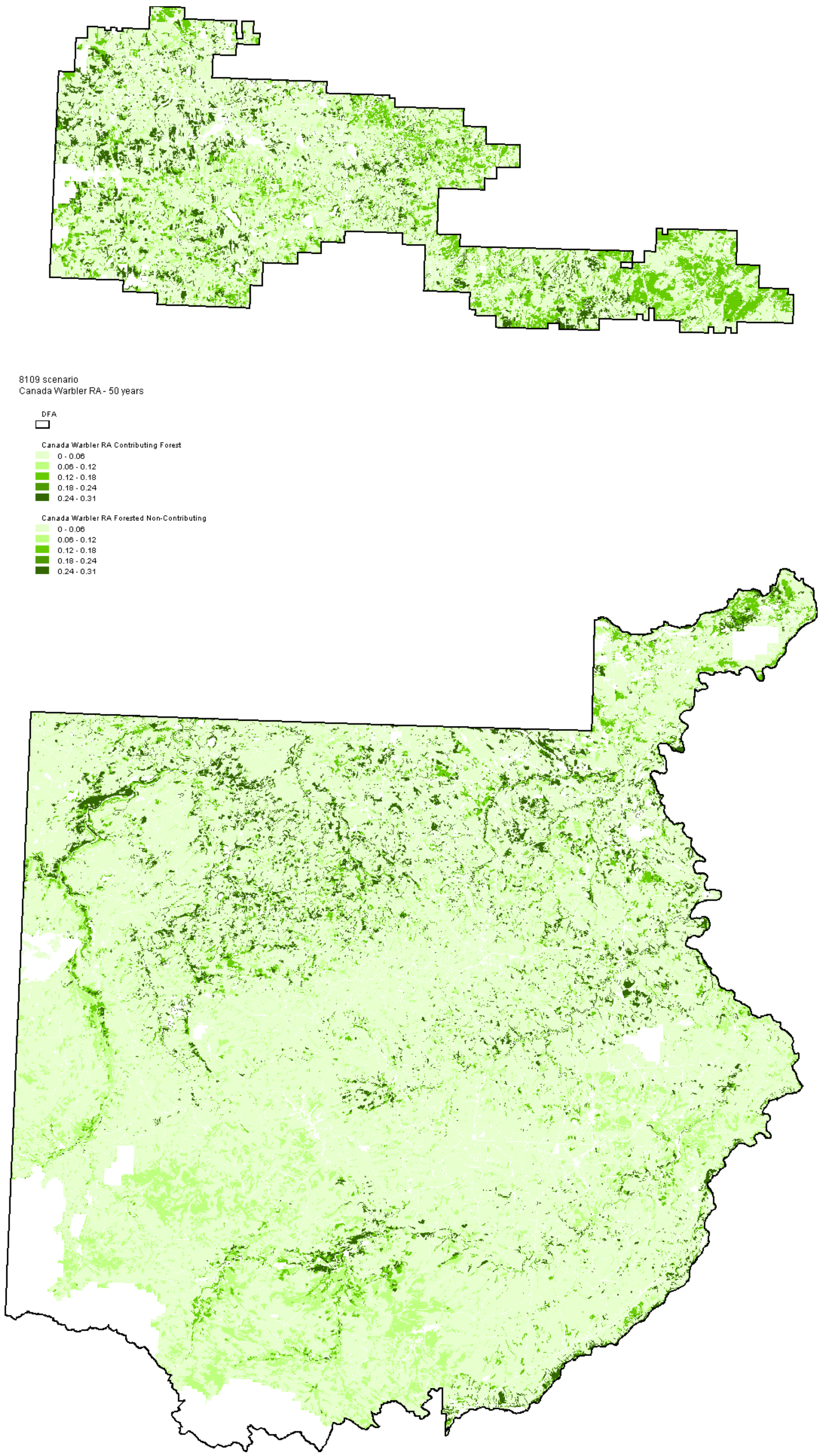


Figure 39 Canada Warbler Relative abundance - 50-Year snapshot

3.8.2 Brown Creeper

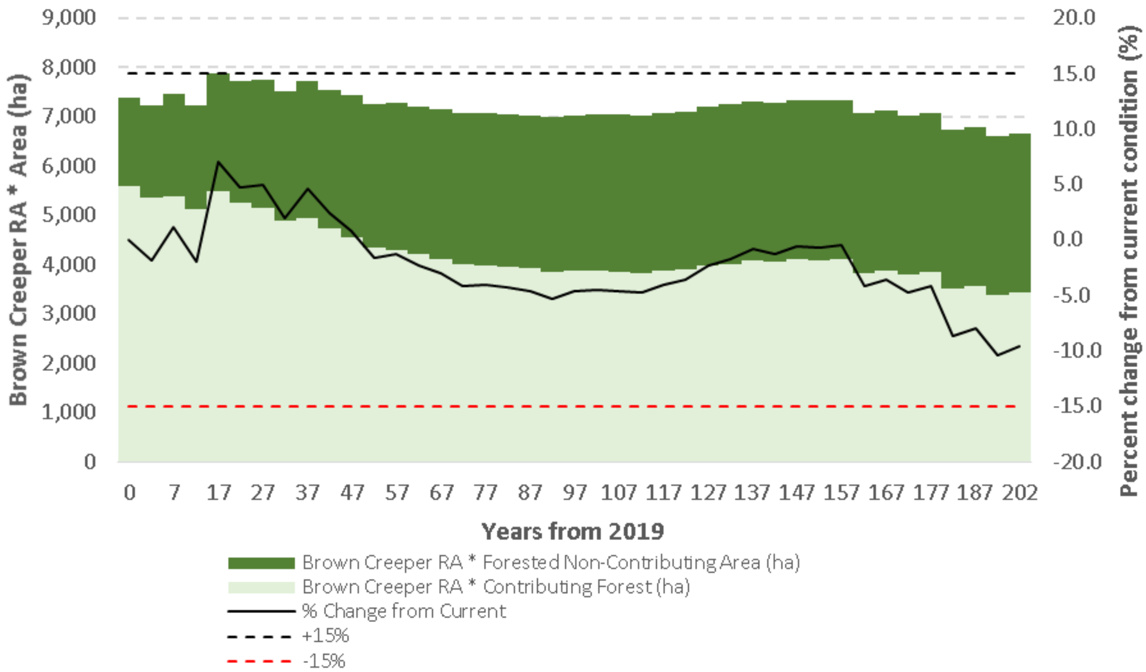


Figure 40 Brown Creeper Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.2.1 **Current Snapshot**

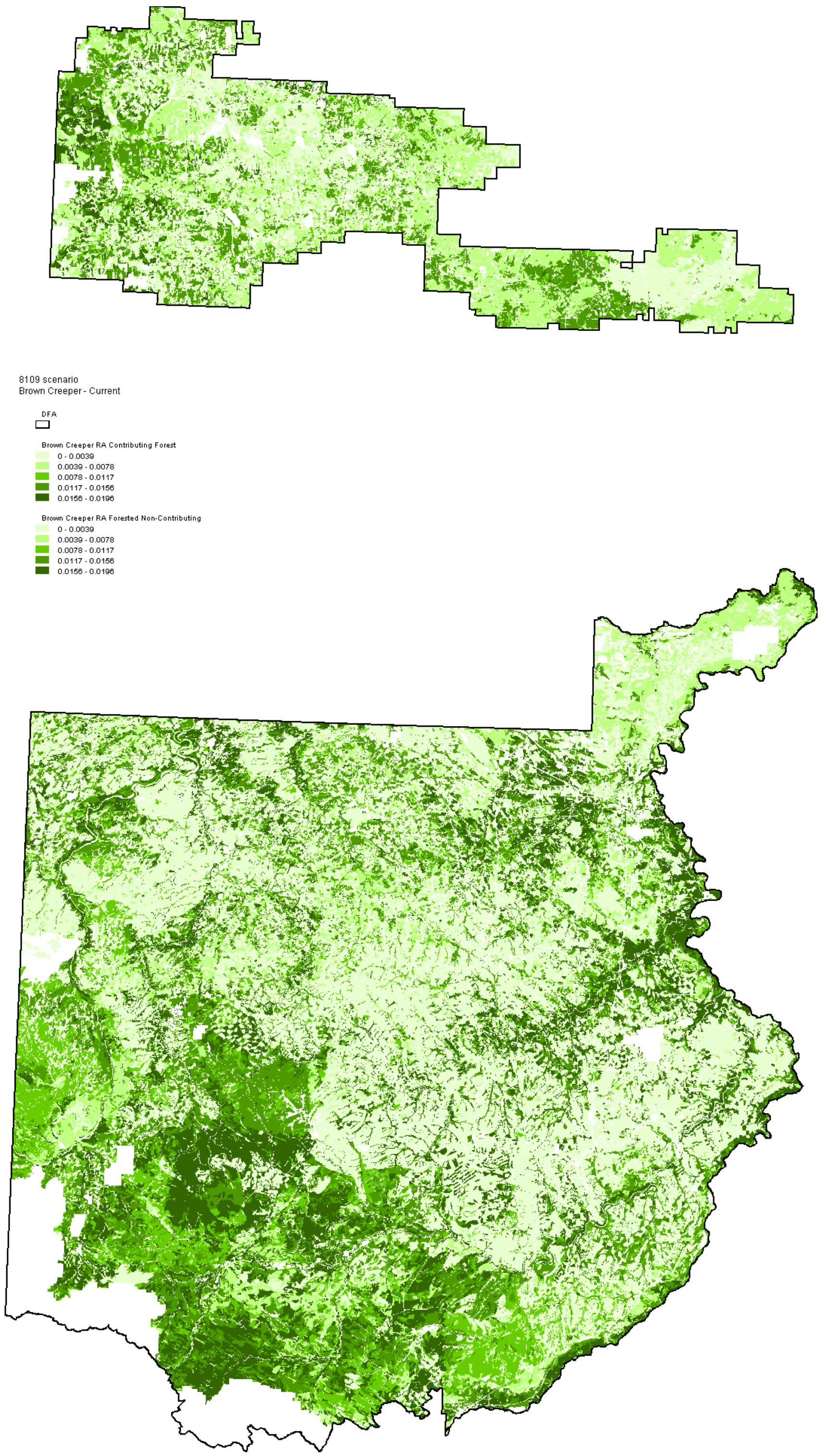


Figure 41 Brown Creeper Relative abundance (RA) – Current

3.8.2.2 **10-year Snapshot**

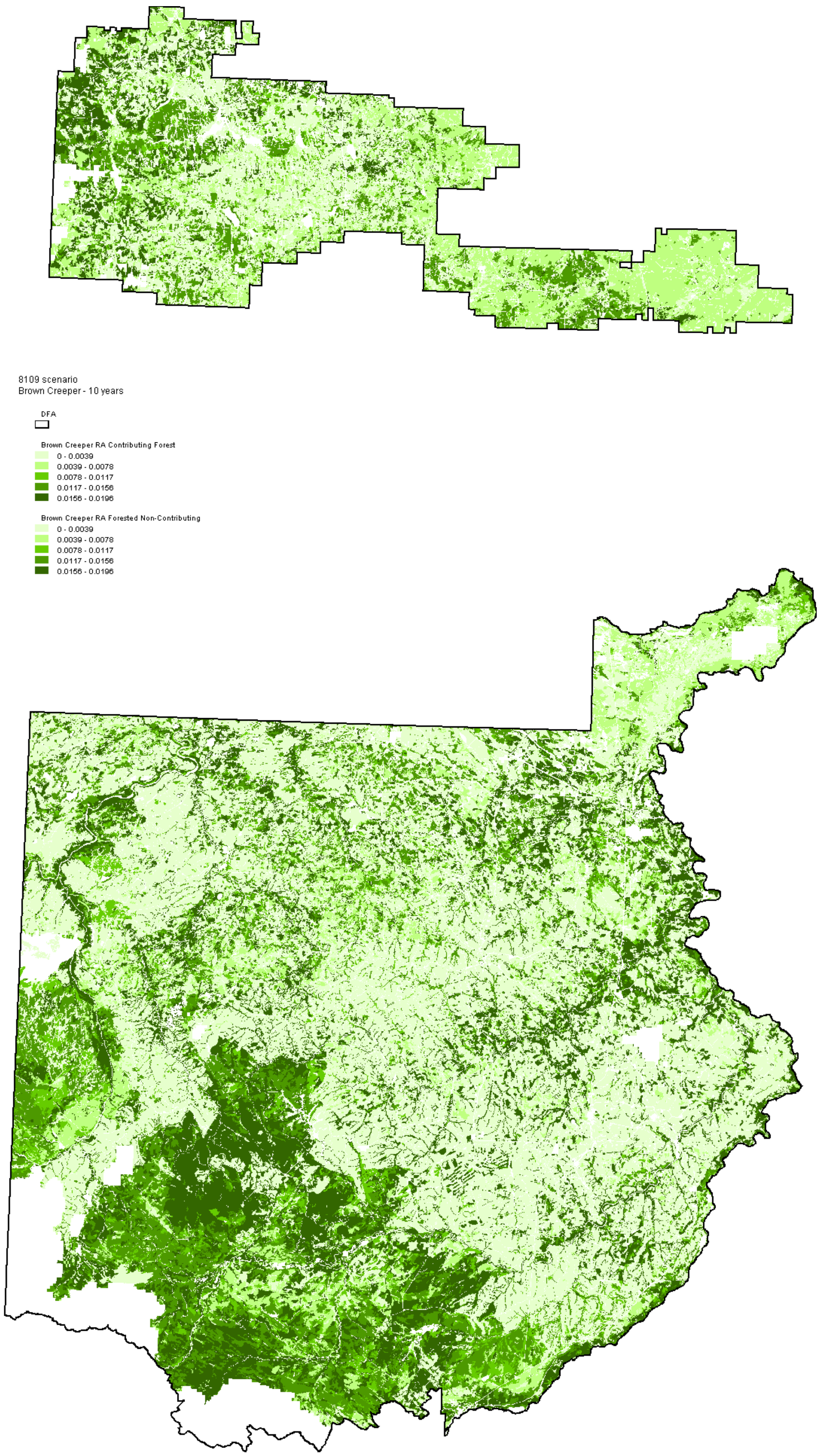


Figure 42 Brown Creeper Relative abundance (RA) – 10 Years

3.8.2.3 **20-year Snapshot**

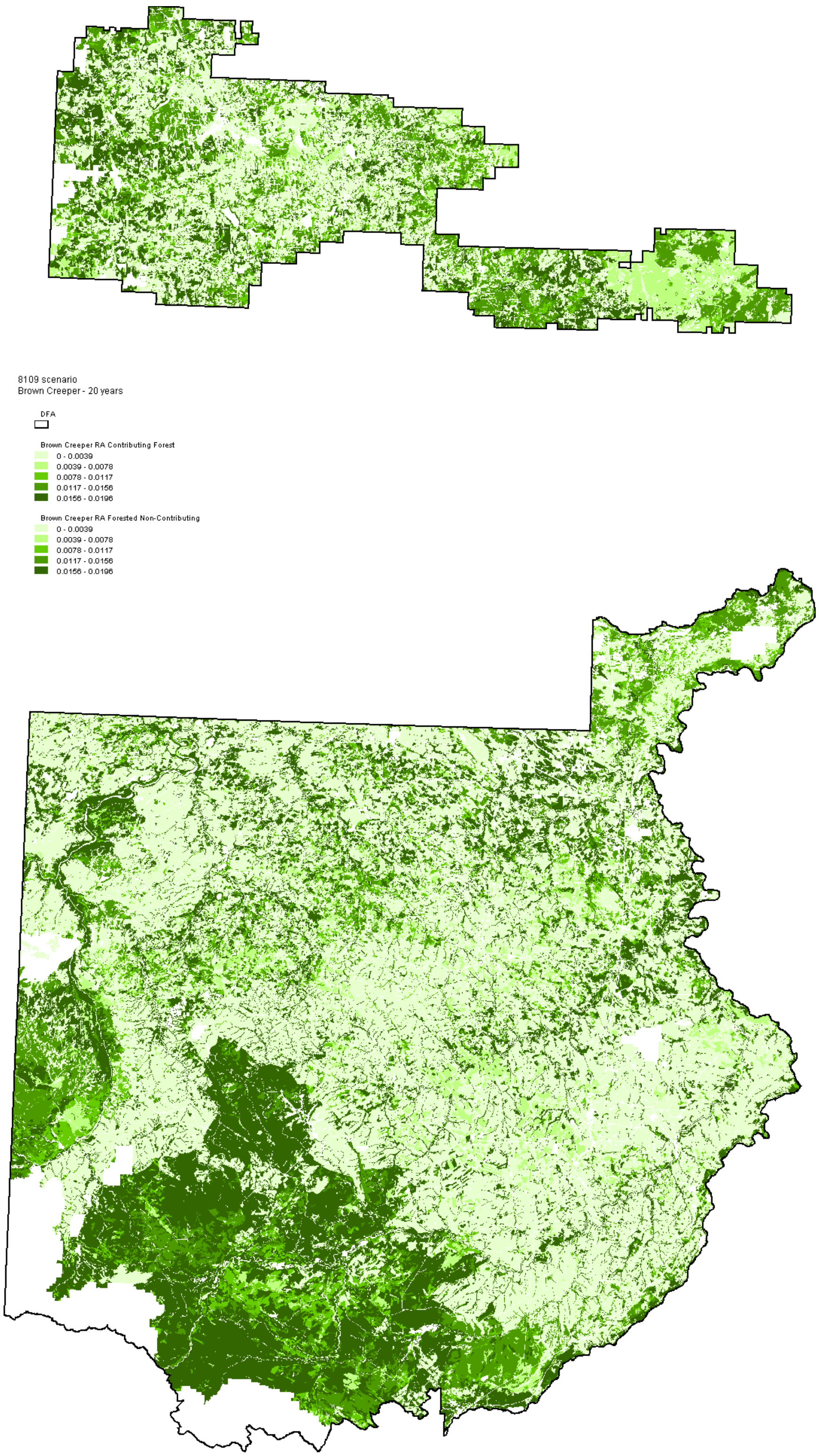


Figure 43 Brown Creeper Relative abundance (RA) – 20 Years

3.8.2.4 **50-year Snapshot**

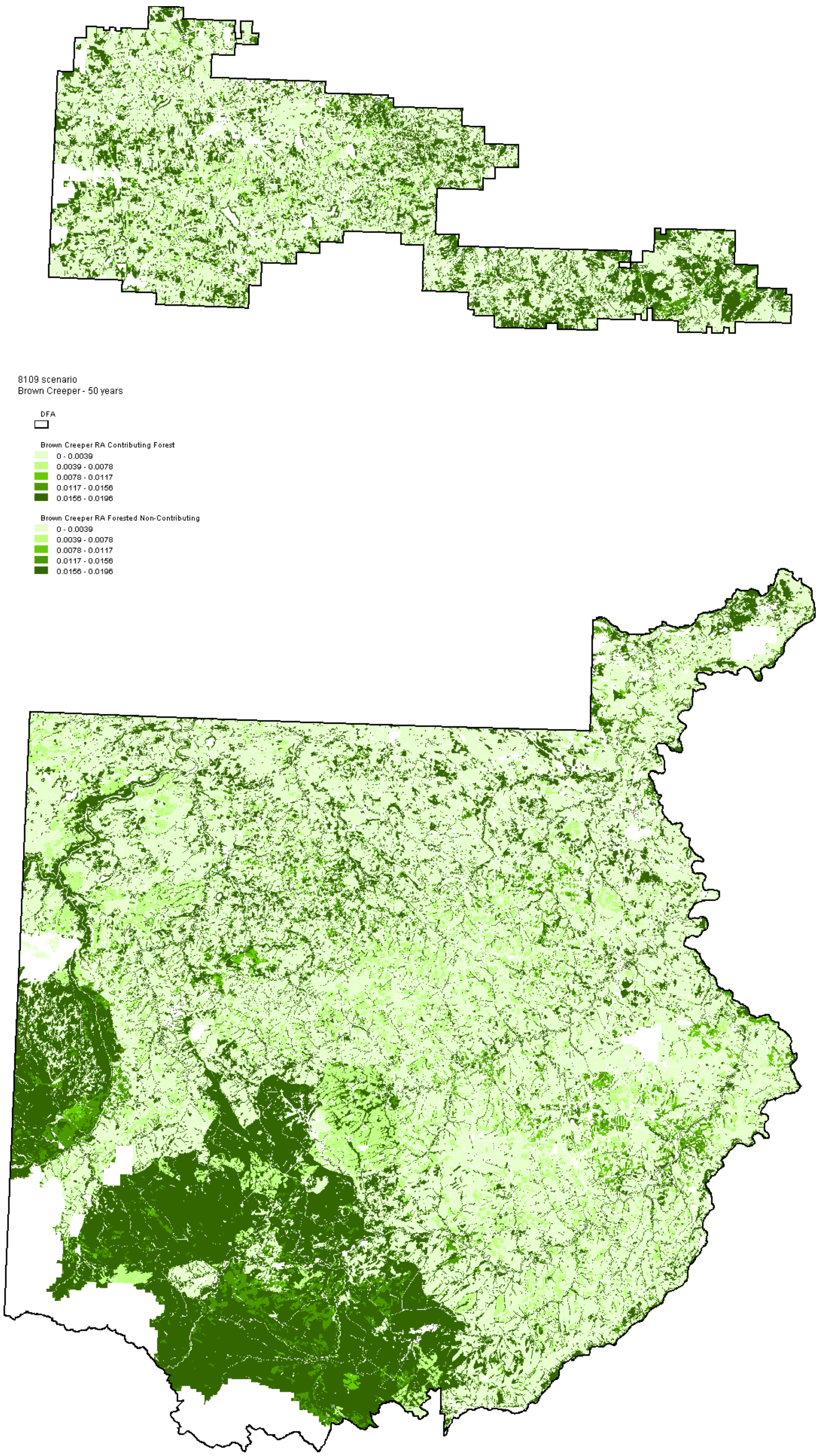


Figure 44 Brown Creeper Relative abundance (RA) – 50 Years

3.8.3 Black-throated Green Warbler

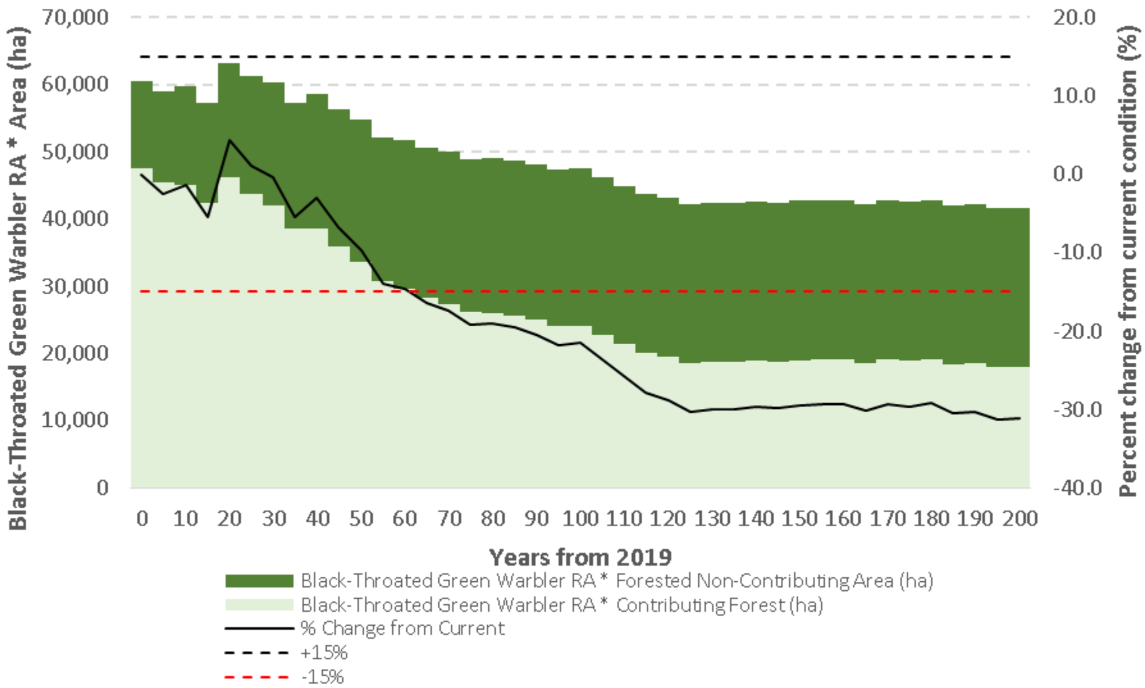


Figure 45 **Black-throated Green Warbler relative abundance multiplied by area (ha) over the 200-year planning horizon**

3.8.3.1 **Current Snapshot**

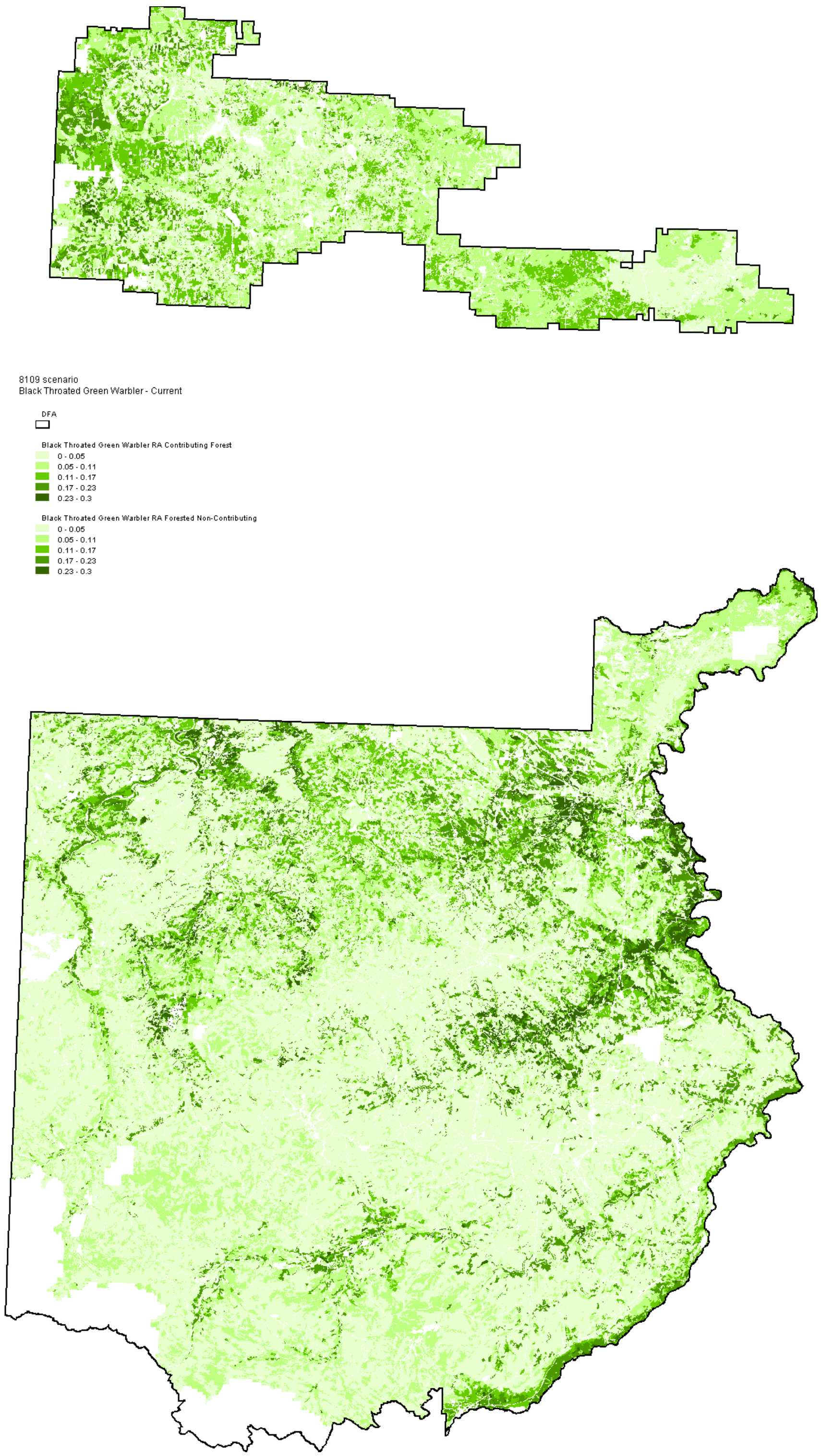


Figure 46 Black Throated Green Warbler Relative abundance - Current snapshot

3.8.3.2 **10-year Snapshot**

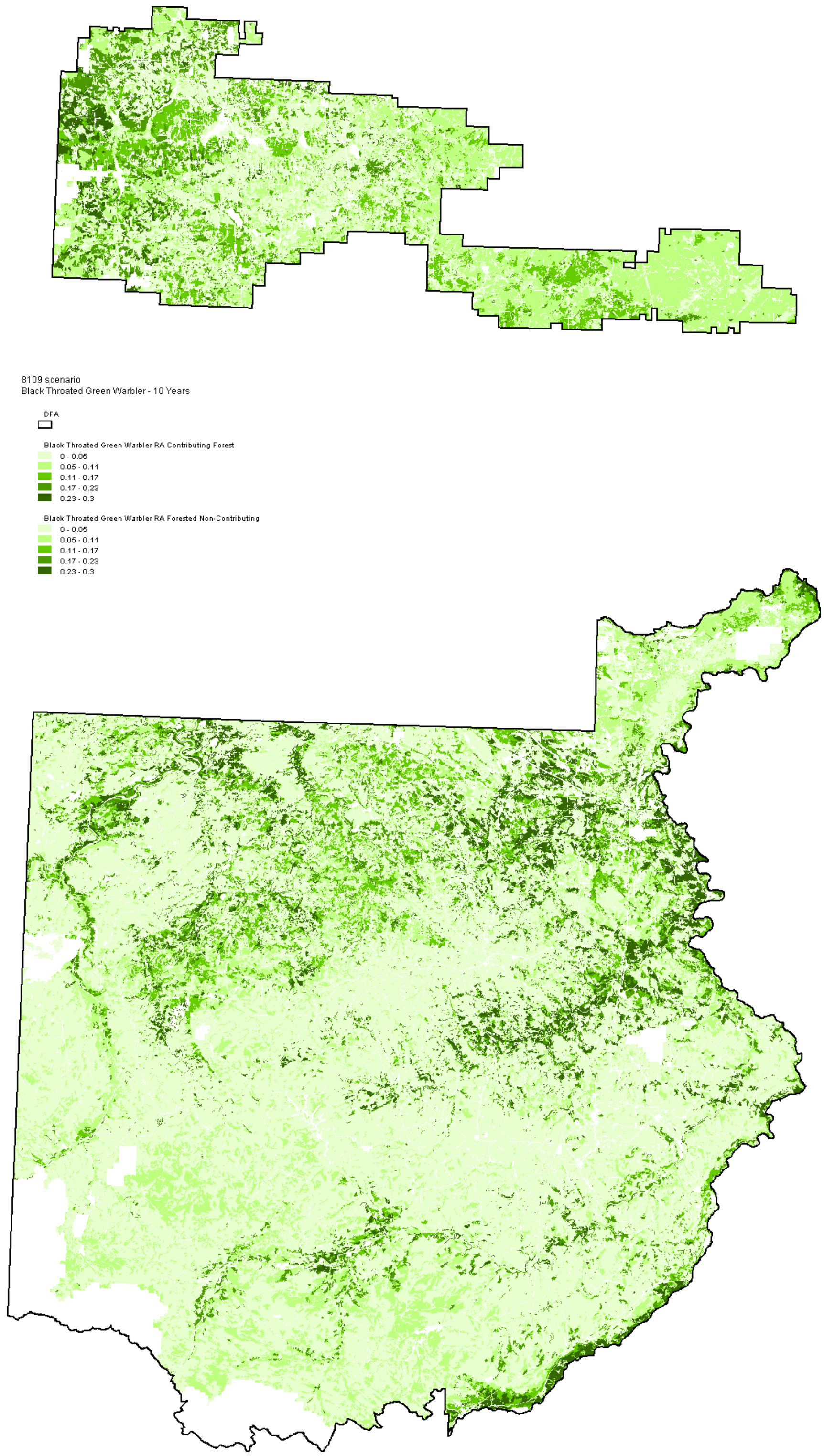


Figure 47 Black Throated Green Warbler Relative abundance - 10-Year snapshot

3.8.3.3 **20-year Snapshot**

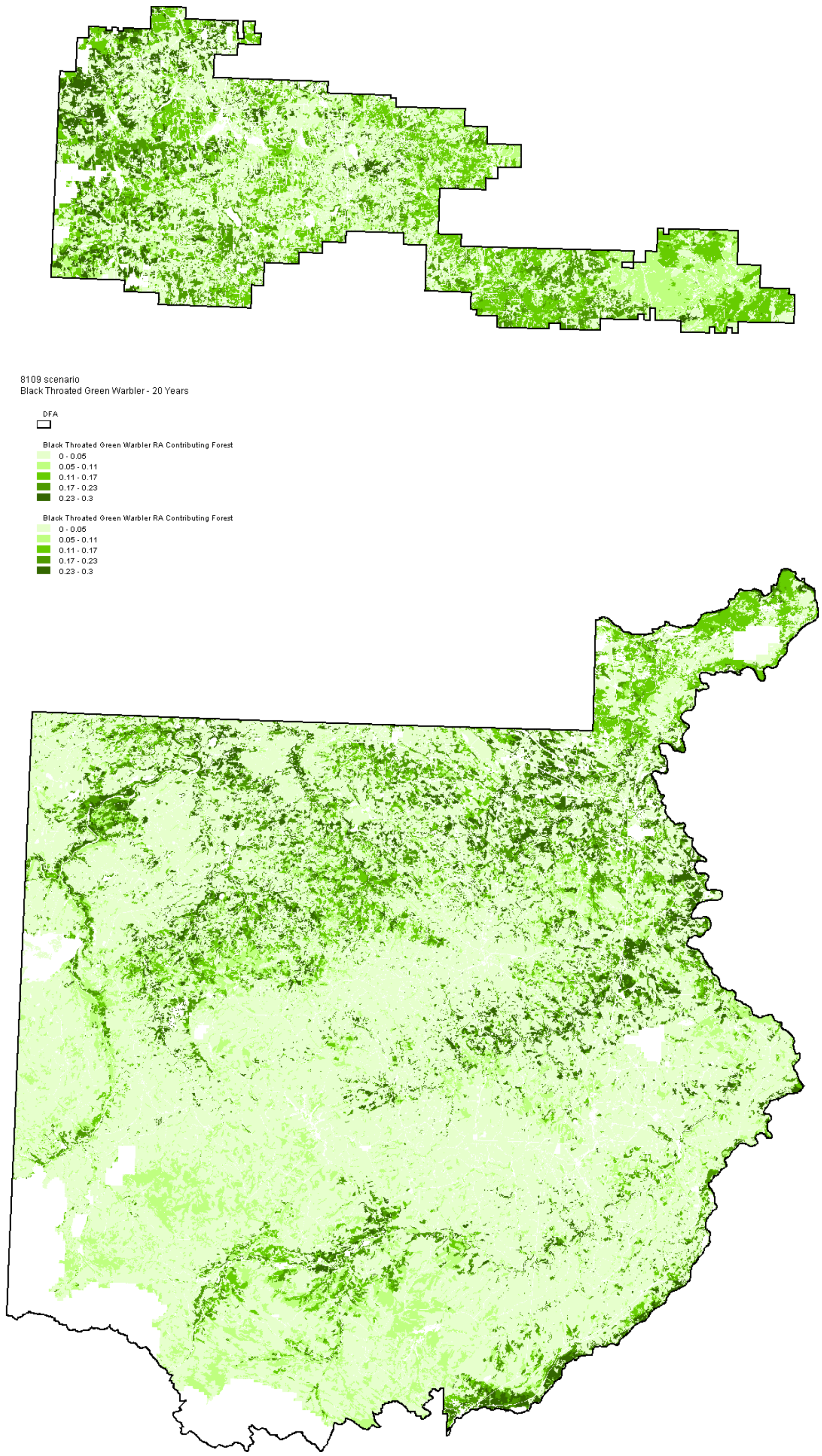


Figure 48 Black Throated Green Warbler Relative abundance - 20-Year snapshot

3.8.3.4 **50-year Snapshot**

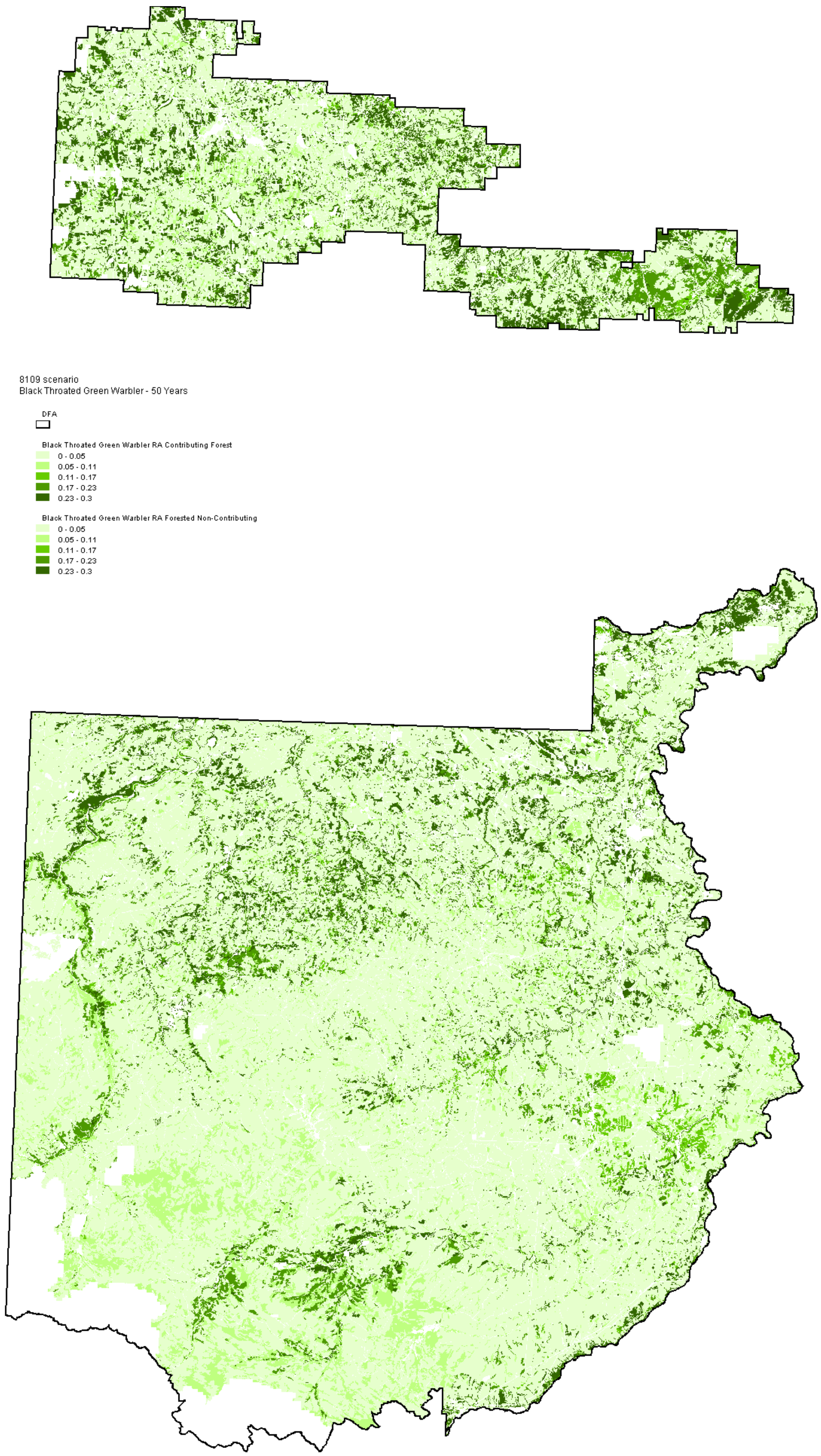


Figure 49 Black Throated Green Warbler Relative abundance - 50-Year snapshot

3.8.4 Ovenbird

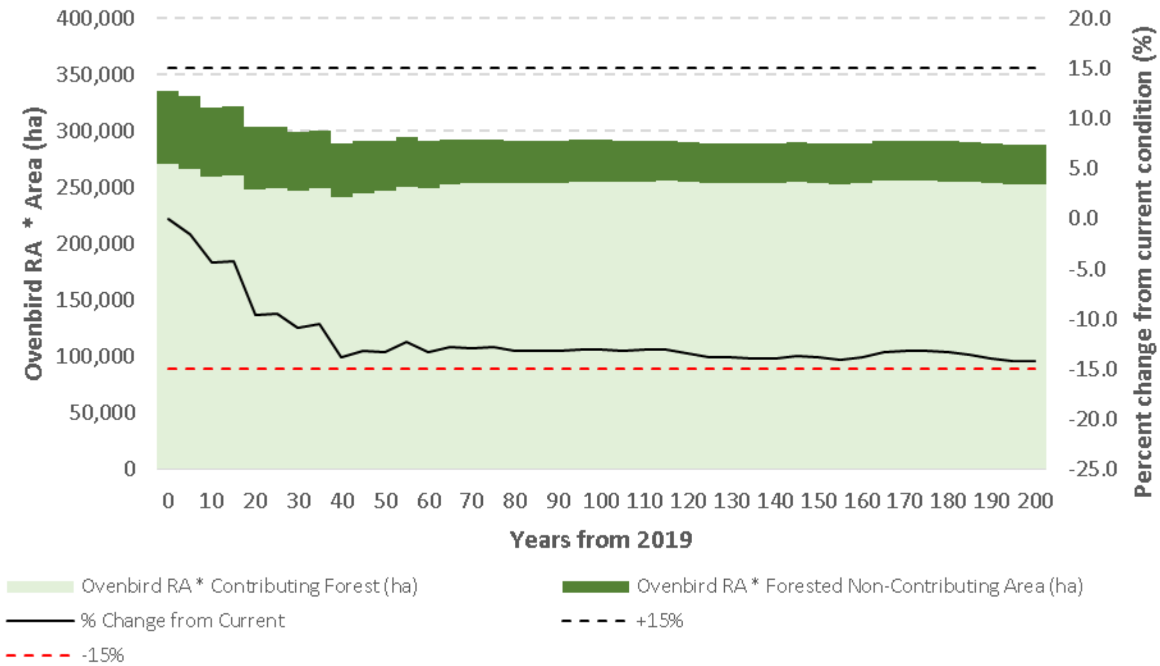


Figure 50 Ovenbird Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.4.1 **Current Snapshot**

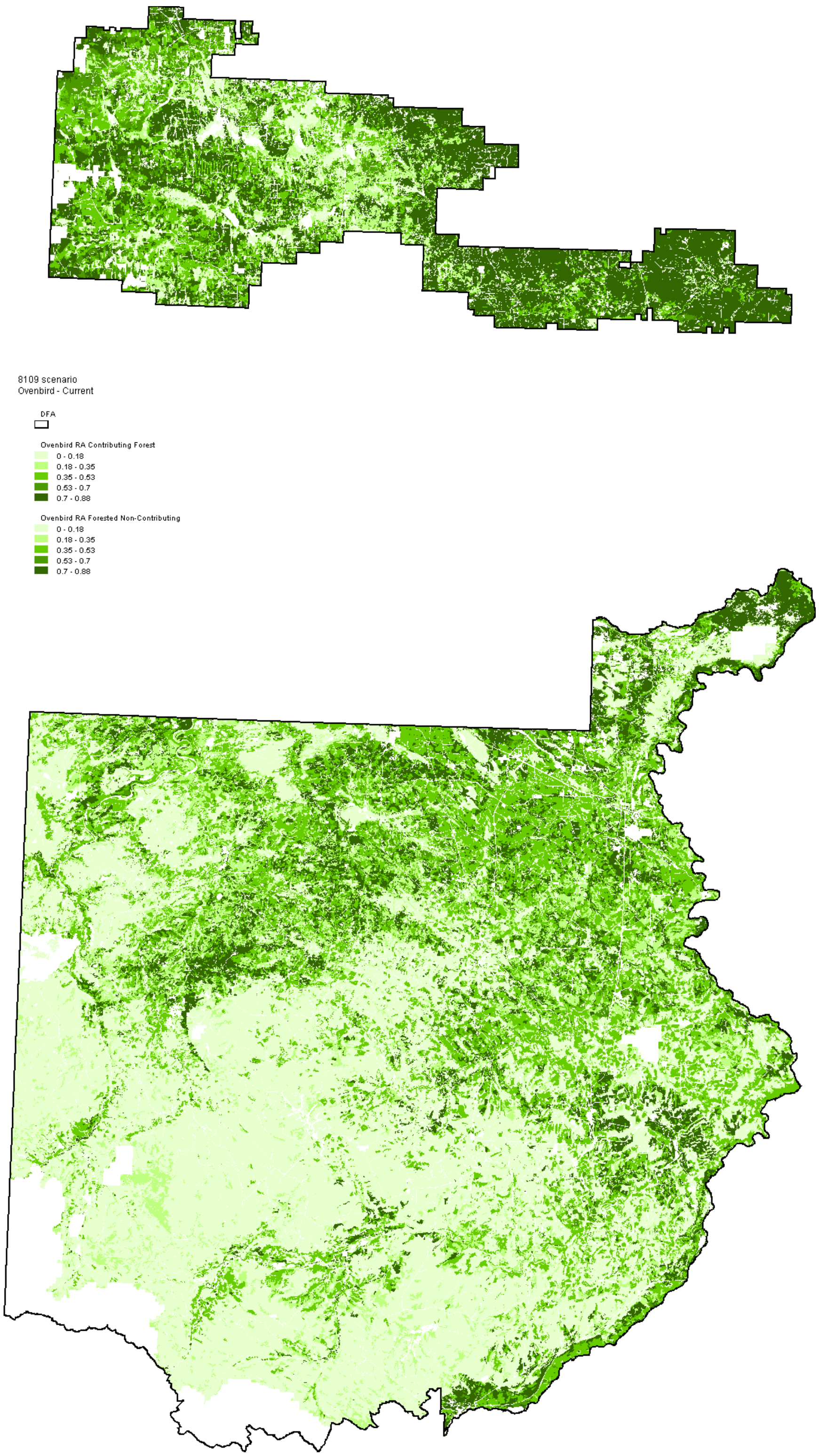


Figure 51 Ovenbird Relative abundance (RA) – Current

3.8.4.2 **10-year Snapshot**

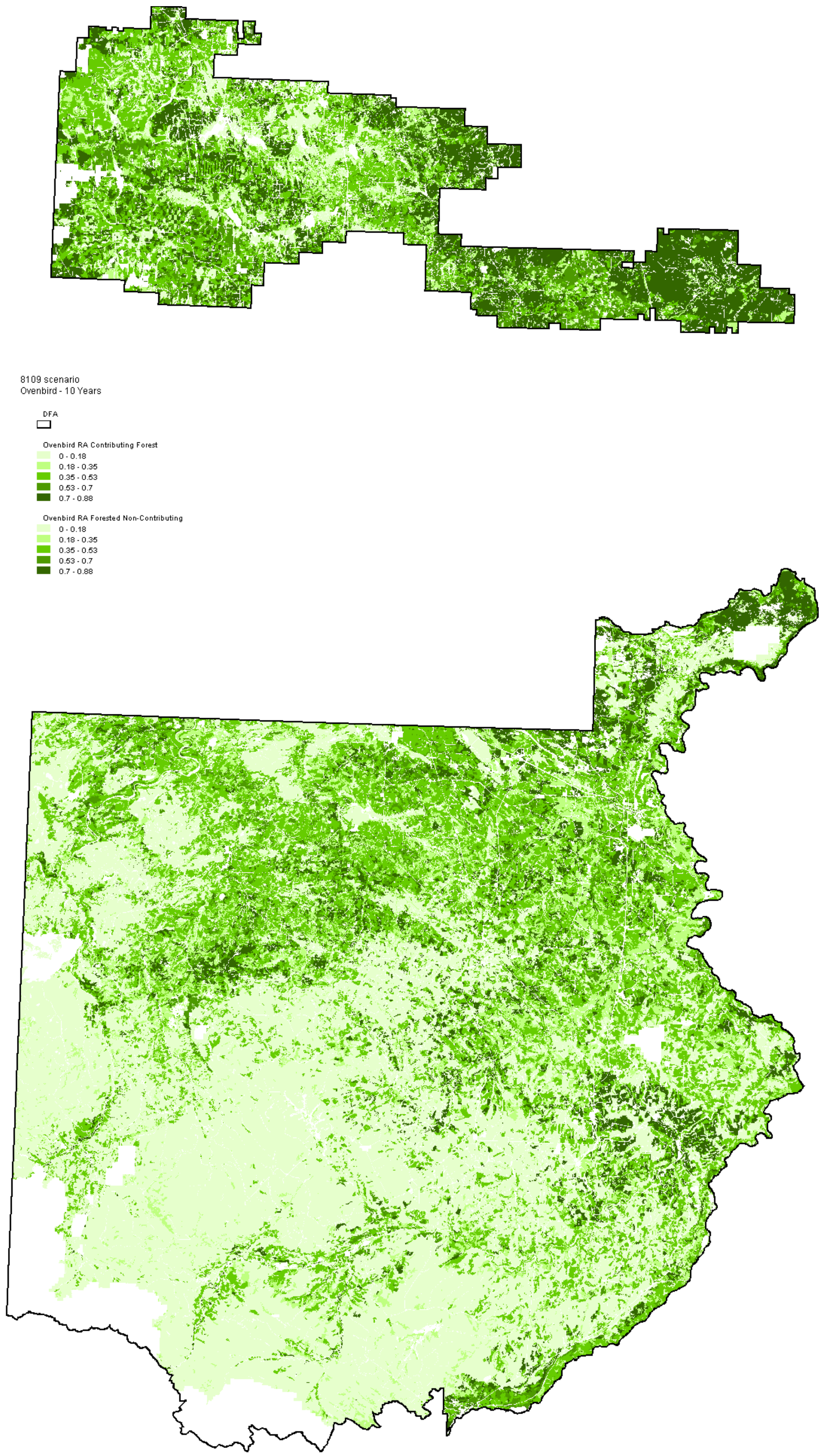


Figure 52 Ovenbird Relative abundance (RA) – 10 Years

3.8.4.3 **20-year Snapshot**

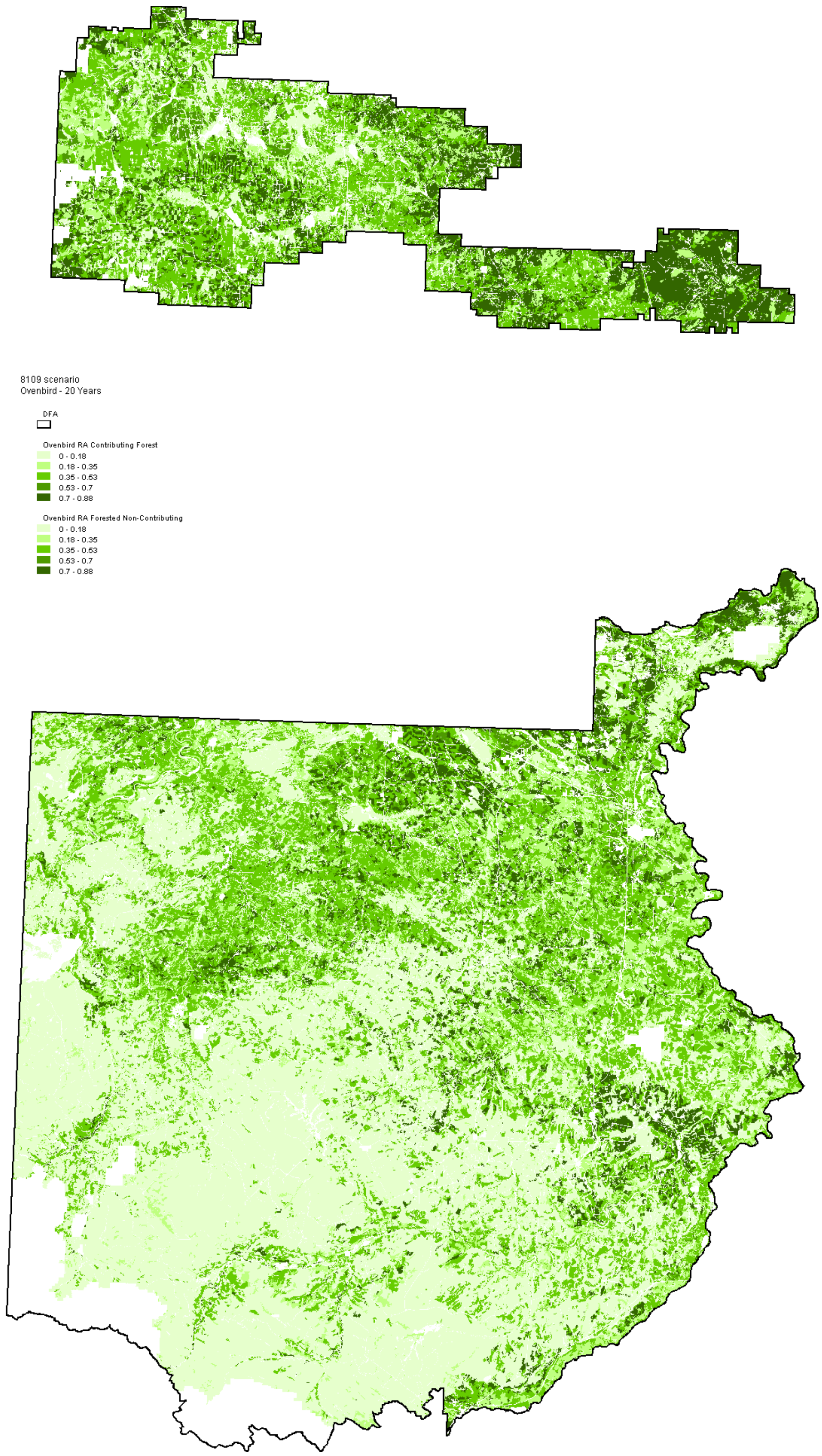


Figure 53 Ovenbird Relative abundance (RA) – 20 Years

3.8.4.4 **50-year Snapshot**

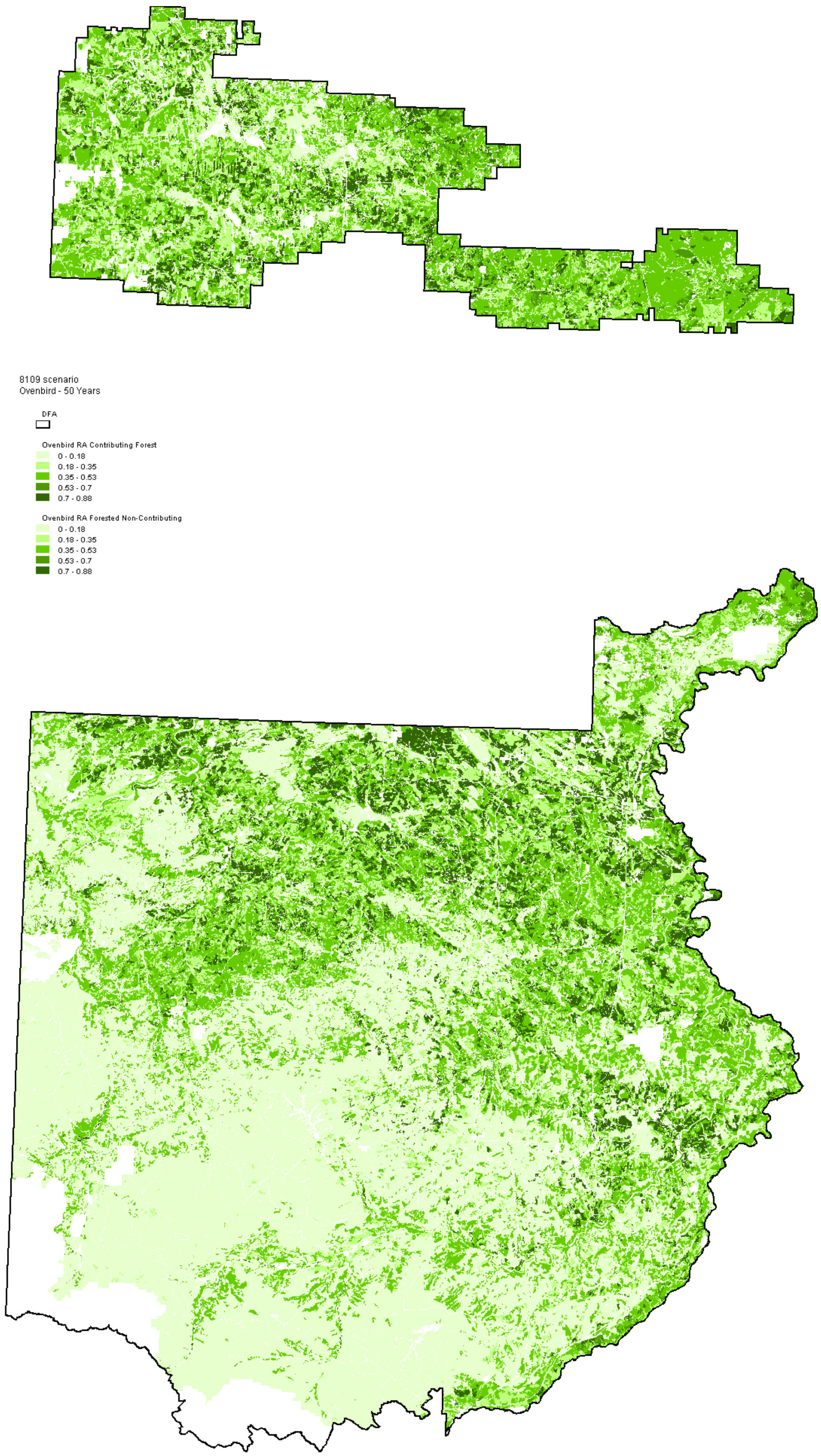


Figure 54 Ovenbird Relative abundance (RA) – 50 Years

3.8.5 Varied Thrush

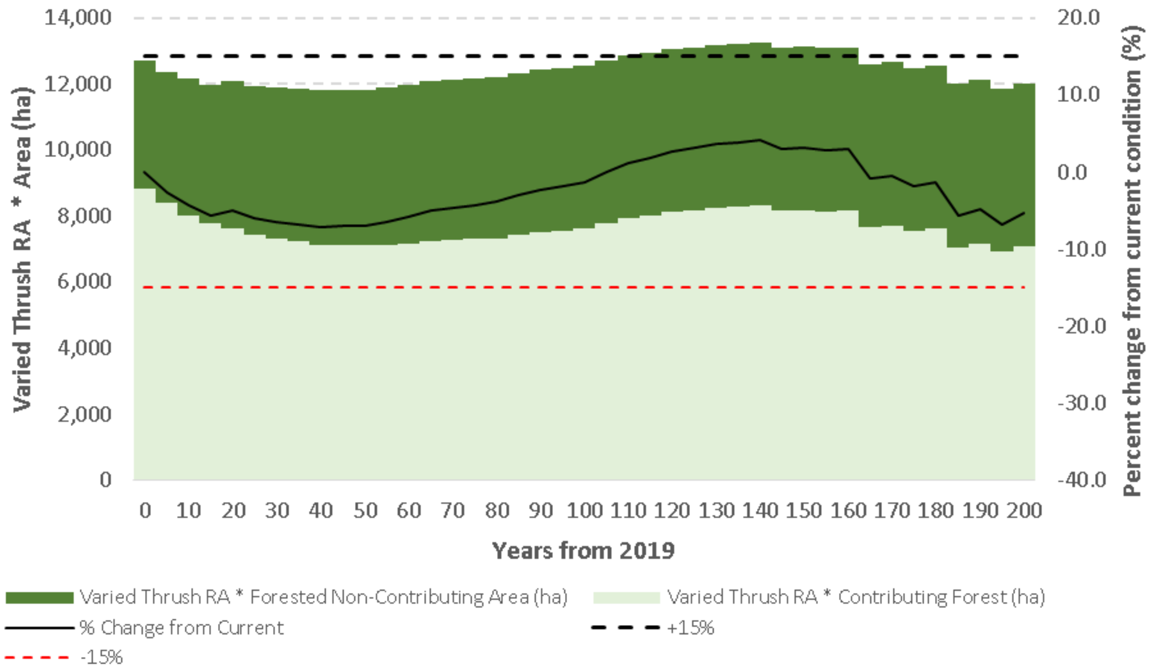


Figure 55 Varied Thrush Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.5.1 **Current Snapshot**

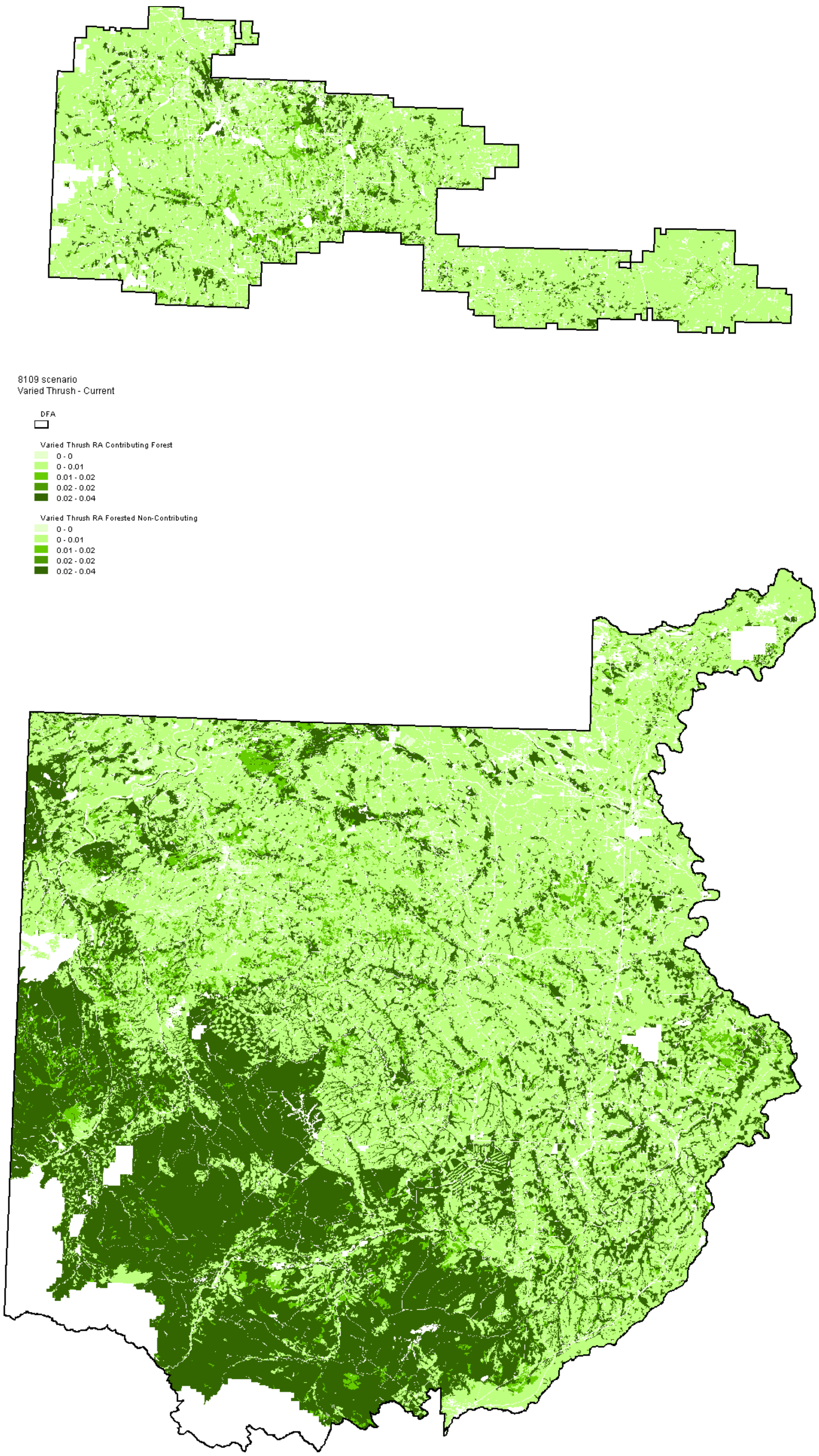


Figure 56 Varied Thrush Relative abundance (RA) – Current

3.8.5.2 **10-year Snapshot**

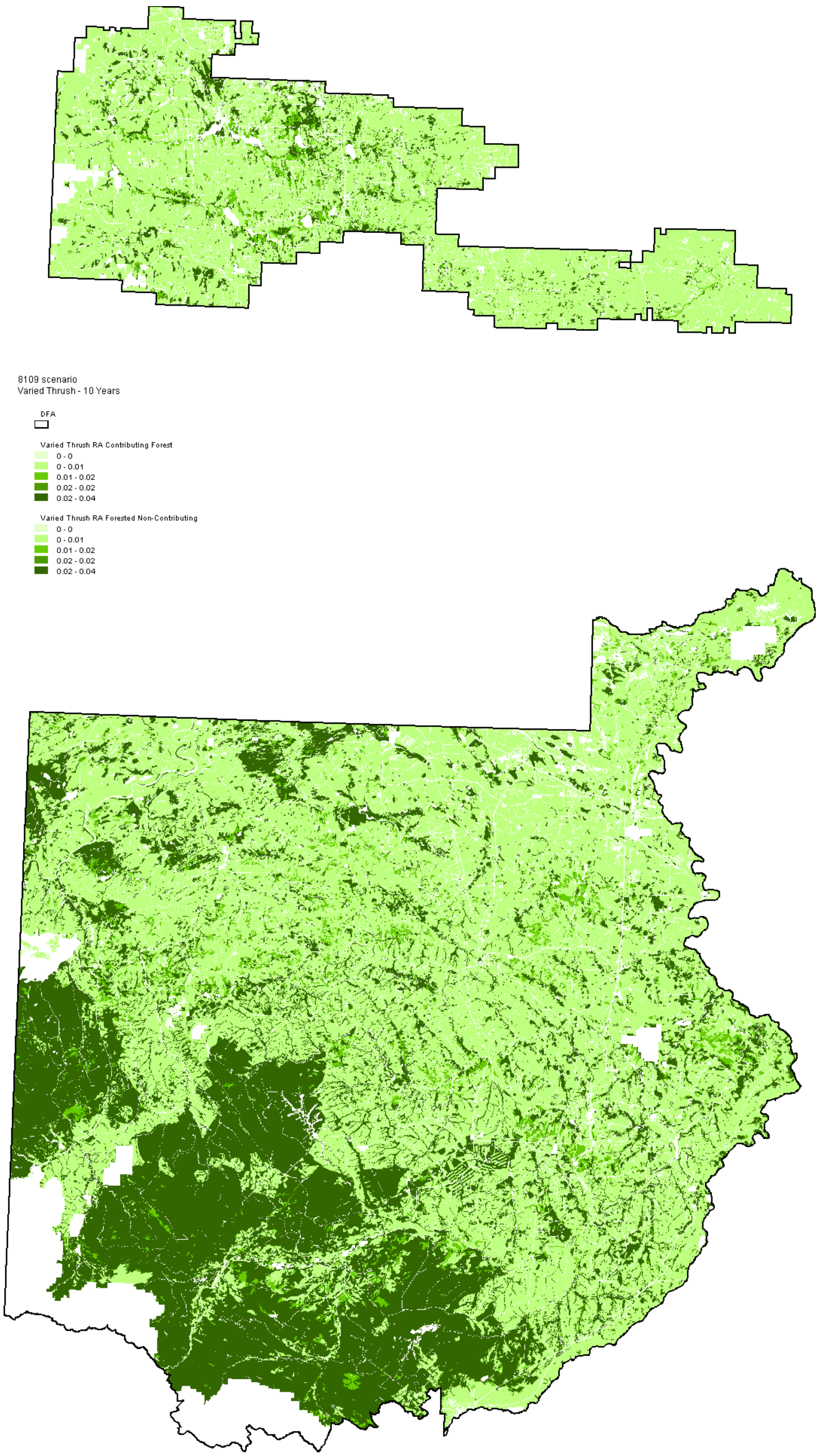


Figure 57 Varied Thrush Relative abundance (RA) – 10-Year snapshot

3.8.5.3 **20-year Snapshot**

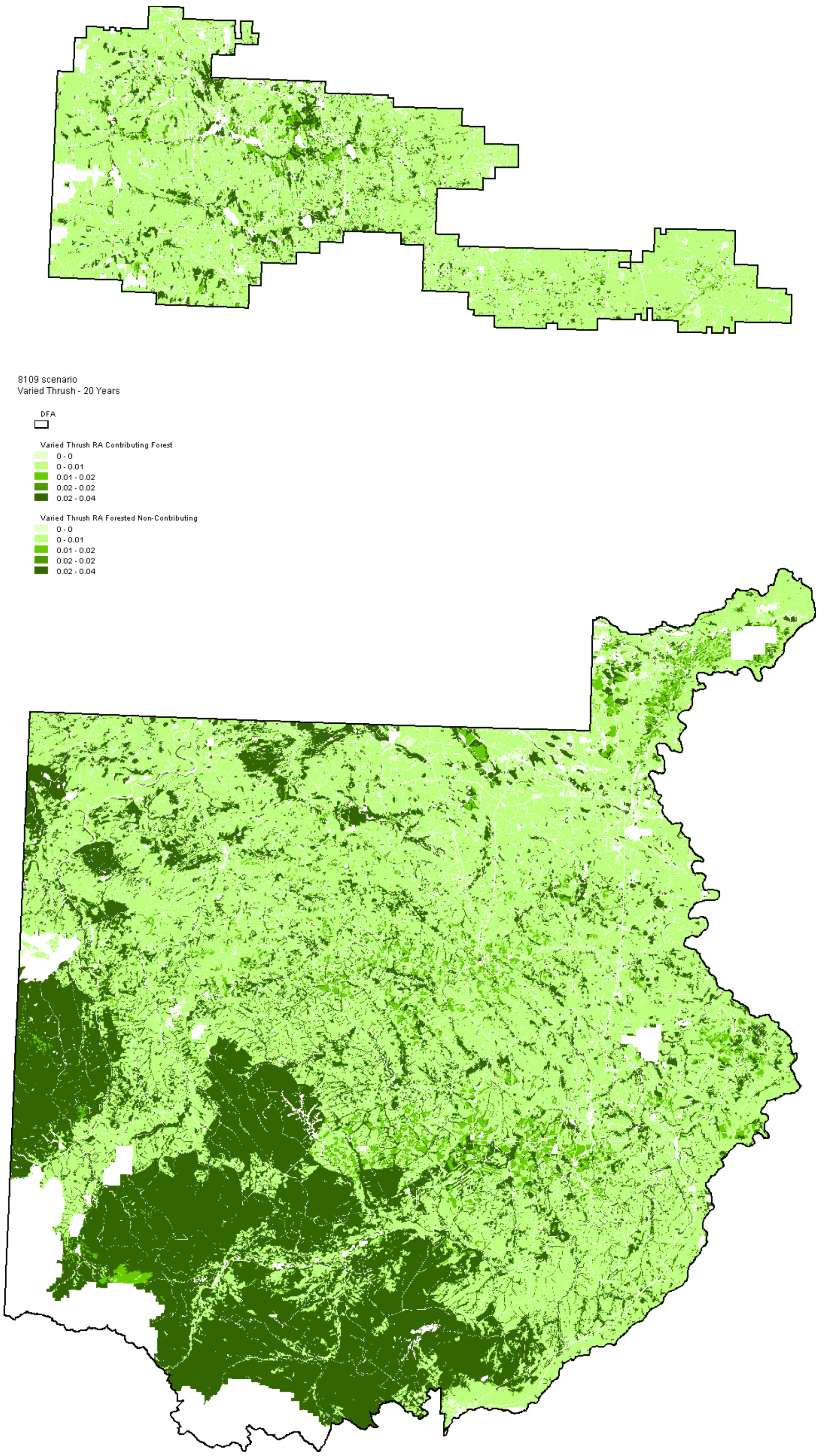


Figure 58 Varied Thrush Relative abundance (RA) – 20-Year snapshot

3.8.5.4 **50-year Snapshot**

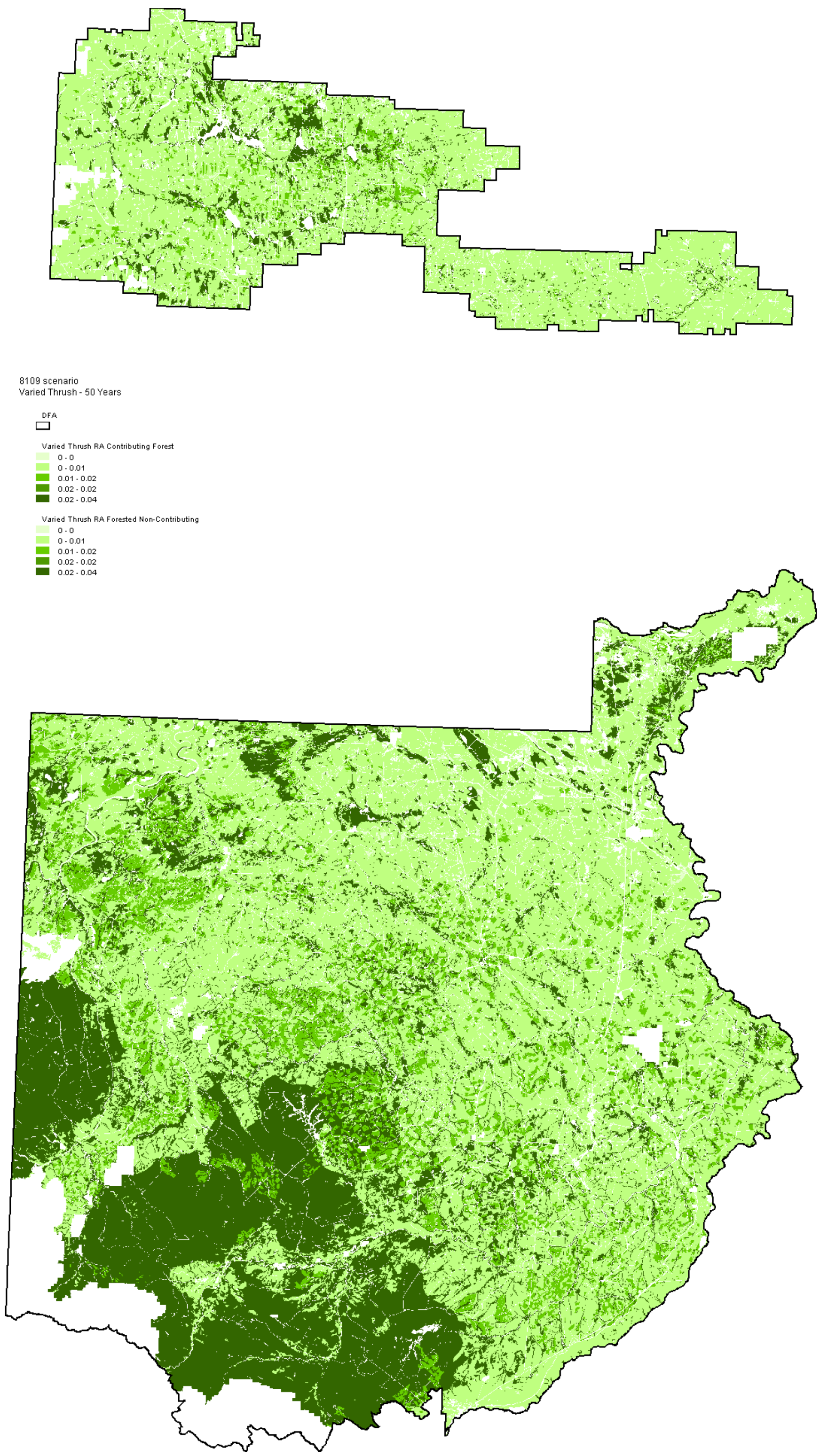


Figure 59 Varied Thrush Relative abundance (RA) – 50-Year snapshot

3.9 *Equivalent Clearcut Area (Cold Water Fish VOIT 1.1.2.1e & Water Yield VOIT 3.2.1.1)*

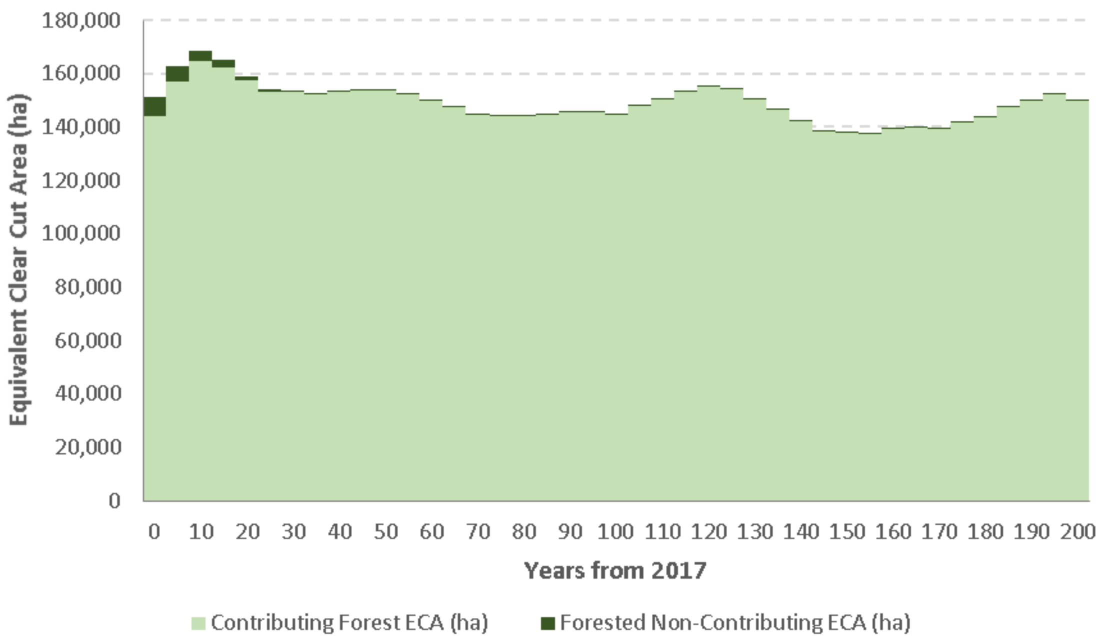


Figure 60 Equivalent Clear-Cut Area (ha) over time on the contributing and forested non-contributing forest over the 200-year planning horizon

3.9.1 Watershed Key Map

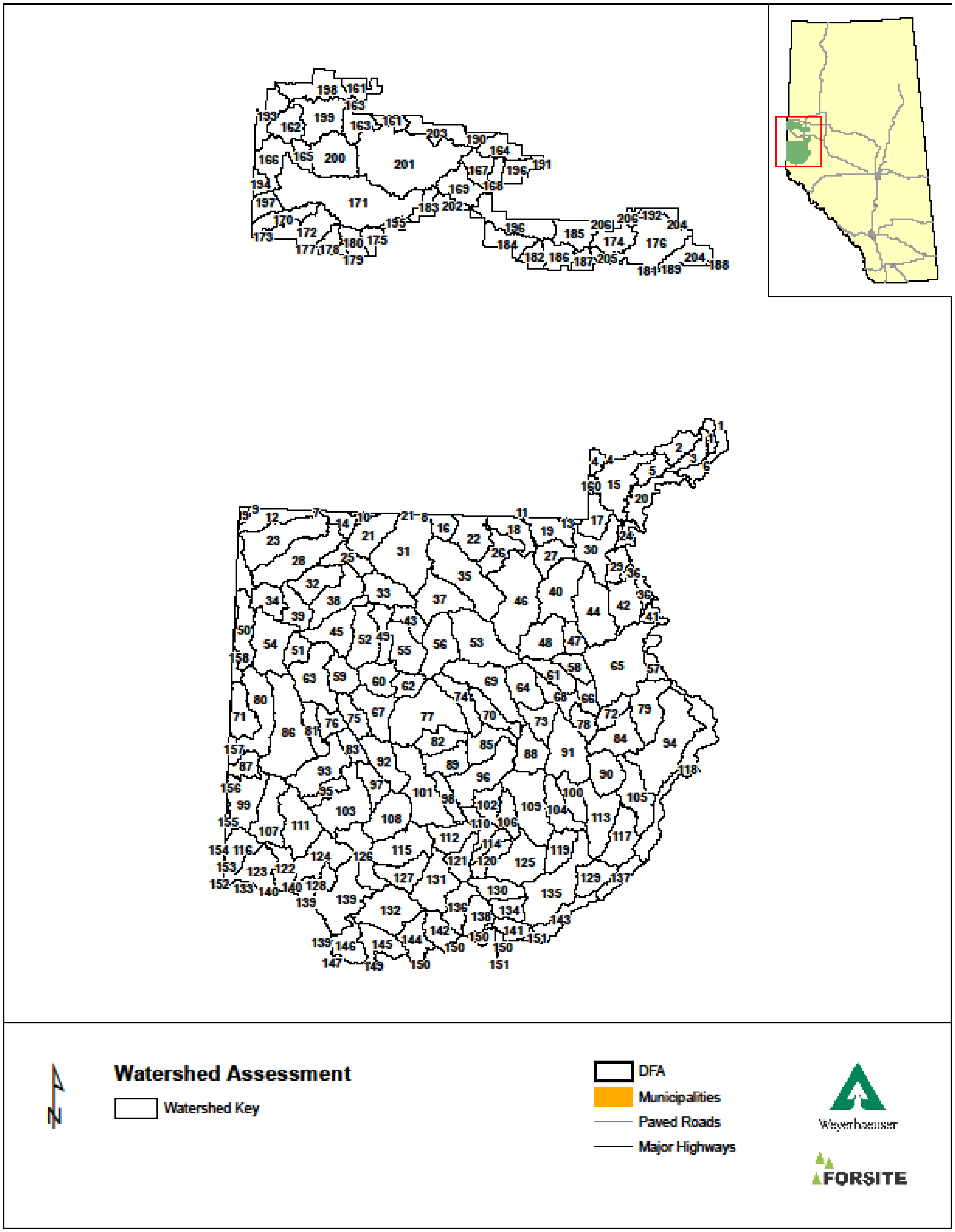


Figure 61 FMUG16 forestry watersheds (2019) by watershed ID number

3.9.2 Current Snapshot

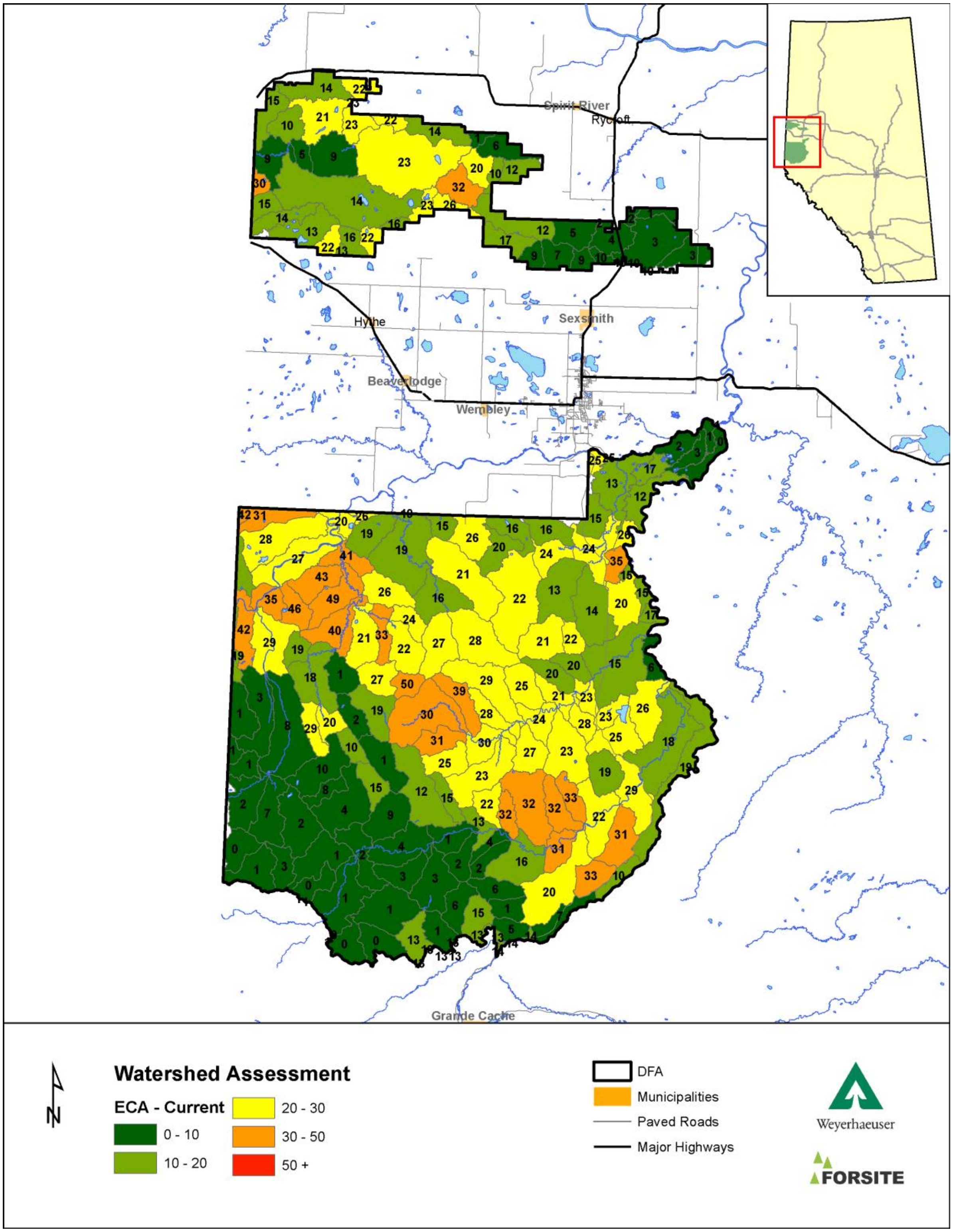


Figure 62 **Current Equivalent Clear-Cut Area proportion by forestry watershed (2019)**

3.9.3 **10-year Snapshot**

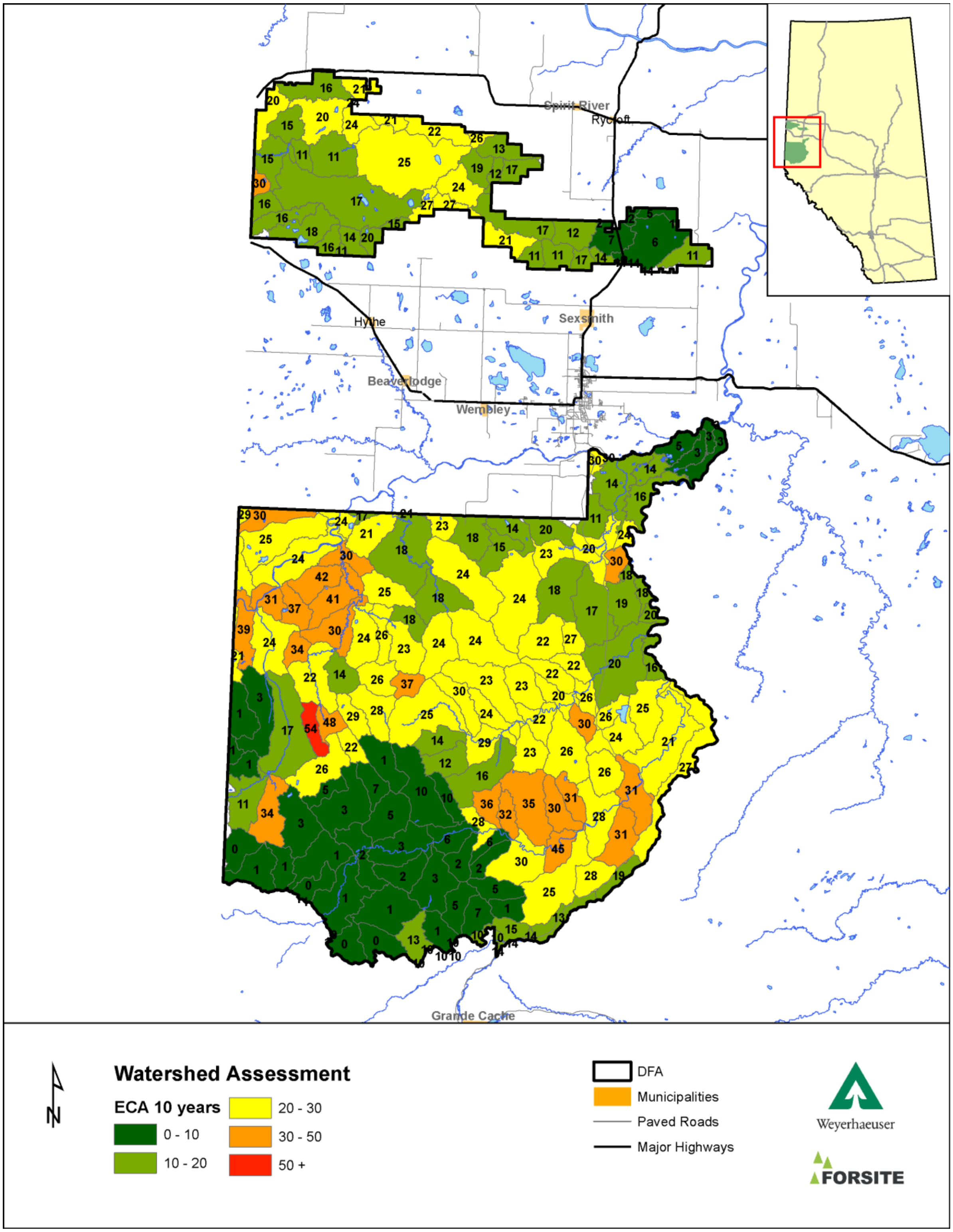


Figure 63 **Equivalent Clear-Cut Area proportion by forestry watershed 10 years from 2019 (2029)**

3.9.4 20-year Snapshot

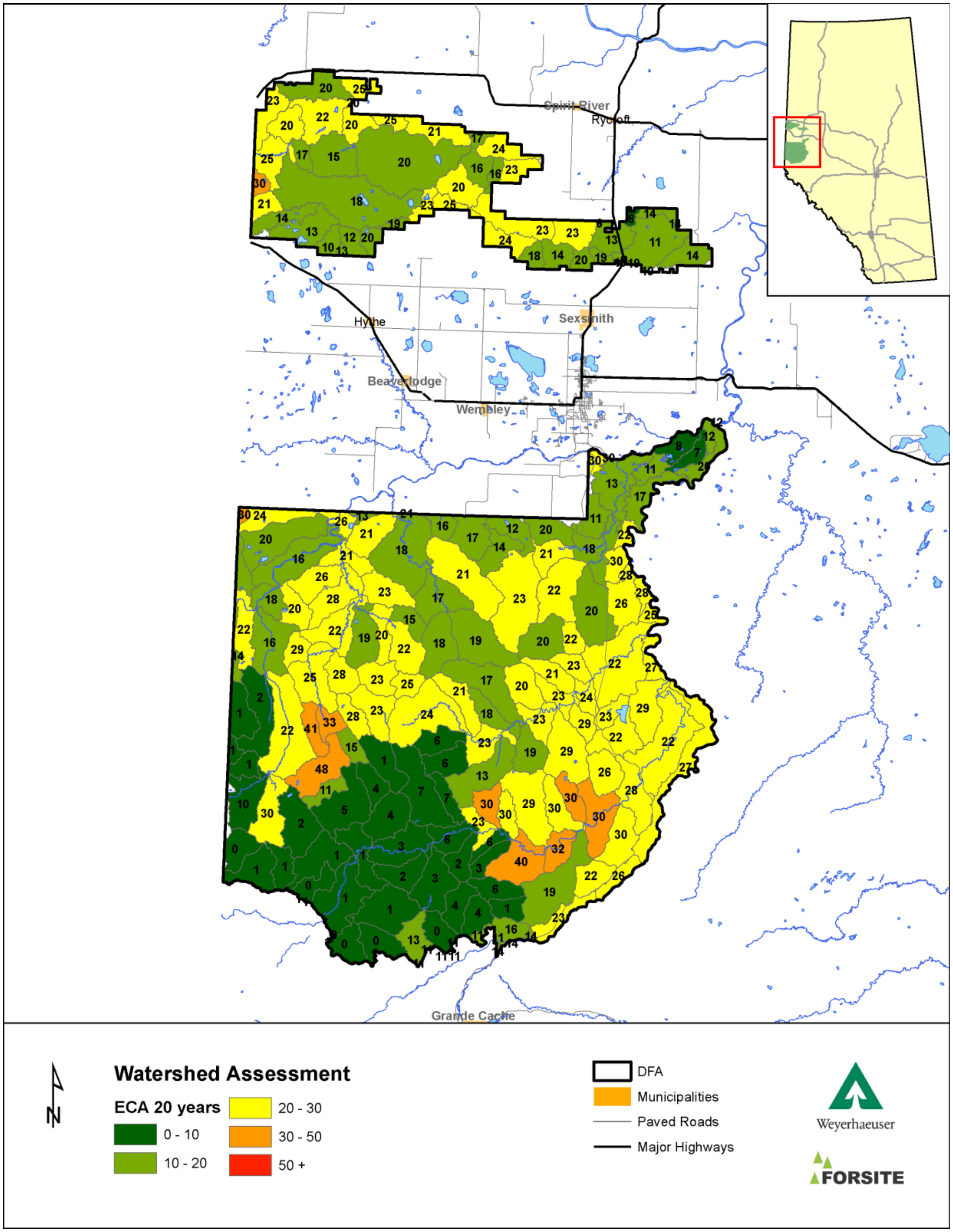


Figure 64 Equivalent Clear-Cut Area proportion by forestry watershed 20 years from 2019 (2039)

3.9.5 50-year Snapshot

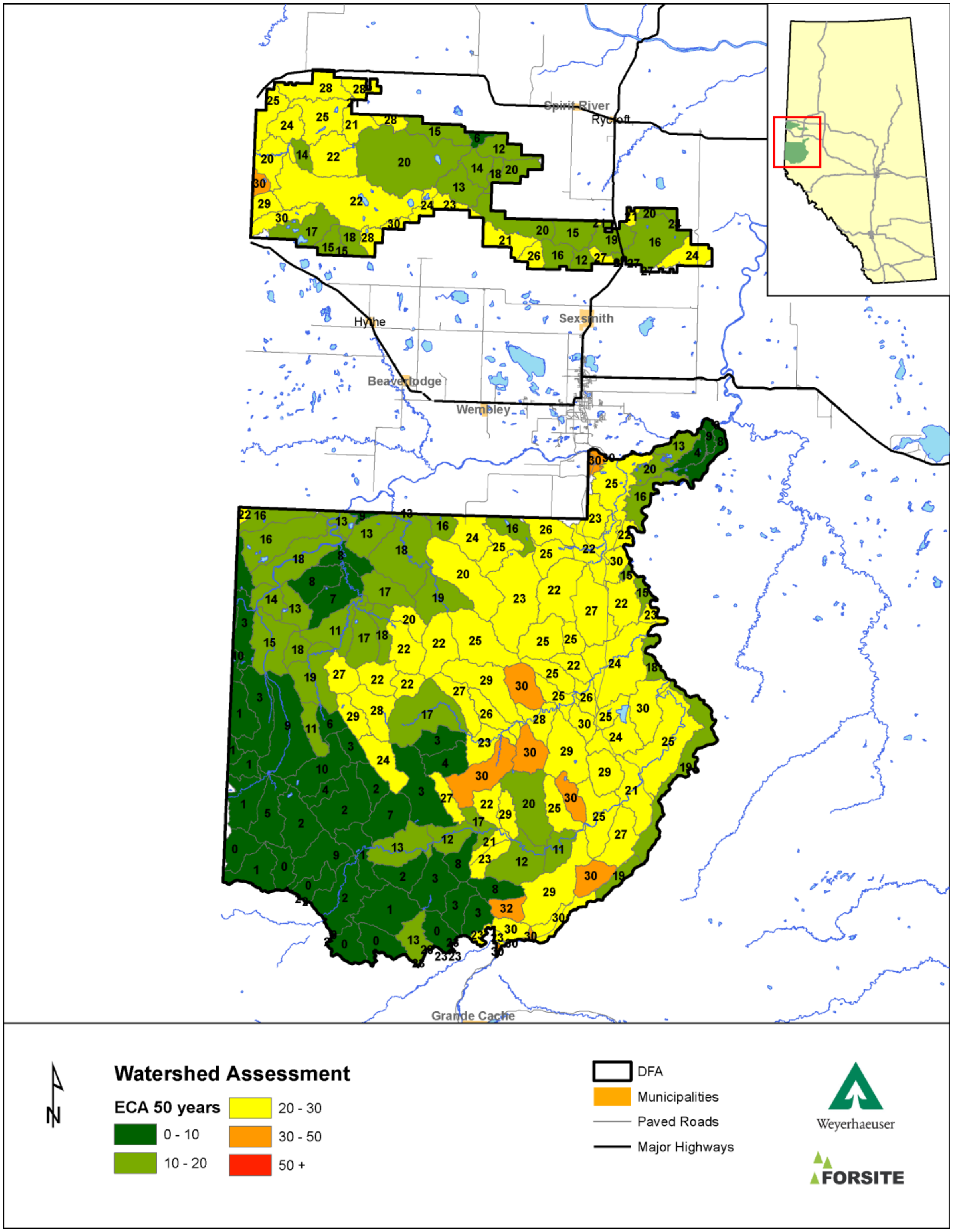


Figure 65 Equivalent Clear-Cut Area proportion by forestry watershed 50 years from 2019 (2069)

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Appendix I Grizzly Bear Details (Tables 11-13)

Note: Road density values do not change from current to future (0-10 years because there is no plan to add more permanent road.

Table 11 Grizzly Bear Habitat States Change by Grizzly Bear Watershed Unit

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G9	Core	104,446	Road Density	0.285	0.285	0.000	0.285	0.000	0.000
G9	Core		Primary Habitat	27,393	30,642	3,250	30,798	3,405	12.4
G9	Core		Secondary Habitat	19,874	17,258	-2,616	17,299	-2,575	-13.0
G9	Core		Non-critical Habitat	11,429	10,673	-756	10,814	-615	-5.4
G9	Core		Secondary Sink	14,412	13,280	-1,132	14,281	-132	-0.9
G9	Core		Primary Sink	31,338	32,593	1,255	31,255	-83	-0.3
G60	Secondary	78,093	Road Density	0.775	0.775	0.000	0.775	0.000	0.000
G60	Secondary		Primary Habitat	15	9	-5	2	-13	-89.6
G60	Secondary		Secondary Habitat	396	232	-164	170	-226	-57.0
G60	Secondary		Non-critical Habitat	58,272	57,187	-1,085	57,199	-1,073	-1.8
G60	Secondary		Secondary Sink	14,639	14,116	-524	15,678	1,038	7.1
G60	Secondary		Primary Sink	4,771	6,549	1,778	5,044	274	5.7
G6	Secondary	45,161	Road Density	0.628	0.628	0.000	0.628	0.000	0.000
G6	Secondary		Primary Habitat	352	324	-29	287	-65	-18.4
G6	Secondary		Secondary Habitat	766	591	-175	603	-163	-21.3
G6	Secondary		Non-critical Habitat	28,000	28,225	224	28,722	722	2.6
G6	Secondary		Secondary Sink	10,965	9,100	-1,865	10,443	-522	-4.8
G6	Secondary		Primary Sink	5,078	6,922	1,844	5,106	28	0.6

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Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G59	Secondary	77,831	Road Density	0.738	0.738	0.000	0.738	0.000	0.000
G59	Secondary		Primary Habitat	314	163	-152	147	-168	-53.4
G59	Secondary		Secondary Habitat	840	948	108	734	-106	-12.6
G59	Secondary		Non-critical Habitat	44,991	44,086	-905	44,448	-543	-1.2
G59	Secondary		Secondary Sink	19,264	18,133	-1,131	20,251	987	5.1
G59	Secondary		Primary Sink	12,421	14,500	2,080	12,251	-170	-1.4
G35	Core	2,116	Road Density	0.183	0.183	0.000	0.183	0.000	0.000
G35	Core		Primary Habitat	1,085	1,057	-28	1,045	-40	-3.7
G35	Core		Secondary Habitat	179	182	2	186	7	3.6
G35	Core		Non-critical Habitat	178	171	-6	169	-8	-4.8
G35	Core		Secondary Sink	56	55	0	54	-1	-1.9
G35	Core		Primary Sink	618	651	32	661	43	6.9
G34	Core	4,682	Road Density	0.157	0.157	0.000	0.157	0.000	0.000
G34	Core		Primary Habitat	2,117	2,163	46	2,164	48	2.3
G34	Core		Secondary Habitat	244	231	-13	230	-14	-5.7
G34	Core		Non-critical Habitat	556	541	-15	537	-19	-3.4
G34	Core		Secondary Sink	131	118	-12	118	-13	-9.8
G34	Core		Primary Sink	1,635	1,630	-5	1,633	-2	-0.1
G29	Core	37,941	Road Density	0.369	0.369	0.000	0.369	0.000	0.000
G29	Core		Primary Habitat	12,627	12,285	-341	12,084	-543	-4.3
G29	Core		Secondary Habitat	3,596	3,292	-304	3,464	-132	-3.7
G29	Core		Non-critical Habitat	1,383	1,118	-266	1,045	-338	-24.4
G29	Core		Secondary Sink	3,540	3,739	199	4,110	570	16.1
G29	Core		Primary Sink	16,795	17,508	712	17,237	442	2.6

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G25	Core	46,295	Road Density	0.264	0.264	0.000	0.264	0.000	0.000
G25	Core		Primary Habitat	29,796	29,796	0	29,793	-3	0.0
G25	Core		Secondary Habitat	6,006	6,006	0	6,006	0	0.0
G25	Core		Non-critical Habitat	3,445	3,445	0	3,445	0	0.0
G25	Core		Secondary Sink	1,260	1,261	1	1,262	1	0.1
G25	Core		Primary Sink	5,788	5,787	-1	5,790	2	0.0
G24	Core	53,773	Road Density	0.292	0.292	0.000	0.292	0.000	0.000
G24	Core		Primary Habitat	32,883	32,705	-178	32,622	-261	-0.8
G24	Core		Secondary Habitat	11,057	11,090	33	11,147	90	0.8
G24	Core		Non-critical Habitat	3,749	3,749	0	3,749	0	0.0
G24	Core		Secondary Sink	991	1,005	14	1,006	15	1.5
G24	Core		Primary Sink	5,092	5,224	132	5,249	157	3.1
G23	Core	77,749	Road Density	0.525	0.525	0.000	0.525	0.000	0.000
G23	Core		Primary Habitat	10,490	10,559	70	10,965	476	4.5
G23	Core		Secondary Habitat	8,618	7,130	-1,488	7,088	-1,530	-17.8
G23	Core		Non-critical Habitat	6,698	5,875	-823	5,348	-1,350	-20.2
G23	Core		Secondary Sink	13,396	12,379	-1,017	14,055	659	4.9
G23	Core		Primary Sink	38,546	41,805	3,259	40,292	1,746	4.5
G19	Secondary	73,118	Road Density	0.722	0.722	0.000	0.722	0.000	0.000
G19	Secondary		Primary Habitat	924	413	-511	379	-545	-59.0
G19	Secondary		Secondary Habitat	2,008	1,161	-847	1,497	-511	-25.5
G19	Secondary		Non-critical Habitat	19,481	18,762	-720	17,775	-1,706	-8.8
G19	Secondary		Secondary Sink	30,958	28,774	-2,183	32,318	1,360	4.4
G19	Secondary		Primary Sink	19,747	24,008	4,261	21,149	1,402	7.1

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G17	Core	68,139	Road Density	0.543	0.543	0.000	0.543	0.000	0.000
G17	Core		Primary Habitat	10,070	8,755	-1,315	8,814	-1,256	-12.5
G17	Core		Secondary Habitat	5,846	5,031	-815	4,843	-1,003	-17.2
G17	Core		Non-critical Habitat	5,679	5,247	-432	4,856	-823	-14.5
G17	Core		Secondary Sink	10,408	11,028	619	11,728	1,320	12.7
G17	Core		Primary Sink	36,136	38,079	1,944	37,898	1,763	4.9
G16	Core	50,700	Road Density	0.329	0.329	0.000	0.329	0.000	0.000
G16	Core		Primary Habitat	20,920	24,283	3,363	24,773	3,853	18.4
G16	Core		Secondary Habitat	15,824	13,792	-2,032	13,691	-2,133	-13.5
G16	Core		Non-critical Habitat	5,066	3,974	-1,091	3,573	-1,493	-29.5
G16	Core		Secondary Sink	2,459	2,155	-304	2,270	-190	-7.7
G16	Core		Primary Sink	6,430	6,495	65	6,392	-37	-0.6
G15	Secondary	23,072	Road Density	0.465	0.465	0.000	0.465	0.000	0.000
G15	Secondary		Primary Habitat	1,341	1,568	226	1,563	221	16.5
G15	Secondary		Secondary Habitat	813	1,023	210	1,282	469	57.7
G15	Secondary		Non-critical Habitat	8,931	8,193	-738	8,104	-827	-9.3
G15	Secondary		Secondary Sink	6,124	5,408	-716	6,469	345	5.6
G15	Secondary		Primary Sink	5,863	6,880	1,018	5,654	-208	-3.6
G14	Secondary	77,850	Road Density	0.639	0.639	0.000	0.639	0.000	0.000
G14	Secondary		Primary Habitat	633	141	-492	130	-503	-79.5
G14	Secondary		Secondary Habitat	988	524	-464	511	-476	-48.2
G14	Secondary		Non-critical Habitat	21,693	22,284	591	22,291	598	2.8
G14	Secondary		Secondary Sink	29,045	27,663	-1,381	31,356	2,311	8.0
G14	Secondary		Primary Sink	25,492	27,238	1,746	23,562	-1,930	-7.6

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G10	Secondary	73,252	Road Density	0.714	0.714	0.000	0.714	0.000	0.000
G10	Secondary		Primary Habitat	3,266	3,410	144	3,031	-235	-7.2
G10	Secondary		Secondary Habitat	4,099	4,333	235	4,209	110	2.7
G10	Secondary		Non-critical Habitat	18,945	19,389	445	20,008	1,064	5.6
G10	Secondary		Secondary Sink	27,436	22,203	-5,232	26,260	-1,175	-4.3
G10	Secondary		Primary Sink	19,506	23,916	4,410	19,743	236	1.2

Table 12 Grizzly Bear Habitat States Change for FMA #6900016

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time 0)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
FMA 6900016	Secondary	441,519	Primary Habitat	6,846	6,026	5,538	-819	-1,308	-19.1
	Secondary		Secondary Habitat	9,908	8,811	9,004	-1,097	-903	-9.1
	Secondary		Non-critical Habitat	194,617	192,415	192,836	-2,201	-1,781	-0.9
	Secondary		Secondary Sink	137,734	124,714	142,091	-13,020	4,357	3.2
	Secondary		Primary Sink	92,415	109,553	92,050	17,138	-365	-0.4
	Core	407,281	Primary Habitat	120,318	125,181	125,998	4,863	5,680	4.7
	Core		Secondary Habitat	67,591	60,356	60,295	-7,235	-7,296	-10.8
	Core		Non-critical Habitat	34,717	31,328	30,070	-3,389	-4,647	-13.4
	Core		Secondary Sink	46,159	44,526	48,389	-1,633	2,230	4.8
	Core		Primary Sink	138,496	145,891	142,528	7,395	4,032	2.9

Table 13 Grizzly Bear Habitat States Change for FMU G16

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time 0)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
FMU G16	Secondary	448,377	Primary Habitat	6,846	6,027	-819	5,538	-1,308	-19.1
	Secondary		Secondary Habitat	9,910	8,813	-1,097	9,007	-903	-9.1
	Secondary		Non-critical Habitat	200,313	198,126	-2,188	198,548	-1,765	-0.9
	Secondary		Secondary Sink	138,431	125,397	-13,033	142,775	4,344	3.1
	Secondary		Primary Sink	92,877	110,014	17,137	92,509	-368	-0.4
	Core	445,841	Primary Habitat	147,380	152,245	4,865	153,058	5,678	3.9
	Core		Secondary Habitat	71,246	64,010	-7,235	63,955	-7,291	-10.2
	Core		Non-critical Habitat	38,183	34,794	-3,389	33,536	-4,647	-12.2
	Core		Secondary Sink	46,654	45,021	-1,634	48,884	2,230	4.8
	Core		Primary Sink	142,378	149,771	7,393	146,408	4,030	2.8

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Appendix II Watershed ECA (Table 14)

Watershed ID	Years from now																																							
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
WS_1	1	3	3	9	12	16	20	24	21	15	9	5	3	7	7	9	10	15	15	18	18	26	24	20	13	6	4	3	5	5	9	10	12	22	19	16	26	23	20	16	9
WS_10	26	21	17	14	13	13	11	10	8	6	9	13	17	21	21	26	25	21	20	20	18	15	12	9	8	7	10	9	18	24	28	29	24	20	18	16	14	11	13	11	10
WS_100	33	31	31	30	30	30	29	30	31	30	30	30	30	30	30	30	30	30	30	30	30	28	25	27	25	27	27	27	27	26	26	25	26	27	30	30	28	28	26	24	13
WS_101	12	11	10	9	7	6	4	4	4	4	3	3	3	3	2	2	2	6	10	22	29	28	25	21	17	13	10	8	6	5	4	4	4	6	8	14	16	16	15	14	9
WS_102	22	27	36	33	30	30	28	25	25	25	22	19	16	13	11	10	9	8	8	7	10	15	17	20	20	23	21	20	18	16	15	12	10	10	10	12	13	15	16	20	16
WS_103	4	3	3	3	5	5	4	4	3	3	2	6	13	13	12	10	7	5	4	3	2	2	2	2	2	2	3	3	6	7	9	9	7	6	5	4	5	5	5	5	4
WS_104	32	30	30	29	30	30	30	29	28	27	25	23	23	20	20	20	18	20	20	21	22	22	20	22	21	19	17	18	17	16	16	16	19	21	23	23	26	26	25	23	15
WS_105	29	32	31	29	28	27	26	24	23	22	21	22	24	25	24	25	29	29	30	30	30	29	30	29	28	26	24	25	24	22	22	24	26	28	28	28	29	30	30	28	16
WS_106	32	31	32	29	30	28	25	24	29	30	29	25	21	16	15	13	13	13	13	14	14	15	18	23	22	24	21	21	18	19	17	17	16	15	15	15	16	17	20	19	15
WS_107	7	16	34	32	30	24	19	14	9	7	5	4	3	6	11	12	14	12	11	8	6	9	11	11	12	14	12	11	9	8	9	10	11	12	11	10	9	10	10	12	10
WS_108	9	7	5	4	4	3	3	5	7	7	7	7	10	9	8	8	8	7	6	7	6	6	6	5	5	4	6	9	9	9	9	9	9	8	7	6	6	6	6	5	2
WS_109	32	34	36	31	30	27	27	25	24	23	20	17	14	12	9	9	8	8	8	9	10	12	13	15	15	16	16	14	14	13	11	11	12	11	11	12	13	15	16	17	13
WS_110	13	15	28	26	23	24	29	27	26	22	17	13	9	6	6	5	4	4	3	3	3	7	15	17	19	23	22	18	14	11	9	7	6	5	4	6	7	10	11	14	15
WS_111	2	3	3	3	2	2	2	2	2	2	2	2	2	7	16	16	16	13	10	7	5	4	3	3	2	2	2	3	4	5	8	11	11	11	10	8	6	5	4	3	1
WS_112	1	2	6	6	6	7	6	6	6	8	12	11	10	9	7	6	4	6	8	9	9	9	8	7	7	7	8	7	7	8	8	7	7	8	9	9	10	9	9	8	6
WS_113	22	27	28	30	30	27	26	23	24	27	25	26	26	24	23	23	24	26	27	29	30	29	28	29	28	27	25	25	24	22	23	23	24	25	25	26	27	26	24	25	17
WS_114	4	4	6	6	6	17	33	32	30	26	21	16	12	9	7	6	5	4	4	4	3	6	10	17	18	19	16	14	12	9	8	7	8	7	7	7	8	11	11	10	12
WS_115	4	4	3	3	3	3	2	6	14	14	13	11	9	10	11	17	20	19	16	15	16	14	12	10	8	7	8	9	10	10	10	12	14	14	15	14	13	11	10	9	6
WS_116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Watershed ID	Years from now																																							
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
WS_117	31	32	31	30	30	30	27	23	19	25	27	30	29	29	26	28	28	27	26	29	30	30	27	24	23	24	26	26	25	25	25	25	25	23	26	28	27	25	23	21	14
WS_118	19	24	27	29	27	25	24	23	22	21	19	18	17	17	17	18	20	21	22	24	27	29	28	27	24	22	20	17	15	15	16	17	19	20	22	25	27	30	28	26	20
WS_119	31	38	45	38	32	30	26	21	17	13	11	9	7	6	6	6	7	7	6	5	7	11	15	17	17	15	13	11	9	8	7	7	6	6	9	9	11	11	13	14	11
WS_12	31	32	30	28	24	23	21	19	16	14	16	22	25	28	30	29	30	30	30	29	27	25	24	21	21	21	20	23	26	28	29	30	29	26	25	25	24	23	21	18	14
WS_120	2	2	2	3	3	19	39	39	35	29	23	17	12	8	6	4	3	3	2	2	2	6	8	11	11	10	9	8	9	7	6	5	4	4	4	6	5	6	9	11	10
WS_121	2	2	2	2	2	3	5	5	4	5	8	7	6	5	4	3	3	2	2	2	2	3	4	5	6	6	6	6	7	6	6	5	4	4	3	3	3	3	3	4	3
WS_122	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	6	17	17	16	14	12	9	6	4	3	2	1	1	1	1	2	5	9	11	11	12	10	8	7	5	3
WS_123	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	13	13	12	10	8	6	4	3	2	2	1	1	1	1	2	5	6	7	7	7	5	4	3	3	1
WS_124	1	1	1	1	1	9	16	16	15	12	9	5	3	2	2	2	2	2	2	2	1	5	7	10	10	8	7	6	4	3	2	3	3	3	3	3	4	6	6	7	6
WS_125	16	32	30	37	40	41	38	31	24	17	12	8	6	4	4	3	3	3	2	2	2	5	7	9	12	13	12	10	8	7	5	4	6	6	7	6	6	8	10	12	11
WS_126	2	2	2	1	1	1	1	1	1	1	1	2	5	5	5	12	18	17	15	12	9	7	5	4	3	3	2	3	4	4	5	7	10	11	11	12	10	8	6	5	2
WS_127	3	3	2	2	2	2	2	2	3	3	2	2	2	4	5	5	4	4	3	3	7	7	6	5	5	4	4	4	4	4	4	3	3	3	3	4	5	5	5	5	3
WS_128	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0
WS_129	33	31	28	24	22	21	23	21	19	28	30	30	30	29	30	28	29	30	28	27	24	20	19	18	22	26	28	26	26	26	27	26	25	23	20	18	16	15	15	15	10
WS_130	6	6	5	5	6	8	12	11	10	9	8	7	5	4	3	2	2	2	1	1	1	2	3	4	4	5	4	4	3	3	2	3	2	2	2	2	3	4	4	5	5
WS_131	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	3	3	3	3	3	3	3	4	4	5	5	5	5	2
WS_132	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1	2	2	2	1
WS_134	1	1	1	1	1	2	5	12	13	24	32	30	25	22	21	16	13	10	8	6	5	5	7	6	6	6	9	12	18	23	21	19	16	12	9	7	6	6	7	6	4
WS_135	20	23	25	22	19	17	15	23	31	30	29	25	20	15	14	14	14	13	13	12	11	12	14	16	17	17	17	18	16	14	13	13	12	12	12	12	13	13	13	13	11

Watershed ID	Years from now																																							
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
WS_136	6	6	5	4	4	3	3	3	3	3	3	3	3	8	11	11	10	9	7	6	5	4	4	3	3	3	3	3	4	4	7	8	9	9	8	7	6	5	4	4	1
WS_137	10	13	19	25	26	30	27	28	25	22	19	15	13	13	13	11	14	17	24	26	27	29	30	26	24	19	17	16	14	13	13	12	15	17	23	25	25	25	22	21	15
WS_138	15	10	7	5	4	4	3	3	3	3	3	3	3	22	37	36	33	27	21	15	11	9	7	6	5	4	4	4	5	14	21	29	29	27	23	18	14	11	8	7	2
WS_139	1	1	1	1	1	2	3	3	3	3	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2	1
WS_14	20	18	24	24	26	26	24	21	17	14	13	17	17	21	20	25	27	26	27	23	21	24	22	20	18	20	18	18	20	23	25	28	28	24	21	19	18	17	19	18	13
WS_141	5	6	15	16	16	16	24	28	30	28	30	24	19	17	18	16	16	19	17	20	19	24	23	29	28	26	24	22	18	16	14	13	17	16	22	27	26	30	28	25	18
WS_142	1	1	1	1	0	1	1	0	0	0	0	0	0	8	13	13	12	11	8	6	5	3	3	2	2	1	1	1	3	6	7	9	12	11	10	8	7	5	4	3	2
WS_143	7	9	13	19	23	22	27	30	30	30	30	24	19	14	12	11	11	13	16	19	20	23	26	29	30	29	28	24	19	16	14	12	12	15	16	20	22	24	28	27	23
WS_144	14	13	13	13	13	13	13	13	13	13	13	13	13	17	22	22	21	20	18	16	15	14	14	13	13	13	13	13	14	14	16	17	17	18	17	16	15	14	14	13	1
WS_145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS_146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS_15	13	14	14	13	13	14	15	18	24	24	25	24	21	19	17	16	16	15	14	14	14	16	16	21	23	23	24	23	22	20	19	17	16	15	14	14	14	15	17	19	14
WS_150	13	10	10	12	11	11	20	25	27	25	23	19	15	24	31	30	29	28	26	25	21	20	22	27	26	25	23	19	19	17	16	15	20	22	20	18	16	15	19	22	17
WS_151	14	14	14	14	14	14	17	27	30	30	30	26	25	30	28	30	27	24	21	18	17	17	27	28	29	29	26	23	27	28	30	27	29	26	23	21	21	26	26	28	14
WS_157	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	2	2	2	1
WS_158	19	24	22	18	14	18	18	16	14	11	10	8	6	5	4	3	3	2	2	3	4	5	5	5	6	6	5	5	4	4	4	4	5	4	4	5	5	5	6	6	4
WS_16	15	22	23	21	16	15	15	16	15	17	16	17	17	16	14	18	17	19	22	20	21	18	19	20	18	16	16	15	14	17	19	20	21	23	21	23	21	20	19	16	12
WS_161	22	21	21	24	25	25	28	29	29	28	28	30	29	28	27	26	24	25	26	27	28	28	28	28	28	27	27	28	27	27	25	24	24	25	25	28	28	29	28	26	11
WS_162	10	11	15	18	20	21	20	23	24	26	24	23	21	18	16	18	17	18	18	18	23	23	25	22	19	19	19	20	18	20	18	18	17	16	15	21	25	25	23	20	12

Watershed ID	Years from now																																								
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WS_163	24	24	24	22	20	20	22	21	22	20	21	21	21	22	23	25	25	25	23	21	20	19	19	18	18	17	18	21	21	22	23	24	24	22	21	21	20	21	21	20	11
WS_164	6	10	13	21	25	26	22	19	17	15	12	10	9	9	11	13	13	15	16	17	25	25	25	20	17	14	11	10	10	11	13	14	16	17	17	16	22	27	24	22	16
WS_165	5	6	11	16	18	23	30	29	25	18	14	11	10	9	9	11	13	15	18	25	26	30	29	26	21	16	12	10	8	8	9	12	13	16	19	20	30	29	28	24	17
WS_166	9	10	15	20	25	29	29	28	26	24	20	19	18	17	17	17	18	21	25	26	27	25	26	25	23	20	20	19	19	19	20	24	24	27	26	24	24	24	23	21	9
WS_167	20	21	19	17	16	14	13	12	16	16	14	15	18	20	24	23	23	20	18	17	17	17	18	17	15	14	16	18	19	21	23	22	21	18	17	17	17	18	18	18	12
WS_168	10	12	12	16	16	19	18	19	20	18	18	15	15	13	13	13	13	13	13	16	18	21	26	25	22	18	15	13	16	17	16	16	15	13	12	17	21	22	26	23	15
WS_169	32	30	25	21	20	18	16	15	14	13	13	16	23	28	30	28	30	27	25	21	19	19	19	18	20	21	21	22	24	25	23	24	24	23	21	22	21	21	22	21	18
WS_17	15	13	11	11	11	10	11	13	16	17	23	27	26	24	24	22	19	16	14	13	13	13	14	15	16	19	24	25	28	27	24	20	18	16	15	13	13	13	15	18	11
WS_170	14	14	16	16	14	14	19	25	28	29	30	26	22	20	16	14	13	15	15	16	16	22	24	27	30	28	25	23	21	20	18	16	16	16	21	24	24	25	25	27	22
WS_171	14	16	17	17	18	18	18	18	19	22	22	22	22	21	19	19	19	19	20	19	20	20	21	22	23	24	22	22	21	20	19	18	18	18	18	20	21	22	23	24	18
WS_172	13	19	18	17	13	11	15	15	16	16	17	16	19	20	19	17	17	17	17	17	16	19	18	19	20	20	19	20	20	18	17	14	14	15	14	15	17	17	18	20	17
WS_174	4	5	7	9	13	17	15	20	19	21	19	23	24	28	25	20	16	14	16	15	16	17	14	15	18	18	18	19	30	29	27	25	23	20	18	15	13	15	15	18	13
WS_175	23	21	20	19	20	21	23	25	28	29	28	29	26	27	28	27	26	27	25	23	23	27	26	30	30	30	29	28	27	26	29	29	28	27	24	25	26	25	29	29	17
WS_176	3	3	6	9	11	14	16	16	19	17	16	16	15	12	12	11	10	10	12	13	13	15	21	22	24	23	20	19	19	16	16	13	12	14	13	15	15	21	20	20	14
WS_178	22	21	16	11	10	12	15	16	14	14	15	15	18	20	20	22	20	20	17	16	16	19	19	20	20	17	15	19	20	21	18	17	15	13	14	14	15	18	22	27	24
WS_179	13	13	11	14	13	12	29	30	26	20	15	13	12	17	15	19	17	15	13	14	12	22	30	29	25	24	20	18	13	15	13	13	14	14	12	12	16	15	28	27	26
WS_18	16	16	14	13	12	11	11	11	13	15	16	20	21	27	25	24	21	17	15	14	13	12	12	12	17	25	29	28	24	21	17	16	16	16	15	13	12	14	23	23	17
WS_180	16	14	14	13	12	13	19	20	20	19	18	18	19	22	20	19	17	19	19	20	19	20	24	23	25	25	23	20	20	20	20	19	19	18	17	18	18	22	25	28	22
WS_182	9	10	11	15	18	24	26	25	25	24	26	28	26	22	17	18	20	22	22	23	25	26	28	27	26	26	25	27	24	22	19	16	19	21	22	23	28	28	28	25	14
WS_183	23	27	27	26	23	21	20	23	24	26	24	22	20	17	16	15	20	24	29	28	28	28	27	28	27	29	25	23	22	20	19	21	23	26	28	28	27	26	27	26	14

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Watershed ID	Years from now																																							
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WS_184	17	20	21	22	24	24	23	23	22	21	22	21	23	24	24	23	23	24	23	23	24	25	26	23	22	20	20	21	27	28	28	23	22	21	22	22	25	24	22	21	13
WS_185	5	7	12	15	23	28	25	22	19	18	15	14	12	10	10	9	11	19	22	30	29	27	22	18	15	16	15	15	13	12	11	12	17	25	29	28	28	22	18	14	8
WS_186	7	11	11	14	14	14	15	13	16	17	16	18	19	19	17	14	13	14	21	23	25	22	19	17	25	23	20	19	18	18	15	13	13	15	19	19	22	20	19	24	19
WS_187	9	8	17	19	20	19	18	15	17	15	13	21	20	19	23	19	19	20	27	26	24	22	20	20	26	28	27	21	19	17	15	16	14	16	18	18	18	24	22	30	26
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WS_190	1	24	26	25	17	11	12	11	10	7	6	5	5	5	10	11	15	15	17	15	15	14	15	13	10	8	6	7	11	11	16	16	13	11	9	16	19	18	14	9	6
WS_192	1	3	5	7	15	17	19	24	29	25	20	16	15	15	12	9	11	11	9	10	15	22	21	19	26	29	25	23	17	13	14	11	10	8	9	16	24	24	25	21	19
WS_193	15	17	20	22	23	27	27	24	21	25	25	25	26	24	24	22	23	22	22	22	23	23	22	22	24	25	29	26	24	22	23	24	24	25	23	21	21	20	22	23	11
WS_194	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0
WS_195	16	15	15	17	19	21	25	24	30	28	30	29	26	25	24	20	17	19	18	17	21	20	20	27	30	28	28	27	27	26	23	27	25	24	22	21	20	25	29	30	21
WS_196	12	14	17	21	23	24	23	24	23	22	20	19	20	19	19	19	19	21	22	25	25	25	24	24	21	20	19	19	20	19	19	19	20	21	23	23	26	26	26	24	13
WS_197	15	15	16	18	21	23	24	24	23	28	29	30	29	27	22	21	20	21	22	25	25	28	30	28	29	30	29	28	24	22	23	22	21	21	22	21	25	29	29	30	16
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WS_2	2	2	5	6	8	11	12	11	13	14	13	13	12	11	8	7	6	9	10	10	11	11	14	16	18	16	18	15	13	10	7	8	7	7	8	9	14	17	18	19	15
WS_20	12	15	17	16	17	17	16	16	18	19	16	16	13	14	14	16	15	16	15	16	16	16	16	16	17	16	18	17	18	15	16	14	15	14	15	15	15	15	14	15	13
WS_200	10	9	11	13	15	17	21	21	21	22	22	22	20	19	17	17	16	16	18	18	18	21	23	25	25	24	22	21	19	18	20	19	18	17	17	18	20	20	21	26	20
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WS_202	26	26	27	26	25	25	25	27	27	25	23	21	22	24	23	24	24	23	23	25	26	27	25	30	26	25	23	25	22	22	20	19	23	22	24	28	27	28	27	27	23
WS_203	14	21	22	23	21	20	19	18	17	16	15	14	15	16	17	19	20	21	23	23	23	22	22	21	19	17	15	14	14	16	18	19	20	19	20	21	21	22	21	19	10

Watershed ID	Years from now																																							
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WS_205	10	14	14	17	19	21	21	21	17	15	27	26	26	20	18	15	14	16	16	22	22	23	22	19	21	18	16	27	29	26	22	17	19	18	18	17	18	20	25	23	15
WS_206	2	3	3	3	6	7	11	25	30	30	21	13	14	16	16	13	15	12	9	9	7	9	7	11	29	28	28	24	18	18	15	15	12	12	12	11	9	10	14	27	23
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WS_23	28	27	25	22	20	22	25	23	20	17	16	14	15	16	16	16	18	18	18	18	17	18	20	20	22	19	19	17	16	14	16	16	16	17	18	19	20	20	23	22	17
WS_24	26	24	24	23	22	20	21	23	23	23	22	20	24	24	29	30	27	28	26	27	25	26	24	22	22	23	23	22	23	28	29	28	27	25	24	25	27	27	26	24	8
WS_25	41	36	30	26	21	16	14	11	9	9	8	12	16	19	20	19	19	16	15	13	12	12	12	11	11	12	12	13	13	14	17	19	19	17	15	14	13	13	12	11	8
WS_26	20	19	15	14	14	15	14	14	15	22	25	28	28	29	26	28	25	25	22	19	17	16	17	22	24	27	27	29	27	25	23	22	23	21	21	19	17	19	23	29	23
WS_27	24	24	23	22	21	23	22	22	23	23	25	28	29	29	29	29	27	25	28	28	26	26	25	24	26	27	27	26	29	27	25	27	26	26	26	27	27	28	27	28	17
WS_28	27	25	24	20	16	14	13	11	10	12	18	18	17	14	12	11	11	11	9	8	8	9	10	11	12	12	14	15	14	14	13	13	13	12	12	12	11	11	14	13	10
WS_29	35	32	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	30	30	30	30	30	30	29	30	29	30	30	29	30	29	30	29	6
WS_3	3	3	3	3	7	11	11	9	7	5	4	4	3	3	4	4	4	6	5	8	7	9	11	10	7	5	5	4	4	3	3	3	4	5	6	9	11	11	10	8	4
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WS_31	19	19	19	19	18	19	19	18	18	18	18	19	21	23	23	23	22	21	19	19	18	18	18	17	18	19	19	19	20	20	21	21	21	20	20	19	19	19	19	20	15
WS_32	43	44	42	34	26	19	14	11	8	8	8	7	7	6	5	5	5	4	4	4	4	5	7	8	9	9	10	9	8	8	7	7	7	7	8	8	7	7	8	8	5
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WS_34	35	37	31	24	18	13	9	7	6	9	14	13	12	10	8	6	5	4	4	4	4	4	5	5	5	6	6	6	7	10	10	10	8	8	7	7	8	7	7	6	2
WS_35	21	25	24	24	22	21	22	21	21	20	20	21	21	25	25	26	25	25	25	24	23	23	22	23	23	23	24	24	24	23	23	22	22	21	21	23	23	23	24	26	20
WS_36	15	16	18	23	28	29	28	23	18	15	16	14	17	19	17	16	15	18	22	24	23	24	22	24	21	21	17	21	19	17	17	18	20	20	20	20	19	23	21	22	15

Watershed ID	Years from now																																							
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WS_38	49	45	42	35	28	22	17	13	10	8	7	7	6	6	7	7	7	6	6	5	5	5	6	6	6	6	6	6	6	6	7	7	8	8	8	7	7	6	6	6	1
WS_39	46	44	37	28	20	14	9	6	5	11	13	13	11	10	8	6	5	4	4	3	3	3	4	4	4	4	6	7	8	7	6	6	5	4	4	3	3	3	3	3	1
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WS_40	13	16	18	19	22	23	22	23	24	23	22	23	22	22	21	21	20	21	22	20	21	22	26	26	27	30	29	26	24	23	23	21	22	21	20	20	18	20	26	27	24
WS_41	17	16	20	24	25	30	29	29	25	22	23	25	27	25	23	24	23	25	26	23	22	21	26	30	30	29	26	25	25	23	23	23	25	25	23	23	21	20	24	28	21
WS_42	21	19	19	22	26	28	27	25	22	20	22	22	23	24	22	21	25	25	26	26	26	28	28	28	28	27	26	23	22	22	20	24	25	25	26	25	27	28	27	28	18
WS_43	24	20	18	15	15	17	18	20	21	20	20	25	26	27	26	27	25	24	21	20	20	18	19	19	21	20	21	21	23	23	27	24	26	24	21	20	20	21	21	22	16
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WS_45	40	34	31	26	22	20	18	16	14	12	11	11	11	11	12	11	11	11	11	12	12	14	14	15	13	12	11	12	12	13	12	11	11	11	12	13	13	13	13	11	8
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WS_48	21	23	22	21	20	17	17	19	22	23	25	25	26	27	25	24	25	23	22	22	20	19	18	19	20	22	23	23	23	23	23	24	24	24	21	22	20	18	18	17	15
WS_49	33	28	26	23	20	19	19	19	19	18	18	21	21	26	28	29	28	25	22	22	22	22	25	24	23	22	19	19	19	23	25	28	27	27	25	24	24	25	25	25	16
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WS_50	42	44	39	31	22	15	10	6	5	3	3	3	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2	2	3	4	4	4	4	4	4	4	1
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WS_52	21	23	24	23	19	19	21	22	21	19	17	15	17	17	16	19	19	21	21	21	23	26	24	25	23	21	19	17	17	16	16	17	19	20	21	21	24	24	22	21	17
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WS_54	29	27	24	20	16	15	15	12	11	12	16	14	13	11	9	7	6	6	5	5	5	7	8	8	9	9	10	12	13	12	11	9	8	7	7	7	8	9	9	8	4

Watershed ID	Years from now																																							
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WS_56	27	27	24	22	18	18	17	18	23	23	22	22	23	25	25	27	28	29	27	25	24	23	23	22	21	20	20	20	21	24	25	27	27	25	23	23	22	22	21	21	14
WS_57	6	8	16	22	27	28	28	26	23	21	18	15	12	11	11	10	13	18	22	23	23	28	27	24	21	19	18	16	13	11	11	12	18	19	18	19	19	20	23	22	18
WS_58	20	22	22	21	23	22	24	26	27	25	22	20	19	18	22	24	24	22	21	23	23	23	25	27	28	25	23	21	20	24	22	23	22	23	24	25	24	26	24	22	16
WS_59	1	4	14	21	28	30	30	30	30	30	27	25	20	16	13	10	9	11	16	22	26	27	30	29	30	29	25	22	18	16	15	14	15	15	17	20	24	27	29	30	27
WS_6	0	1	3	14	20	23	19	16	13	11	8	7	7	5	4	4	4	6	6	17	20	19	18	13	13	11	9	7	7	7	5	14	14	15	13	10	10	10	11	10	11
WS_60	27	27	26	23	23	21	25	27	26	24	22	21	19	17	18	23	24	27	29	27	25	26	25	24	24	22	21	21	19	19	17	19	22	22	23	24	22	22	21	21	19
WS_61	20	21	22	21	21	20	20	26	30	29	25	22	20	18	17	20	21	22	23	24	24	23	23	27	28	28	26	21	18	17	17	17	22	22	23	23	24	25	26	26	21
WS_62	50	46	37	30	25	24	24	23	27	24	22	19	16	19	25	30	30	30	30	30	28	26	25	28	27	25	22	18	16	19	18	22	28	29	29	27	28	24	22	26	19
WS_63	18	19	22	22	25	25	26	26	25	23	20	17	17	15	16	17	19	19	21	23	24	23	22	23	22	24	22	20	18	15	15	15	17	19	20	21	21	21	22	22	22
WS_64	25	23	23	22	20	18	16	20	27	29	30	27	27	23	25	23	24	22	24	22	22	21	20	24	25	30	30	28	25	22	21	20	19	21	21	20	21	21	21	21	17
WS_65	16	18	20	22	22	21	22	22	21	24	24	23	22	22	22	22	22	22	21	22	22	22	22	22	23	23	22	22	22	22	23	24	23	21	20	20	20	21	20	21	15
WS_66	23	25	26	25	24	23	23	22	21	28	26	24	22	25	25	27	26	25	24	21	20	20	19	21	24	23	26	26	23	26	26	26	25	22	19	18	18	19	20	20	14
WS_67	19	28	28	27	23	20	16	15	13	17	28	30	30	27	25	20	21	25	26	25	23	20	17	15	13	12	17	20	21	25	23	23	24	24	24	24	22	19	17	14	11
WS_68	21	20	20	20	23	22	23	23	22	23	25	23	23	20	20	19	20	18	17	20	20	21	22	23	25	24	22	25	22	21	19	18	18	18	20	21	21	20	24	25	20
WS_69	29	27	23	19	17	15	16	19	25	27	29	27	26	26	28	27	28	25	23	22	21	19	20	22	24	24	25	23	24	23	23	22	21	21	20	19	18	19	18	20	15
WS_70	28	27	24	21	18	16	16	17	22	25	26	26	27	25	25	28	28	25	24	23	19	18	17	19	18	20	21	21	21	21	26	26	23	22	21	21	20	19	19	21	15
WS_71	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	3	3	3	3	3	2	3	2	4	4	4	4	3	3	2	2	3	3	3	2
WS_72	23	29	27	23	23	22	20	18	16	20	25	24	25	28	26	25	25	23	23	22	21	20	19	17	18	21	23	23	25	26	23	23	22	22	20	19	18	16	16	15	11
WS_73	24	22	22	22	23	24	23	22	19	19	28	27	26	26	26	25	24	22	22	22	22	23	23	22	22	27	27	25	24	24	25	23	21	21	20	22	20	21	20	20	18

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Watershed ID	Years from now																																							
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WS_75	2	11	29	29	28	24	20	31	31	31	29	25	20	14	10	7	5	4	3	2	2	2	4	7	13	16	18	18	17	14	10	8	7	7	6	7	6	6	9	8	8
WS_76	20	48	48	43	33	29	22	17	12	8	6	4	3	2	4	4	10	12	11	11	10	9	9	9	9	9	8	6	5	4	5	8	10	10	10	8	9	8	10	11	9
WS_77	30	28	25	24	24	22	20	17	14	15	17	18	20	20	21	22	24	25	25	24	22	21	18	17	15	16	16	16	16	17	19	20	21	21	22	21	21	20	19	18	13
WS_78	28	28	30	30	29	30	29	28	25	30	30	30	30	28	27	26	22	23	23	26	27	26	28	30	28	30	27	28	28	30	29	27	27	26	24	23	24	24	27	29	22
WS_79	26	24	25	29	29	30	29	27	24	26	30	30	30	30	30	28	26	24	28	27	26	25	23	22	20	20	21	23	25	26	26	28	26	27	28	28	27	26	24	22	15
WS_80	3	3	3	3	2	3	3	3	3	3	3	3	2	2	2	4	4	12	23	27	27	24	20	15	11	8	6	5	4	3	3	4	5	7	13	15	16	15	13	11	6
WS_81	29	46	54	48	41	33	27	20	15	12	11	12	12	13	12	13	13	12	11	10	8	9	9	9	11	12	12	13	12	13	13	13	12	11	10	11	11	11	13	13	10
WS_82	31	22	14	9	6	4	3	3	3	3	3	20	30	30	26	20	14	10	7	5	4	3	3	3	4	4	5	7	12	14	17	16	13	10	8	6	4	4	4	4	2
WS_83	10	22	22	20	15	11	8	5	4	3	3	14	22	21	18	13	12	8	6	5	4	3	2	2	2	2	4	5	8	12	15	17	14	11	8	6	4	3	3	3	2
WS_84	26	25	24	23	22	21	22	22	22	23	24	25	25	26	27	27	25	24	23	22	22	20	23	23	24	27	27	28	27	26	24	23	25	25	26	24	22	22	24	25	15
WS_85	30	30	29	26	23	21	23	23	23	23	23	22	21	21	23	26	30	30	27	24	21	20	21	20	19	19	17	20	19	20	21	26	27	26	25	22	19	17	17	16	13
WS_86	8	11	18	20	22	20	19	16	13	11	9	7	6	5	5	9	10	15	18	20	23	22	21	19	18	16	14	12	9	9	8	9	10	12	13	14	15	15	15	14	11
WS_87	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	18	18	17	14	11	8	7	5	4	3	2	2	1	2	3	4	11	13	12	11	8
WS_88	27	24	23	20	19	19	19	23	23	27	30	30	29	26	26	25	28	27	25	24	22	22	22	23	23	25	24	26	24	23	23	24	26	27	27	24	22	20	19	18	14
WS_89	25	17	12	8	6	5	5	4	4	4	4	21	33	33	29	22	16	11	8	6	5	4	4	4	4	4	8	11	13	17	18	16	15	12	10	7	6	5	5	5	1
WS_9	42	32	29	30	30	27	23	19	15	13	22	29	30	30	29	29	24	19	23	30	30	29	23	20	15	12	14	15	18	17	27	28	27	24	20	23	24	22	20	16	12
WS_90	19	25	26	26	26	25	28	30	30	30	29	26	25	22	21	21	23	23	22	22	22	24	26	30	30	30	28	27	24	22	22	23	26	27	26	26	26	29	30	30	19
WS_91	23	23	26	30	29	27	30	30	31	28	29	30	28	26	26	27	26	24	25	25	26	27	29	30	28	26	27	26	24	23	25	26	25	24	25	26	27	27	26	25	17
WS_92	2	2	2	2	2	2	2	2	2	13	24	24	22	17	13	15	21	29	35	32	27	21	15	11	7	6	9	12	14	14	12	13	12	21	22	24	24	20	16	11	8

Watershed ID	Years from now																																							
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
WS_93	10	16	26	39	49	44	37	29	21	15	10	7	5	4	4	4	3	3	3	3	3	6	8	10	12	15	13	12	10	9	8	7	7	7	7	7	10	11	14	15	14
WS_94	18	20	21	22	22	22	22	24	25	24	25	25	23	23	22	21	20	20	19	19	19	20	22	25	27	28	27	25	22	21	22	20	20	19	18	19	20	21	22	23	19
WS_95	8	7	5	8	11	10	10	8	7	5	4	7	7	6	6	5	5	4	3	3	3	4	4	4	5	7	7	7	6	5	5	5	5	5	4	4	3	4	4	4	3
WS_96	23	19	16	14	13	12	14	23	30	29	30	30	29	26	23	21	18	16	14	14	13	13	16	19	22	22	24	24	24	23	22	20	17	15	14	13	13	14	13	15	11
WS_97	15	11	8	5	4	3	3	3	2	2	2	12	24	23	21	20	18	14	11	8	6	5	4	3	3	3	5	9	12	14	14	14	12	11	9	7	6	5	4	4	1
WS_98	15	12	10	8	7	6	4	18	31	30	27	23	20	15	11	8	6	5	4	3	3	3	7	9	12	11	14	15	13	12	12	10	8	7	6	6	7	7	9	11	9
WS_99	2	5	11	11	10	8	6	4	3	2	1	1	1	1	0	0	0	0	0	1	2	3	4	4	4	4	4	3	2	2	2	1	2	2	2	2	3	3	3	4	4

Weyerhaeuser Forest Management Plan

Annex IX: Non-Timber Assessments for the Preferred Forest Management Scenario (PFMS)

AUTHOR: Jeremy Hachey, RPF

DATE: July 22, 2019

REVISION DATE: August 22, 2019

2019

Weyerhaeuser

WEYERHAEUSER COMPANY LIMITED
GRANDE PRAIRIE TIMBERLANDS
FMA #6900016

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1. Introduction

This report summarizes the results of the Non-timber Assessments associated with the Preferred Forest Management Scenario (PFMS) Timber Supply Analysis (TSA) Scenario conducted in support of the FMP process; scenario #8110.

The Government of Alberta (GoA) provided a package of scripts and tools to assist Weyerhaeuser in undertaking a non-timber assessment for its 2019 Forest Management Plan (FMP). Values, Objectives, Indicators, and Targets (VOITS) were developed using these metrics as benchmarks to assess potential change over the Defined Forest Area (DFA).

The tools were provided to generate preliminary assessments for the following indicators:

- Old and Very Old Seral (VOIT 1.1.1.1)
- Patch Size (VOIT 1.1.1.2a)
- Old Interior (VOIT 1.1.1.2b)
- Grizzly Bear (VOIT 1.2.1.1a)
- Barred Owl (VOIT 1.2.1.1b)
- Marten (VOIT 1.2.1.1c)
- 5 Songbird Species (VOIT 1.2.1.1d):
    - Brown Creeper
    - Black-throated Green Warbler
    - Canada Warbler
    - Ovenbird; and
    - Varied Thrush
- Watersheds (VOIT 1.2.1.1e and VOIT 3.2.1.1)

Non-timber assessments can be applied as two ways: the snapshot and the Timber Supply Analysis (TSA) Integration approach.

The snapshot approach uses forest conditions at a given time period, either now or sometime in the future (e.g. after the 20-year SHS is complete), to assess the non-timber metrics given the forest conditions at that time. The intent is to quantify the relative change in non-timber metrics resulting from changes in forest conditions over the time between the two snapshots.

The Timber Supply Analysis (TSA) Integration approach uses age-dependant curves to integrate into the timber supply model. This allows change assessments to occur 'on-the-fly' during timber supply modeling. Also, because the timber supply model tracks these metrics as features, controls can be applied to features in the model so that model scheduler can influence harvest scheduling to ensure non-timber metrics are not unduly compromised.

Currently, the GoA tools only support the snapshot approach for the barred owl, whereas both the snapshot and TSA integration are available for pine marten, songbirds, and watershed assessment tools.

2. Approach / Methodology

2.1 *Seral Retention Targets (VOIT 1.1.1.1)*

Managing for landscape level biodiversity is achieved by retaining target amounts of seral representation by 5 distinct forest cover classes. Accounts and features were constructed in the forest estate model to dynamically keep track of the amount of classified and contributing forest in a young seral (<20 years) state, mature seral (80-120 years) as well as in an old (> 120 years) and very old (> 180 years) seral state for each of the five cover classes; Pine-dominated conifer (Cx-Pl), Spruce-dominated conifer (Cx-Sw), other-conifer dominated (Cx-Sb/Lt/Fd), mixedwood-dominated (MW), deciduous-dominated mixedwood (DC), and deciduous-dominated stands (Dx). Targets were set for both the contributing net landbase as well as the total classified forested landbase (Table 1).

Table 1 Active Seral Targets for Contributing and Classified Land Base by Cover Class and Seral Stage

Cover Class	Contributing			Classified		
	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)
Pine-dominated conifer (CxPl)	46	2.5	16.5	31	4	18
Spruce-dominated conifer (CxSw)	37	2	7.5	27.5	3.5	26
Other Conifer Dominated (Cx-Sb/Lt/Fd)	46	1.5	15	9	1	35.5
Mixedwood stands (MW)	46.5	1.5	3.5	40	3	13.5
Deciduous Dominated (DX)	38.5	1.5	3.5	31.5	2.5	3.5

2.2 *Patch Size (VOIT 1.1.1.2a)*

A patch is defined as a stand of forest in the same seral stage and not split by a linear feature greater than 8m wide. The Values, Objectives, Indicators and Targets (VOITs) table specified targets for 5 patch size classes (Table 2). To actively control patch size distribution in the TSA, a patch account was created in the Patchworks model for young seral class (<20 years old) using a topology distance of 8m.

Table 2 Young Seral Patch Size Targets

Patch Size Class	Target
0-5 ha	Maximum of 5%
6-19 ha	Maximum of 20%
20-99 ha	Maximum of 50%
100-250 ha	Minimum of 15%
>250 ha	Minimum of 10%

2.3 *Old Interior Forest (VOIT 1.1.1.2b)*

Interior forest is a forested area greater than 100 hectares in size located beyond edge effect buffer zone along a forest edge and not split by a linear feature greater than 8m wide. The edge effect buffer zone is 60m where adjacent is non-forested or <40 years old, 30 m where adjacent forest is >= 40 years and less than mature seral age definition (80 year), and 0 m where the adjacent forest is mature or older (>80 years). This metric is not dynamically kept of track within the timber supply model and is instead calculated post-scenario completion using a python script for the respective future time periods (0, 10, 20, and 50 years into the future).

2.4 *Grizzly Bear Habitat States (VOIT 1.2.1.1a)*

The FRI Grizzly Bear Research Program produced a package that included, among other models, the 2018 Habitat States Model. This particular model was used to generate current habitat metrics for Grizzly Bear within the G16 FMU. It is a combination of the Grizzly RSF and mortality risk models. Positive values generated are considered potential sources of primary and secondary habitat while negative values indicate potential sinks (i.e., areas where mortality risks are greater). A value of 0 indicates non-critical habitat.

The Area of Interest (AOI) was the area intersecting the Grizzly Bear zone and the DFA, and to ensure the appropriate coefficients were used the Grande Cache population was selected. Since the inventory surface available was current only to 2018, newer cutblocks were used to reflect harvesting since 2018 and a value of 1 years was then assigned in the Forecast Age dialogue to forecast crown closure attributes for regenerating cutblocks for the current snapshot. No other optional user inputs were used (i.e., New pipelines, new roads, reclaimed roads, and deletions).

For future scenarios, the spatial harvest sequence produced from the timber supply scenario were used as development inputs for future time periods (0, 10, and 20 years from 2019) and the respective start years were used as inputs (1, 11, 21 years for 2019, 2029, and 2039, respectively).

2.5 *Barred Owl (VOIT 1.1.2.1b)*

The Barred Owl Model is a Resource Selection Function (RSF) model based on the MSc Thesis[1] work done by Mike Russell. The habitat metric (value) produced by this model is proportional to the probability of use for a resource unit. Barred owl are more likely found in areas with higher values. The model requires 5 variables to determine the habitat suitability metric, as described below:

$$\text{MODEL} = \text{Exp}((0.442 * [\text{UPSW}]) - (.057 * [\text{UPSW}] * [\text{UPSW}]) + (0.408 * [\text{HW}]) - ([\text{HW}] * [\text{HW}] * 0.028) + (0.222 * \text{Ln}([\text{ATOP}] + 1)) + (0.152 * \text{Ln}([\text{DISTOPEN}] + 1)) - (0.104 * \text{Ln}([\text{DISTOLD}] + 1)) - 3.862)$$

Where:

- UPSW - Proportion of upland softwood within 150m (multi-stand)
- HW - Proportion of hardwood within 150m (multi-stand)
- ATOP - Area to perimeter ratio of all contiguous older stands (>30 years old)
- DISTOPEN – Euclidean distance to nearest patch <30 years old
- DISTOLD – Distance to nearest stand older than 89 years

[1] Russell, M.S. 2008. Habitat selection of barred owls (*Strix varia*) across multiple spatial scales in a boreal agricultural landscape in north-central Alberta. MSc Thesis. University of Alberta (Canada)

The GOA has not yet developed its approach for incorporating barred Owl RSF tracking into a timber supply model. The snapshot Barred Owl Model uses spatial analyst tools to create proximity metrics (Euclidian Distance) raster features to calculate the relative importance of habitat. These distance metrics cannot be easily calculated dynamically within a timber supply model. Thus, the only way to assess barred owl habitat changes over time is to conduct future 'snapshots' using an AVI that reflects projected growth and disturbances. The Foothills coefficients were used to run these future snapshots at 0, 10, 20, 50, 100, 150, and 200 years from now using age attribute tables produced by the timber supply model and linked to the original input planning file.

2.6 *American Marten (VOIT 1.1.2.1c)*

Marten Habitat Suitability Index is a numerical index that represents the capacity of a given habitat to support Marten; in this case, winter habitat (cover and foraging). Higher values mean that the habitat can support more Marten. The GoA has provided methodology (Appendix H of Non-Timber Assessments in Forest Management Planning) to assist in developing marten HSI curves to dynamically track and report habitat suitability indices directly in the forest estate model. The methodology requires age-height curves to be converted into marten HSI-age curves using the following formula:

$$HSI = S4 * \sqrt{S1 * S2 * S3}$$

Where:

S1 is a value between 0 and 1 assigned based on percent tree canopy closure

S2 is a value between 0 and 1 assigned based on percent spruce + fir in the tree canopy

S3 is a value between 0 and 1 assigned based on tree canopy height

S4 is a value between 0 and 1 assigned based on percent pine + spruce + fir in the tree canopy

These relationships are depicted graphically in Figure 1. HSI calculations result in values between 0 and 1 (inclusive) depending on the four variables above.

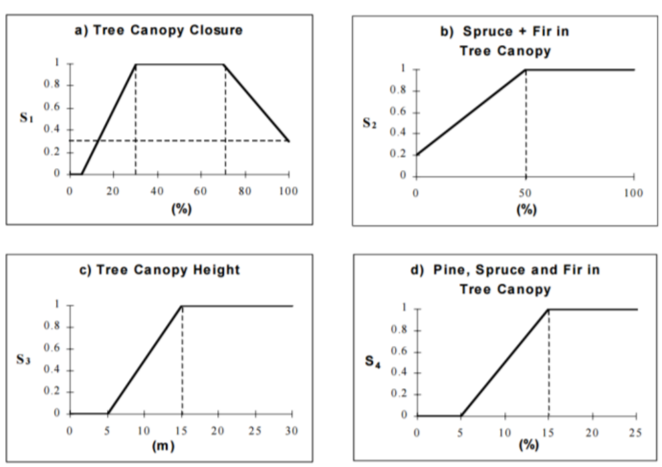


Figure 1 Relationships between habitat variables and HSI components in the marten model (from Takats et al. 1999[2])

[2] Takats, L, Stewart, R., Todd, M., Bonar, R., Beck, J., Beck, B., Quinlan, R., 1999. American Marten: Habitat Suitability Index Model v5. Edmonton, AB

2.7 *Songbirds (VOIT 1.1.2.1d)*

Resource Availability (RA) values for 5 songbird species commonly found in Alberta was integrated into the forest estate model: Canada Warbler, Brown Creeper, Black-Throated Green Warbler, Ovenbird, and Varied Thrush.

The GoA provided songbird RA – Age curves that were incorporated directly in the timber supply model. The curves were mapped to the company-specific yield curve strata (option 2 of step 3 of Appendix F in the document “Non-timber Assessments in Forest Management Planning”). To generate RA map snapshots that resemble the raster output from the provided snapshot tools, stand level RA values were normalized by the polygon areas.

2.8 *Watersheds / Fisheries (VOIT 1.1.2.1e / 3.2.1.1*

A watershed assessment is required under the ABFMPS in the timber supply analysis section (Section 5.9.13) and VOIT Objectives 1.1.2.1e and 3.2.1.1. The purpose of watershed assessment is to:

1. Determine the potential for water yield increases that would result from forest harvesting
2. Use Equivalent Clearcut Area (ECA) as a measure of disturbance and an indicator of potential water yield increase.
3. Constrain, using timber supply analysis, forestry operations to minimize the potential for adverse changes in water yields.

Provincial hydrologic recovery curves and coefficients developed by GoA were used to incorporate ECA curves into the model so that ECA could be tracked and controlled within the timber supply model. Current permanent anthropogenic disturbance outside the classified forest for each watershed was calculated and added to the ECA values reported by the model (which only contains classified forest).

3. Results

The following sections provide results of the Non-Timber elements specified in the final version of the VOITs table associated with the forecasted future condition of the Preferred Forest Management Scenario (PFMS).

3.1 *Seral Retention (VOIT 1.1.1.1a) – Contributing*

3.1.1 Young (<20 years)

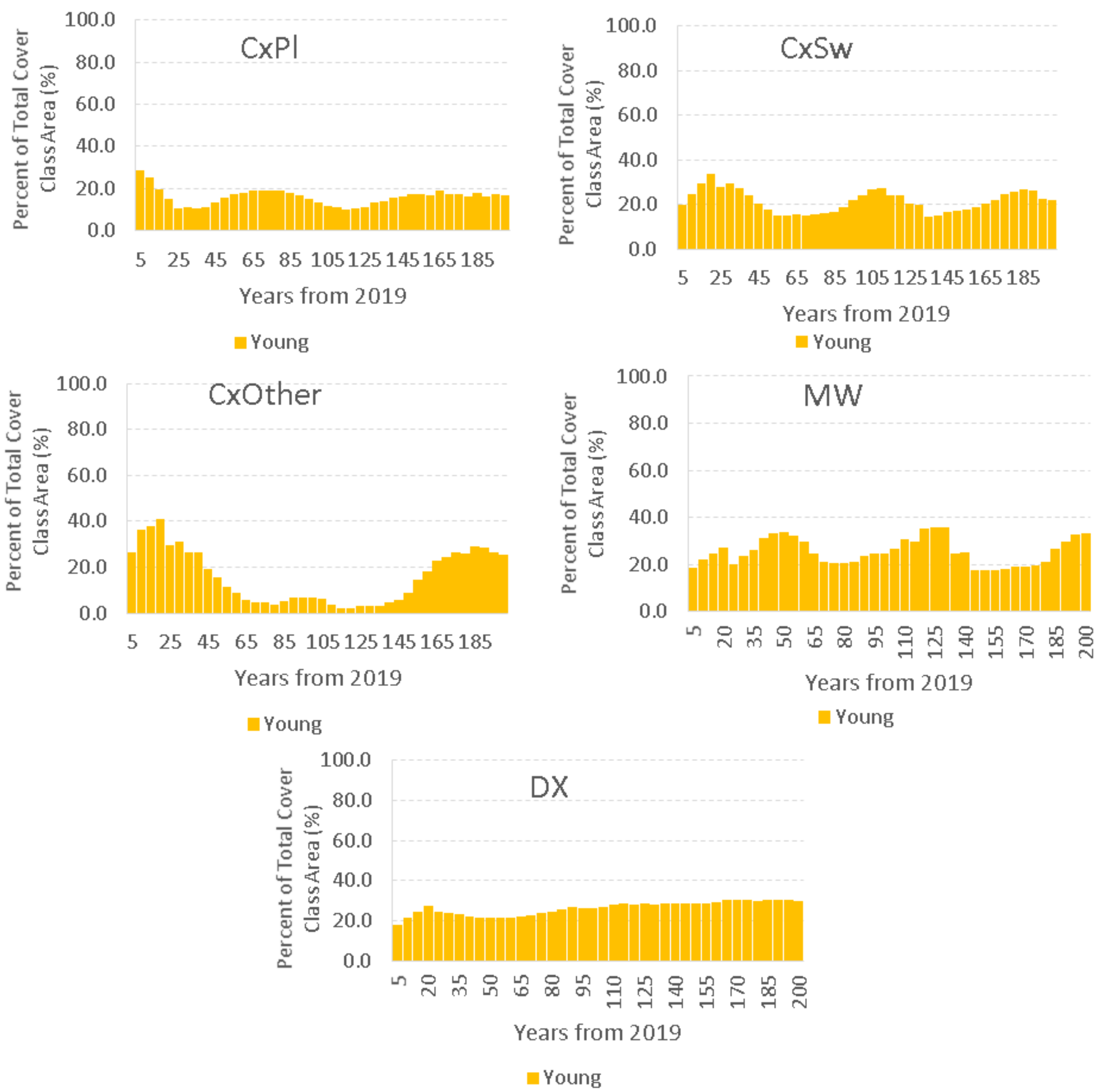


Figure 2 Young Seral on the DFA Contributing Land base by Cover Class

Table 3 Maximum proportion (%) of Young Seral by Cover Class on the Contributing Landbase

Cover Class	Maximum Young Proportion (%)	Target Maximum Proportion (%)
CxPl	29.6	46.0
CxSw	33.6	37.0
CxOther	41.2	46.0
MW	36.0	46.5
DX	30.7	38.5

3.1.2 Mature (80-120 years)

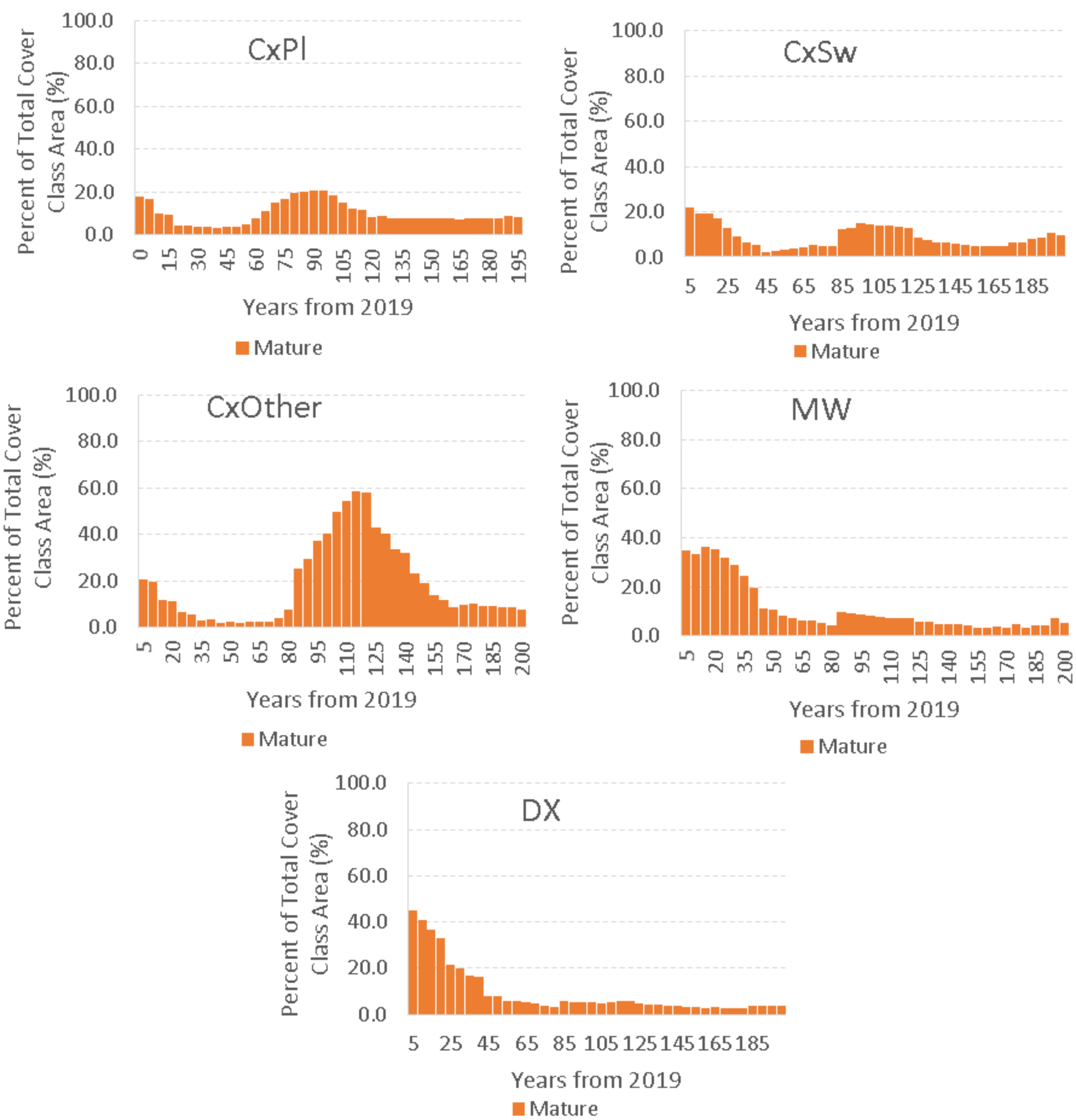


Figure 3 Mature Seral on the DFA Contributing Land base by Cover Class

Table 4 Minimum proportion (%) of Mature Seral by Cover Class on the Contributing Landbase

Cover Class	Minimum Mature Proportion (%)	Target Minimum Mature Proportion (%)
CxPl	3.3	2.5
CxSw	2.4	2.0
CxOther	2.0	1.5
MW	3.4	1.5
DX	2.6	1.5

3.1.3 Old+Very Old (>120 years)

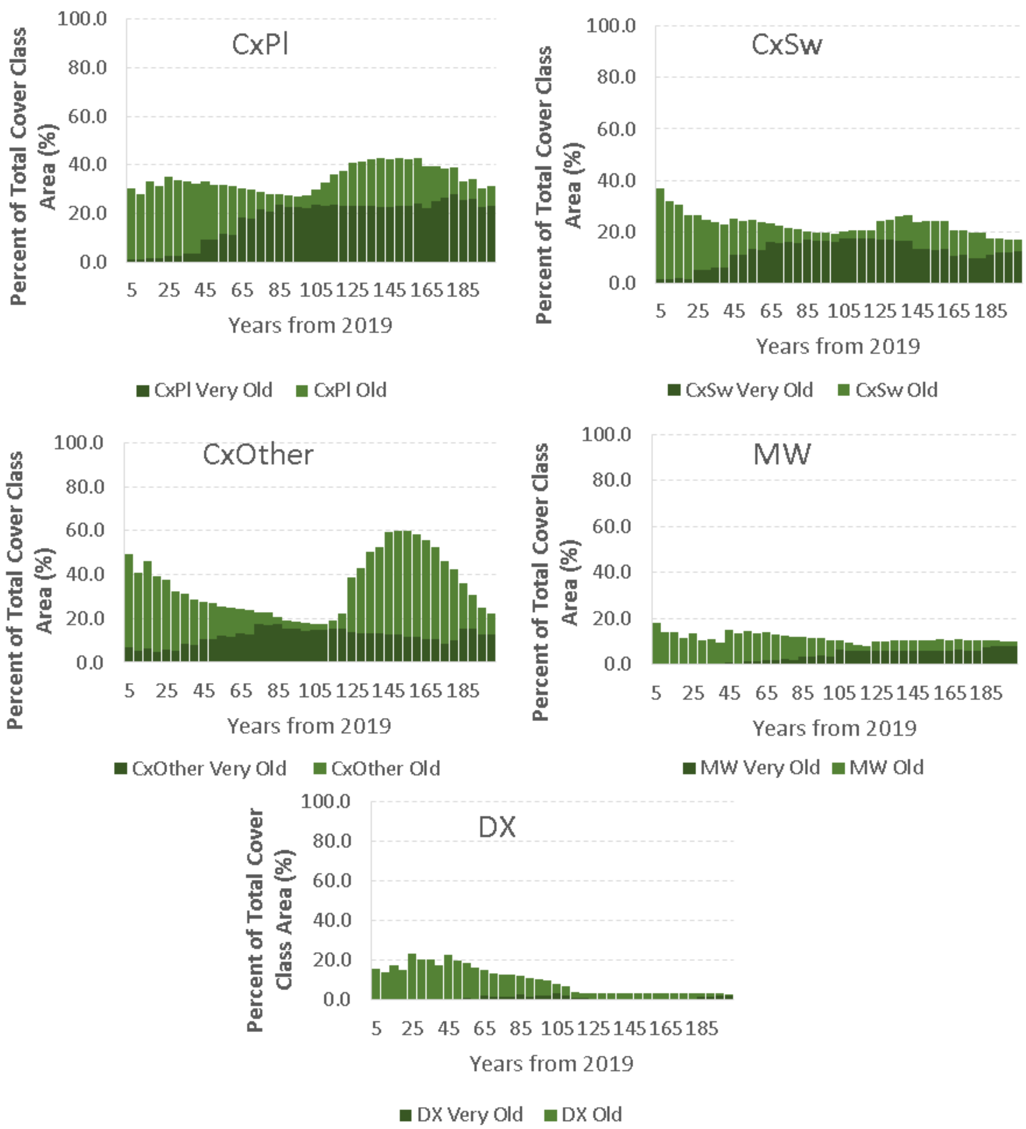


Figure 4 Old + Very Old Seral on the DFA Contributing Land base

Table 5 Minimum proportion of Old + Very Old by Cover Class on the FMA Contributing Landbase

Cover Class	Minimum Old+Very Old Proportion (%)	Target Minimum Old+Very Old Proportion (%)
CxPl	20.2	16.5
CxSw	16.7	7.5
CxOther	17.5	15
MW	8.1	3.5
DX	3.1	3.5

3.2 *Seral Retention (VOIT 1.1.1.1b) – Classified*

3.2.1 Young (<20 years)

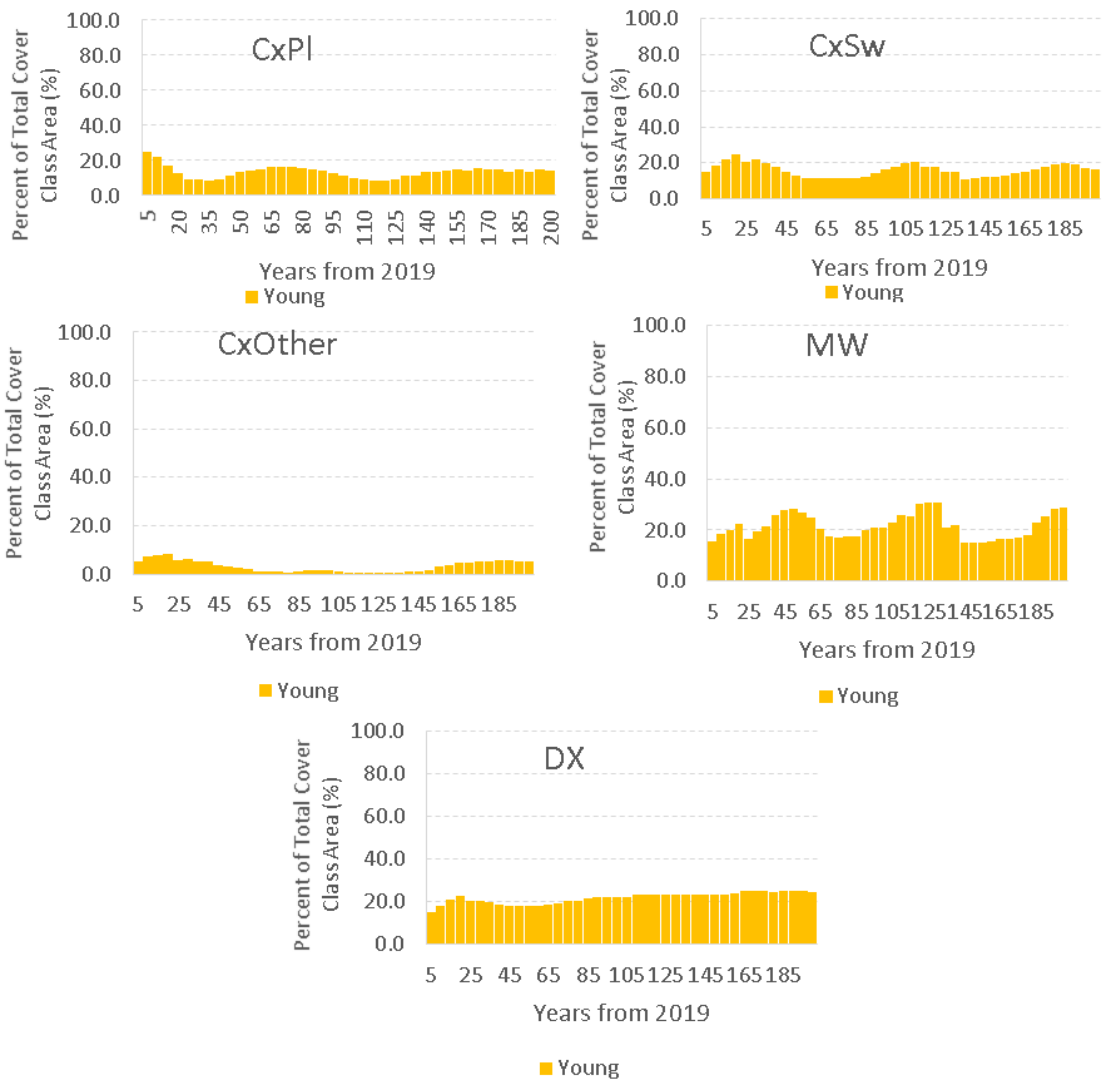


Figure 5 Young Seral on the DFA Classified Land base by Cover Class

Table 6 Maximum proportion (%) of Young Seral by Cover Class on the Classified Landbase

Cover Class	Maximum Young Proportion (%)	Target Maximum Proportion (%)
CxPl	26.2	31
CxSw	24.9	27.5
CxOther	8.2	9
MW	30.9	40
DX	25.0	31.5

3.2.2 Mature (80-120 years)

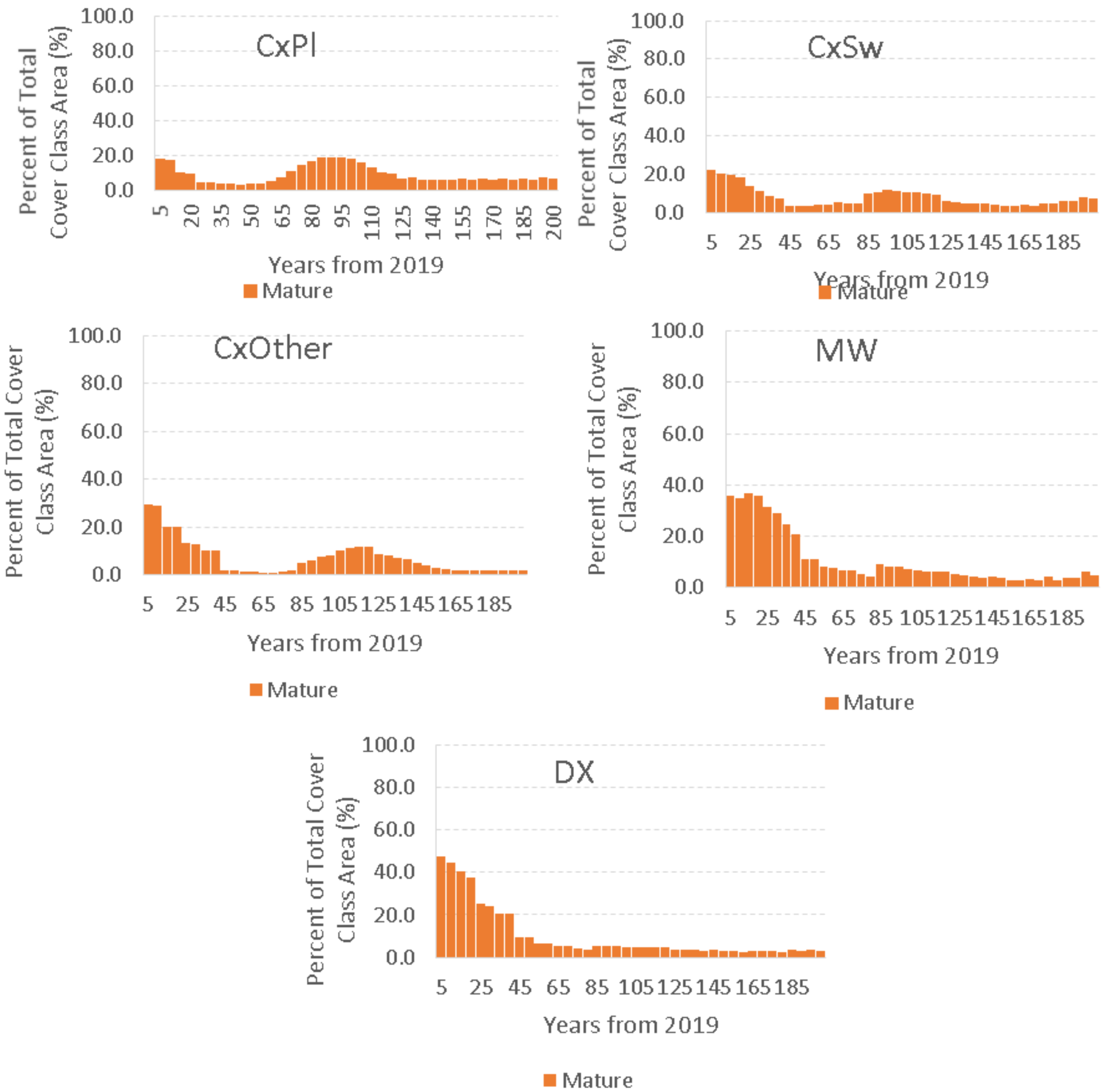


Figure 6 Mature Seral on the DFA Classified Land base by Cover Class

Table 7 Minimum proportion (%) of Mature Seral by Cover Class on the Classified Landbase

Cover Class	Minimum Mature Proportion (%)	Target Minimum Mature Proportion (%)
CxPl	3.4	4.0
CxSw	3.3	3.5
CxOther	0.9	1.0
MW	3.0	3.0
DX	2.5	2.5

3.2.3 Old+Very Old (>120 years)

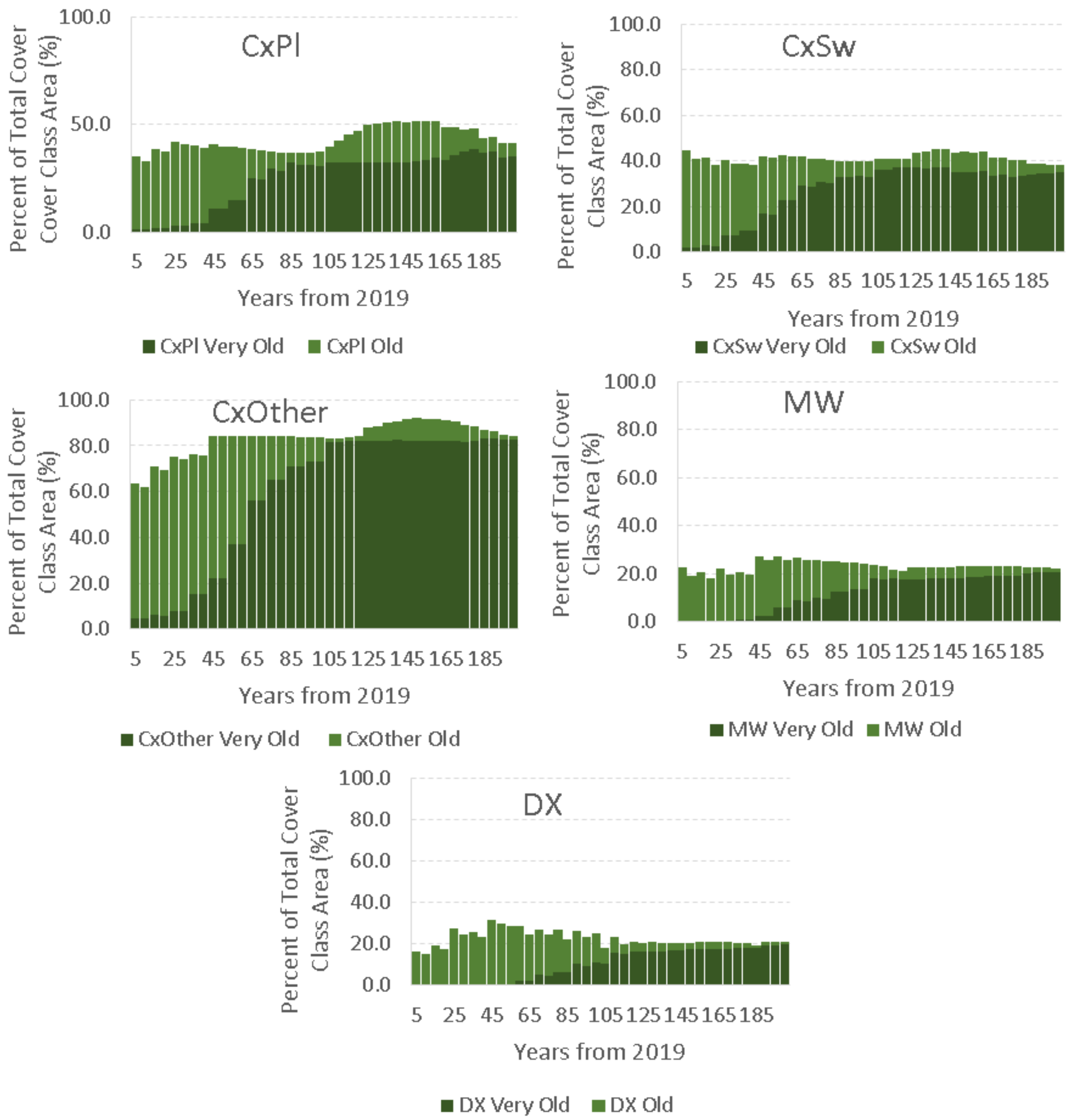


Figure 7 **Old + Very Old Seral on the DFA Classified Land base**

Table 8 **Minimum proportion of Old + Very Old by Cover Class on the DFA Classified Forested Landbase**

Cover Class	Minimum Old+Very Old Proportion (%)	Target Minimum Old+Very Old Proportion (%)
CxPl	22.4	18
CxSw	37.9	26
CxOther	44.0	35.5
MW	17.5	13.5
DX	7.0	3.5

3.3 *Patch Size (VOIT 1.1.1.2a)*

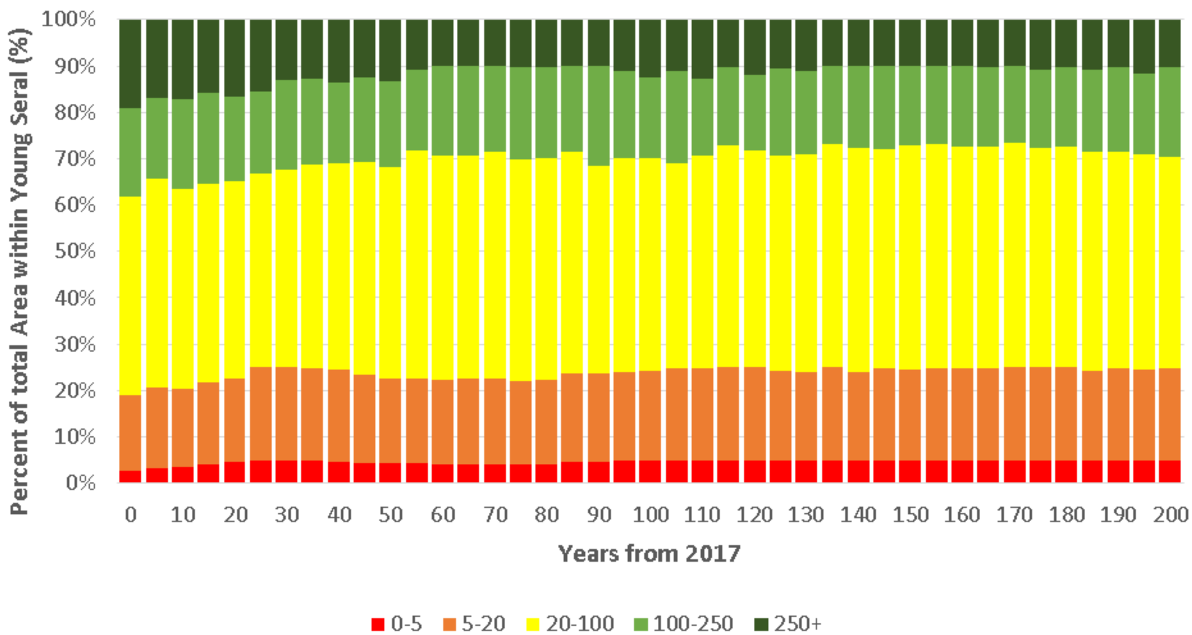


Figure 8 Young Seral (0-20 years old) Patch Size Distribution over time

3.3.1 Current Snapshot

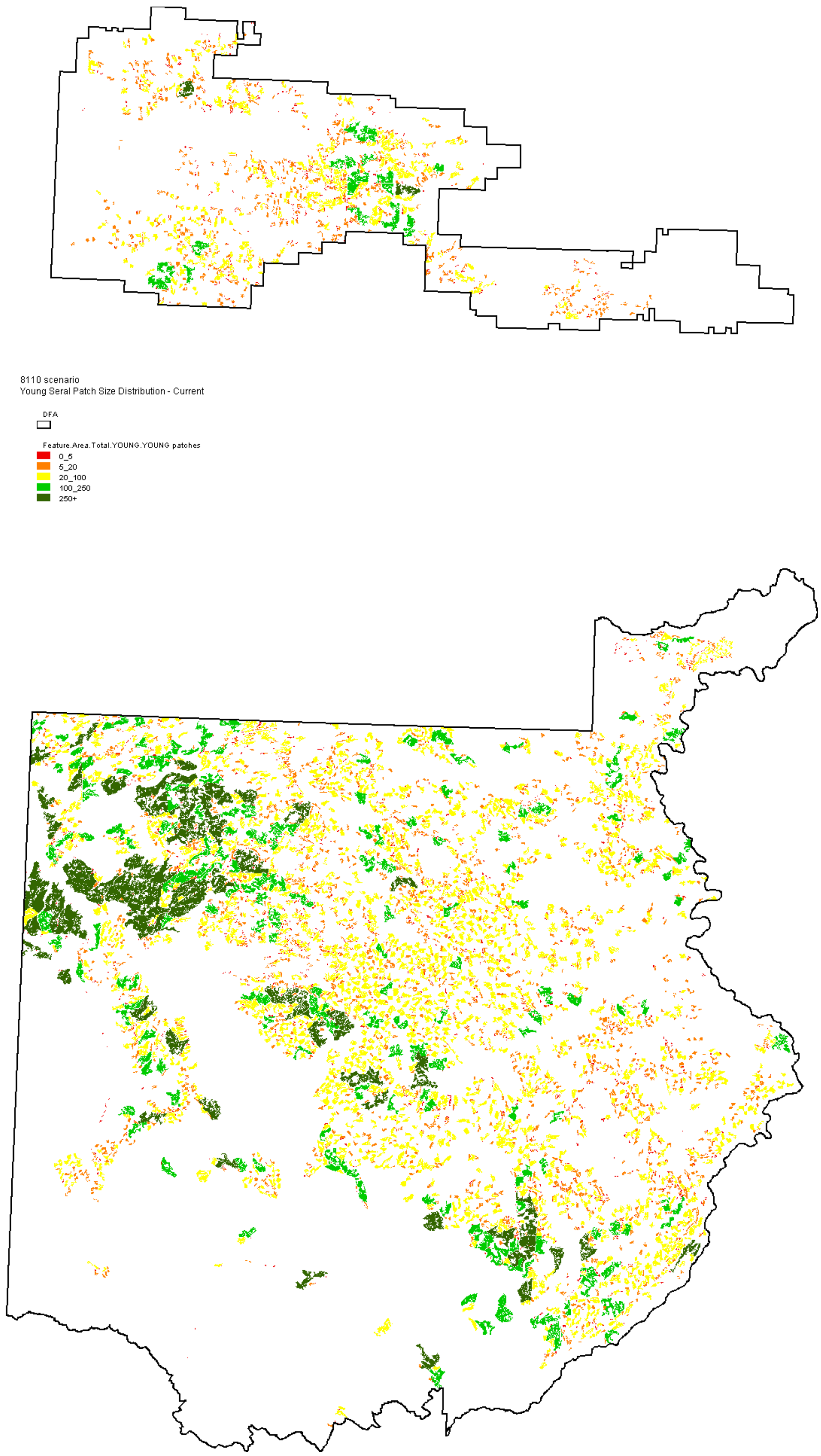


Figure 9 Young Seral Patch Size Distribution – Current

3.3.2 10-Year Snapshot

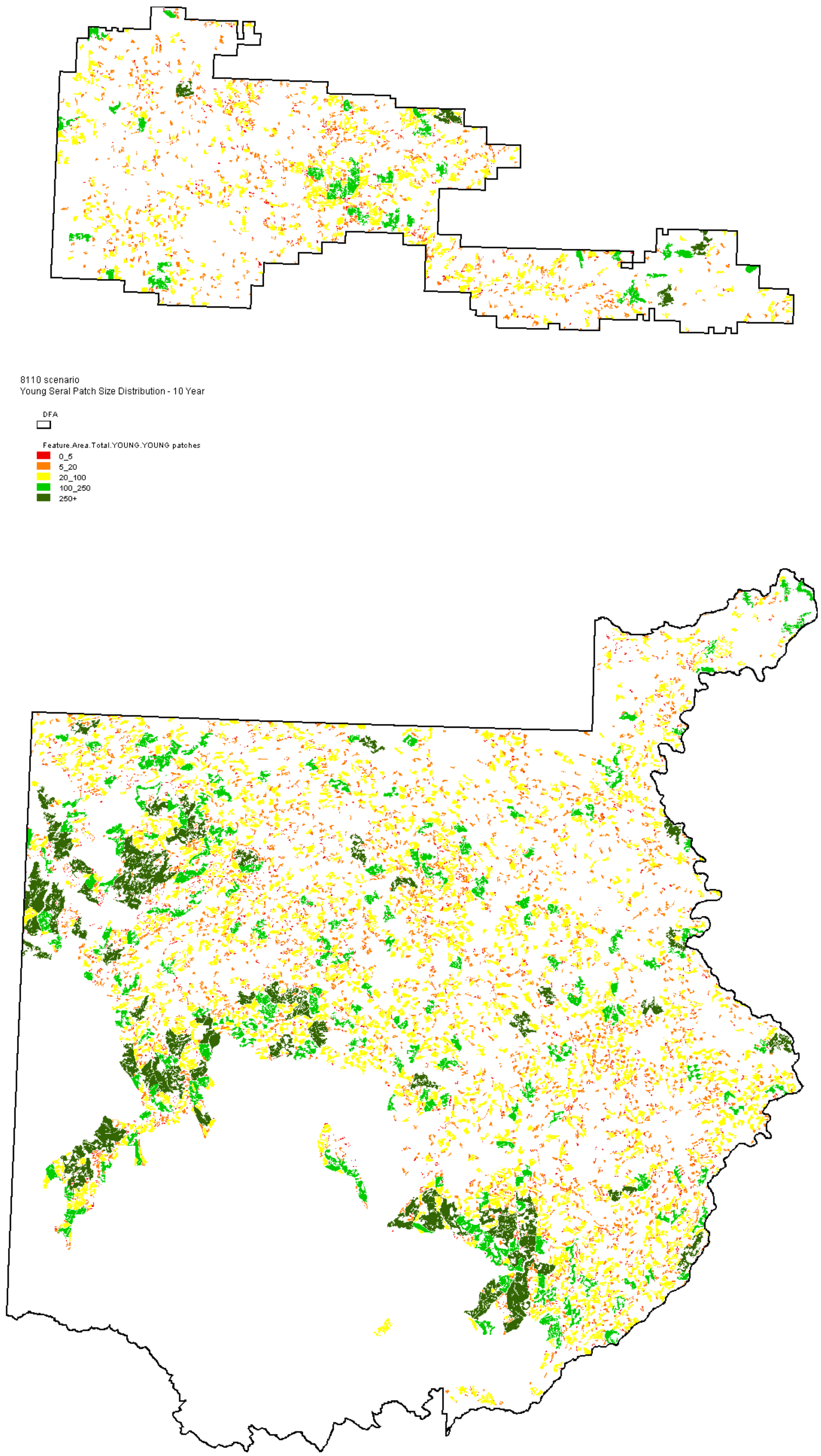


Figure 10 Young Seral Patch Size Distribution – 10-Year Snapshot

3.3.3 **50-Year Snapshot**

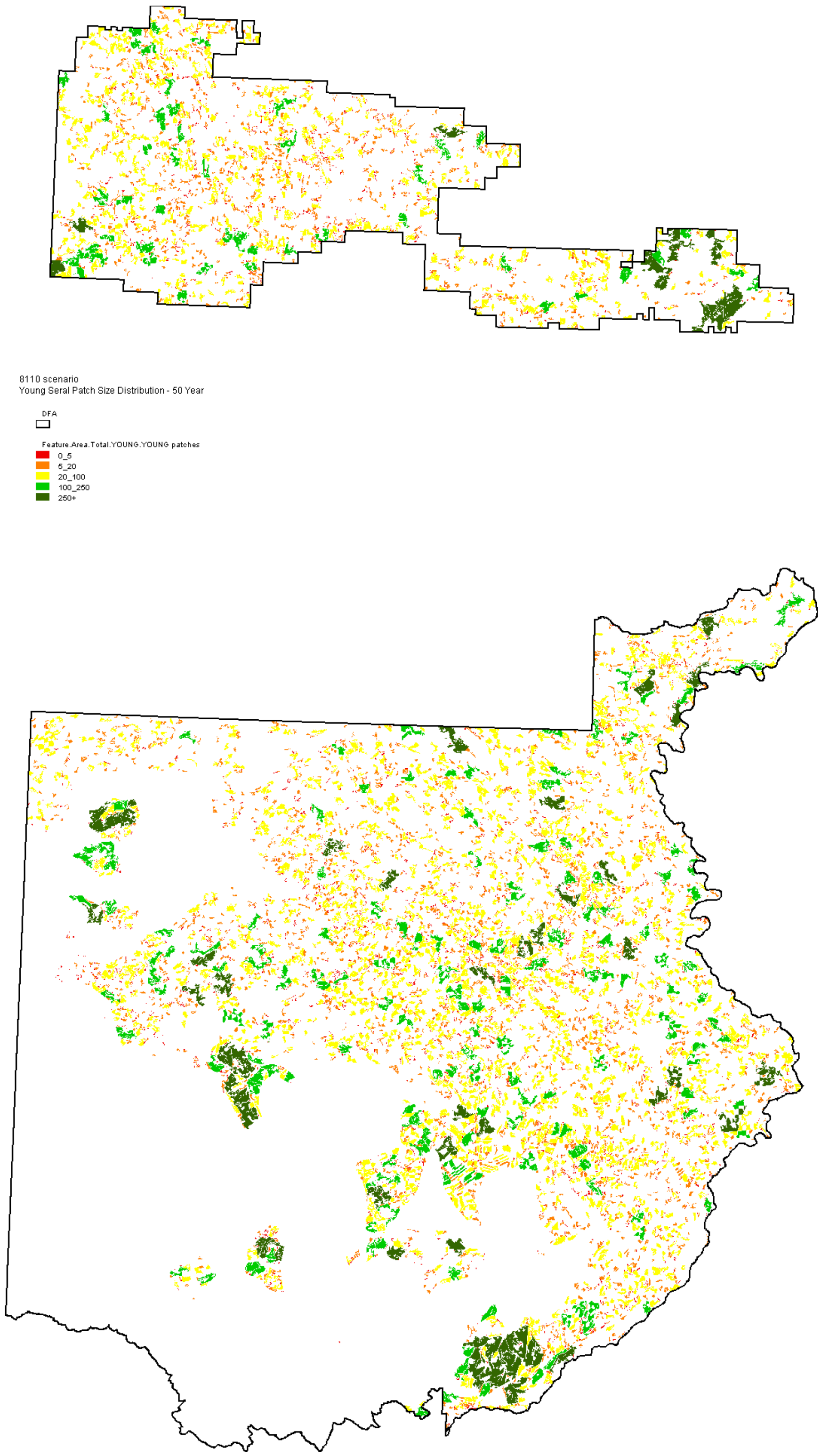


Figure 11 Young Seral Patch Size Distribution – 50-Year Snapshot

3.4 *Old Interior Forest (VOIT 1.1.1.2b)*

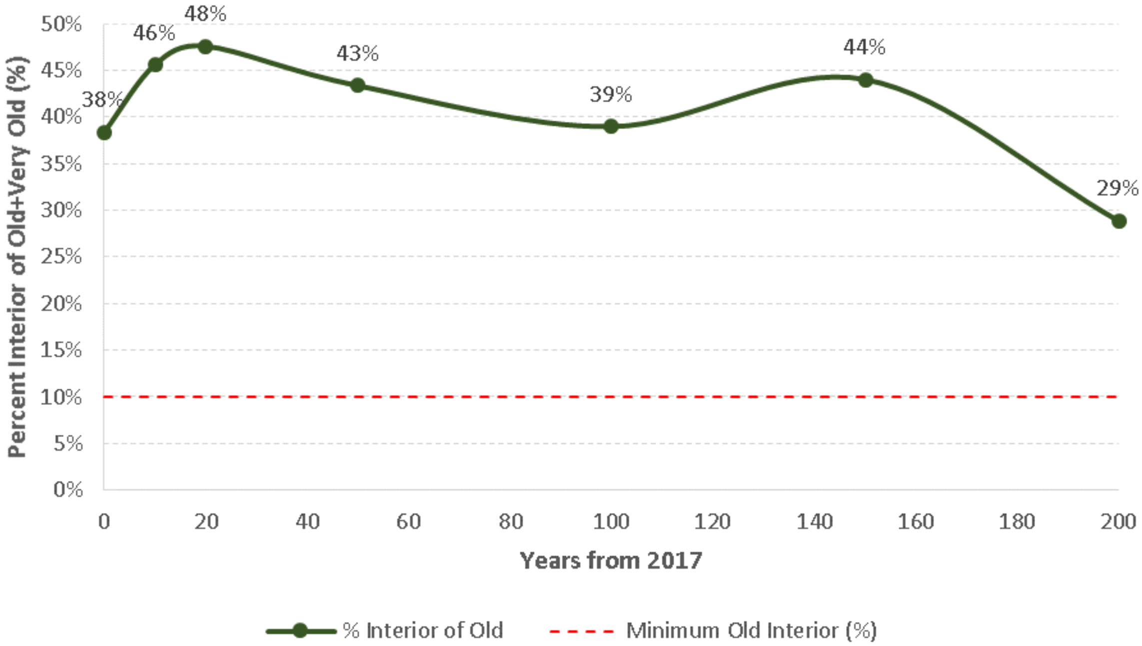


Figure 12 Old Interior forest area over the next 50 years

3.4.1 Current Snapshot

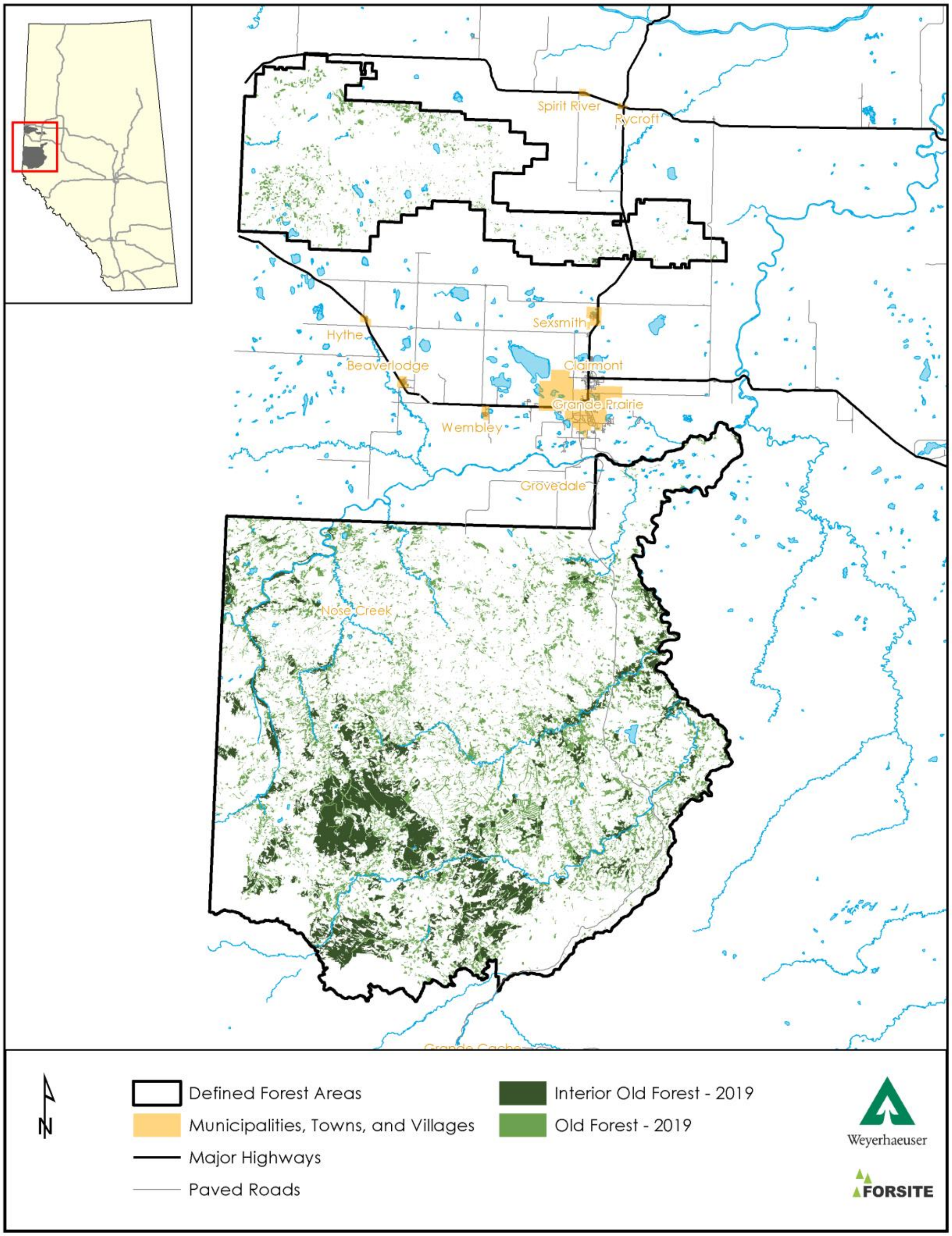


Figure 13 Current Distribution of Old Interior Forest

3.4.2 10-Year Snapshot

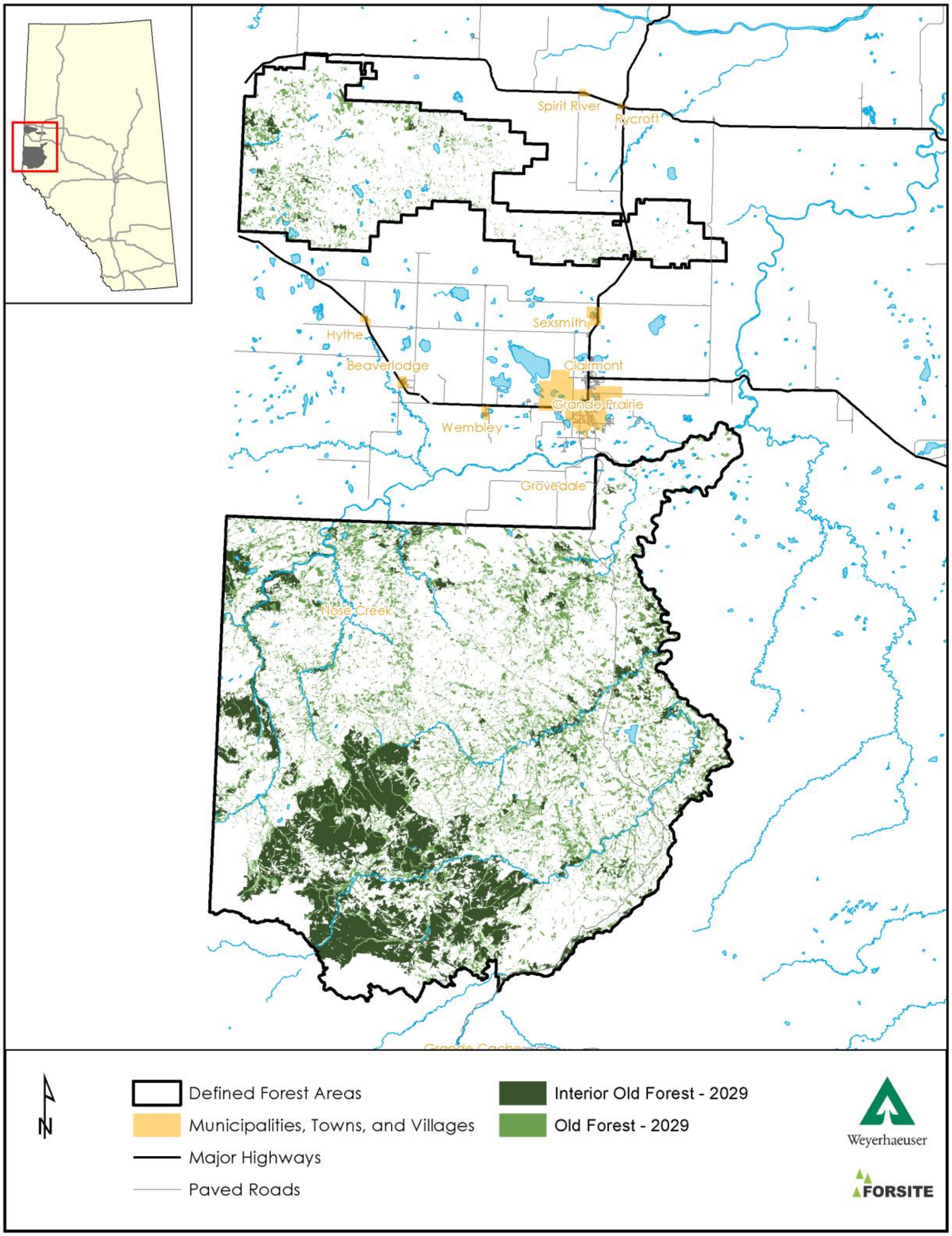


Figure 14 **Forecasted Old Interior Forest in 2029**

3.4.3 50-Year Snapshot

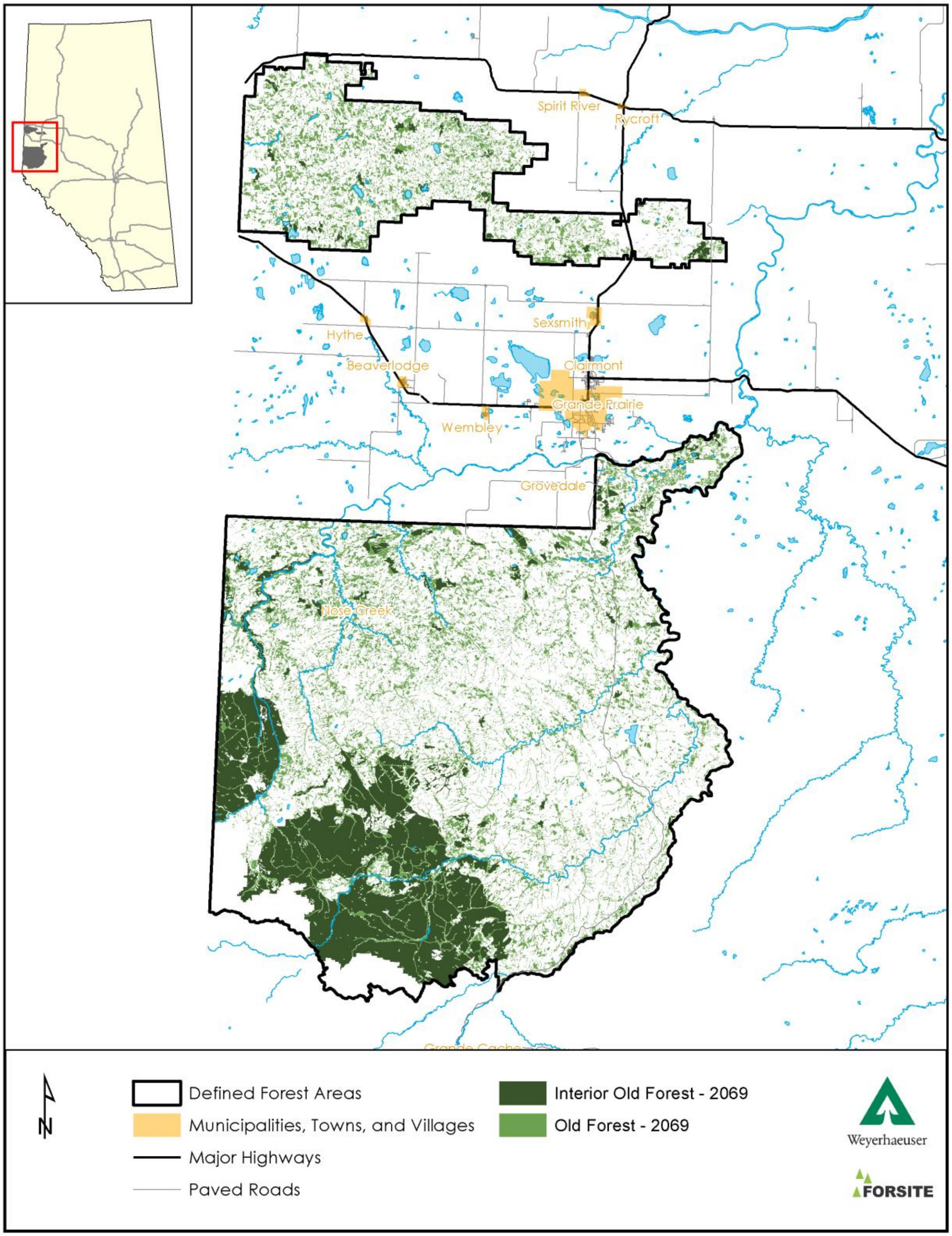


Figure 15 Forecasted Old Interior Forest in 2069

3.5 *Grizzly Bear Habitat States (VOIT 1.2.1.1a)*

A summary of the change in Primary and Secondary Grizzly Bear habitat states for FMU G16 is provided in Figure 16. Appendix I provides detailed reporting for each Grizzly Bear Watershed Unit, for FMA #6900016, and for FMU G16.

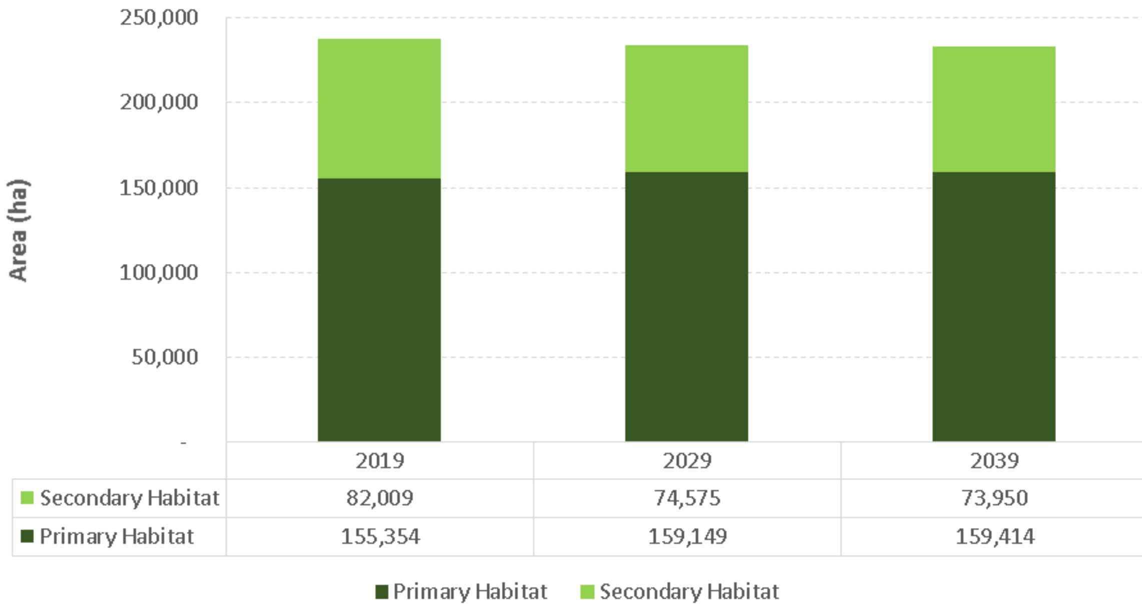


Figure 16 Primary and Secondary Grizzly bear habitat in in 2019 and forecasted to 2029 and 2039

3.5.1 Current Snapshot

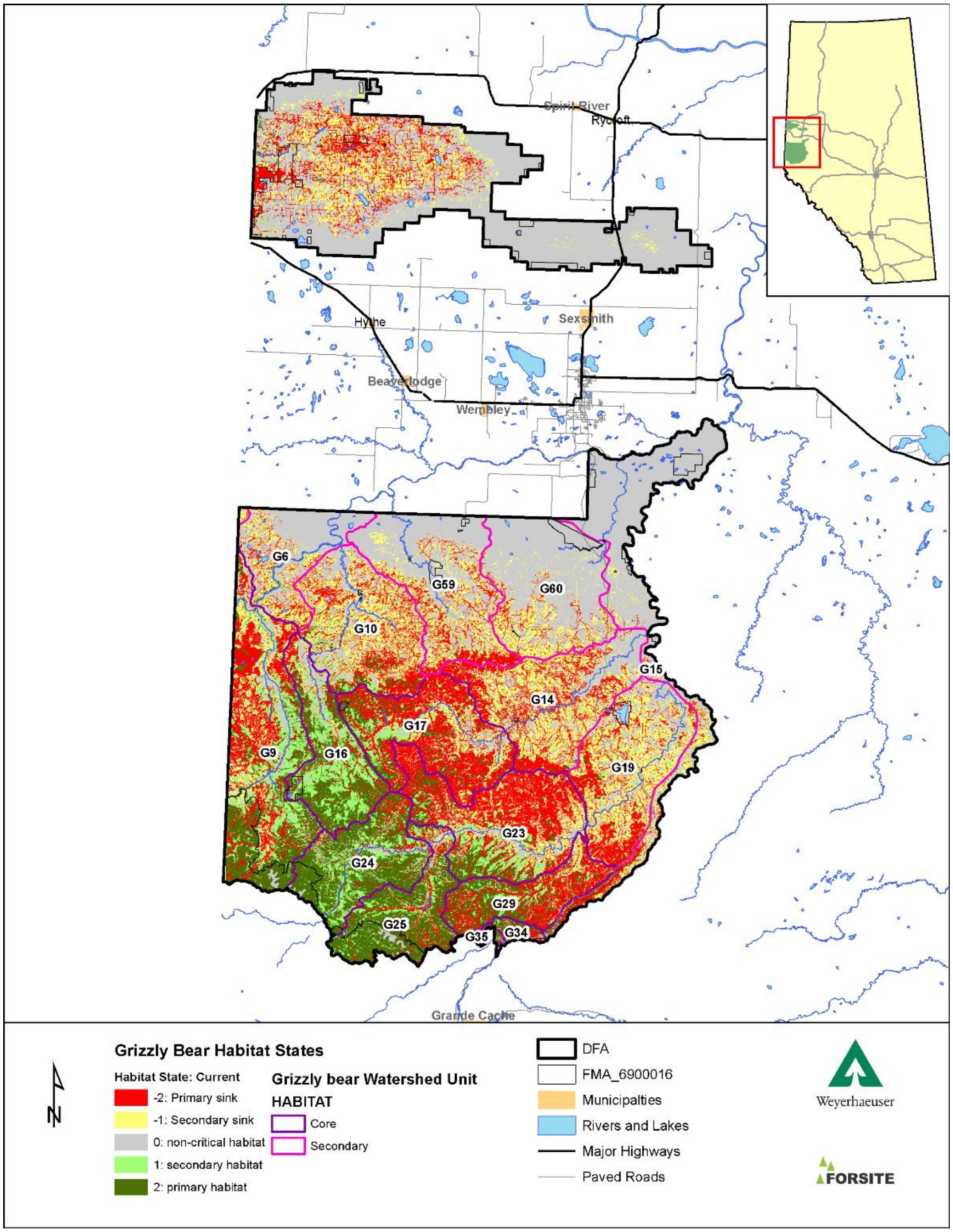


Figure 17 Grizzly Bear Habitat States - Current Snapshot

3.5.2 10-year Snapshot

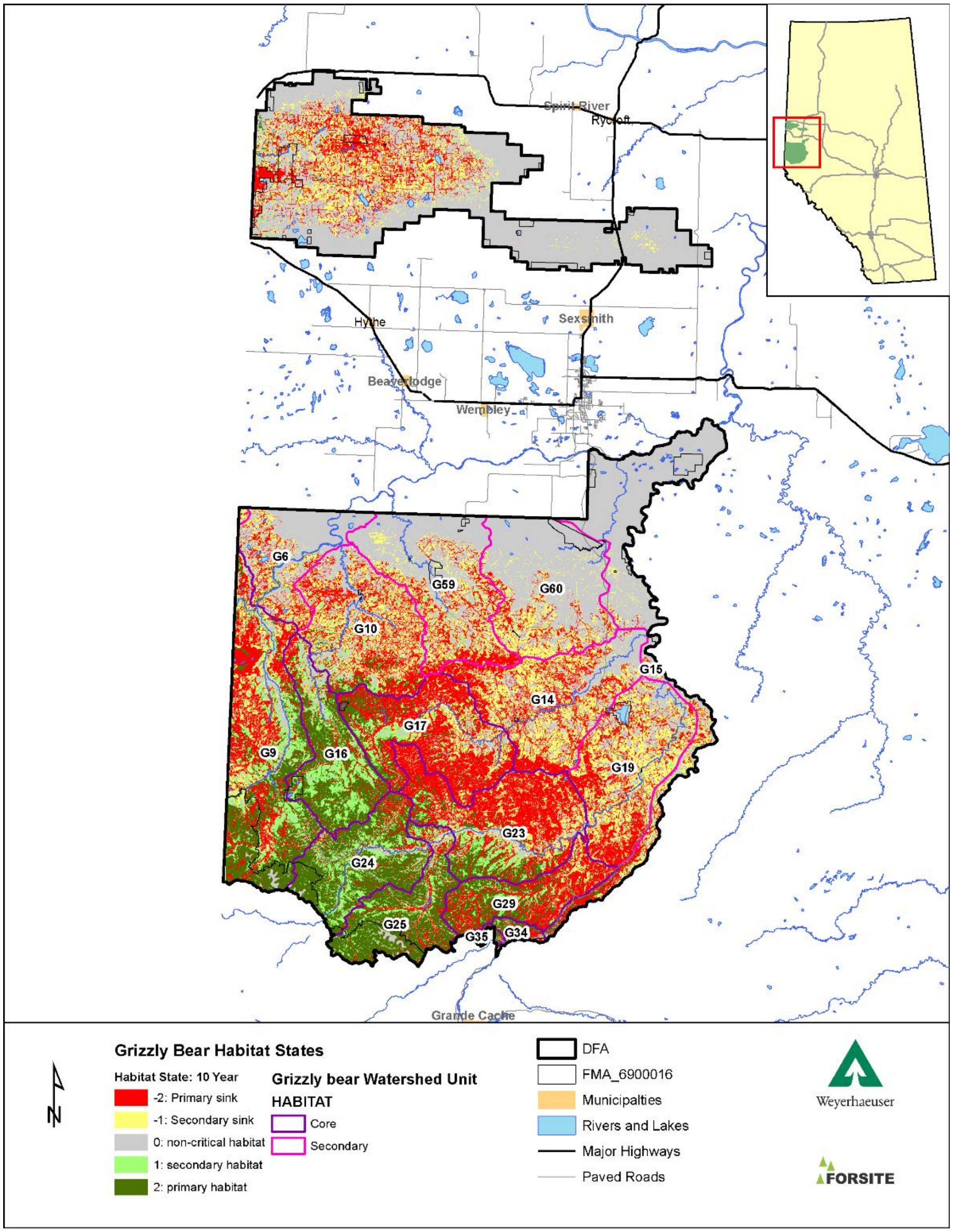


Figure 18 Grizzly Bear Habitat States - 10 years from now (2027)

3.5.3 20-year Snapshot

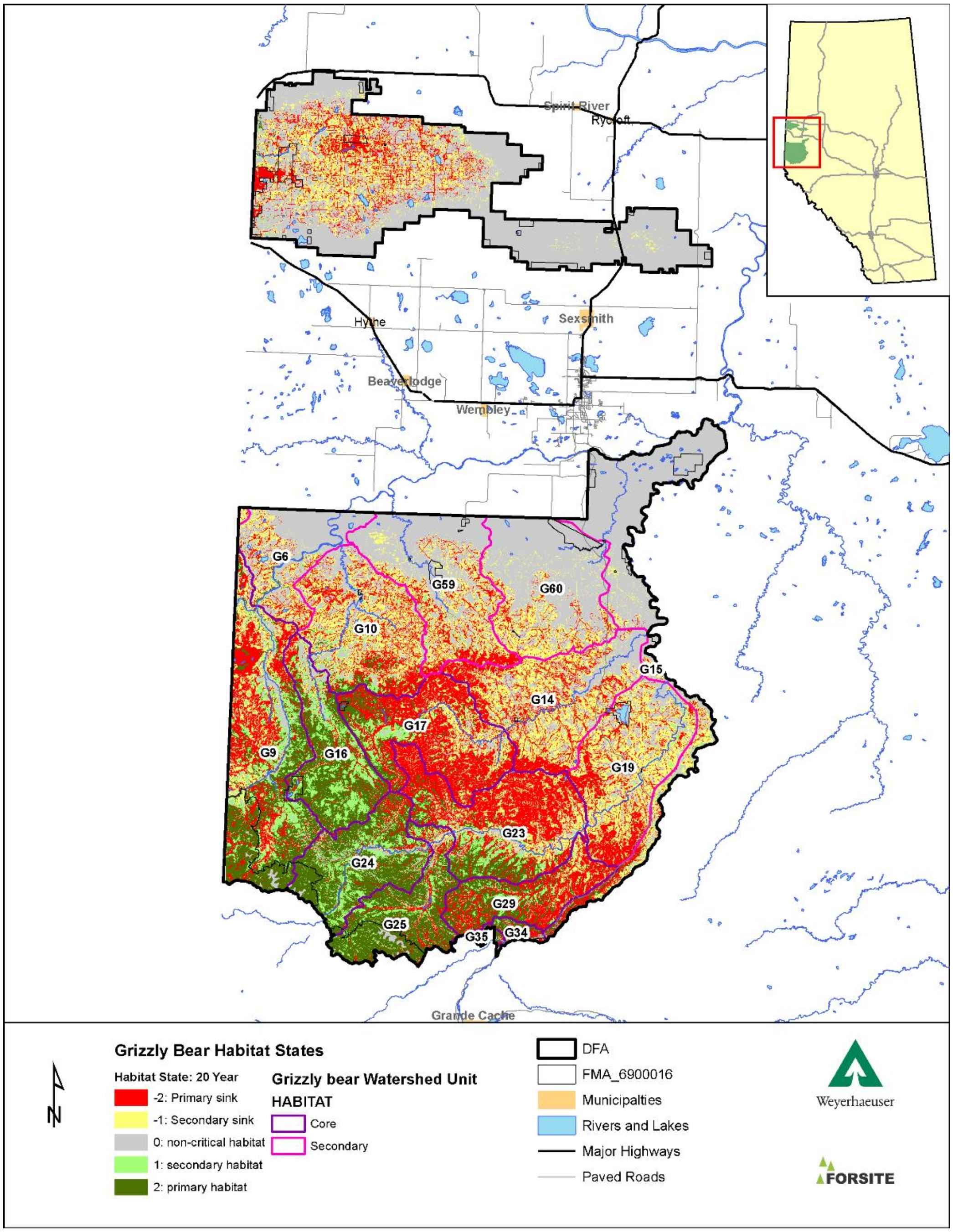


Figure 19 Grizzly Bear Habitat States - 20 years from now (2037)

3.6 *Barred Owl (VOIT 1.1.2.1b)*

3.6.1 Barred Owl RSF

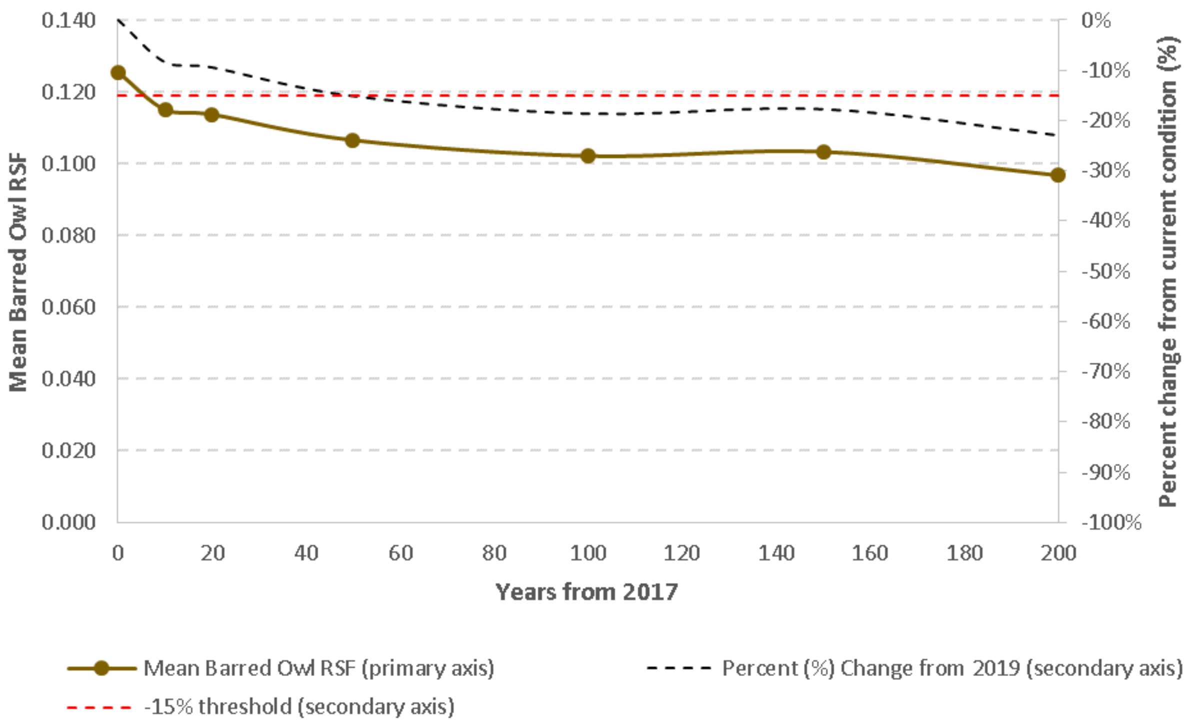


Figure 20 Barred Owl Resource Selection Function (RSF) at 0, 10, 20, 50, 100, 150, and 200 years from 2019

Table 9 Barred Owl Resource Selection Function (RSF) at 0, 10, 20, 50, 100, 150, and 200 years from 2019

Years from 2017	Mean Barred Owl RSF	±SD	Percent (%) Change from 2019
0	0.1255	0.1185	0.0%
10	0.1150	0.1108	-8.4%
20	0.1137	0.1121	-9.4%
50	0.1065	0.1018	-15.1%
100	0.1021	0.0947	-18.6%
150	0.1033	0.0929	-17.7%
200	0.0967	0.0894	-22.9%

3.6.1.1 **Current Snapshot**

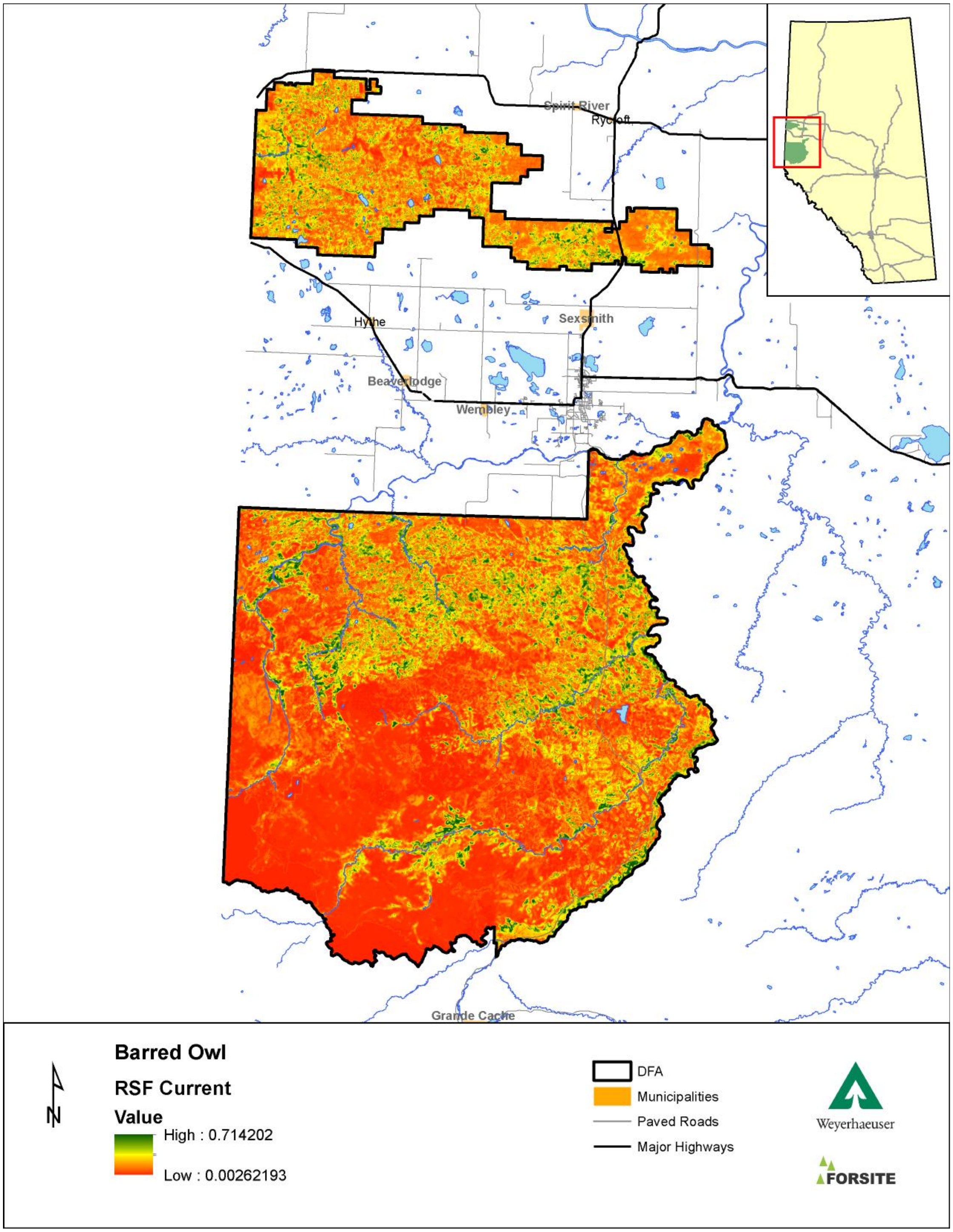


Figure 21 Current Habitat Suitability for Barred Owl (2019)

3.6.1.2 **10-year Snapshot**

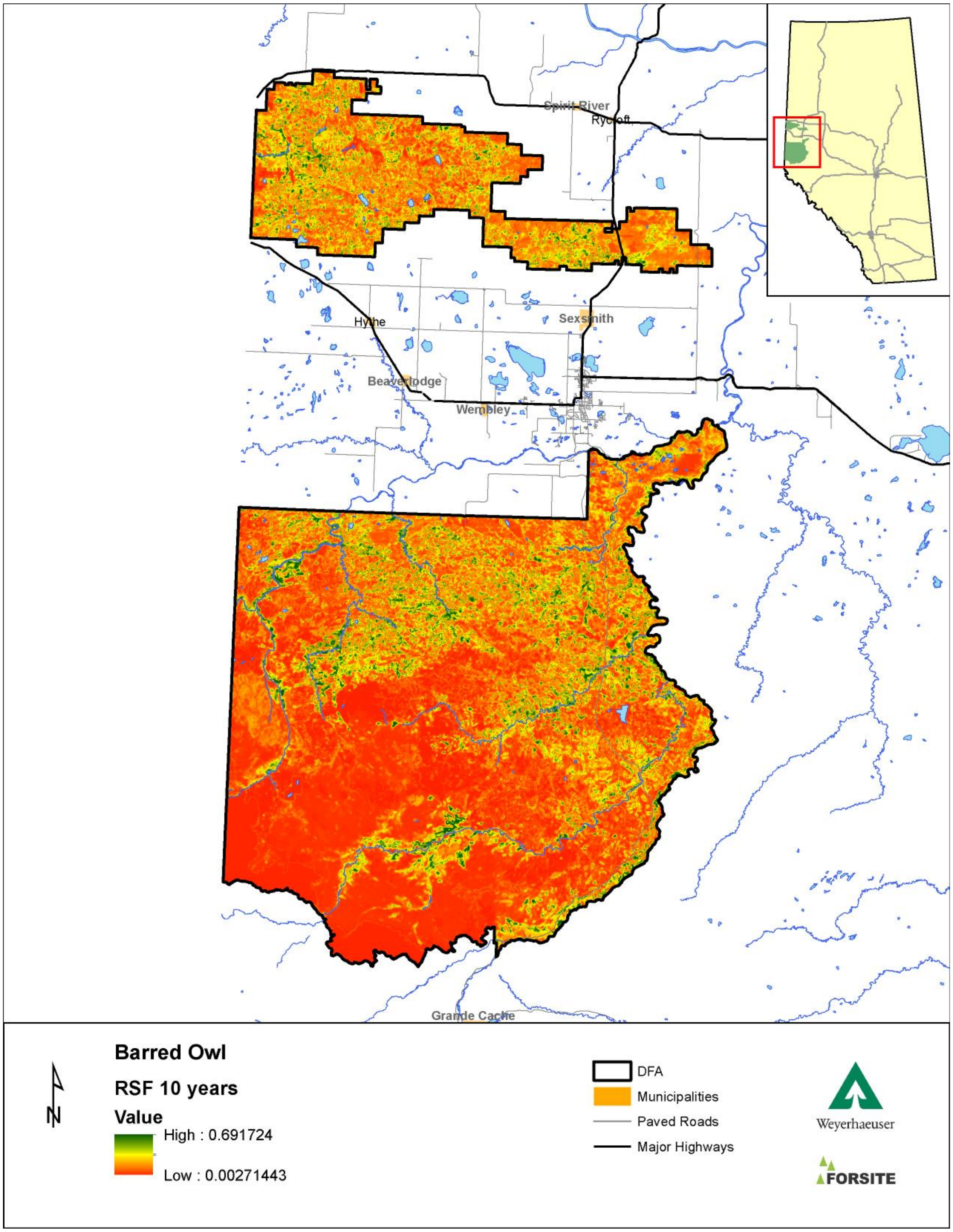


Figure 22 Forecasted Habitat Suitability for Barred Owl in 2027

3.6.1.3 **20-year Snapshot**

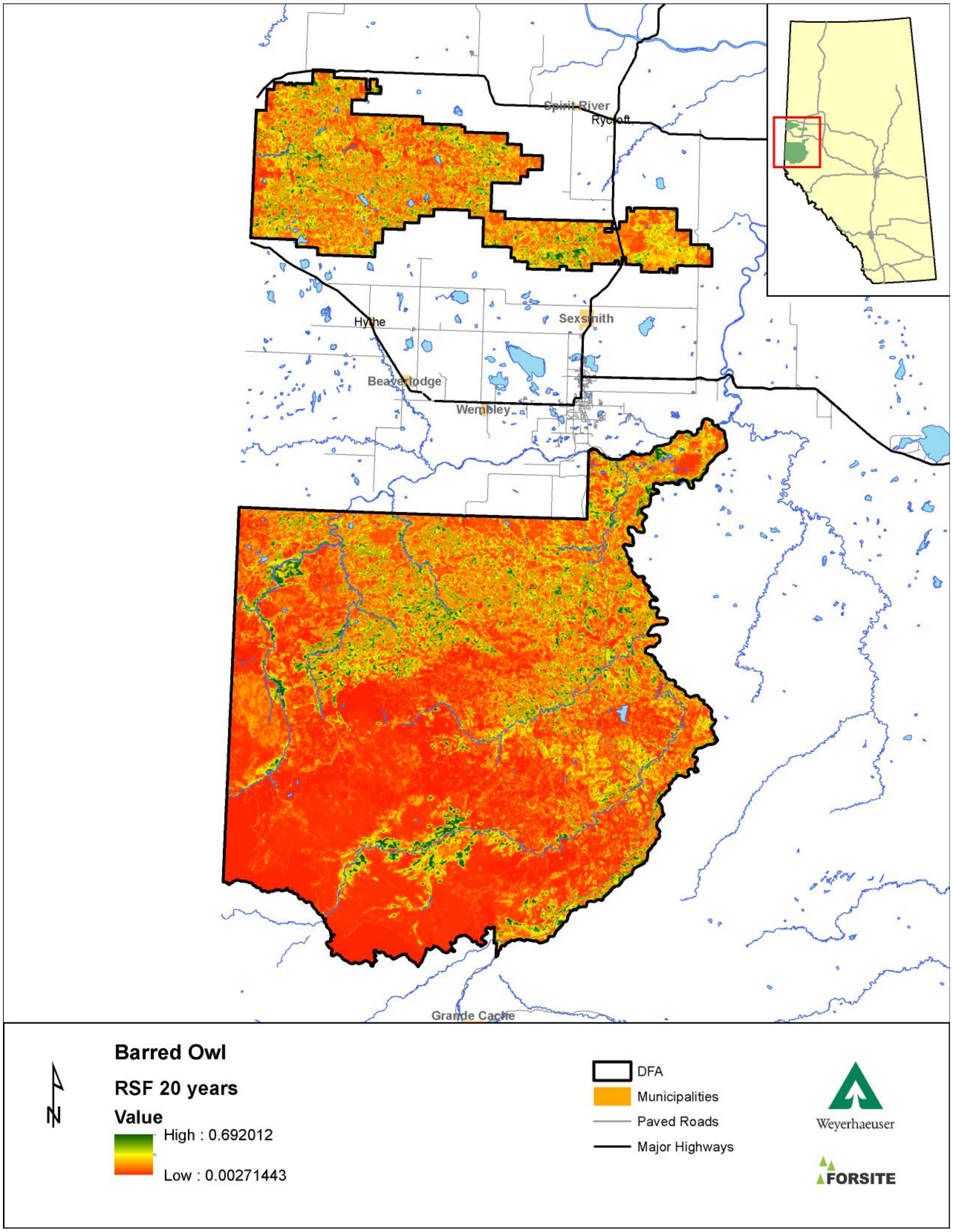


Figure 23 Forecasted Habitat Suitability for Barred Owl in 2037

3.6.1.4 **50-year Snapshot**

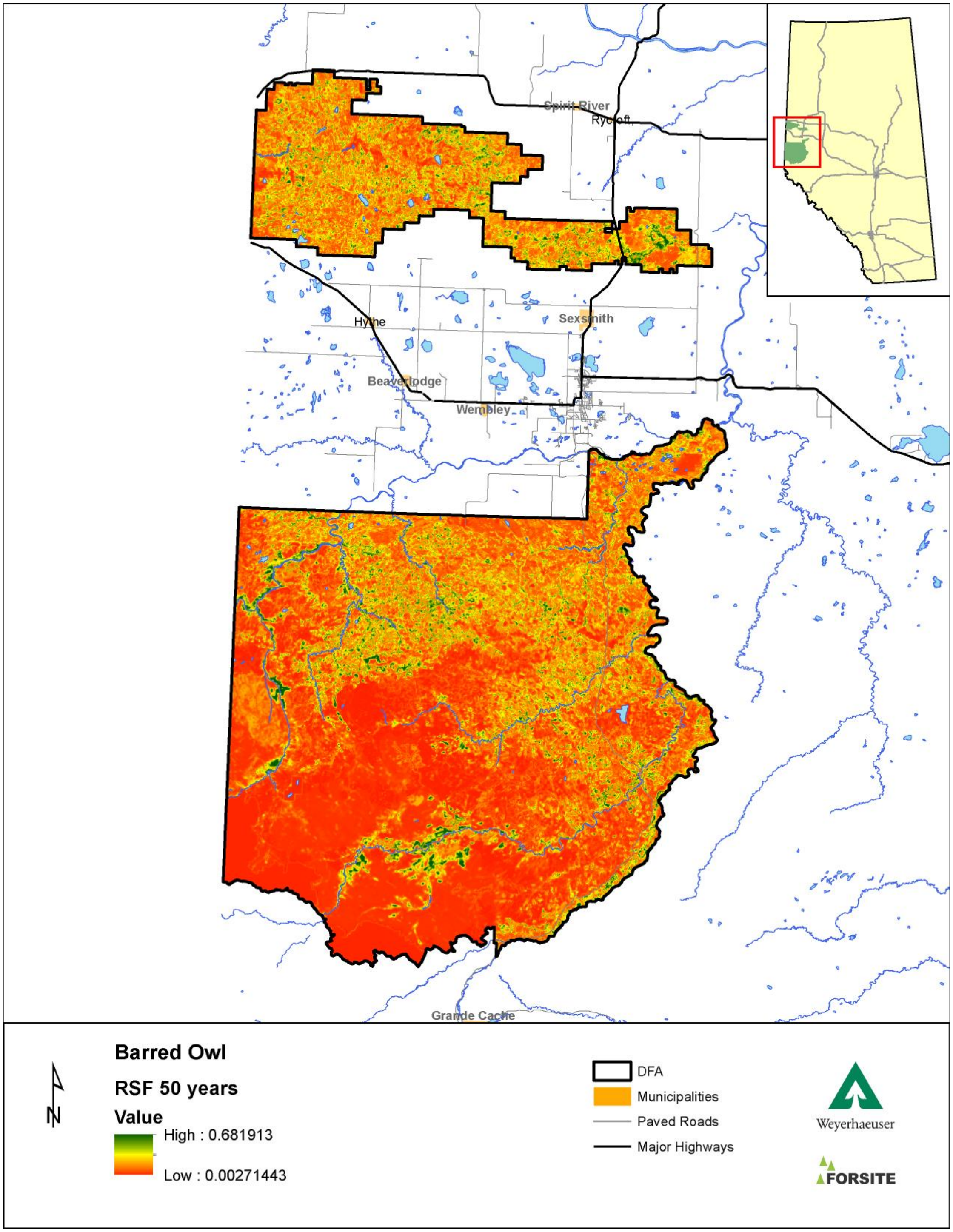


Figure 24 Forecasted Habitat Suitability for Barred Owl in 2067

3.6.2 Barred Owl Breed Pair

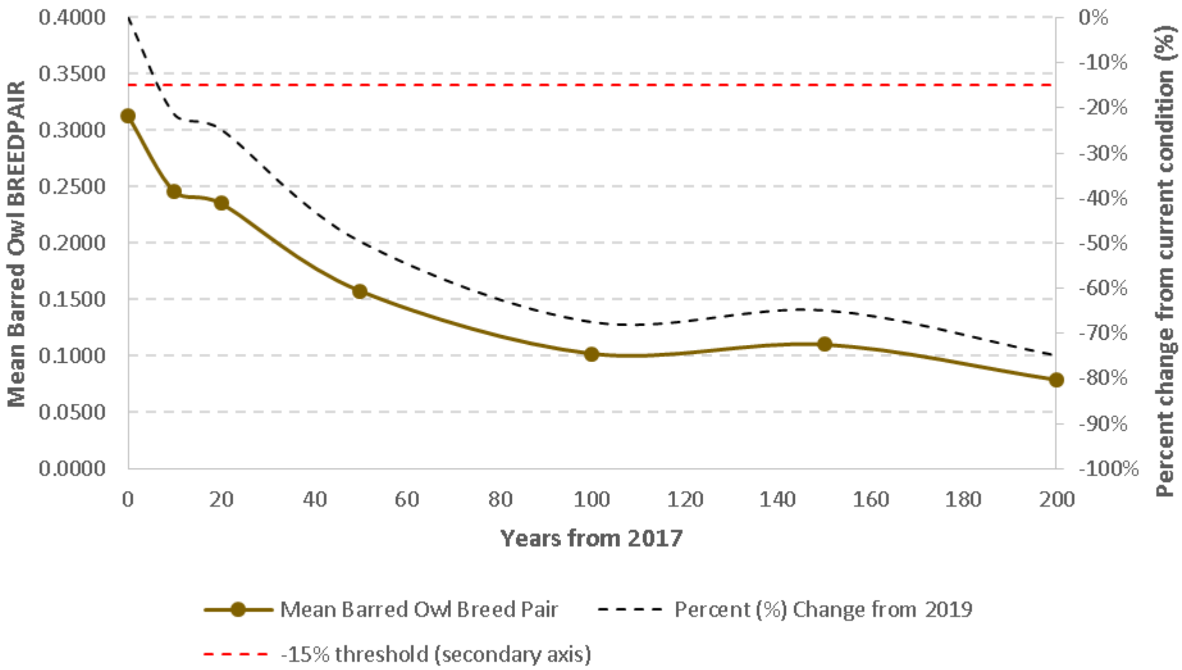


Figure 25 Mean Barred Owl Breed pair 0, 10, 20, 50, 100, 150, and 200 years from 2019

Table 10 Mean Barred Owl Breed pair 0, 10, 20, 50, 100, 150, and 200 years from 2019

Years from 2017	Mean Barred Owl Breed Pair	±SD	Percent (%) Change from 2019
0	0.3129	0.4637	0.0%
10	0.2457	0.4305	-21.1%
20	0.2352	0.4241	-22.2%
50	0.1576	0.3644	-48.1%
100	0.1020	0.3026	-67.4%
150	0.1101	0.3130	-65.2%
200	0.0788	0.2694	-76.7%

3.6.2.1 Current Snapshot

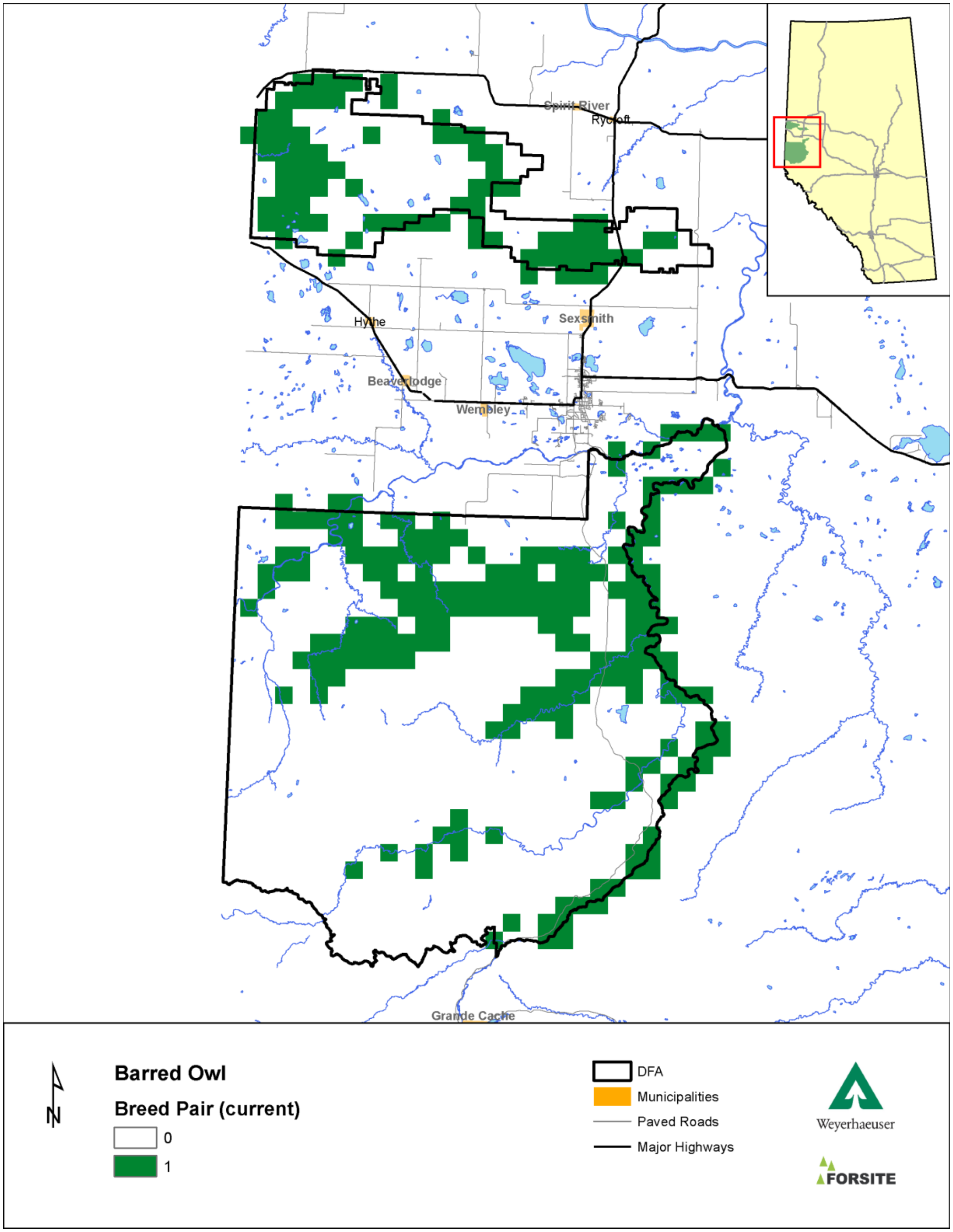


Figure 26 Barred Owl Breed Pair – Current

3.6.2.2 **10-year Snapshot**

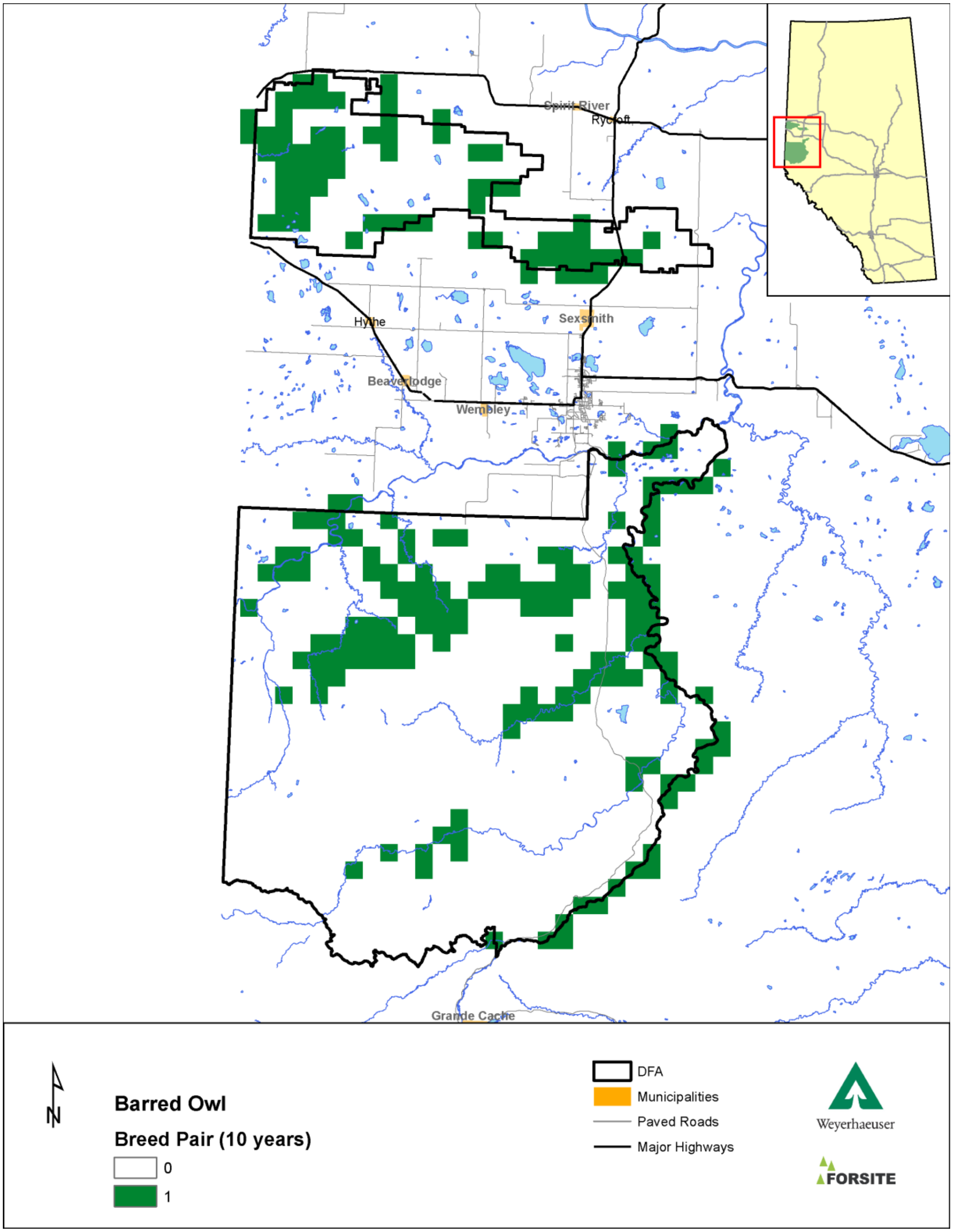


Figure 27 Barred Owl Breed Pair – 10 years

3.6.2.3 **20-year Snapshot**

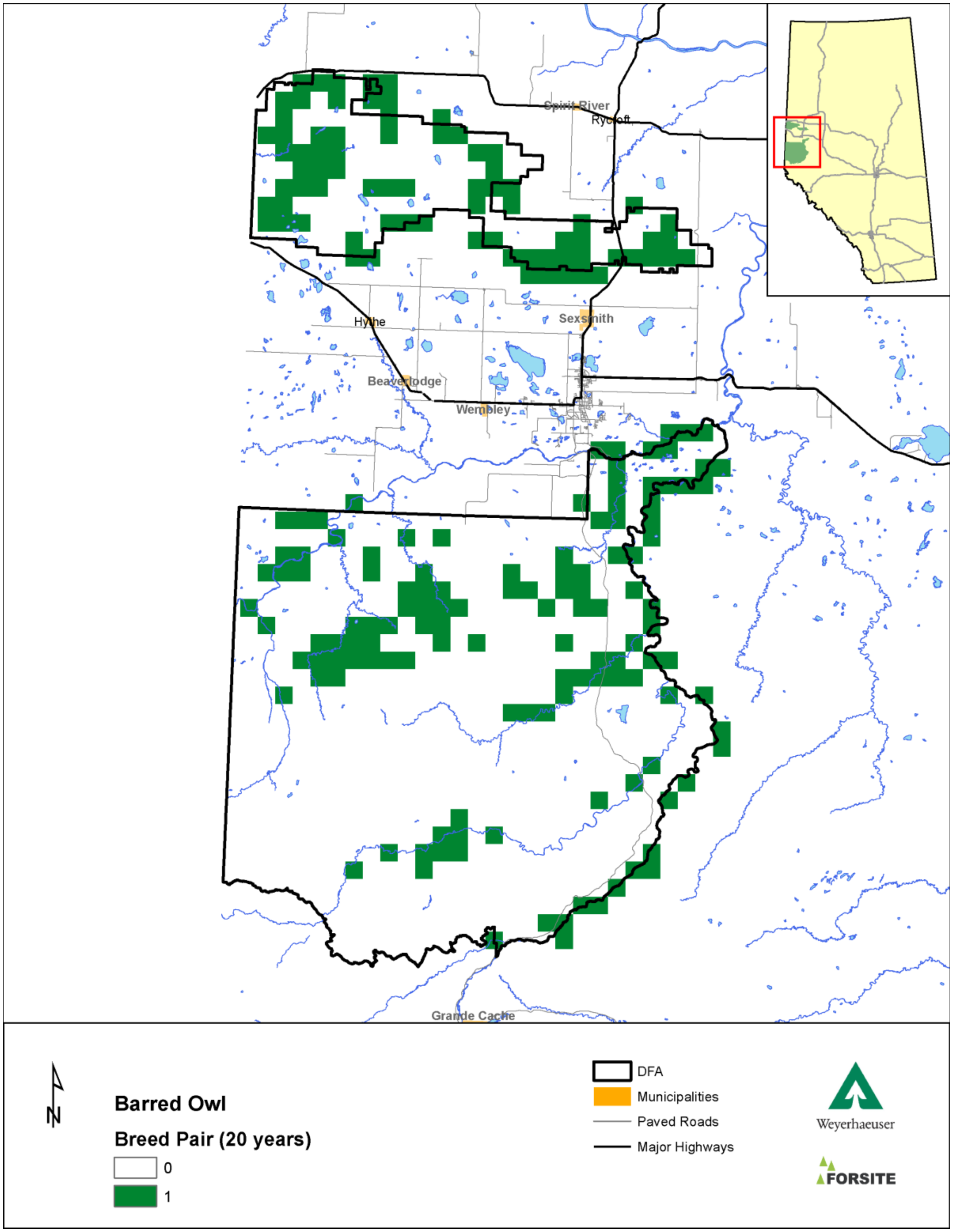


Figure 28 Barred Owl Breed Pair – 20 years

3.6.2.4 **50-year Snapshot**

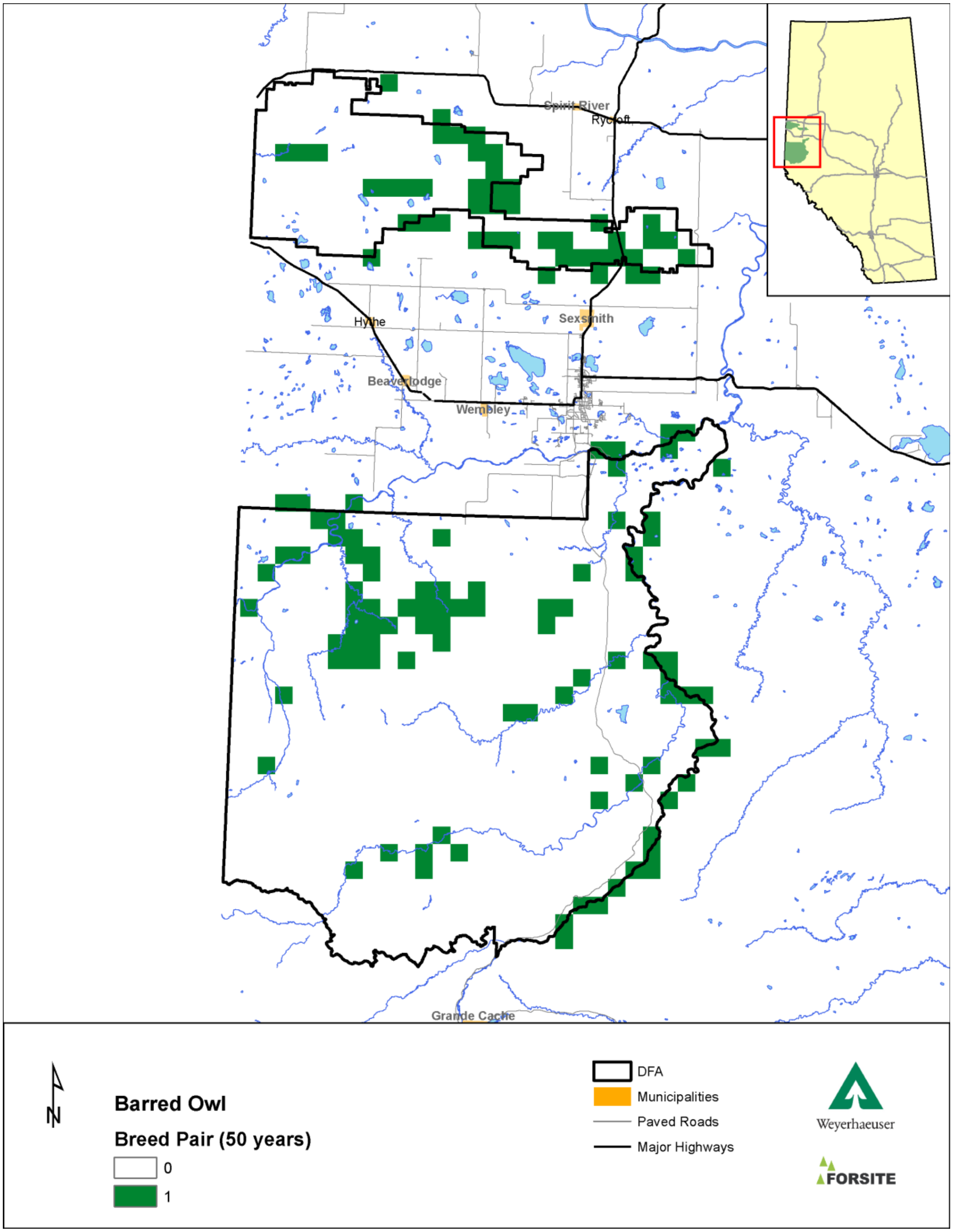


Figure 29 Barred Owl Breed Pair – 50 Year

3.7 *Marten (VOIT 1.1.2.1c)*

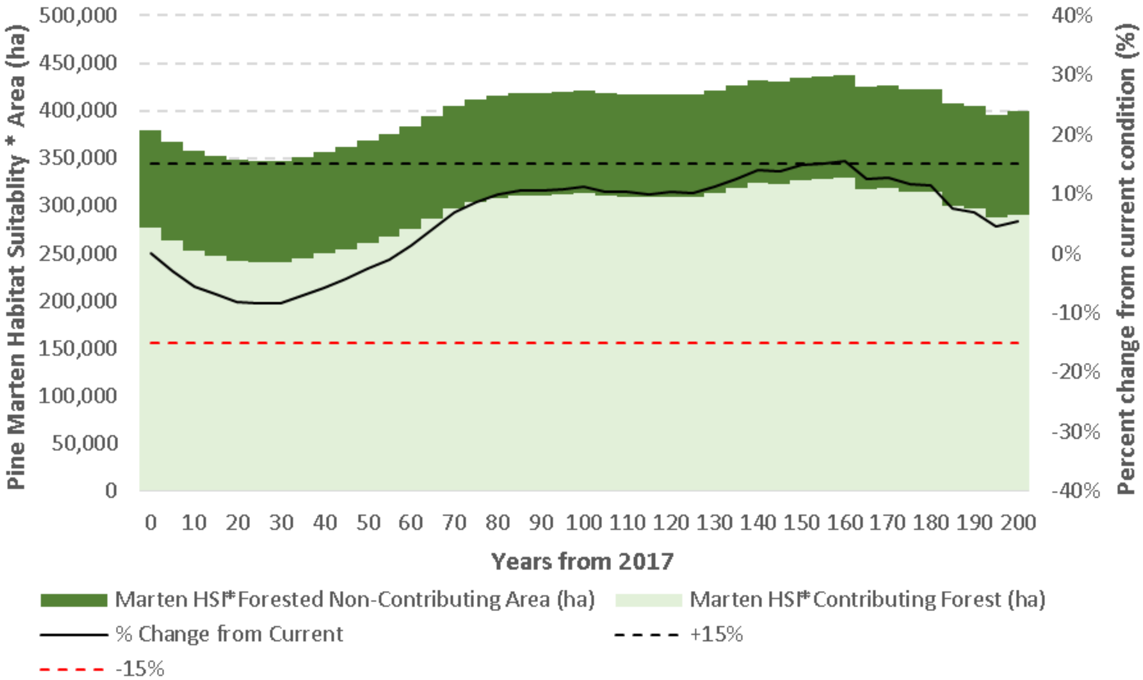


Figure 30 **Change in Marten Habitat Suitability Index (HSI) *Area over a 200-year planning horizon**

3.7.1 **Current Snapshot**

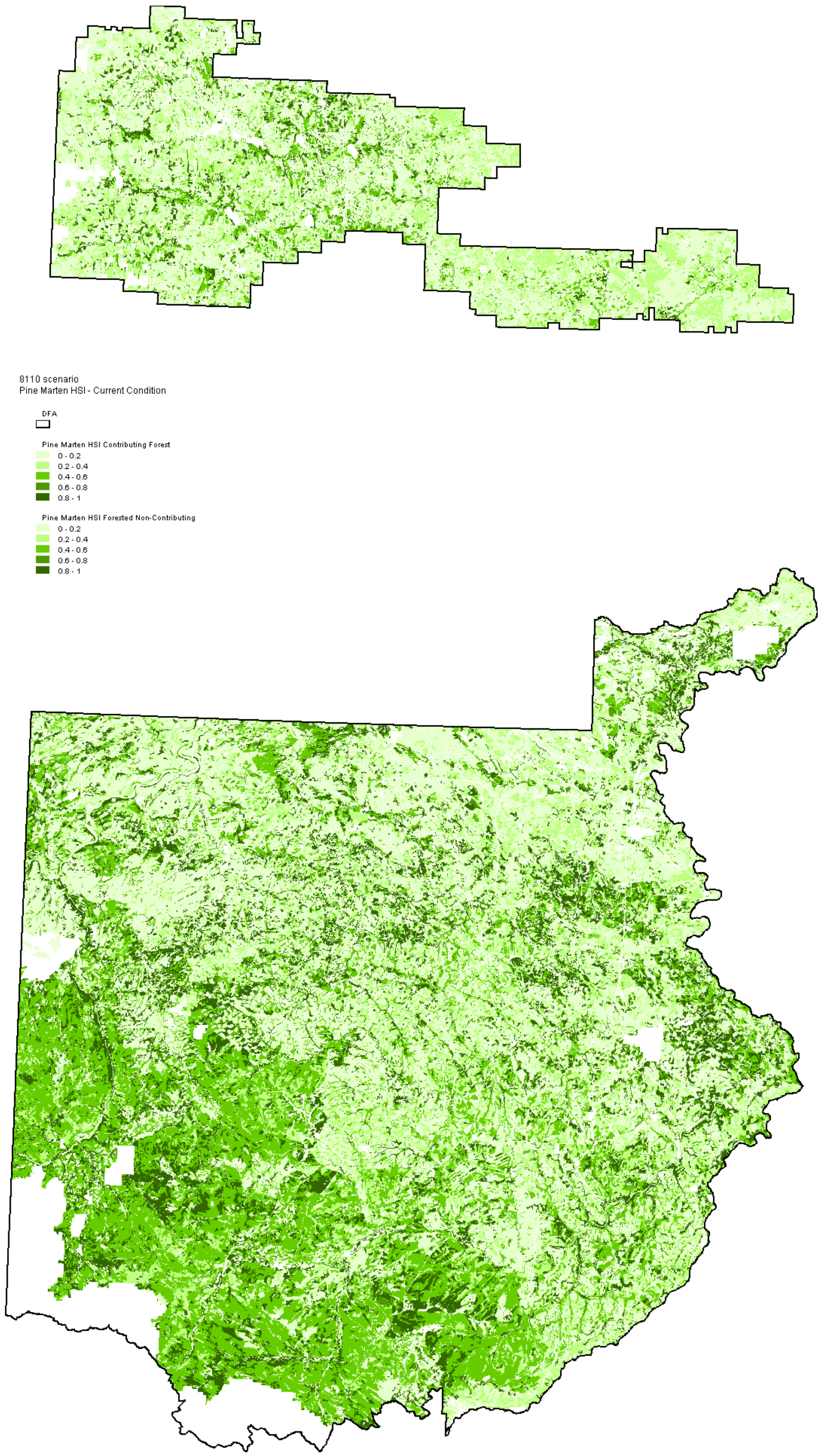


Figure 31 Current Habitat Suitability for Marten Habitat

3.7.2 10-year Snapshot

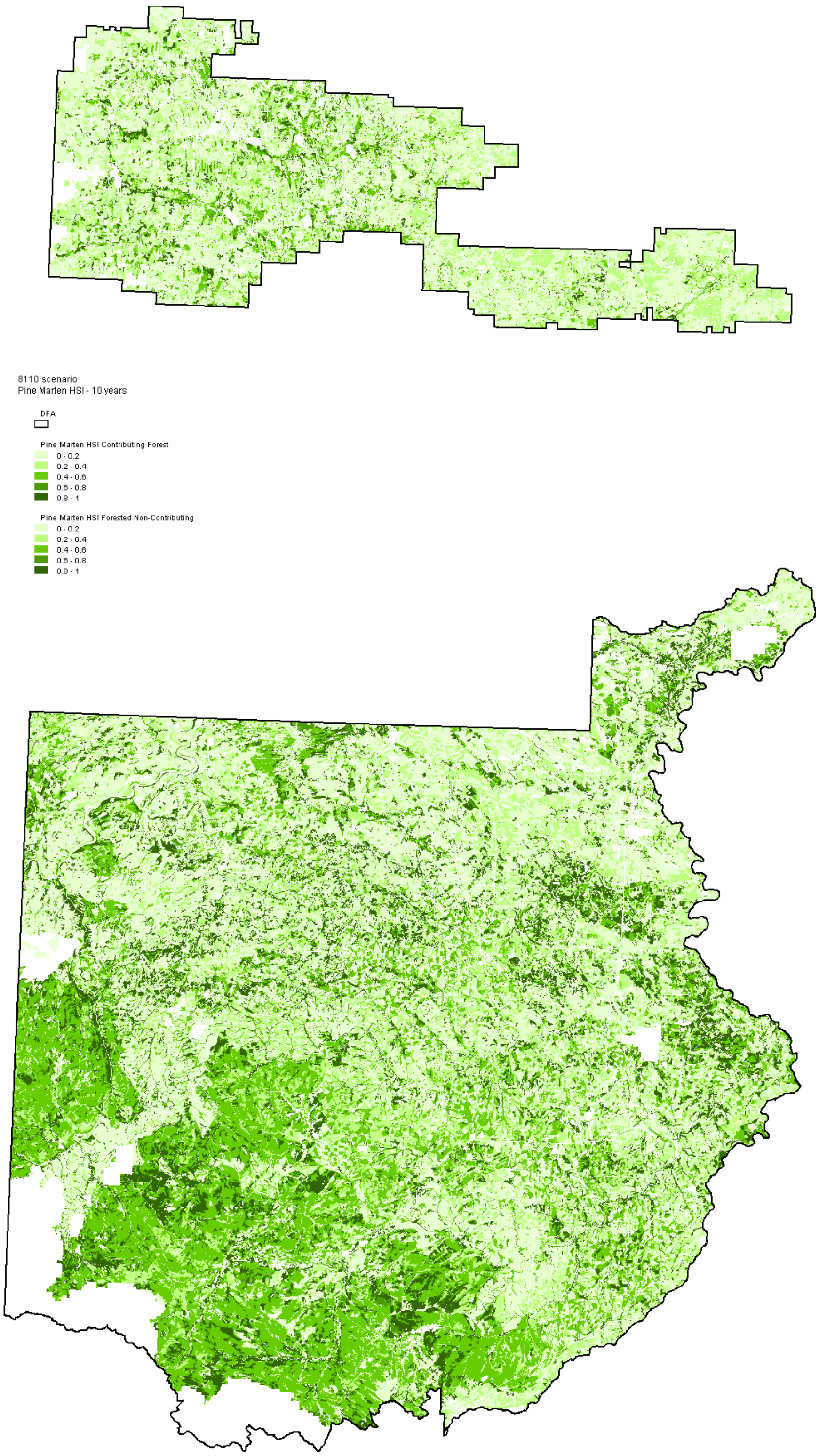


Figure 32 10-Year Habitat Suitability for Pine Marten

3.7.3 20-year Snapshot

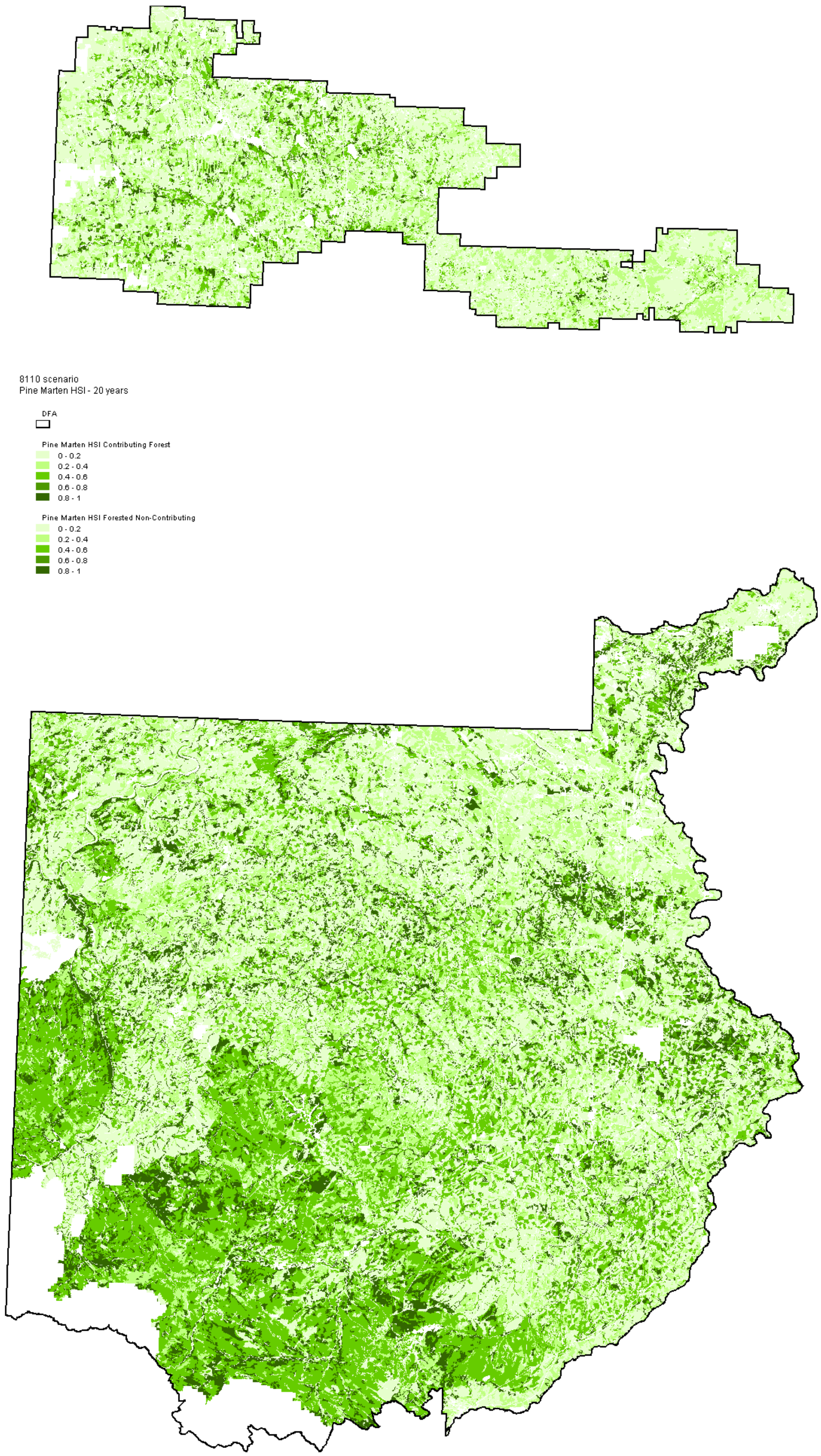


Figure 33 20-Year Habitat Suitability for Pine Marten

3.7.4 **50-year Snapshot**

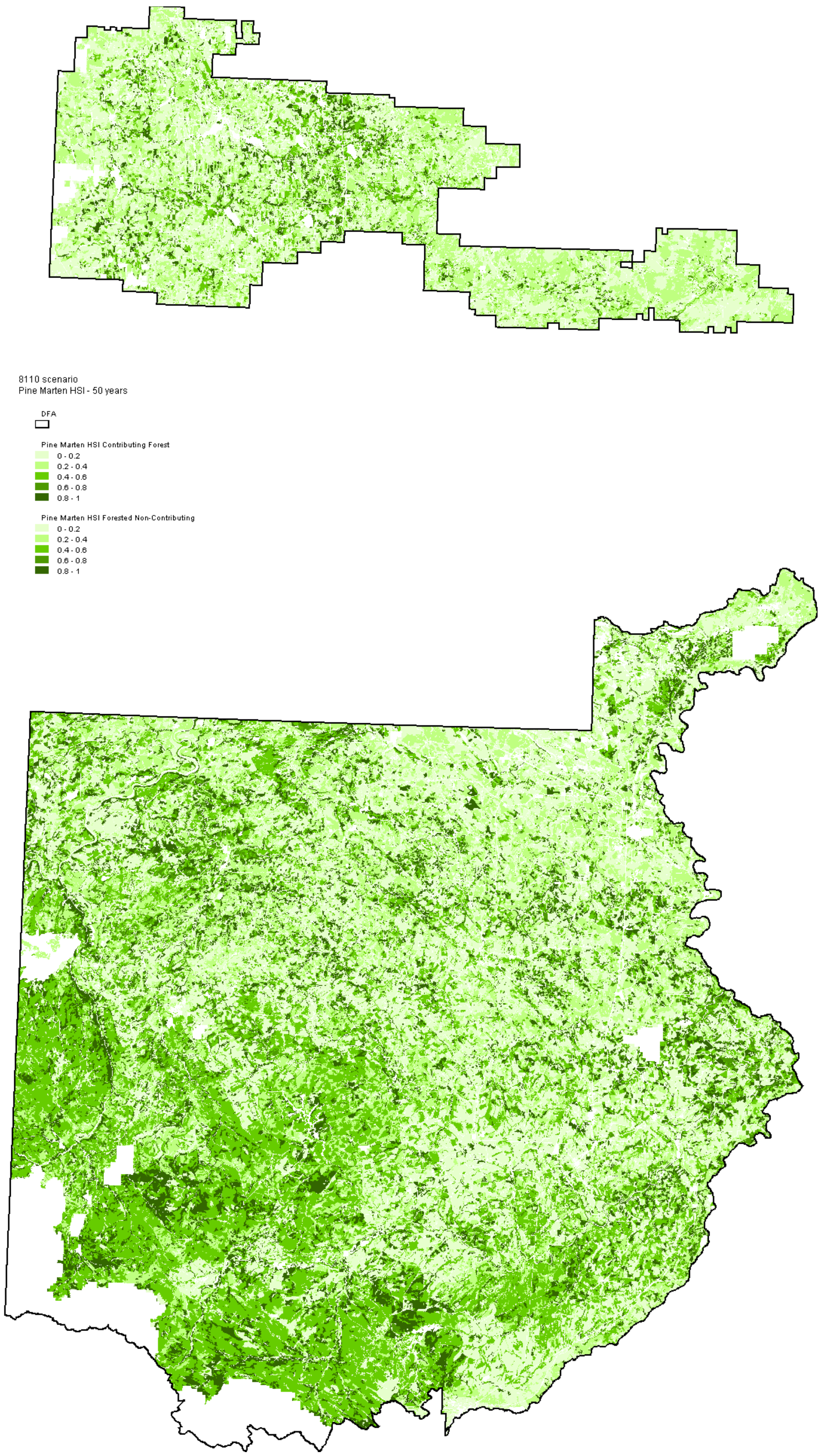


Figure 34 50-Year Habitat Suitability for Pine Marten

3.8 *Songbirds (VOIT 1.1.2.1d)*

3.8.1 Canada Warbler

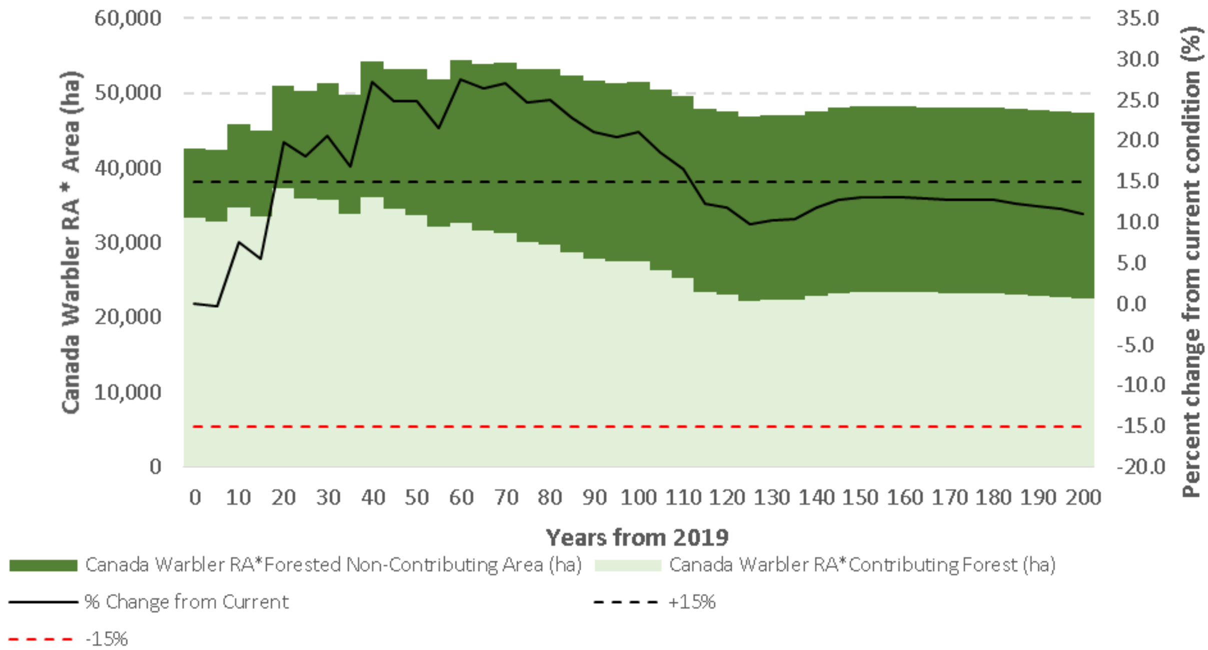


Figure 35 Canada Warbler relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.1.1 **Current Snapshot**

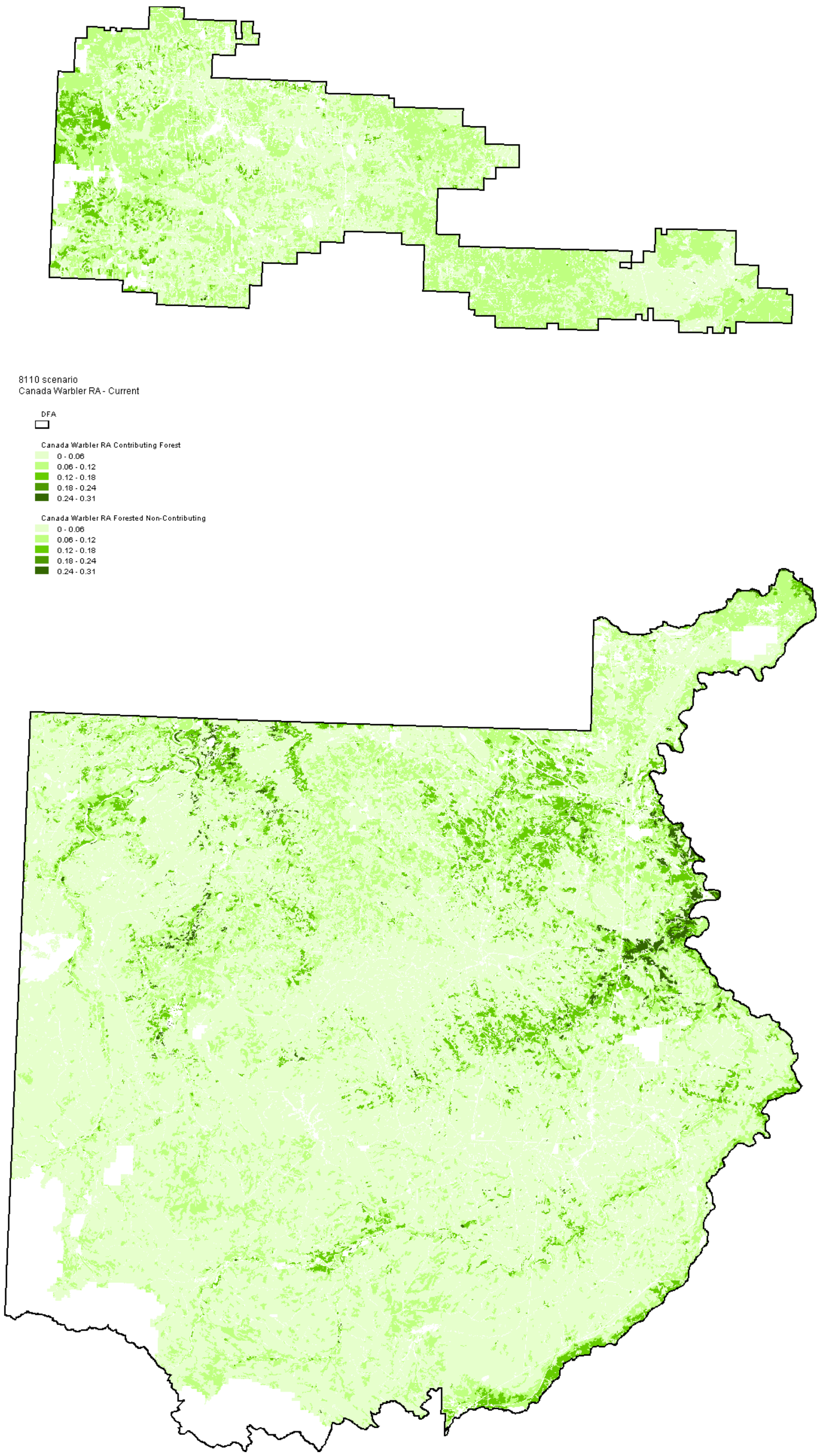


Figure 36 Current Canada Warbler Relative abundance (2017)

3.8.1.2 **10-year Snapshot**

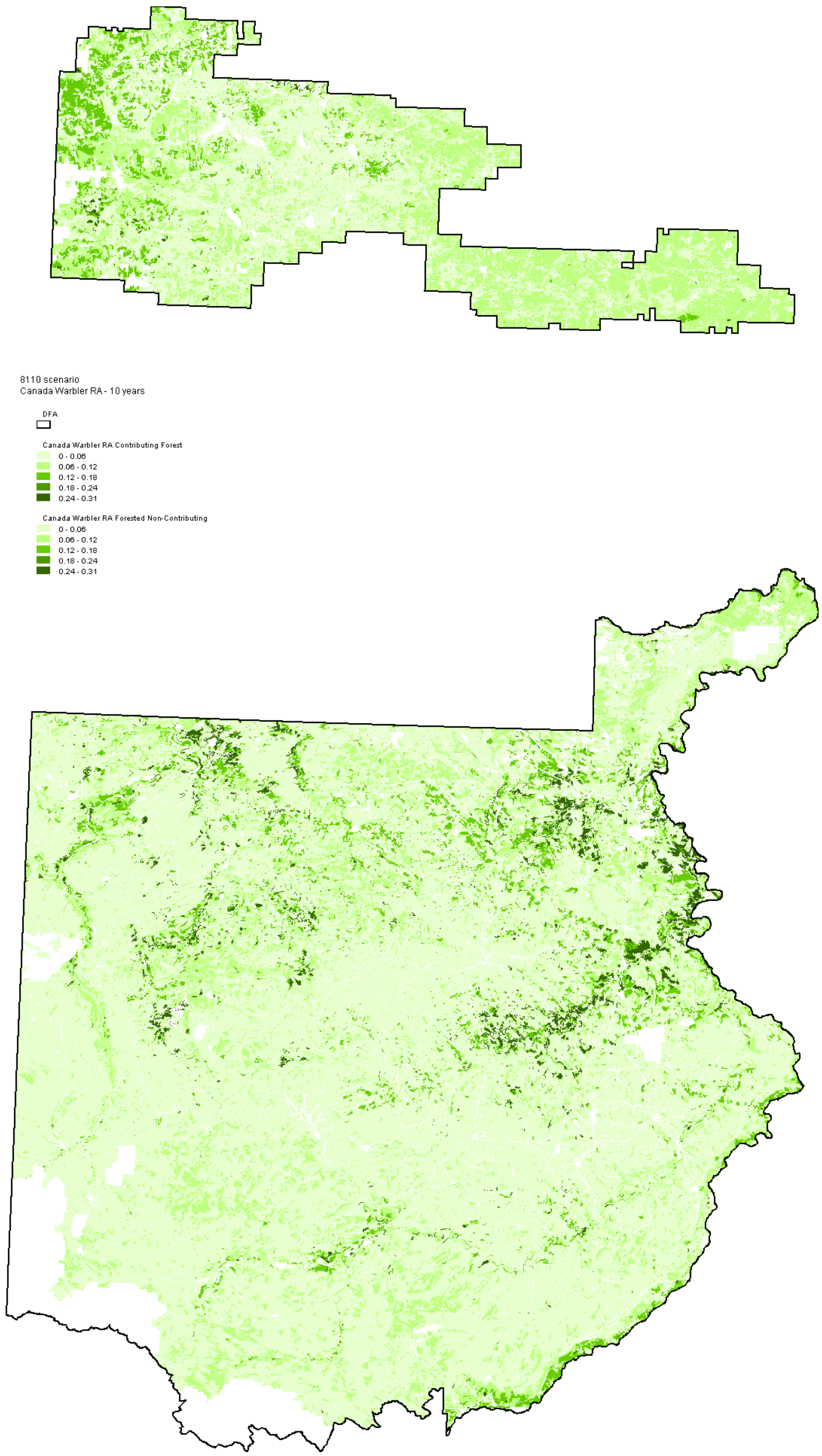


Figure 37 Canada Warbler Relative abundance - 10-Year snapshot

3.8.1.3 **20-year Snapshot**

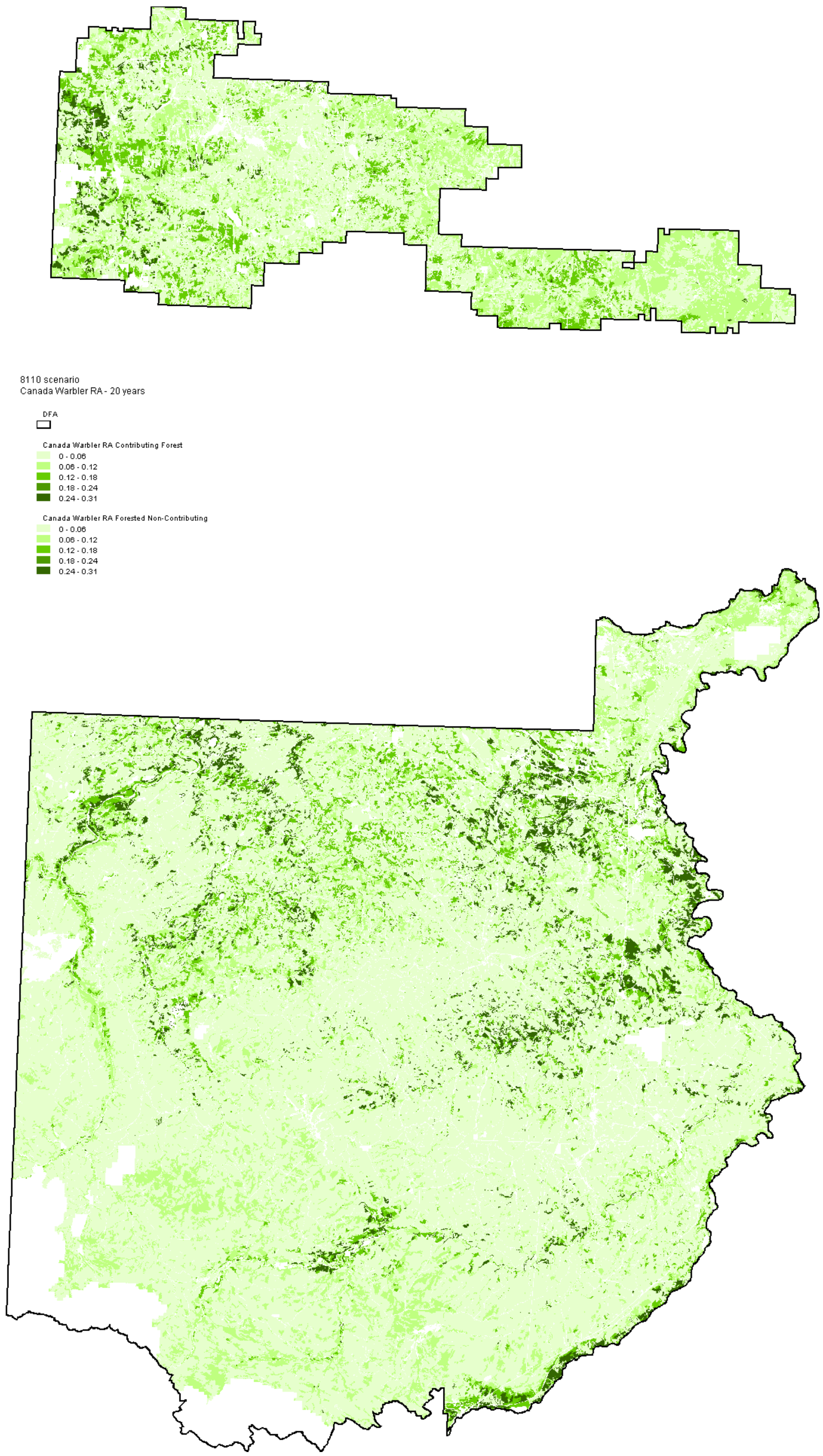


Figure 38 Canada Warbler Relative abundance - 20-Year snapshot

3.8.1.4 **50-year Snapshot**

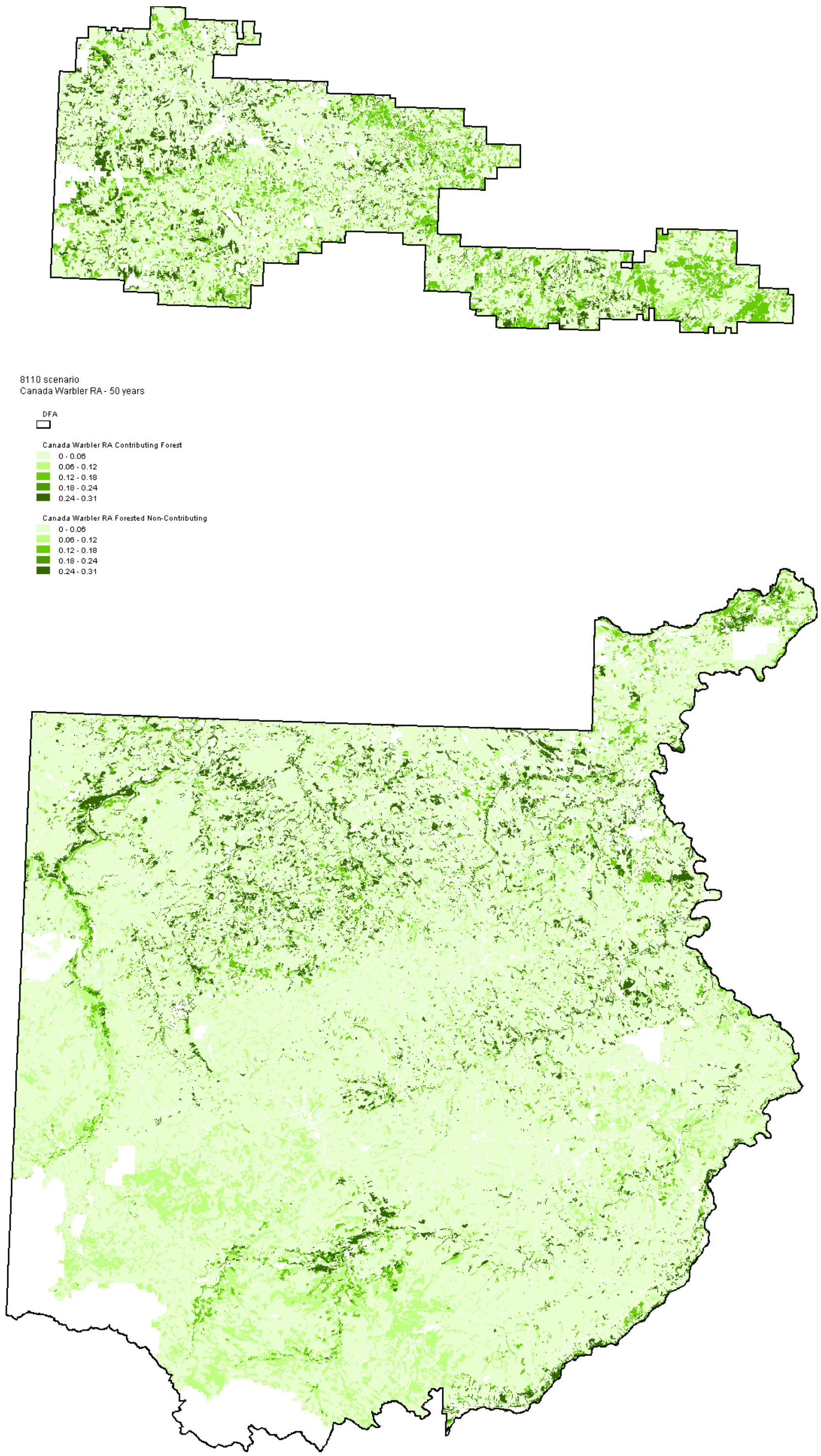


Figure 39 Canada Warbler Relative abundance - 50-Year snapshot

3.8.2 Brown Creeper

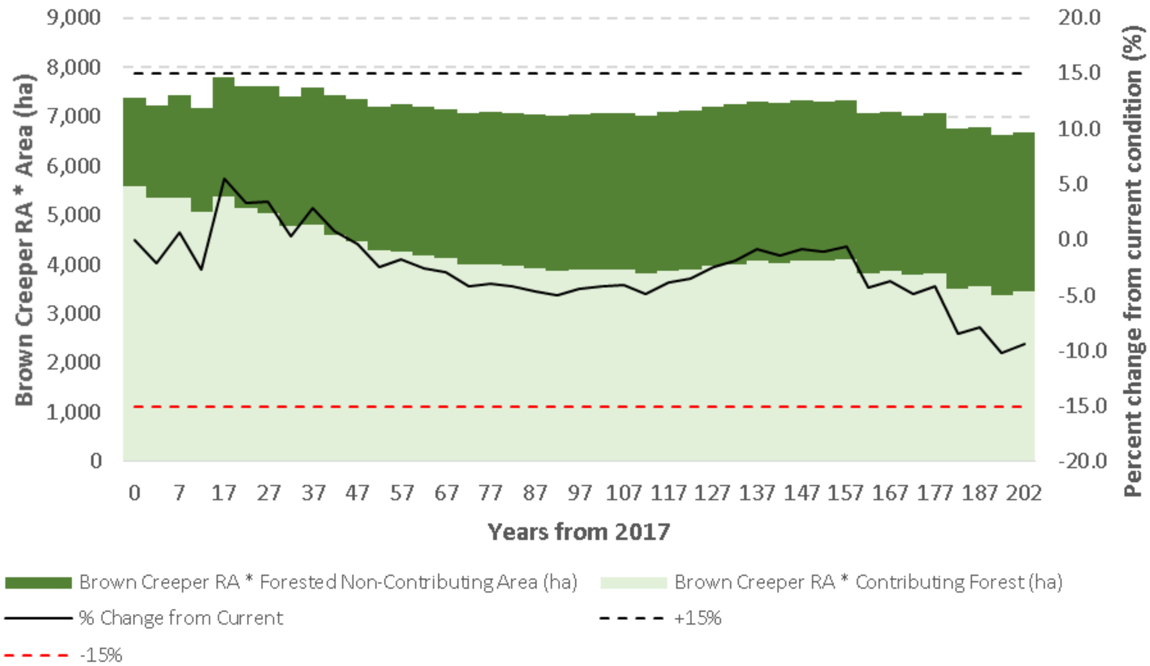


Figure 40 Brown Creeper Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.2.1 **Current Snapshot**

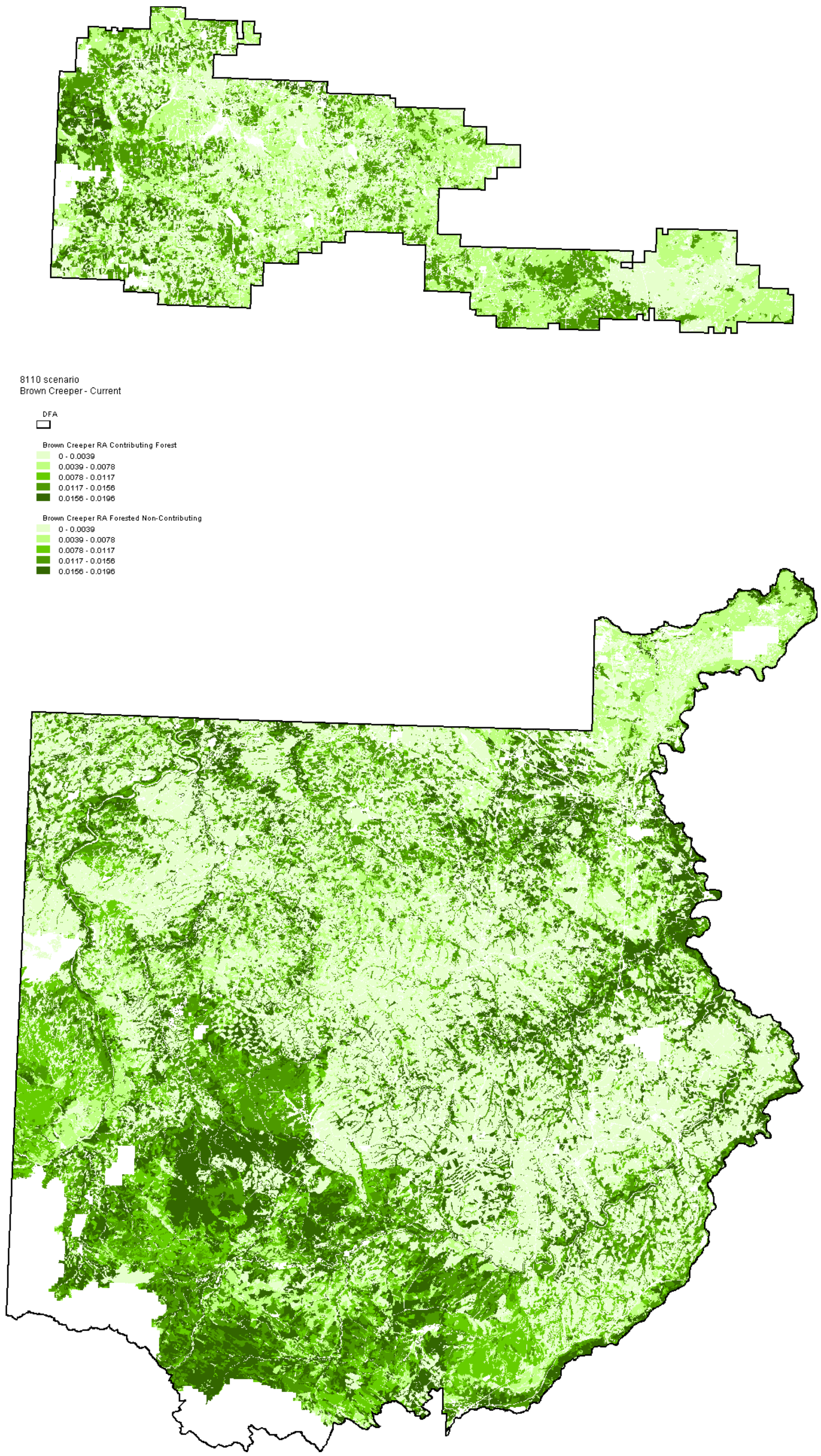


Figure 41 Brown Creeper Relative abundance (RA) – Current

3.8.2.2 **10-year Snapshot**

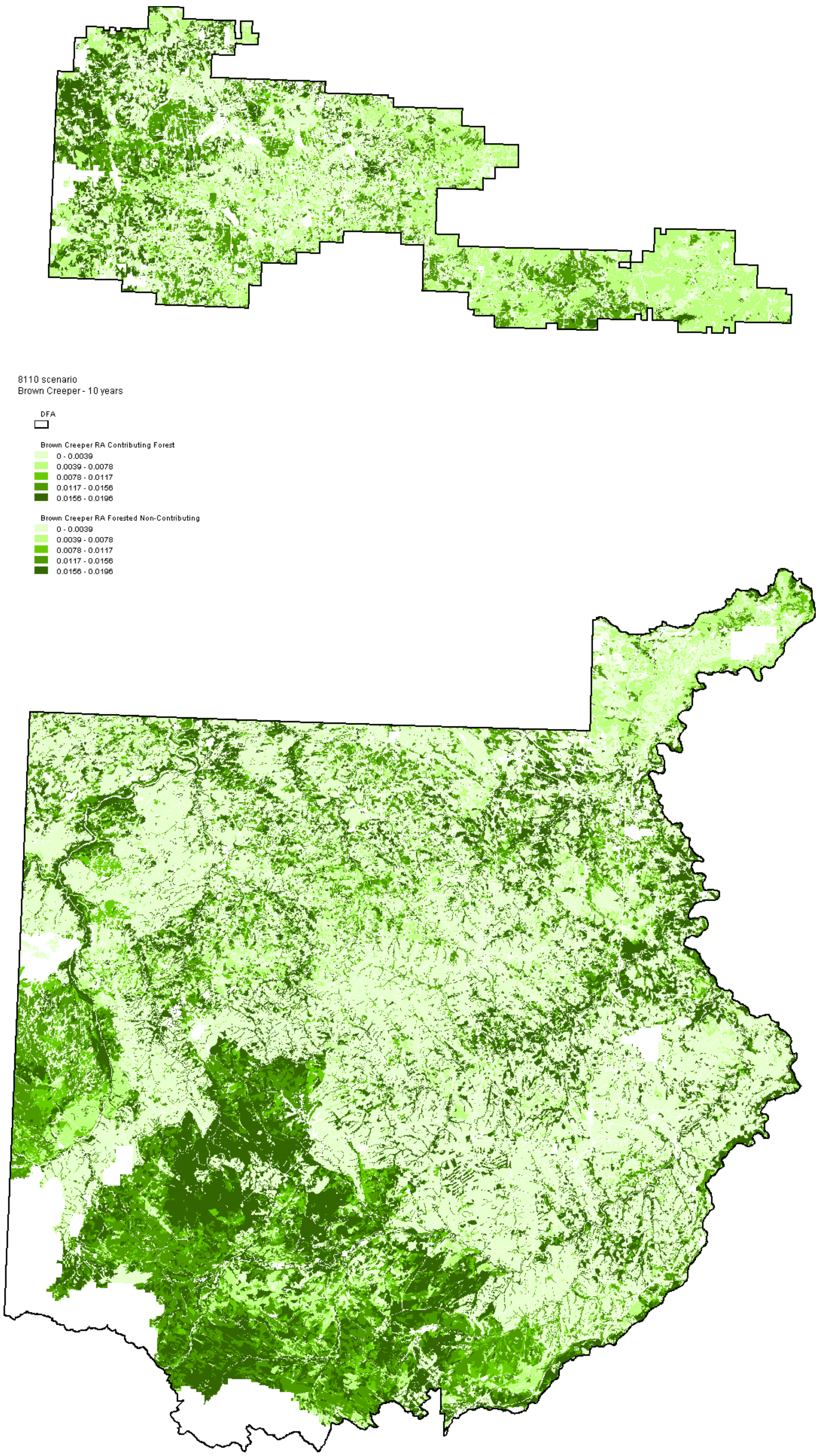


Figure 42 Brown Creeper Relative abundance (RA) – 10 Years

3.8.2.3 **20-year Snapshot**

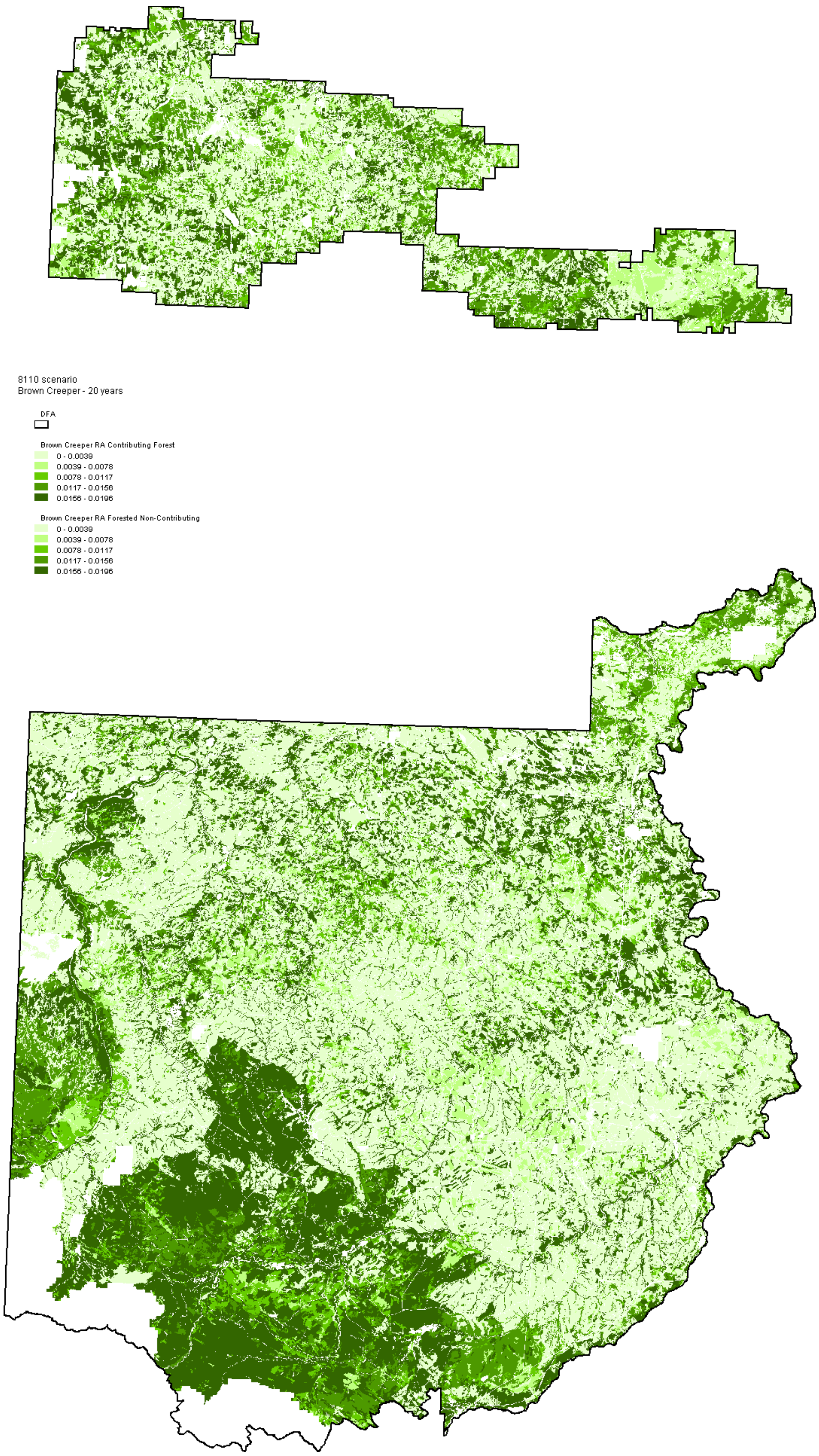


Figure 43 Brown Creeper Relative abundance (RA) – 20 Years

3.8.2.4 **50-year Snapshot**

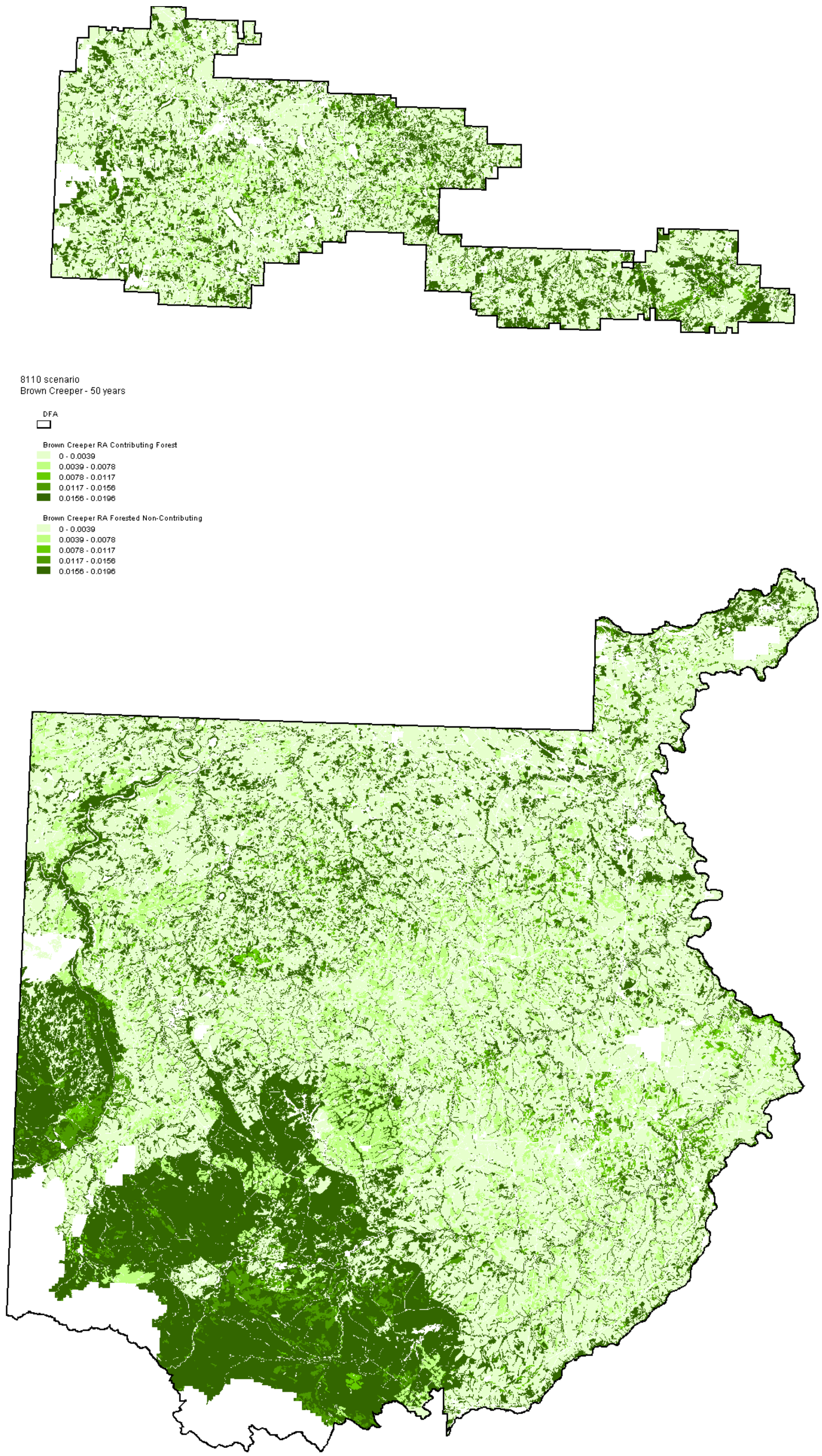


Figure 44 Brown Creeper Relative abundance (RA) – 50 Years

3.8.3 Black-throated Green Warbler

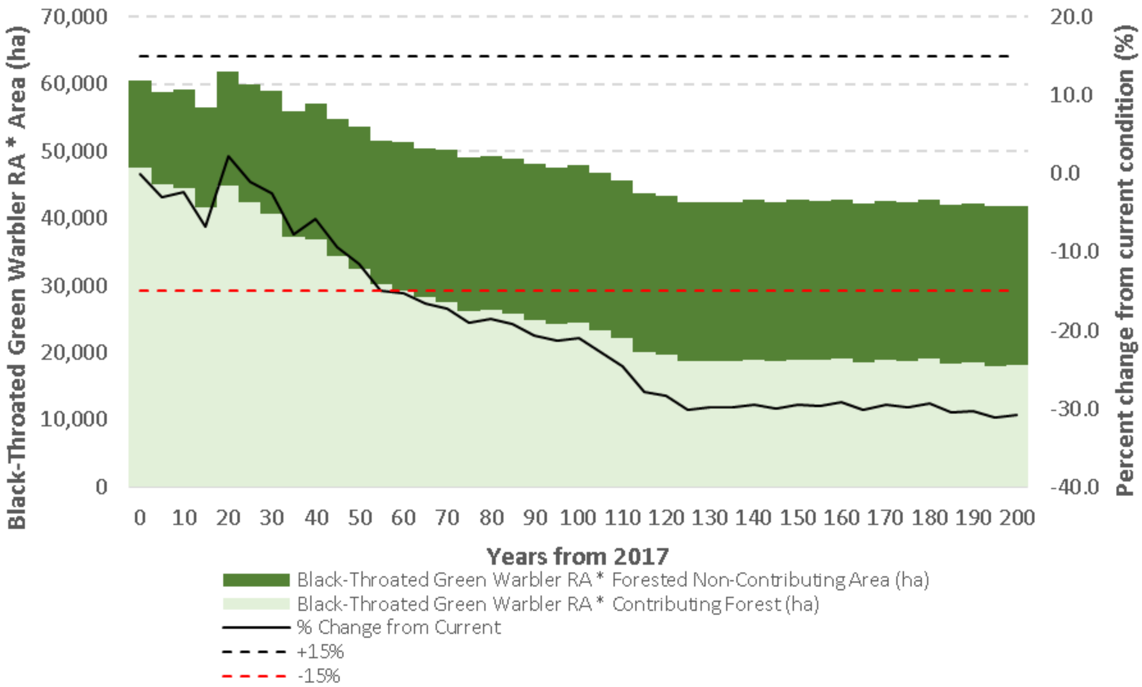


Figure 45 Black-throated Green Warbler relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.3.1 **Current Snapshot**

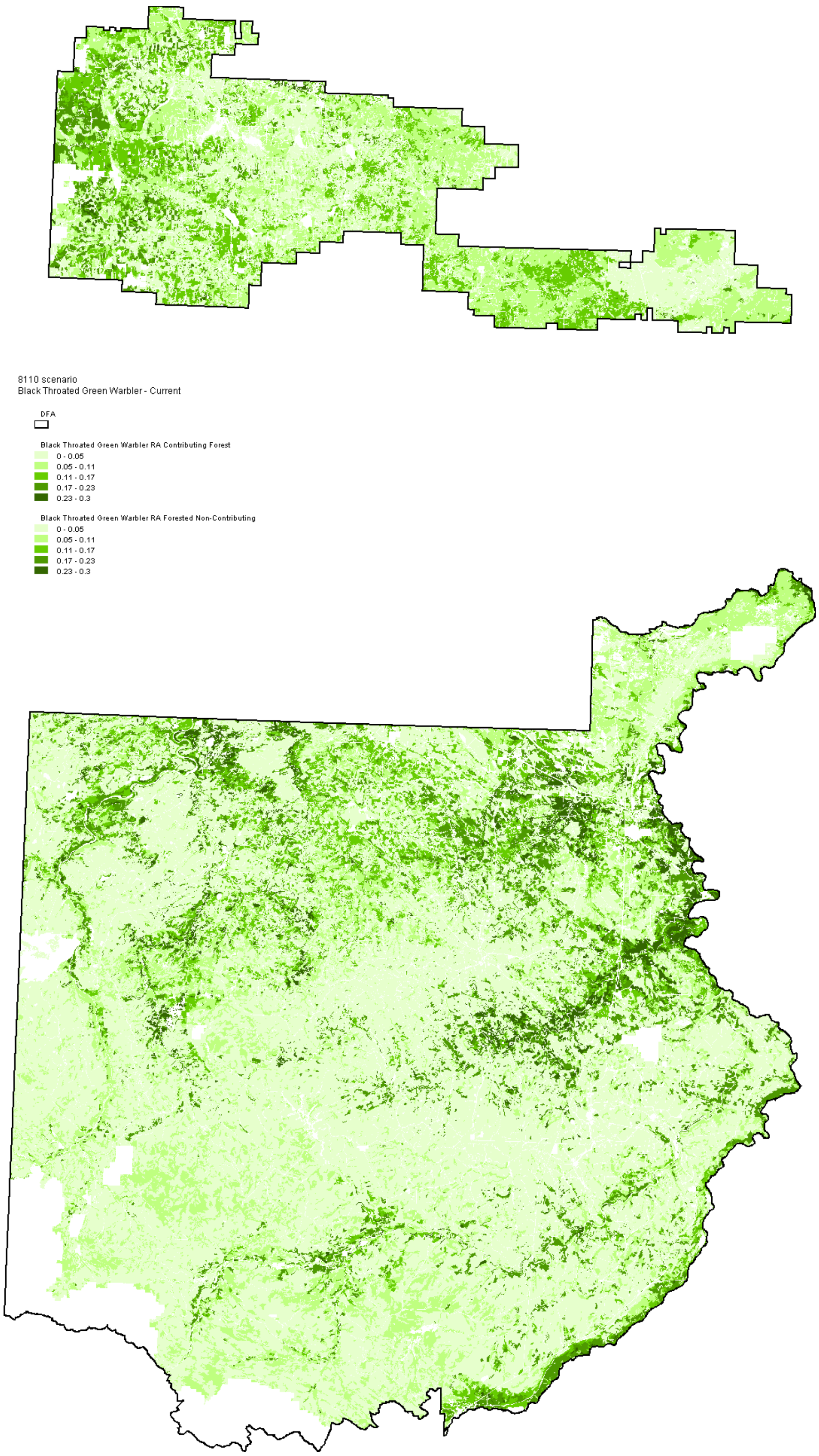


Figure 46 Black Throated Green Warbler Relative abundance - Current snapshot

3.8.3.2 10-year Snapshot

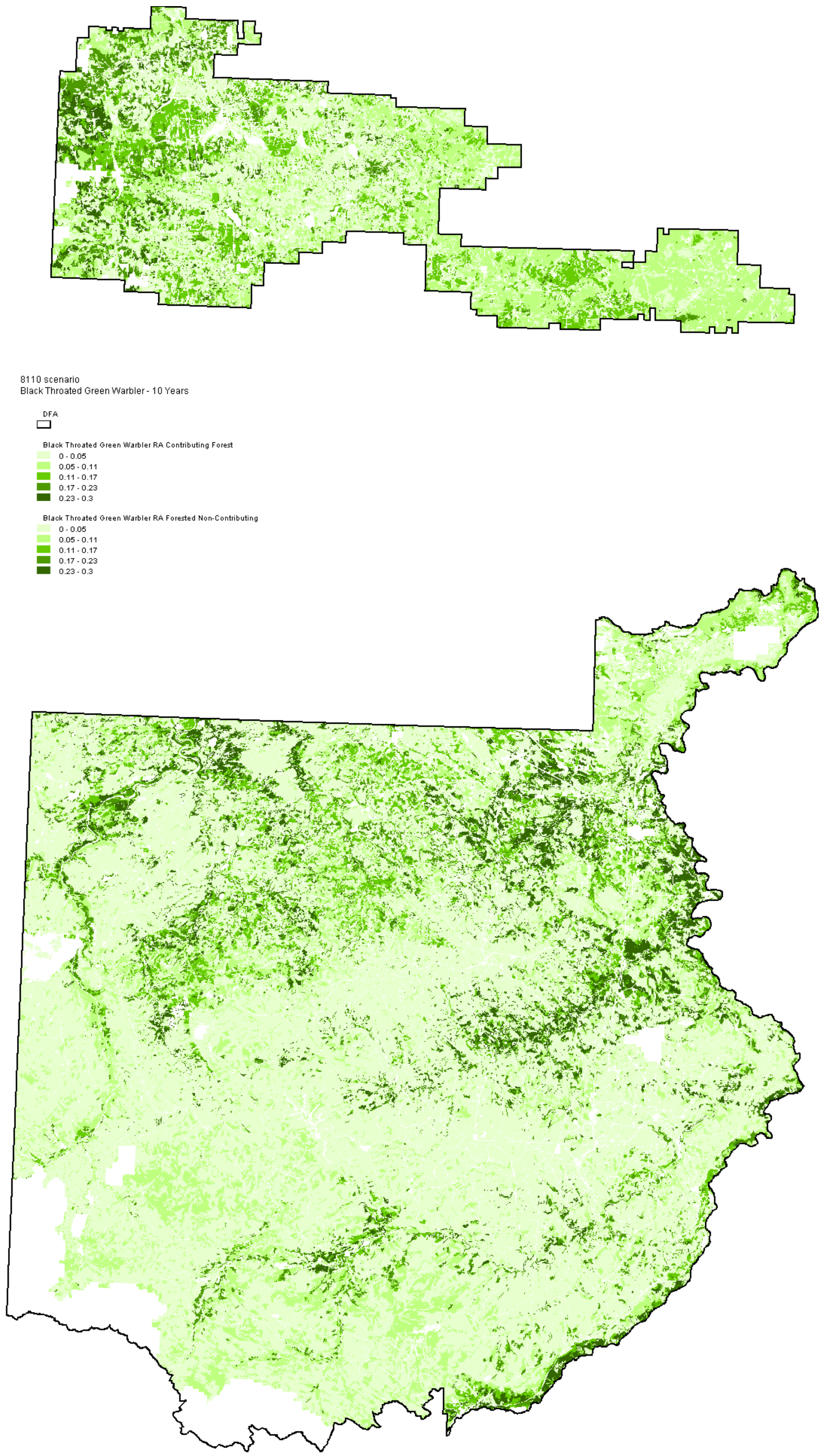


Figure 47 Black Throated Green Warbler Relative abundance - 10-Year snapshot

3.8.3.3 **20-year Snapshot**

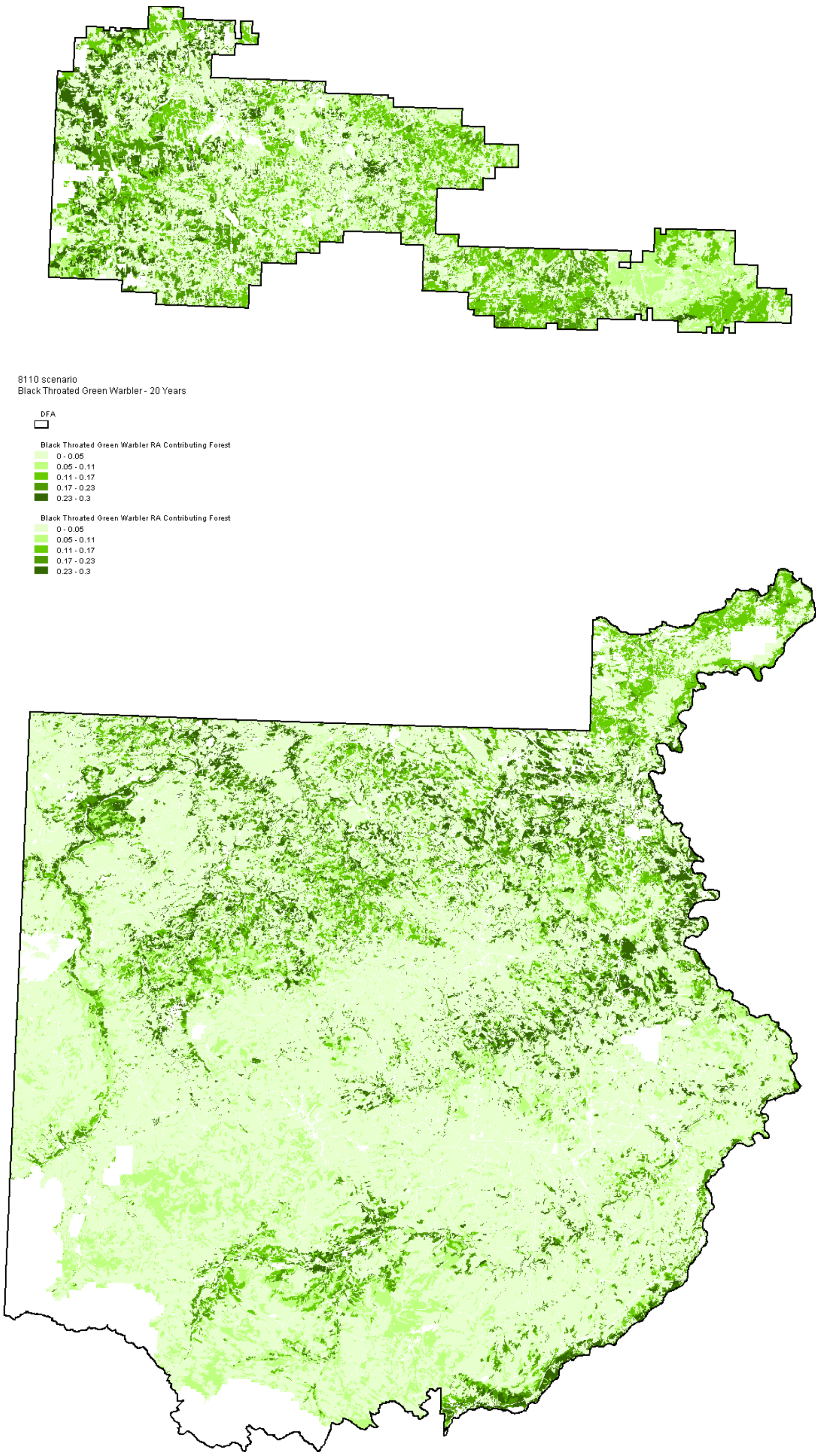


Figure 48 Black Throated Green Warbler Relative abundance - 20-Year snapshot

3.8.3.4 **50-year Snapshot**

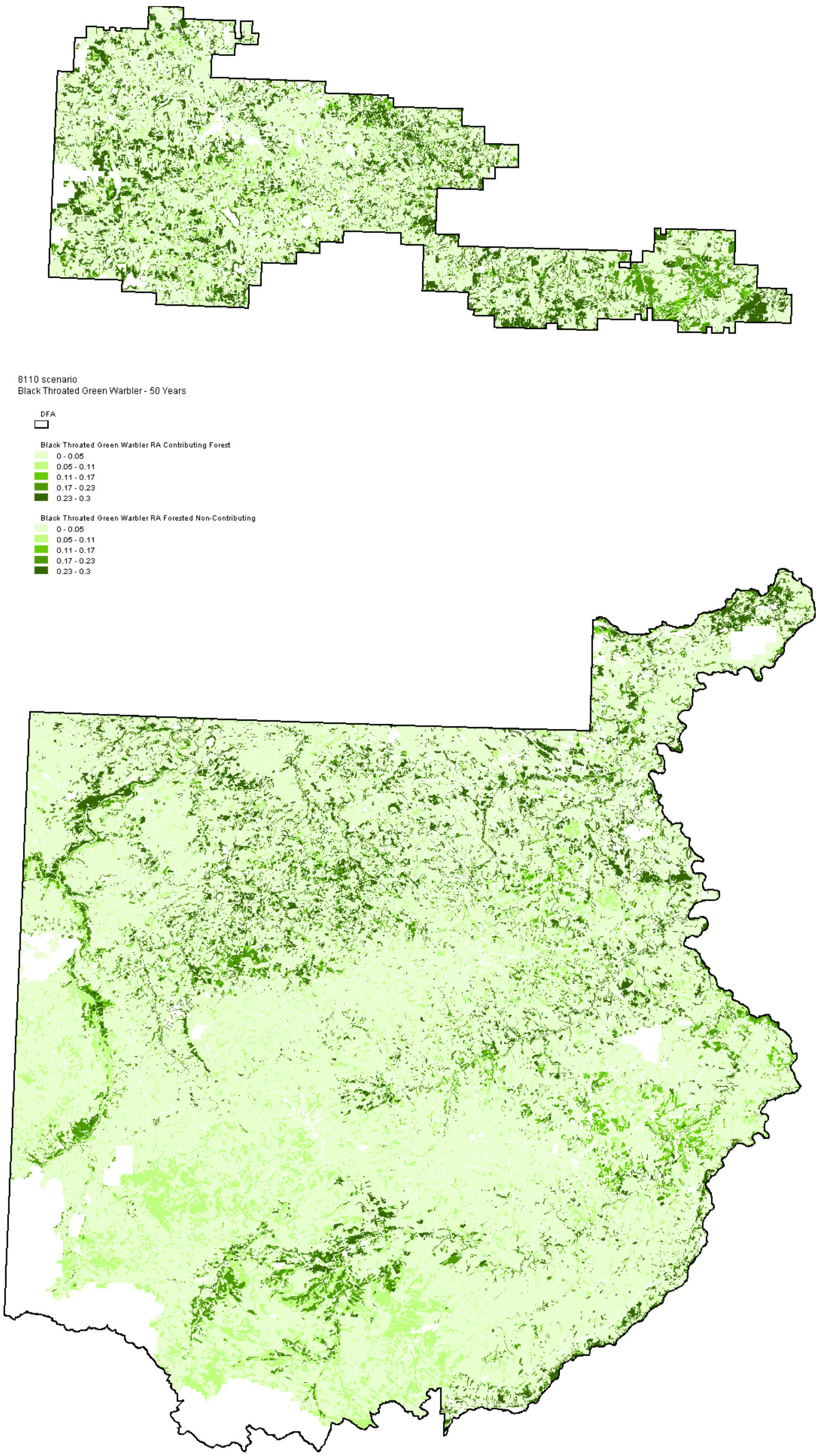


Figure 49 Black Throated Green Warbler Relative abundance - 50-Year snapshot

3.8.4 Ovenbird

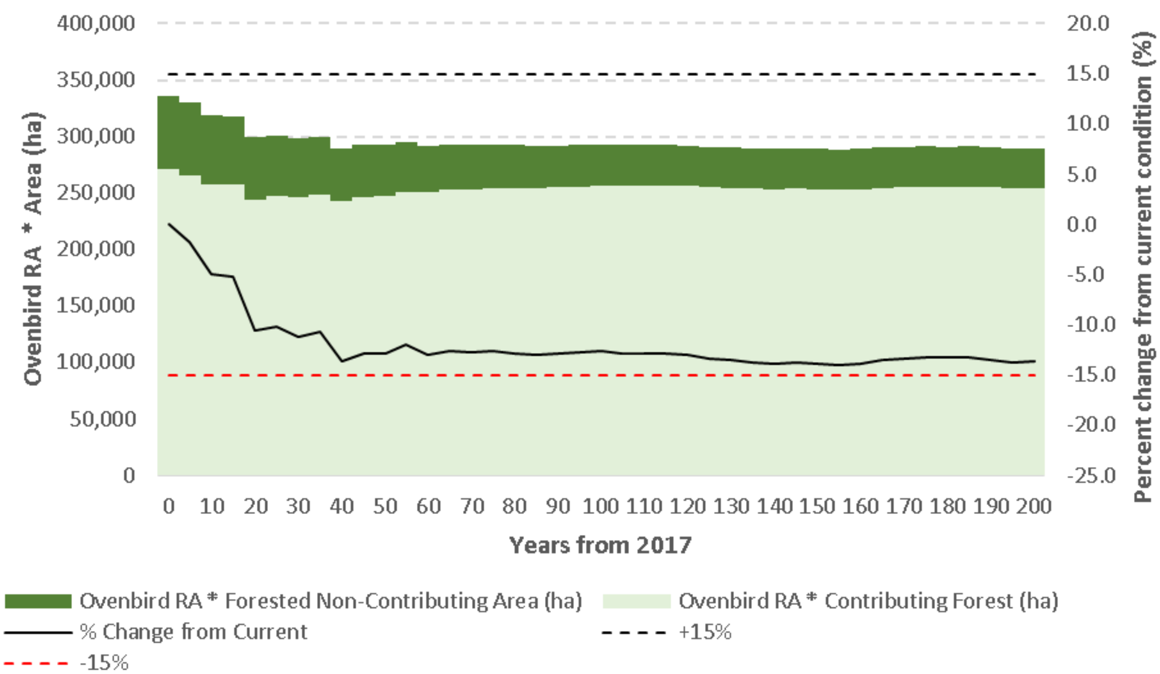


Figure 50 Ovenbird Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.4.1 **Current Snapshot**

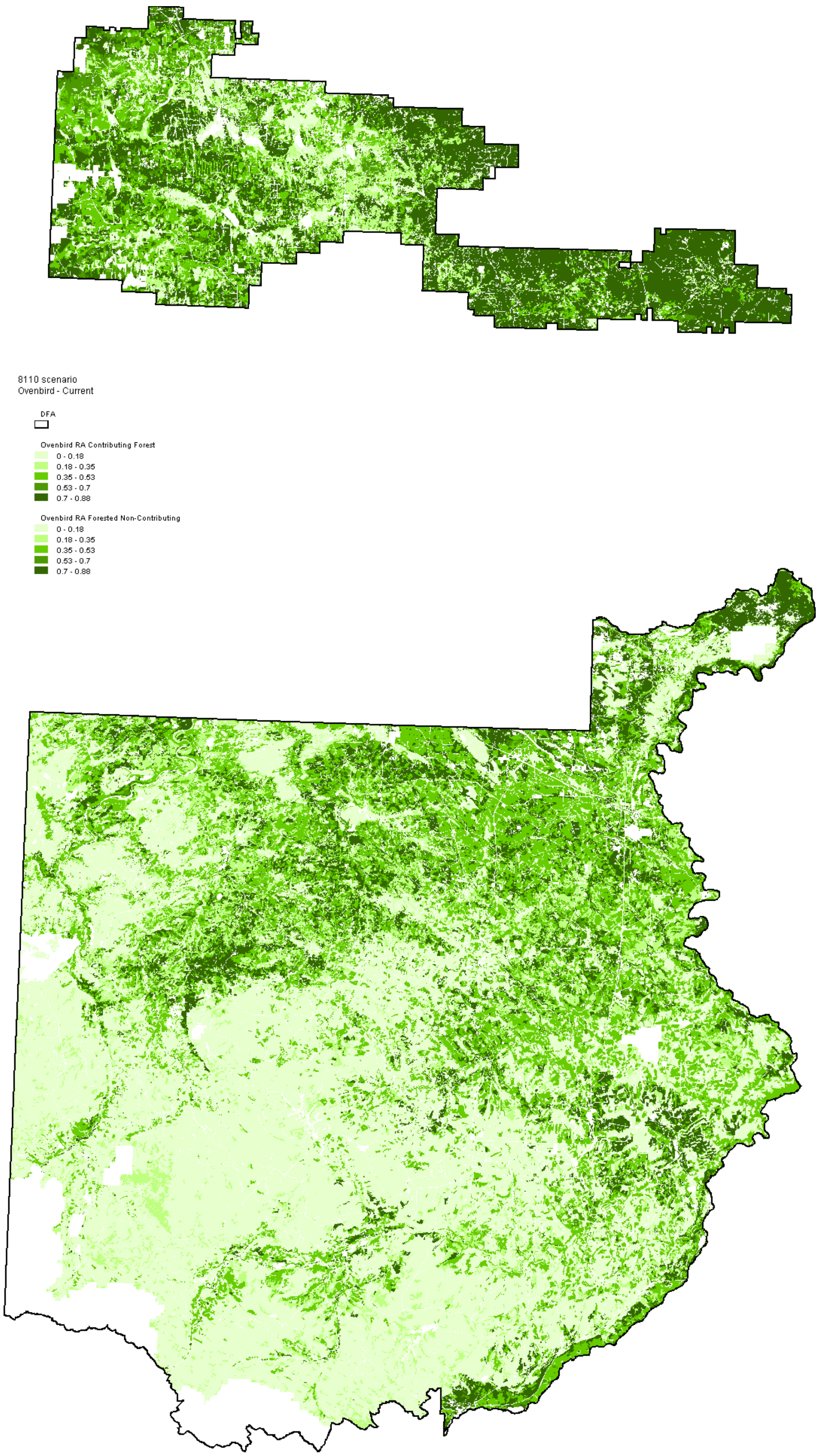


Figure 51 Ovenbird Relative abundance (RA) – Current

3.8.4.2 **10-year Snapshot**

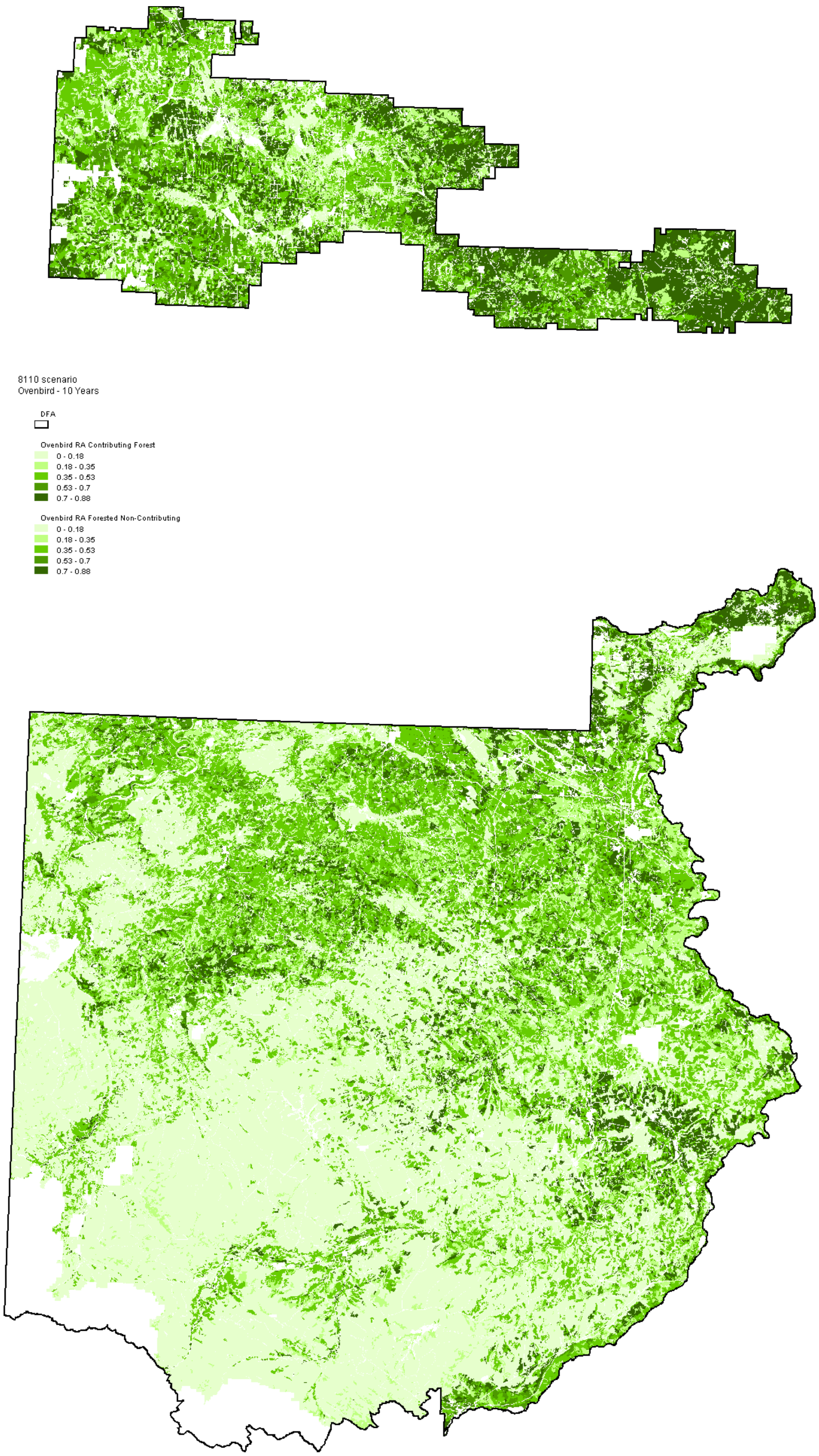


Figure 52 Ovenbird Relative abundance (RA) – 10 Years

3.8.4.3 **20-year Snapshot**

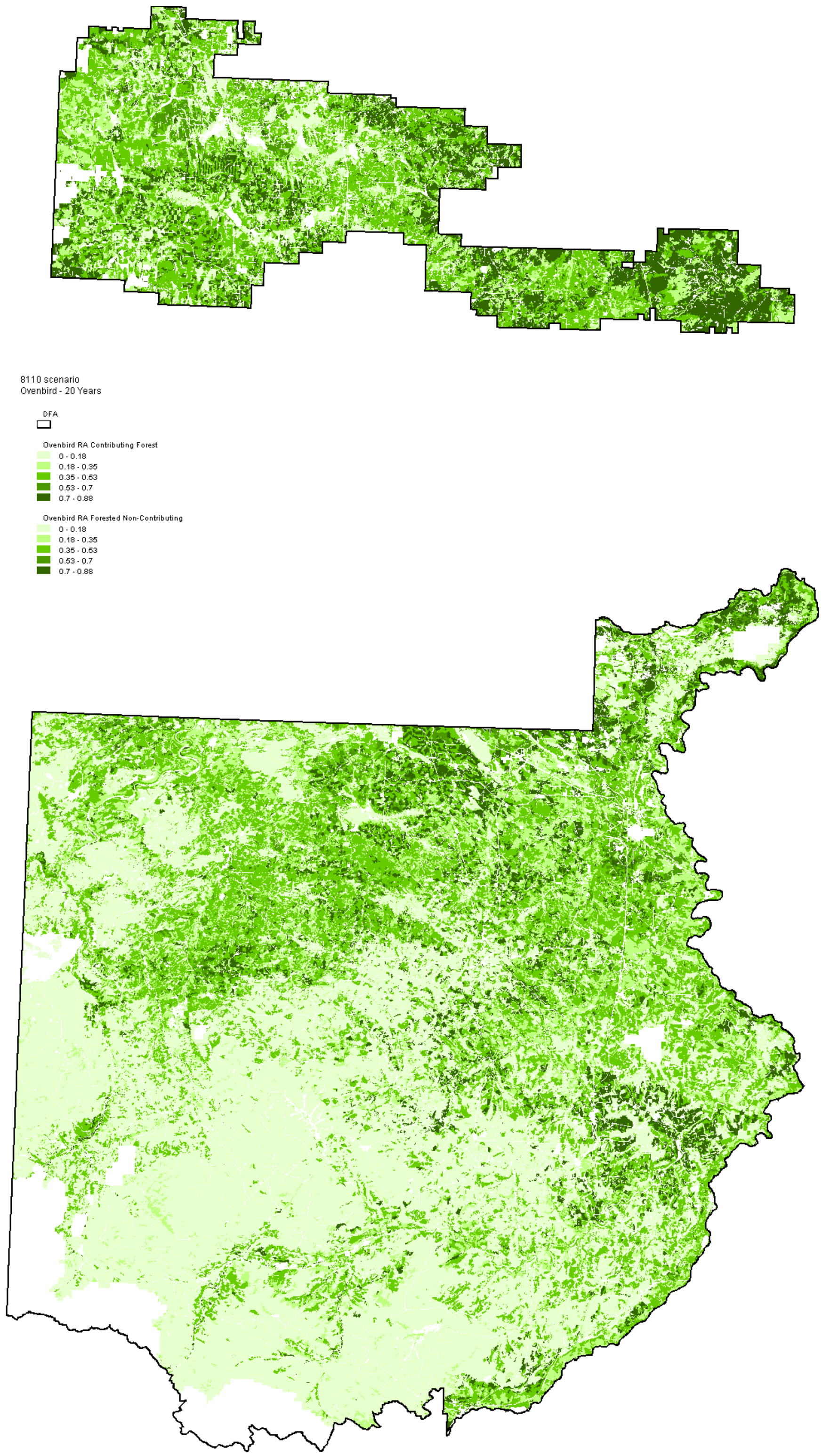


Figure 53 Ovenbird Relative abundance (RA) – 20 Years

3.8.4.4 **50-year Snapshot**

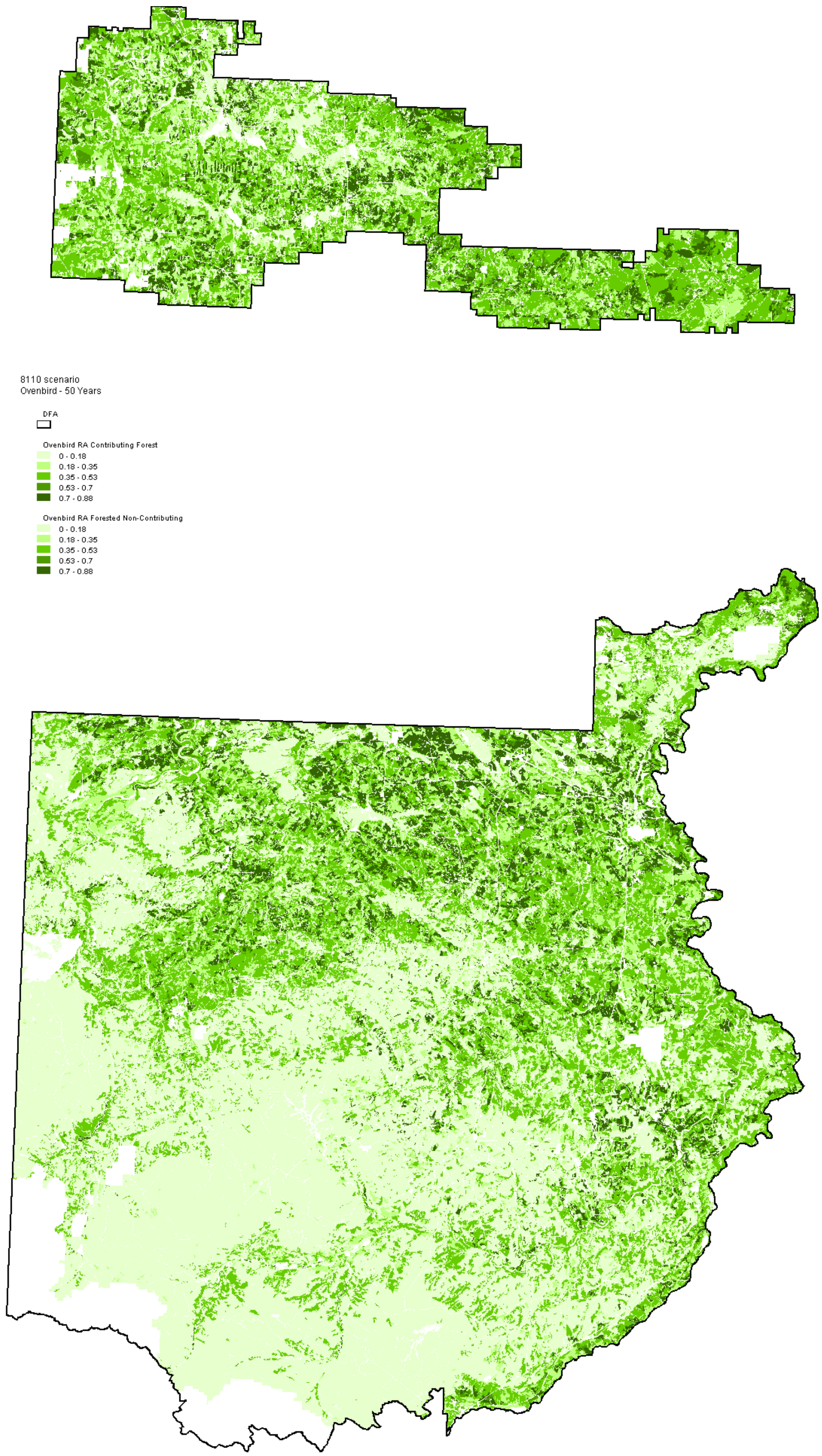


Figure 54 Ovenbird Relative abundance (RA) – 50 Years

3.8.5 Varied Thrush

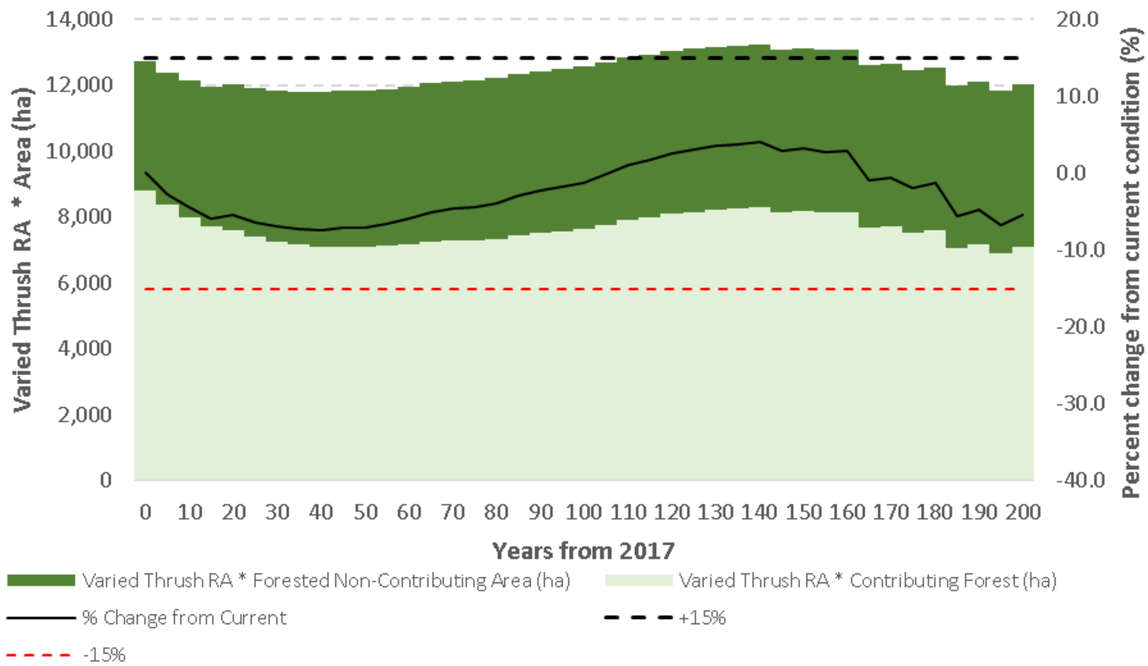


Figure 55 Varied Thrush Relative abundance multiplied by area (ha) over the 200-year planning horizon

3.8.5.1 **Current Snapshot**

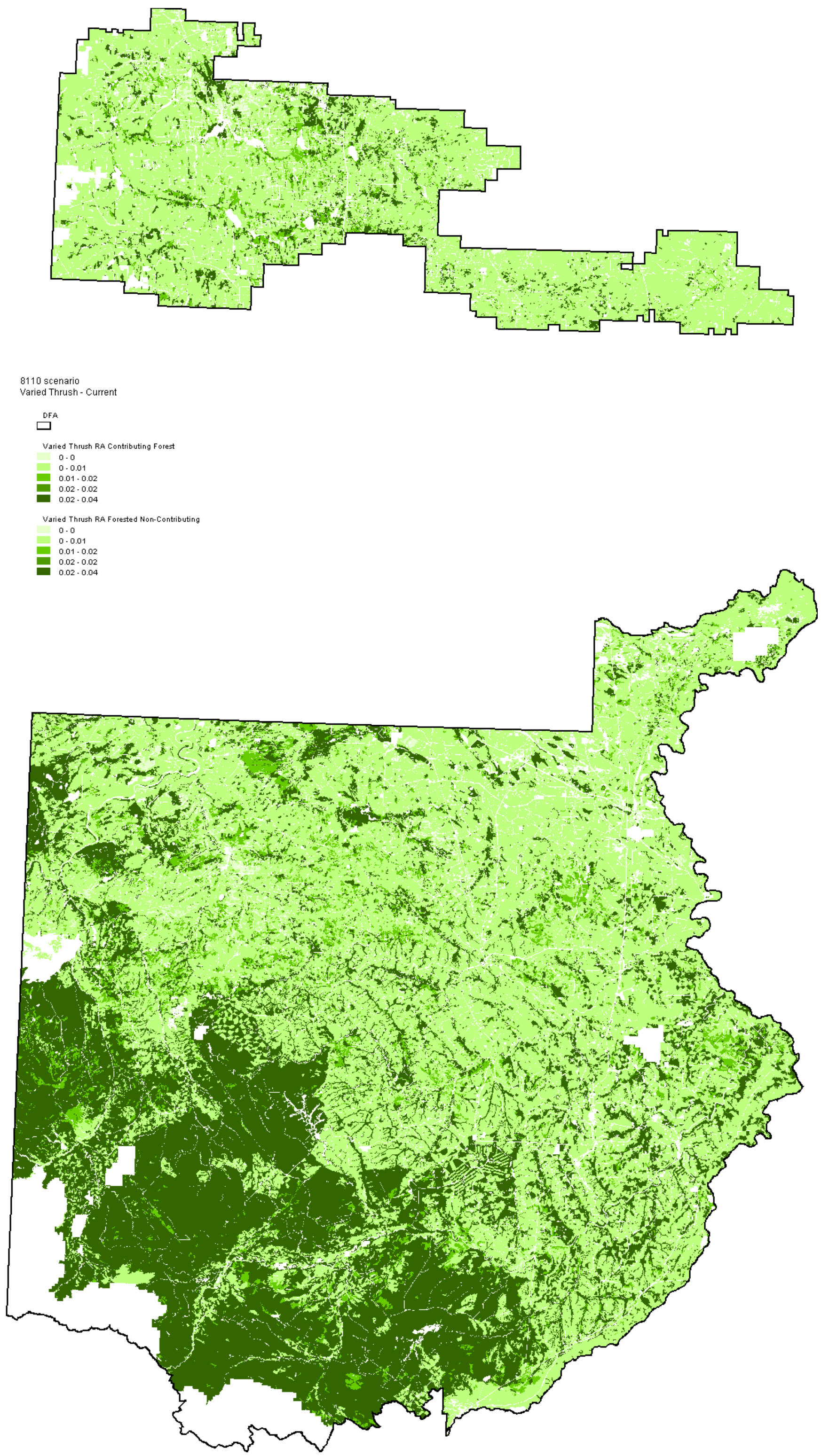


Figure 56 Varied Thrush Relative abundance (RA) – Current

3.8.5.2 **10-year Snapshot**

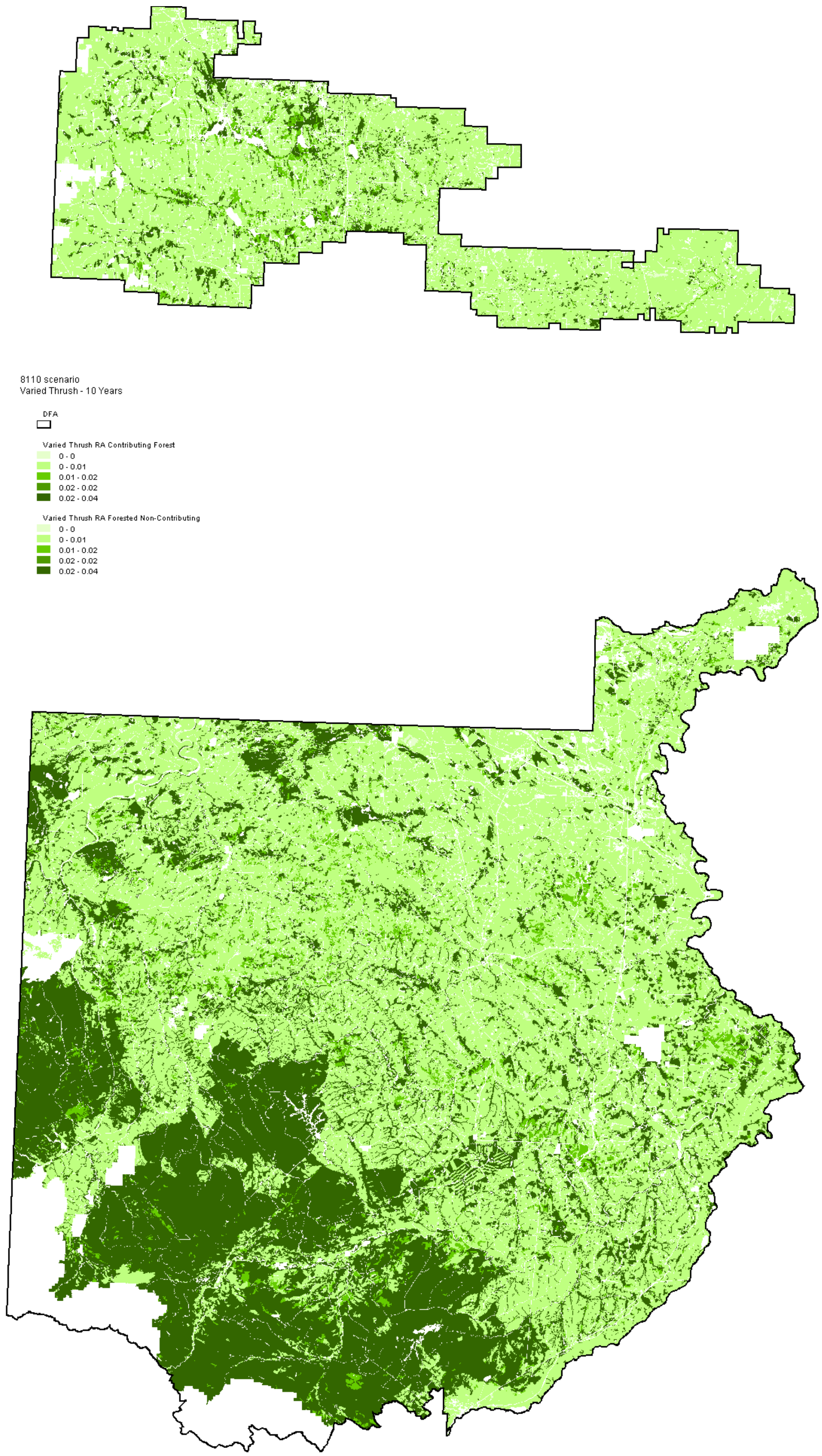


Figure 57 Varied Thrush Relative abundance (RA) – 10-Year snapshot

3.8.5.3 **20-year Snapshot**

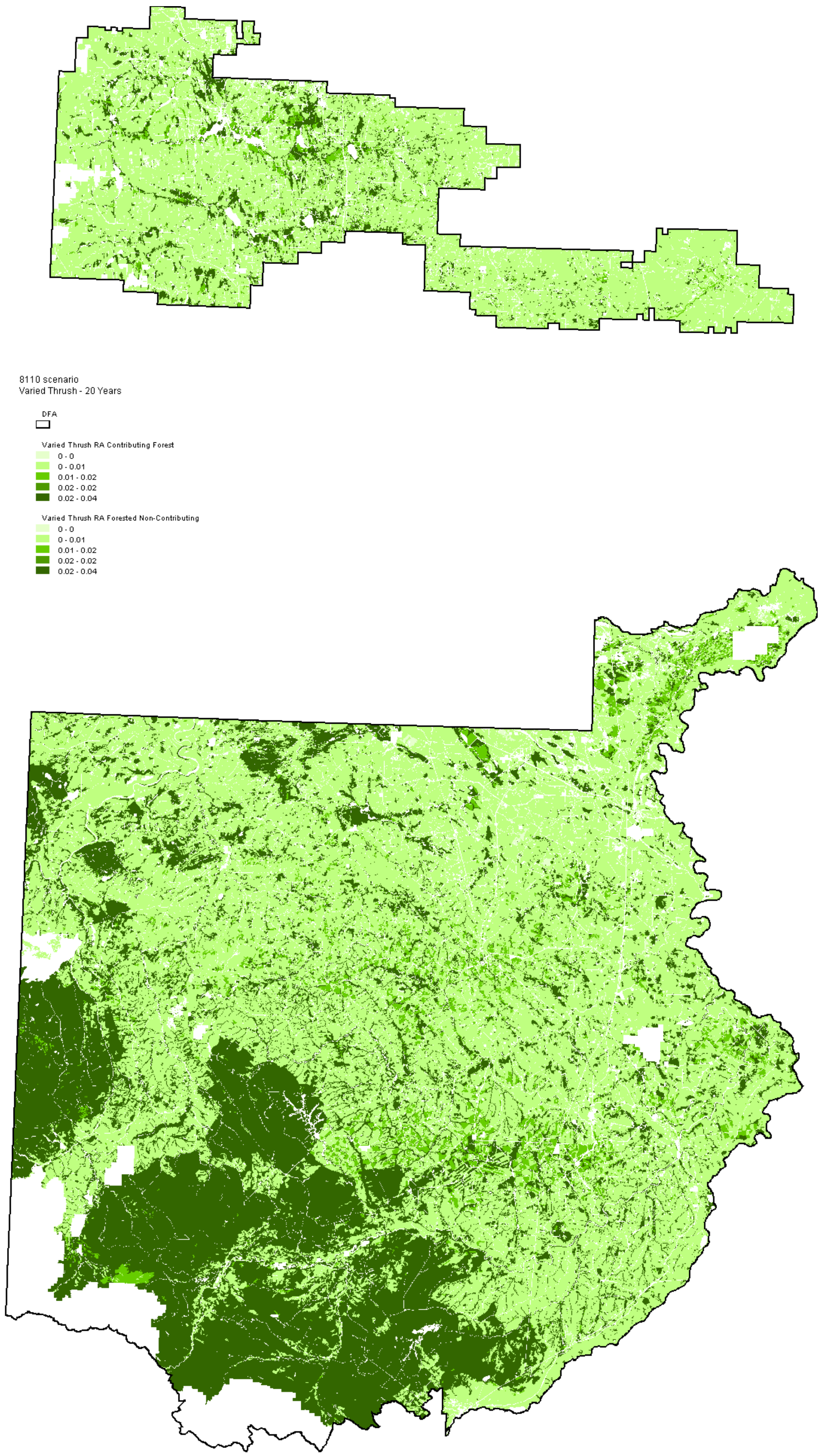


Figure 58 Varied Thrush Relative abundance (RA) – 20-Year snapshot

3.8.5.4 **50-year Snapshot**

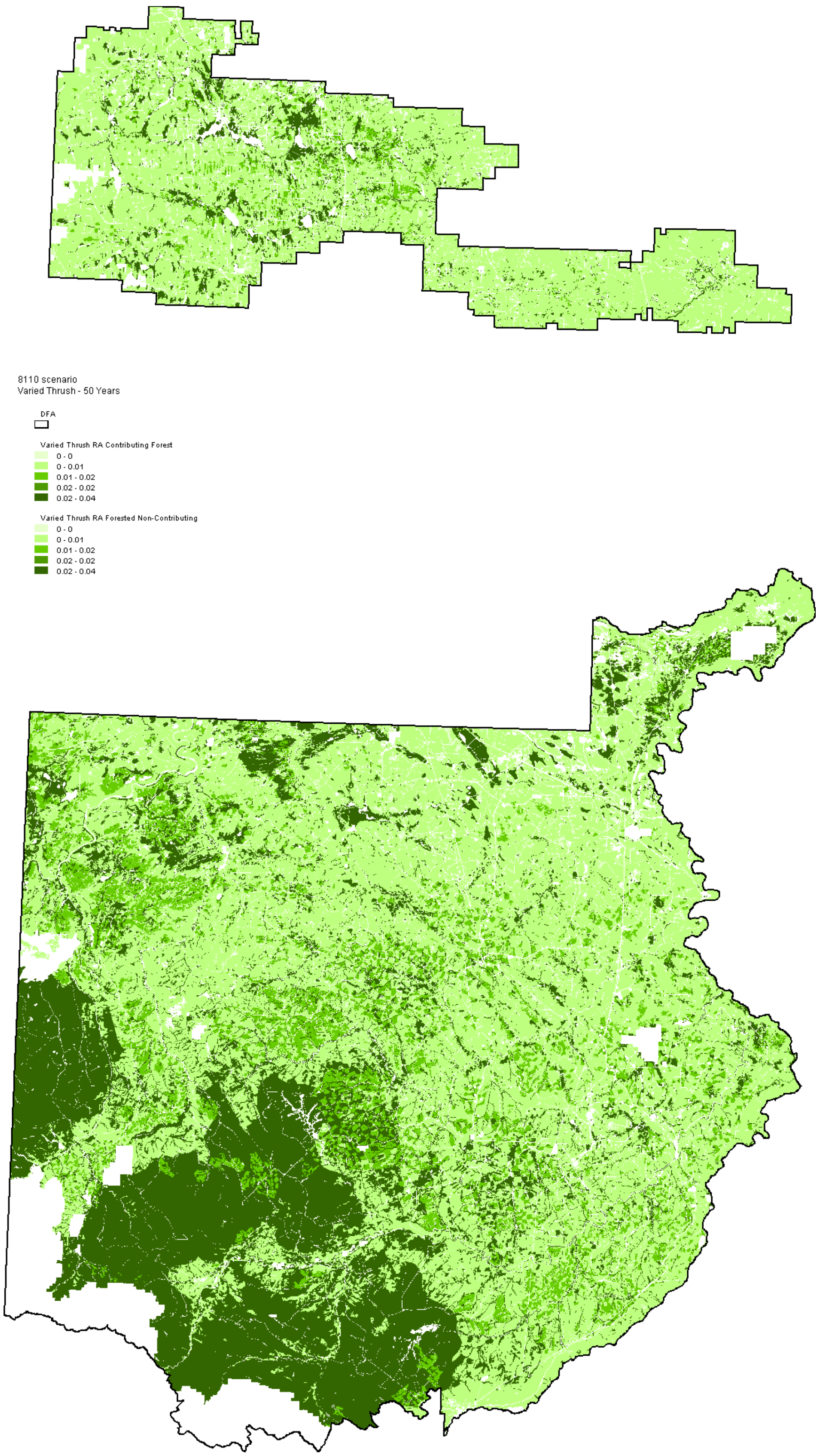


Figure 59 Varied Thrush Relative abundance (RA) – 50-Year snapshot

3.9 *Equivalent Clearcut Area (Cold Water Fish VOIT 1.1.2.1e & Water Yield VOIT 3.2.1.1)*

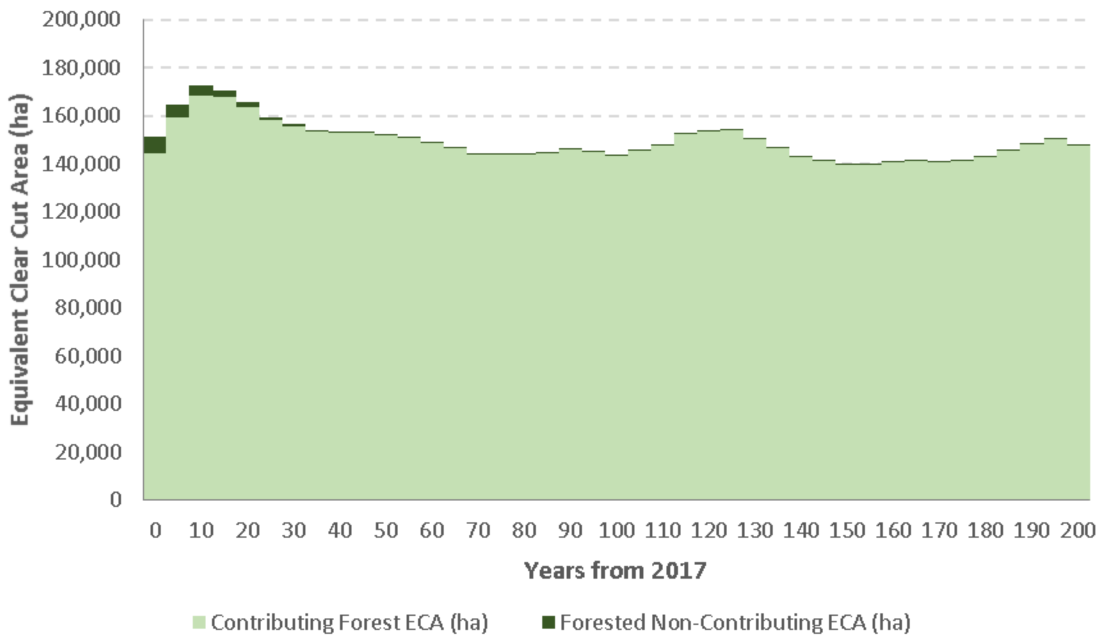


Figure 60 **Equivalent Clear Cut Area (ha) over time on the contributing and forested non-contributing forest over the 200-year planning horizon**

3.9.1 Watershed Key Map

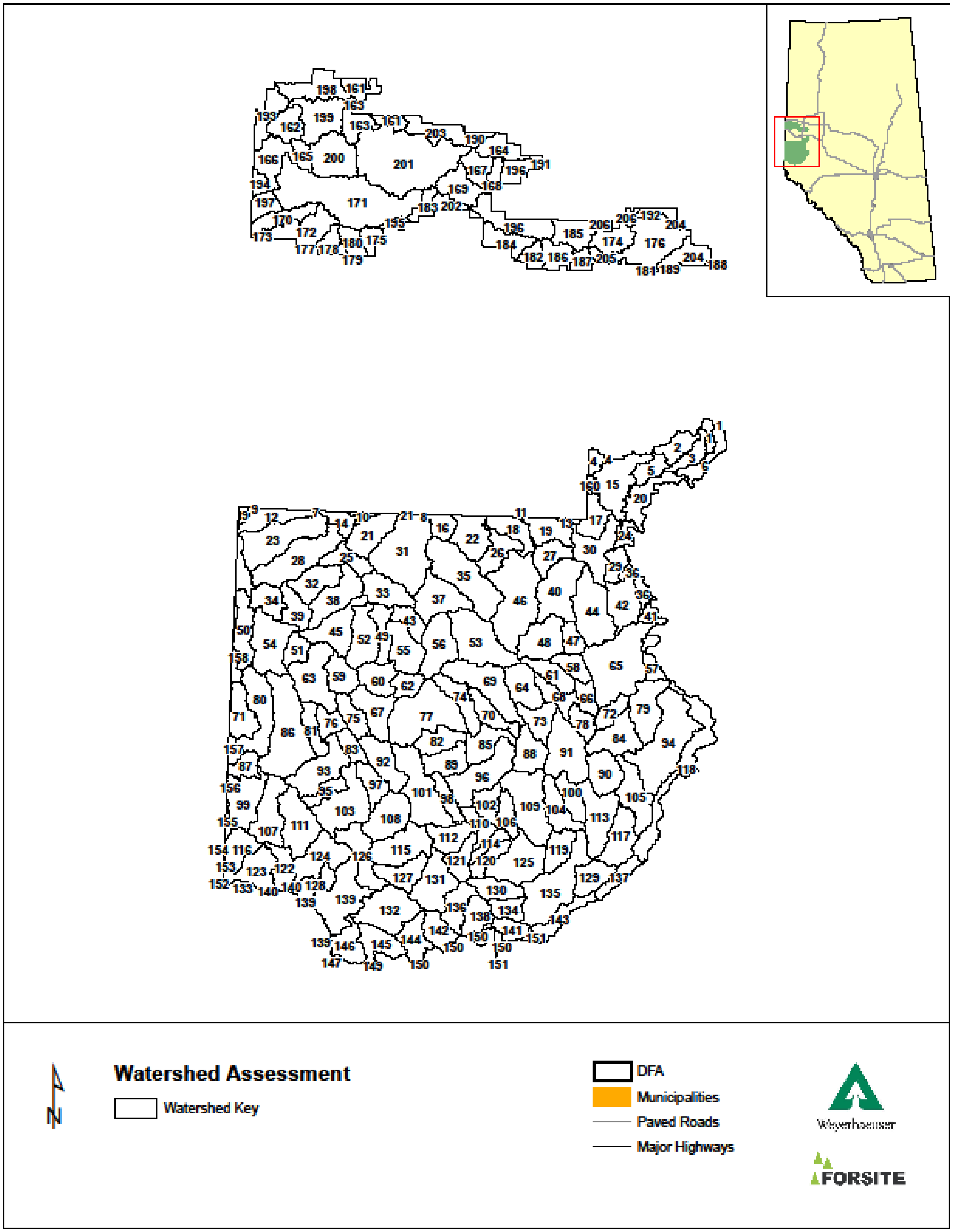


Figure 61 FMUG16 forestry watersheds (2019) by watershed ID number

3.9.2 Current Snapshot

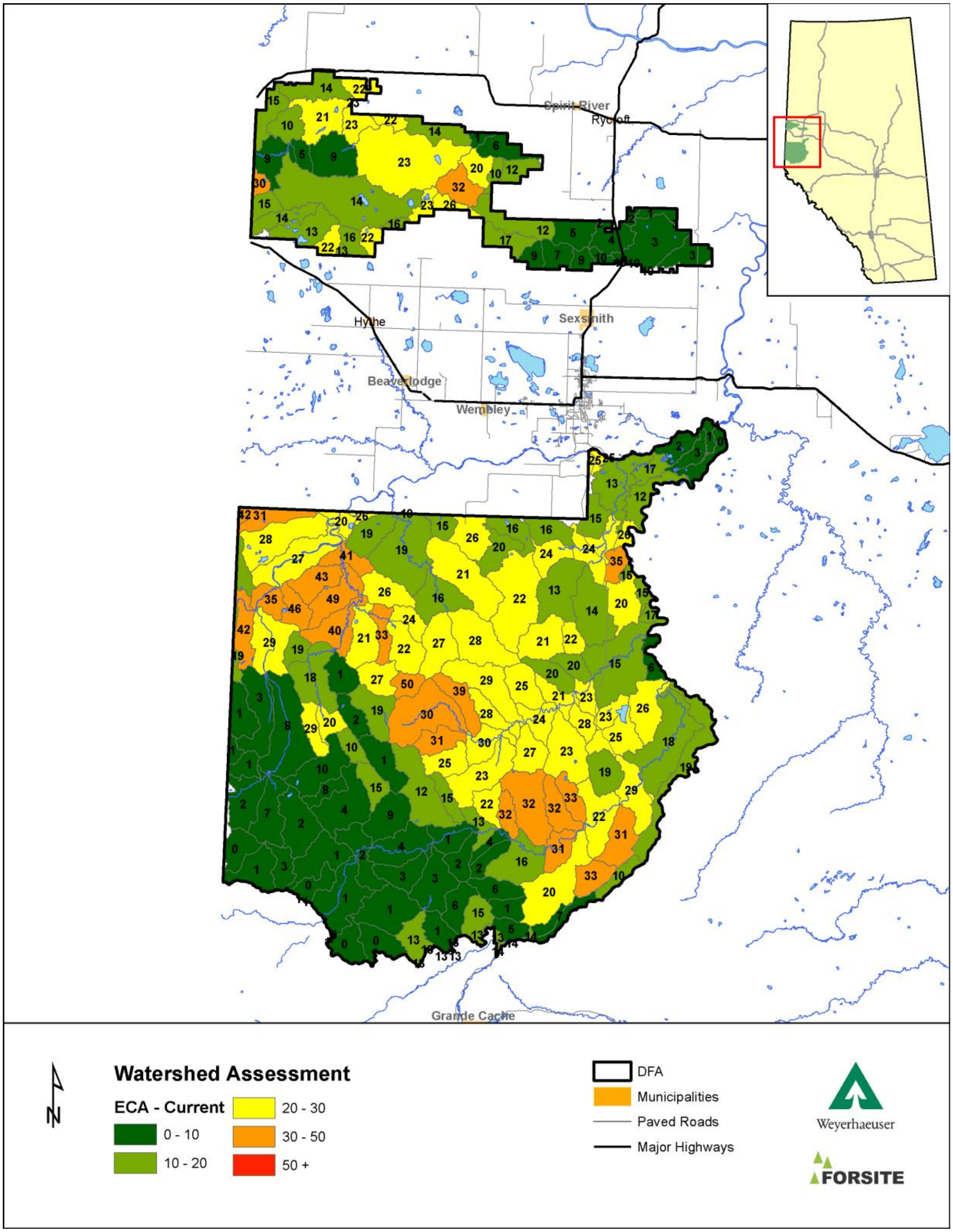


Figure 62 Current Equivalent Clear Cut Area proportion by forestry watershed (2019)

3.9.3 10-year Snapshot

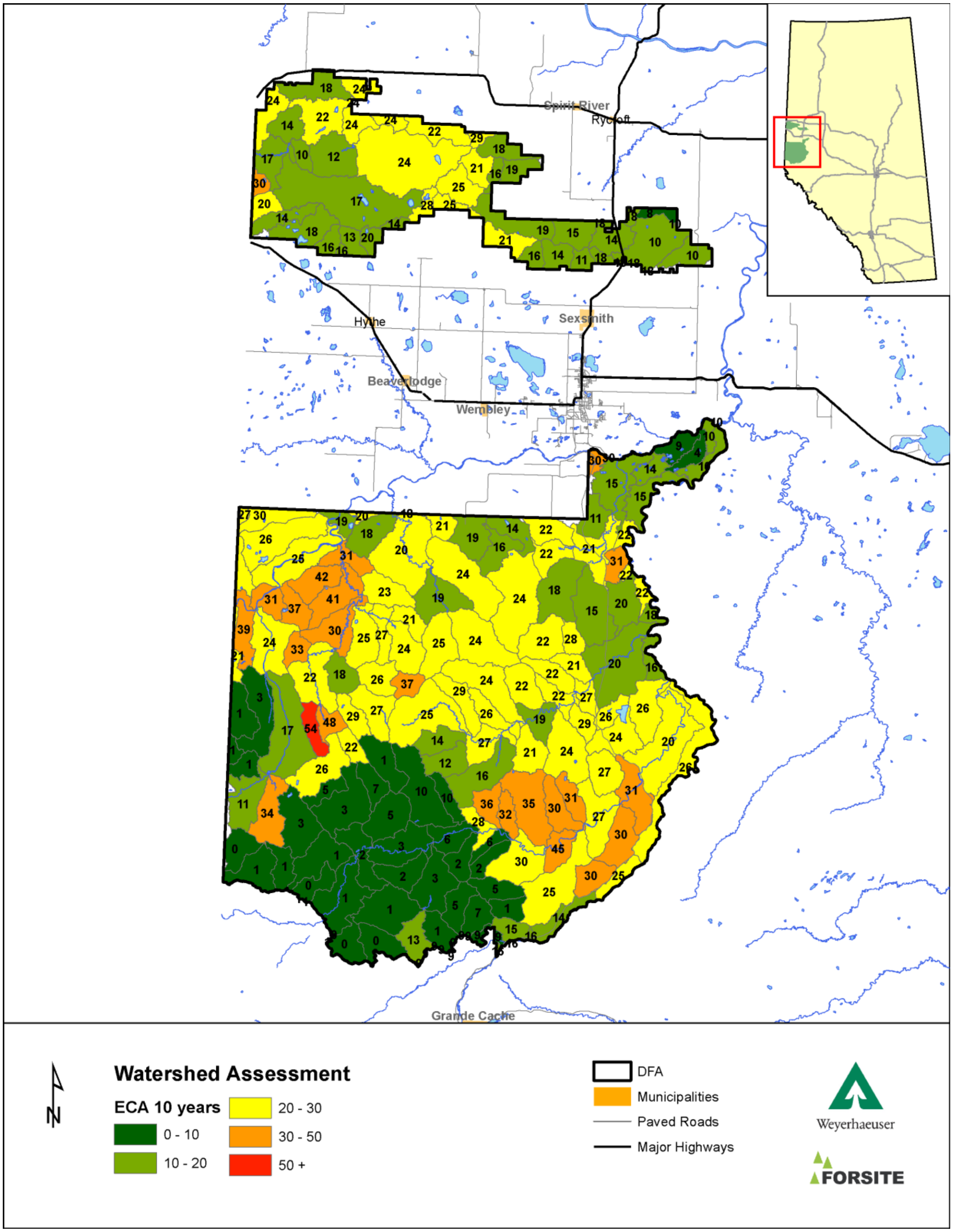


Figure 63 Equivalent Clear Cut Area proportion by forestry watershed 10 years from 2019 (2029)

3.9.4 20-year Snapshot

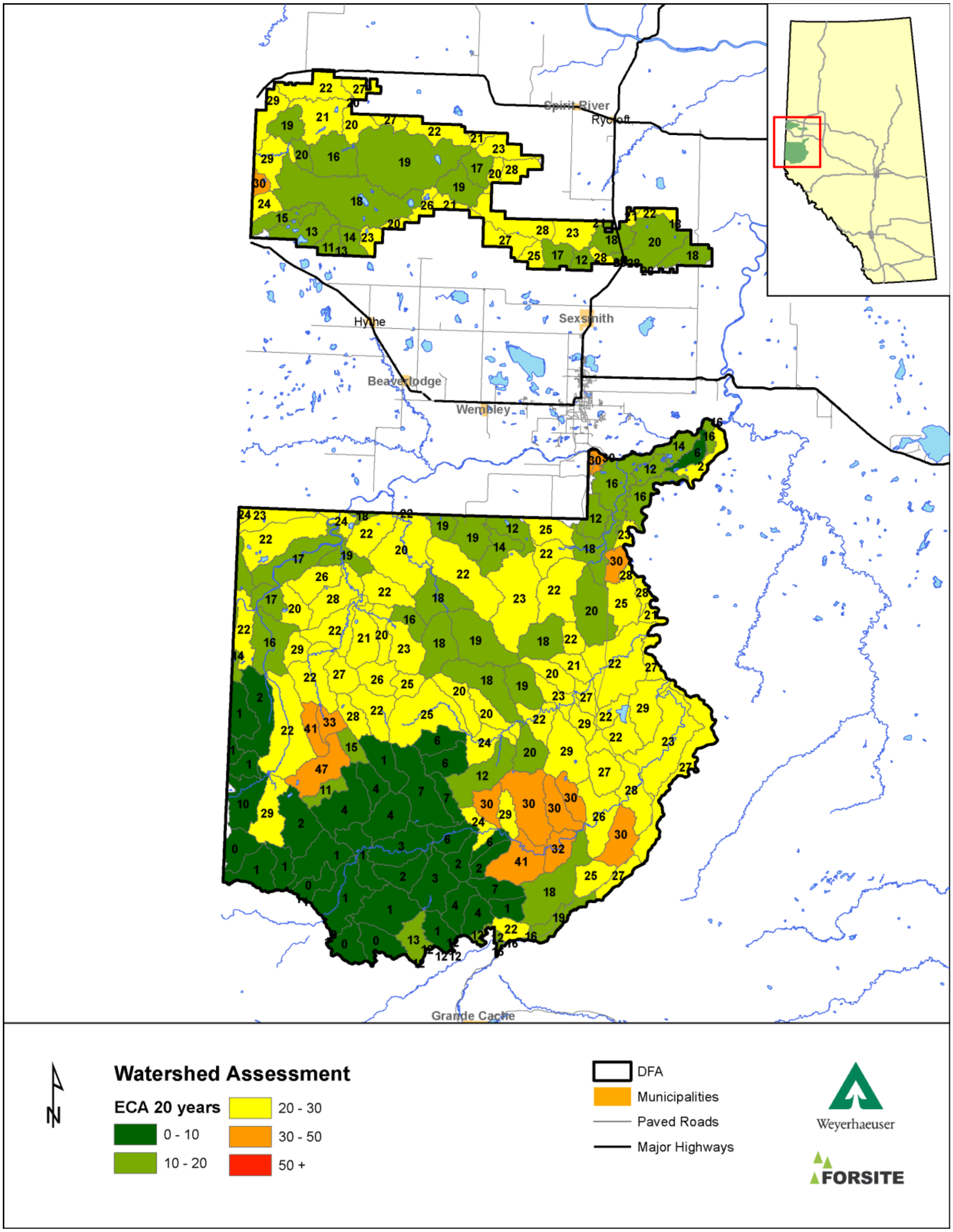


Figure 64 Equivalent Clear Cut Area proportion by forestry watershed 20 years from 2019 (2039)

3.9.5 50-year Snapshot

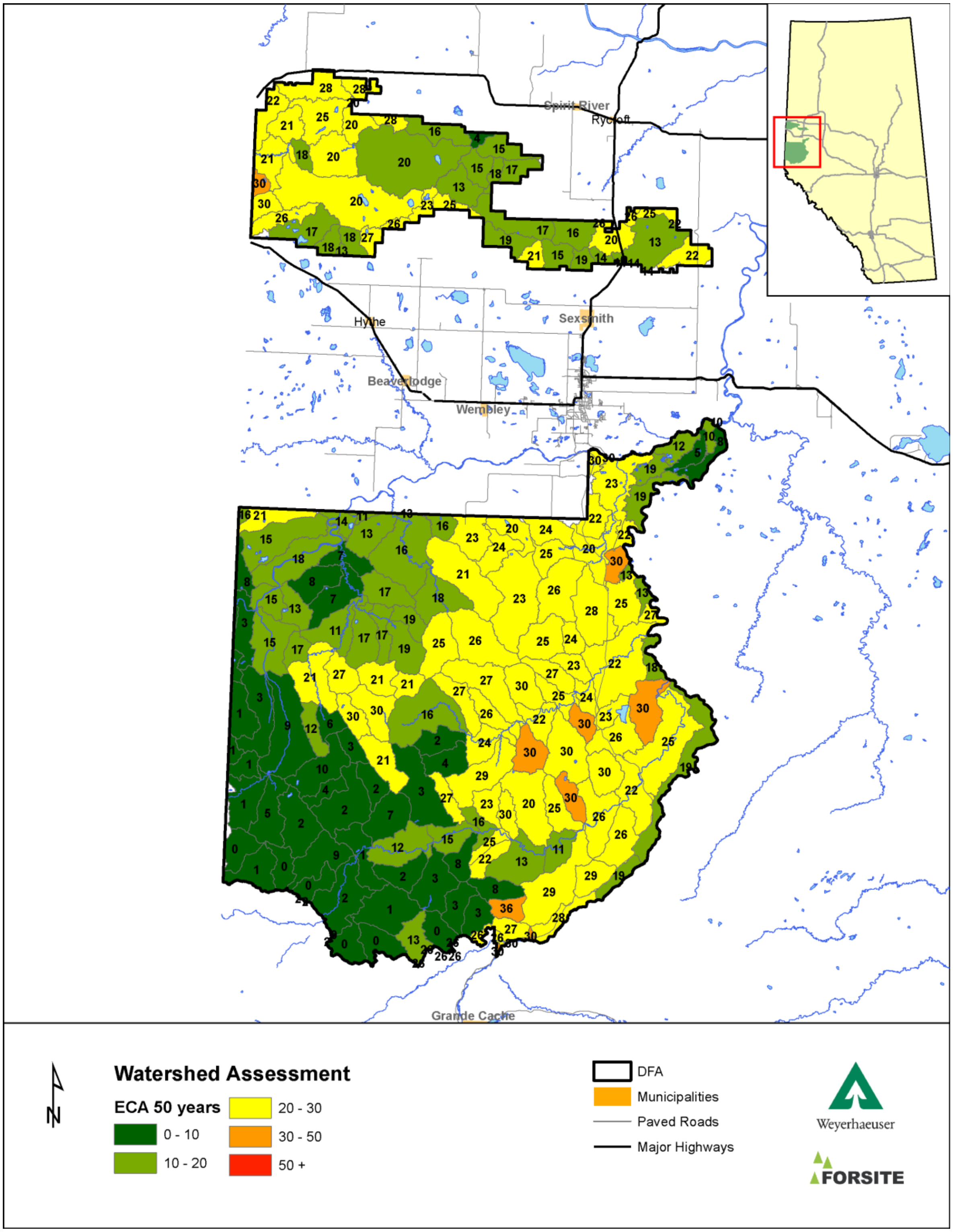
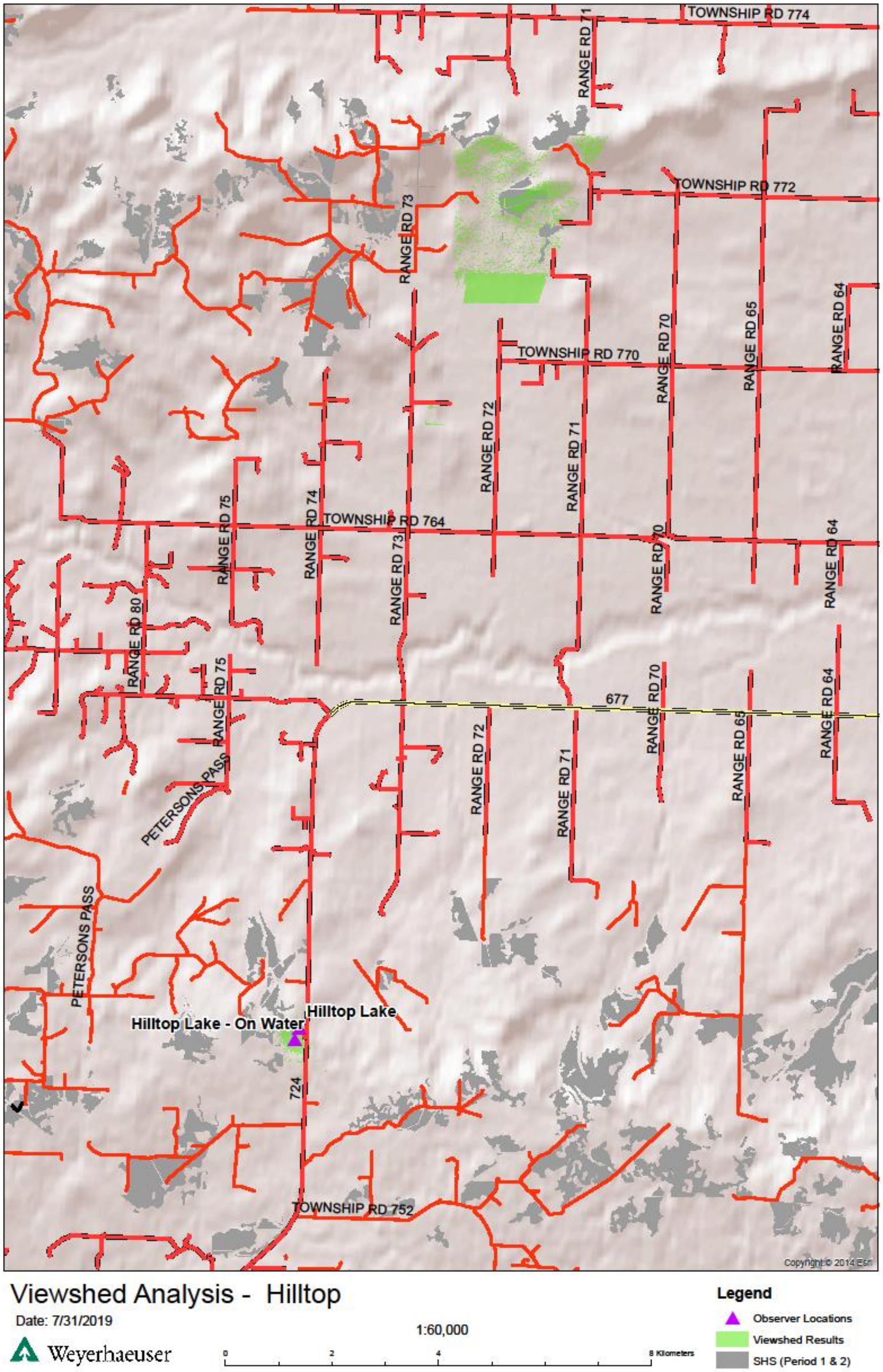


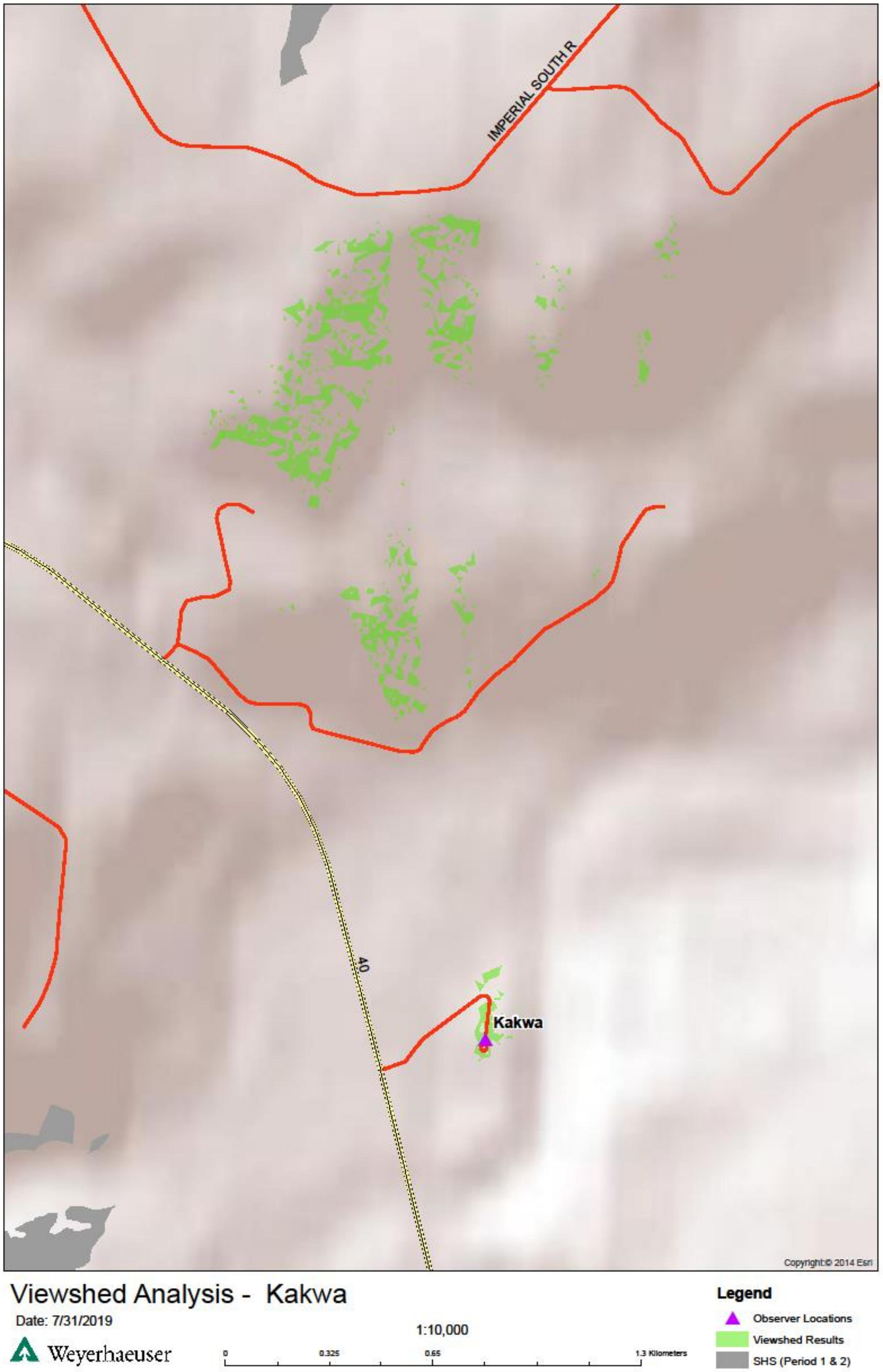
Figure 65 Equivalent Clear Cut Area proportion by forestry watershed 50 years from 2019 (2069)

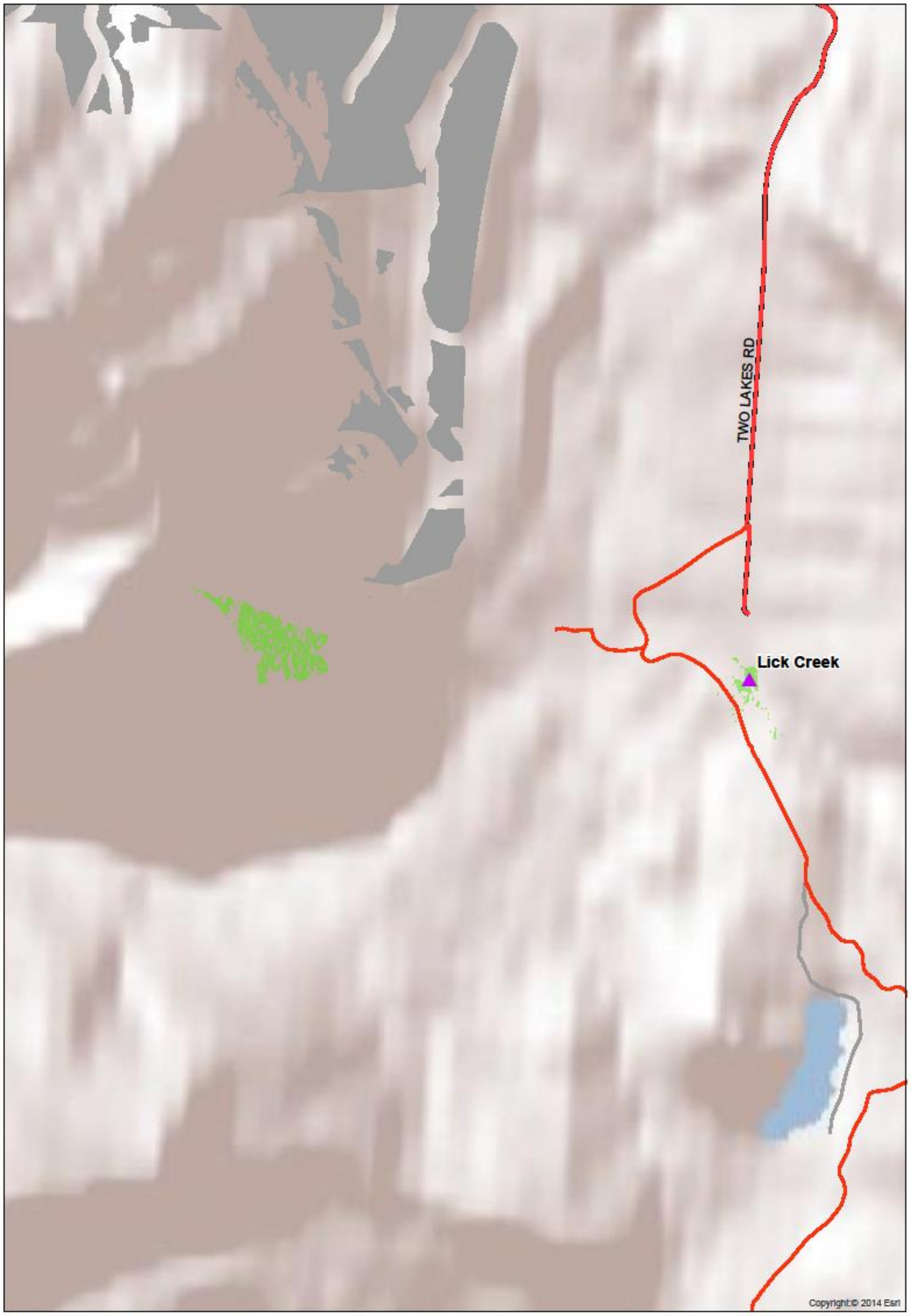
3.10 *Viewshed Assessment Maps_P1&2_ PFMS*

A Viewshed Assessment was completed on areas within the FMA that have been identified through public consultation as having high visual importance. The process used to complete these assessments, as well as options for mitigation strategies, are described in *Chapter 6 Forest Management Strategies*.

1. Hilltop Lake Recreation Area
2. Kakwa Provincial Recreation Area
3. Lick Creek
4. Musreau Lake Provincial Campsite
5. Nose Creek Settlement
6. Sherman Meadows
7. Shuttler Flats Provincial Recreation Area
8. Southview Provincial Recreation Area
9. Spring Lake Recreation Area
10. Torrens Falls
11. Two Lakes Provincial Campsites


TOWNSHIP RD 774
RANGE RD 71
TOWNSHIP RD 772
RANGE RD 73
TOWNSHIP RD 770
RANGE RD 70
RANGE RD 65
RANGE RD 64
RANGE RD 72
RANGE RD 71
TOWNSHIP RD 764
RANGE RD 75
RANGE RD 74
RANGE RD 80
677
PETERSONS PASS
Hilltop Lake - On Water
Hilltop Lake
724
TOWNSHIP RD 752
Copyright© 2014 Esri
Viewshed Analysis - Hilltop
Date: 7/31/2019
Weyerhaeuser
1:60,000
0 2 4 8 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


IMPERIAL SOUTH R
40
Kakwa
Copyright:© 2014 Esri
Viewshed Analysis - Kakwa
Date: 7/31/2019
Weyerhaeuser
1:10,000
0
0.325
0.65
1.3 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)



Viewshed Analysis - Lick Creek

Date: 7/31/2019

Weyerhaeuser

1:15,000

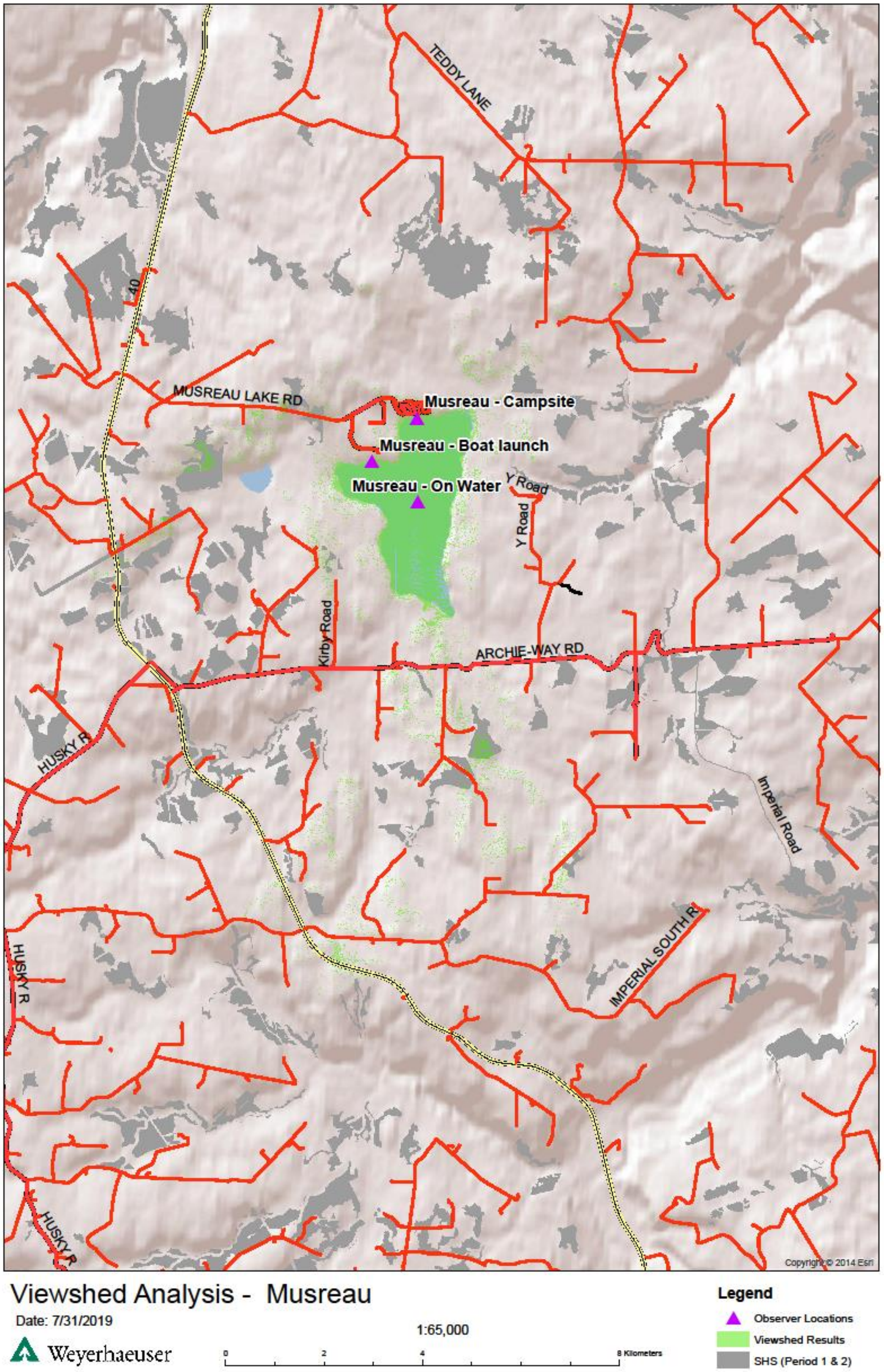
0 0.5 1 2 Kilometers

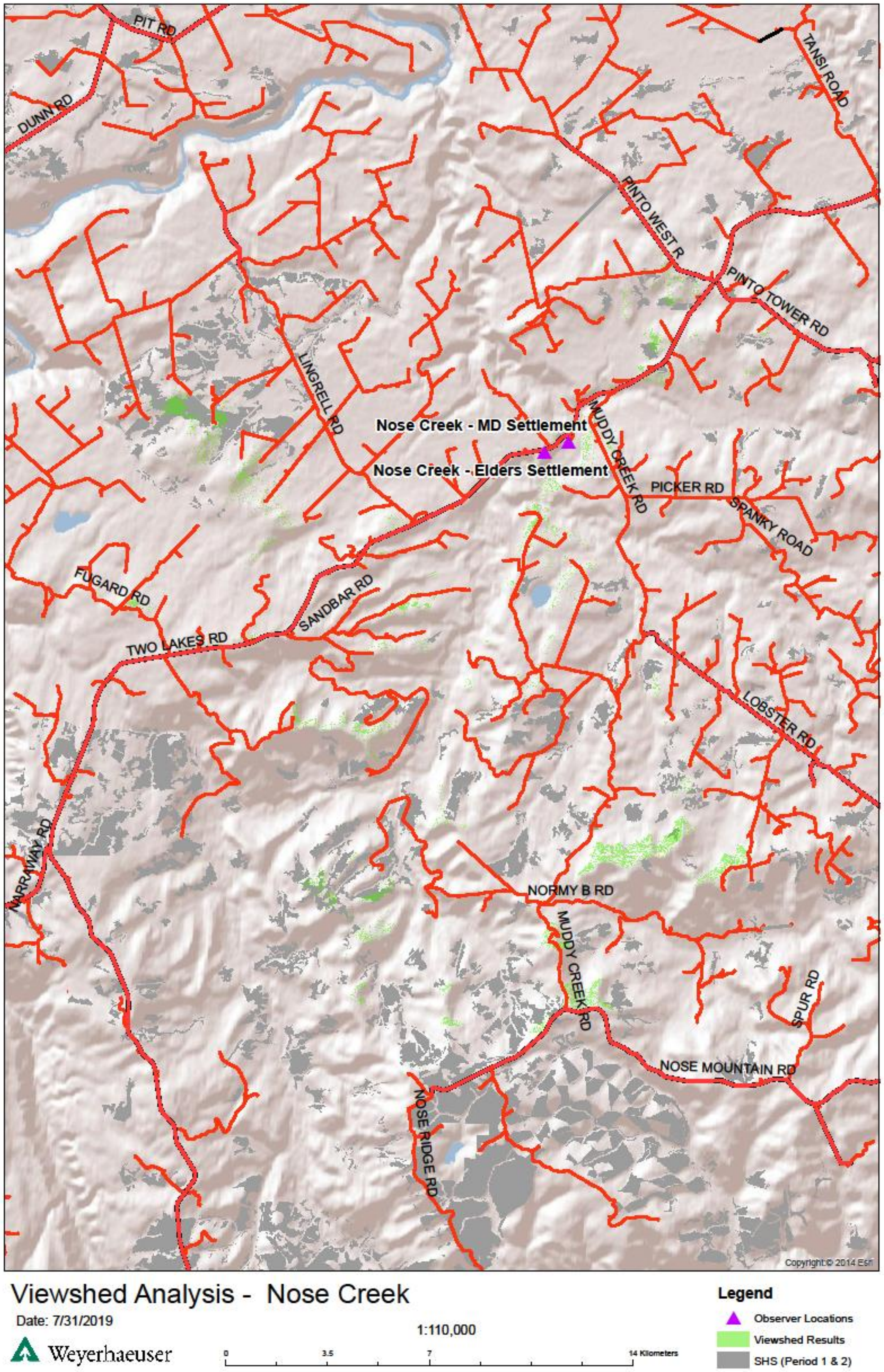
Legend

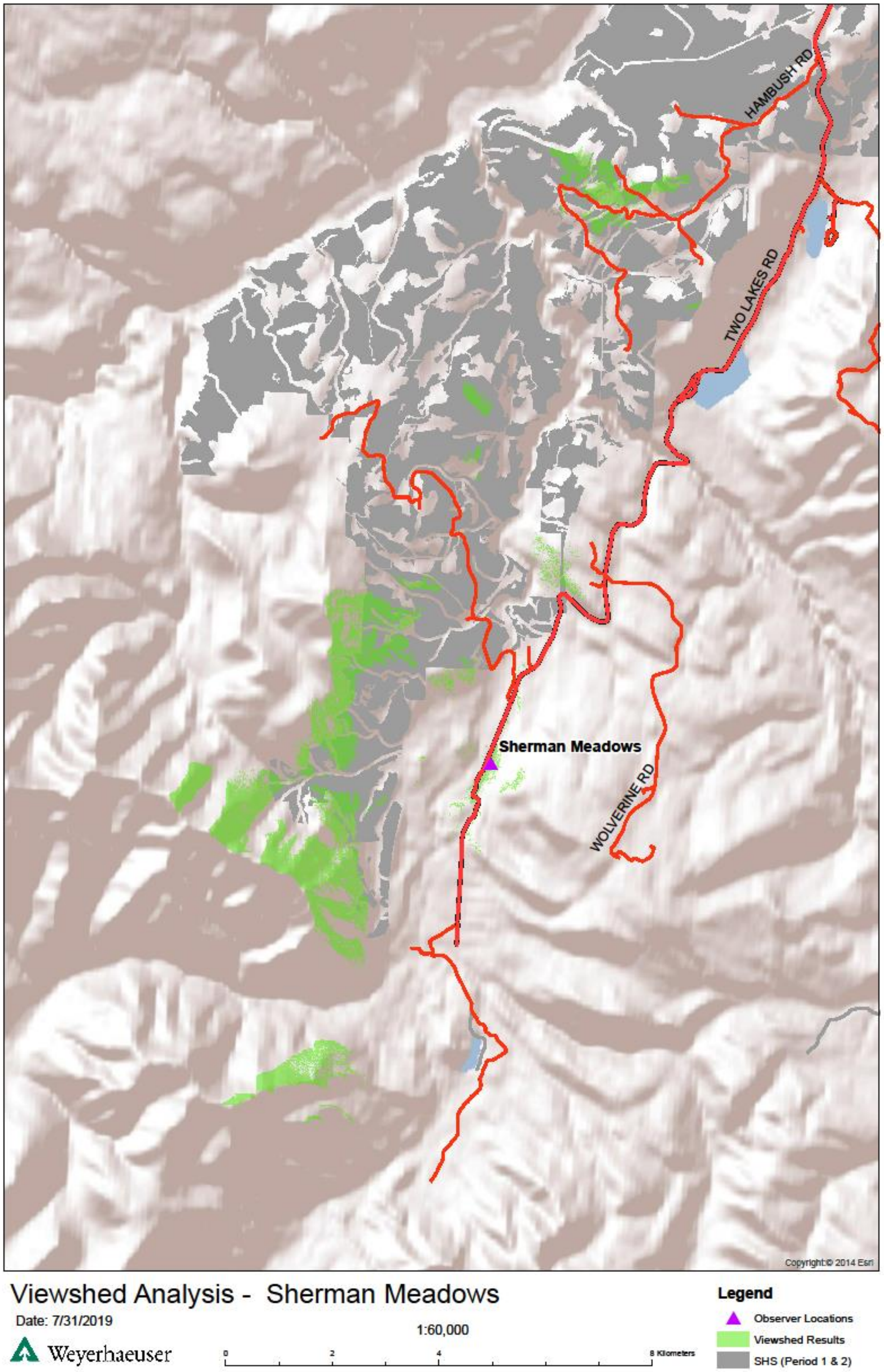
Observer Locations

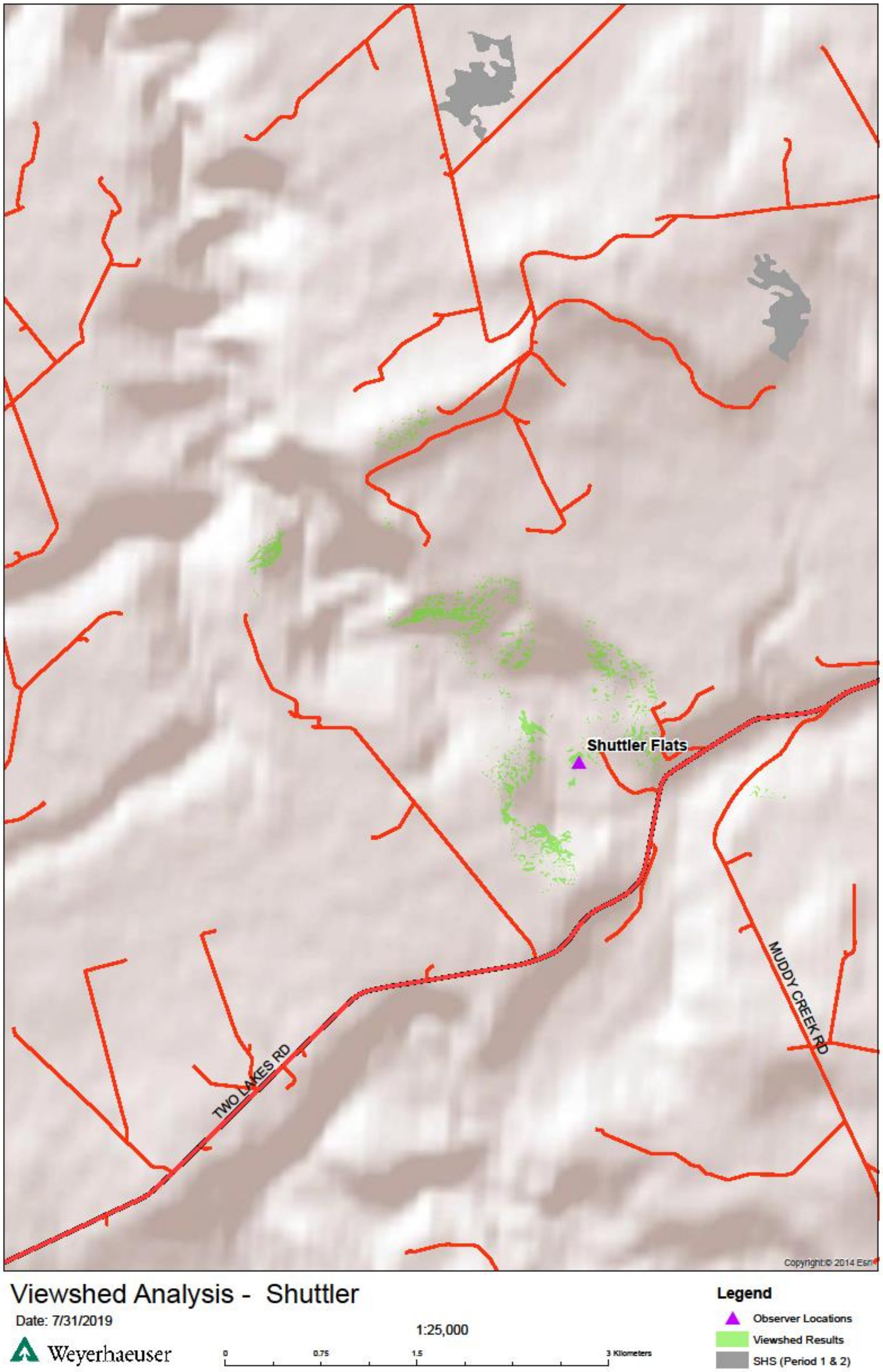
Viewshed Results

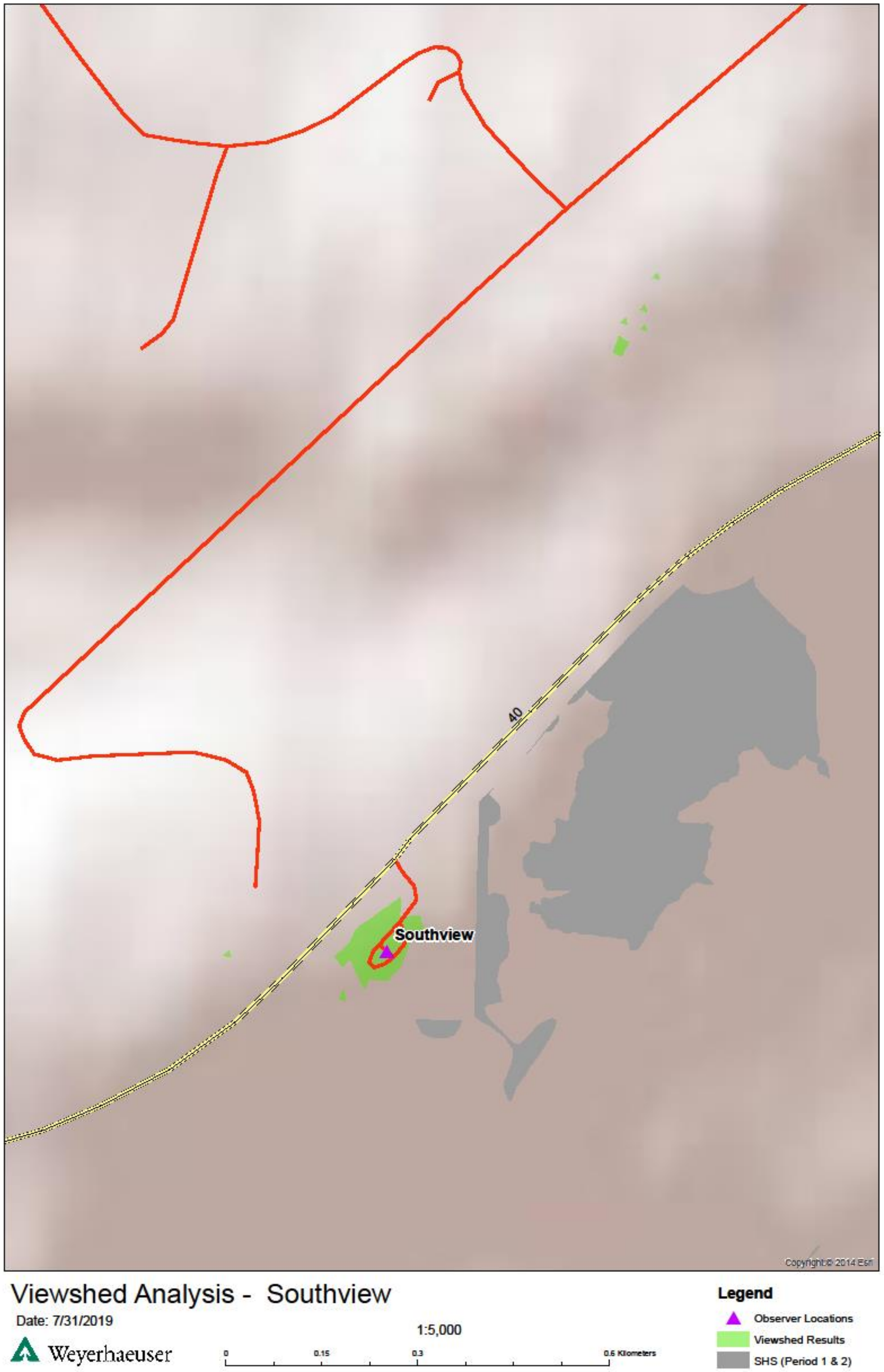
SHS (Period 1 & 2)

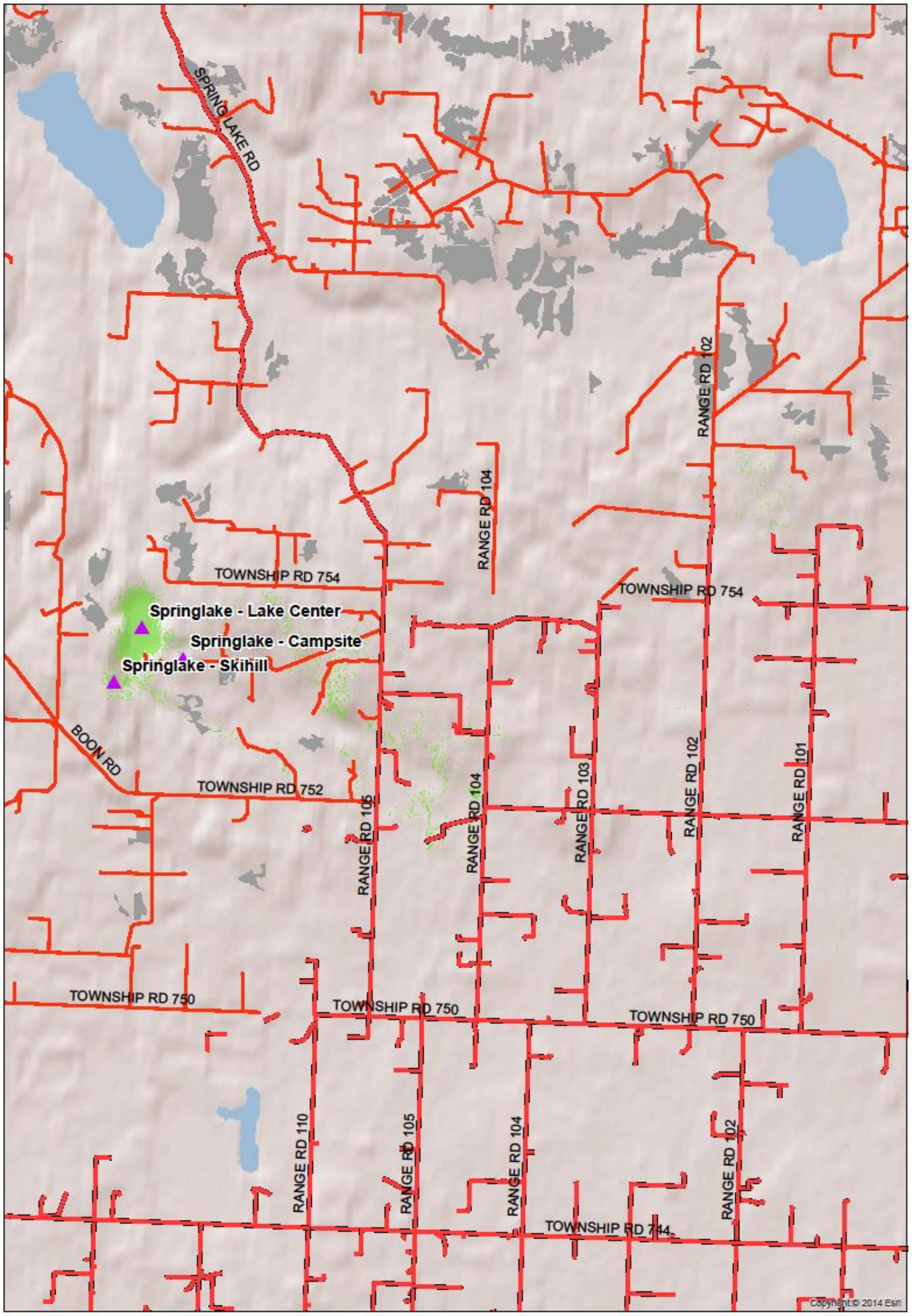

TEDDY LANE
40
MUSREAU LAKE RD
Musreau - Campsite
Musreau - Boat launch
Musreau - On Water
Y Road
Y Road
Kirby Road
ARCHIE-WAY RD
HUSKY R
Imperial Road
IMPERIAL SOUTH R
HUSKY R
HUSKY R
Copyright:© 2014 Esri
Viewshed Analysis - Musreau
Date: 7/31/2019
Weyerhaeuser
1:65,000
0
2
4
8 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


PIT RD
DUNN RD
TANSI ROAD
PINTO WEST R
PINTO TOWER RD
LINGRELL RD
Nose Creek - MD Settlement
Nose Creek - Elders Settlement
MUDDY CREEK RD
PICKER RD
SPANKY ROAD
FUGARD RD
SANDBAR RD
TWO LAKES RD
LOBSTER RD
NARRAWAY RD
NORMY B RD
MUDDY CREEK RD
SPUR RD
NOSE MOUNTAIN RD
NOSE RIDGE RD
Copyright:© 2014 Esri
Viewshed Analysis - Nose Creek
Date: 7/31/2019
Weyerhaeuser
1:110,000
0 3.5 7 14 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


HAMBUSH RD
TWO LAKES RD
Sherman Meadows
WOLVERINE RD
Copyright:© 2014 Esri
Viewshed Analysis - Sherman Meadows
Date: 7/31/2019
Weyerhaeuser
1:60,000
0
2
4
8 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


Shuttler Flats
TWO LAKES RD
MUDDY CREEK RD
Copyright:© 2014 Esri
Viewshed Analysis - Shuttler
Date: 7/31/2019
Weyerhaeuser
1:25,000
0
0.75
1.5
3 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


40
Southview
Copyright© 2014 Esri
Viewshed Analysis - Southview
Date: 7/31/2019
Weyerhaeuser
1:5,000
0
0.15
0.3
0.6 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)



Viewshed Analysis - Spring Lake

Date: 7/31/2019

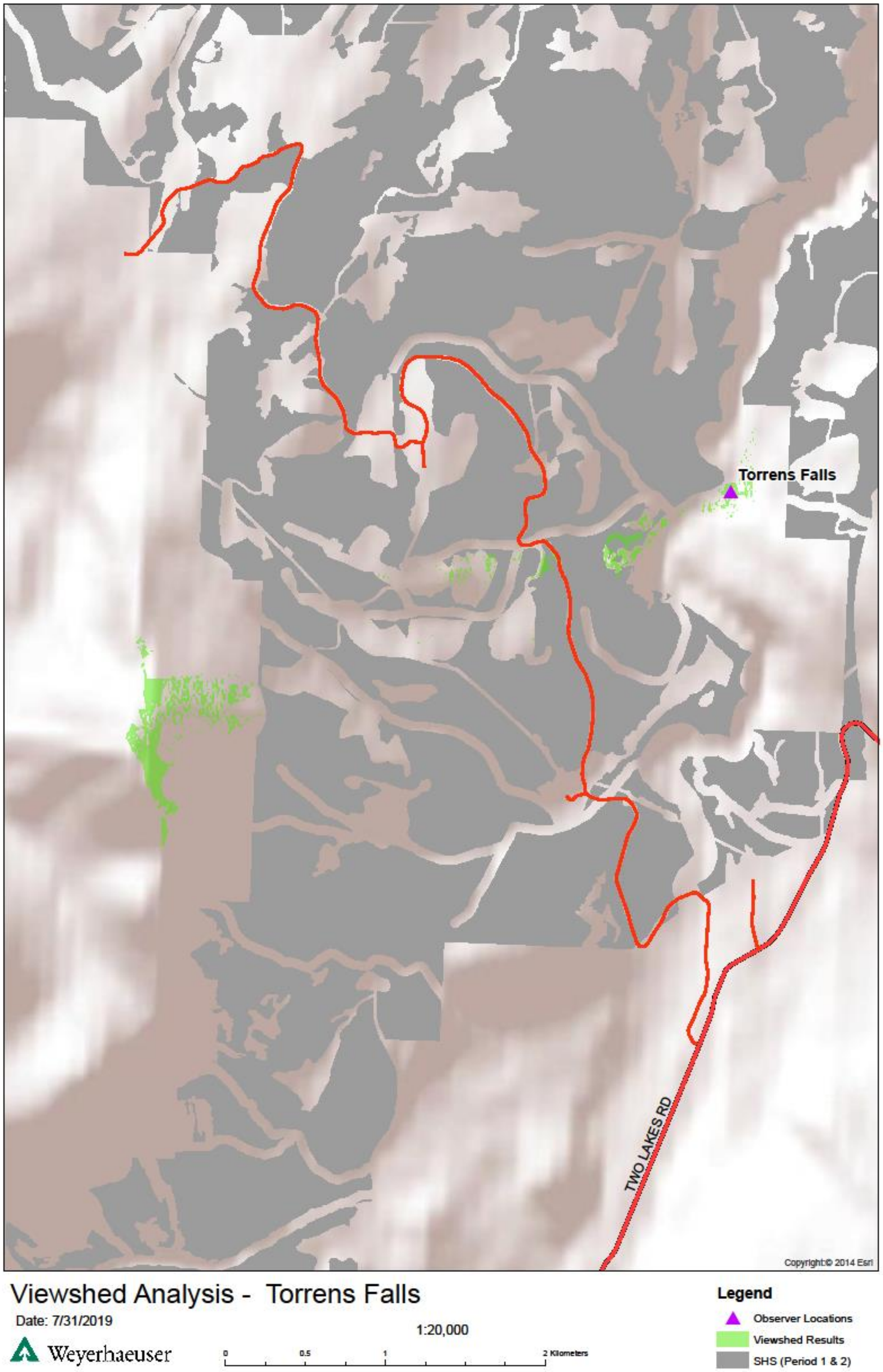
Weyerhaeuser

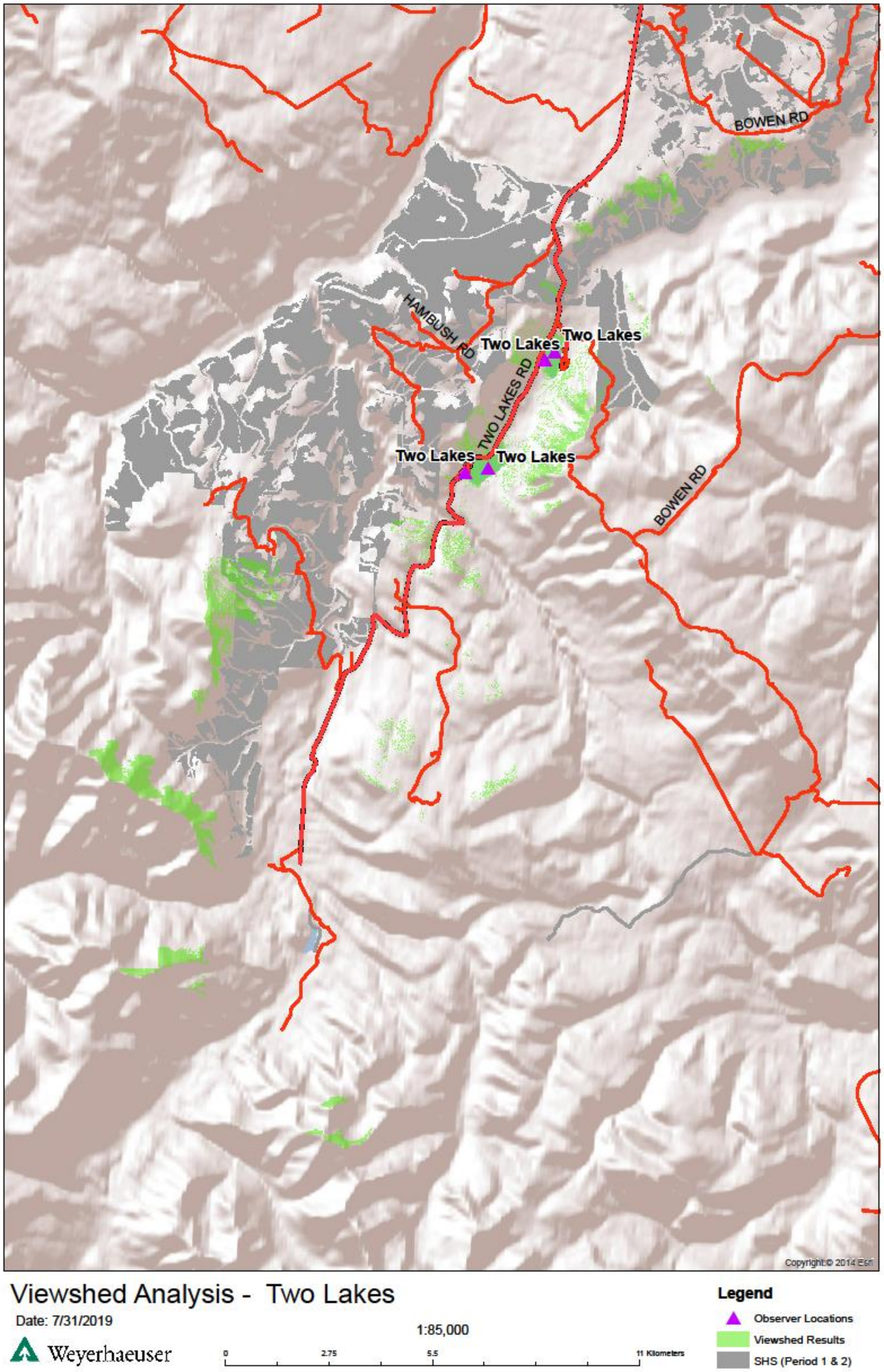
1:50,000

0 1.5 3 6 Kilometers

Legend

Observer Locations
Viewshed Results
SHS (Period 1 & 2)


Torrens Falls
TWO LAKES RD
Copyright:© 2014 Esri
Viewshed Analysis - Torrens Falls
Date: 7/31/2019
Weyerhaeuser
1:20,000
0
0.5
1
2 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)


BOWEN RD
HAMBUSH RD
Two Lakes
Two Lakes
TWO LAKES RD
Two Lakes
Two Lakes
BOWEN RD
Copyright:© 2014 Esri
Viewshed Analysis - Two Lakes
Date: 7/31/2019
Weyerhaeuser
1:85,000
0
2.75
5.5
11 Kilometers
Legend
Observer Locations
Viewshed Results
SHS (Period 1 & 2)

Appendix I Grizzly Bear Details (Tables 11-13)

Note: Road density values do not change from current to future (0-10 years because there is no plan to add more permanent road.

Table 11 Grizzly Bear Habitat States Change by Grizzly Bear Watershed Unit

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G9	Core	104,446	Road Density	0.285	0.285	0.000	0.285	0.000	0.000
G9	Core		Primary Habitat	27,393	30,635	3,242	30,822	3,429	12.5
G9	Core		Secondary Habitat	19,874	17,264	-2,610	17,284	-2,590	-13.0
G9	Core		Non-critical Habitat	11,429	10,672	-758	10,810	-620	-5.4
G9	Core		Secondary Sink	14,412	13,288	-1,124	14,285	-128	-0.9
G9	Core		Primary Sink	31,338	32,587	1,249	31,246	-91	-0.3
G60	Secondary	78,093	Road Density	0.775	0.775	0.000	0.775	0.000	0.000
G60	Secondary		Primary Habitat	15	9	-6	2	-13	-86.6
G60	Secondary		Secondary Habitat	396	271	-125	150	-246	-62.0
G60	Secondary		Non-critical Habitat	58,272	57,132	-1,140	57,163	-1,109	-1.9
G60	Secondary		Secondary Sink	14,639	14,141	-499	15,691	1,051	7.2
G60	Secondary		Primary Sink	4,771	6,540	1,769	5,087	316	6.6
G6	Secondary	45,161	Road Density	0.628	0.628	0.000	0.628	0.000	0.000
G6	Secondary		Primary Habitat	352	330	-22	286	-66	-18.8
G6	Secondary		Secondary Habitat	766	588	-178	603	-163	-21.3
G6	Secondary		Non-critical Habitat	28,000	28,216	216	28,645	645	2.3
G6	Secondary		Secondary Sink	10,965	9,039	-1,926	10,515	-450	-4.1
G6	Secondary		Primary Sink	5,078	6,988	1,910	5,111	34	0.7

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Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G59	Secondary	77,831	Road Density	0.738	0.738	0.000	0.738	0.000	0.000
G59	Secondary		Primary Habitat	314	164	-151	136	-178	-56.7
G59	Secondary		Secondary Habitat	840	1,010	169	723	-117	-13.9
G59	Secondary		Non-critical Habitat	44,991	44,072	-920	44,443	-548	-1.2
G59	Secondary		Secondary Sink	19,264	18,128	-1,136	20,336	1,072	5.6
G59	Secondary		Primary Sink	12,421	14,457	2,037	12,192	-228	-1.8
G35	Core	2,116	Road Density	0.183	0.183	0.000	0.183	0.000	0.000
G35	Core		Primary Habitat	1,085	1,036	-49	1,041	-44	-4.0
G35	Core		Secondary Habitat	179	188	9	189	9	5.1
G35	Core		Non-critical Habitat	178	178	0	172	-6	-3.1
G35	Core		Secondary Sink	56	57	1	55	-1	-1.2
G35	Core		Primary Sink	618	657	39	659	41	6.6
G34	Core	4,682	Road Density	0.157	0.157	0.000	0.157	0.000	0.000
G34	Core		Primary Habitat	2,117	2,168	51	2,187	71	3.3
G34	Core		Secondary Habitat	244	230	-14	240	-4	-1.6
G34	Core		Non-critical Habitat	556	520	-36	492	-64	-11.5
G34	Core		Secondary Sink	131	129	-2	121	-10	-7.5
G34	Core		Primary Sink	1,635	1,635	0	1,642	7	0.4
G29	Core	37,941	Road Density	0.369	0.369	0.000	0.369	0.000	0.000
G29	Core		Primary Habitat	12,627	12,276	-350	12,107	-520	-4.1
G29	Core		Secondary Habitat	3,596	3,283	-313	3,429	-167	-4.6
G29	Core		Non-critical Habitat	1,383	1,123	-260	1,038	-345	-24.9
G29	Core		Secondary Sink	3,540	3,770	230	4,130	590	16.7
G29	Core		Primary Sink	16,795	17,489	693	17,237	442	2.6

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G25	Core	46,295	Road Density	0.264	0.264	0.000	0.264	0.000	0.000
G25	Core		Primary Habitat	29,796	29,796	0	29,793	-3	0.0
G25	Core		Secondary Habitat	6,006	6,006	0	6,006	0	0.0
G25	Core		Non-critical Habitat	3,445	3,445	0	3,445	0	0.0
G25	Core		Secondary Sink	1,260	1,261	1	1,262	1	0.1
G25	Core		Primary Sink	5,788	5,787	-1	5,790	2	0.0
G24	Core	53,773	Road Density	0.292	0.292	0.000	0.292	0.000	0.000
G24	Core		Primary Habitat	32,883	32,705	-178	32,622	-261	-0.8
G24	Core		Secondary Habitat	11,057	11,090	33	11,147	90	0.8
G24	Core		Non-critical Habitat	3,749	3,749	0	3,749	0	0.0
G24	Core		Secondary Sink	991	1,005	14	1,006	15	1.5
G24	Core		Primary Sink	5,092	5,224	132	5,249	157	3.1
G23	Core	77,749	Road Density	0.525	0.525	0.000	0.525	0.000	0.000
G23	Core		Primary Habitat	10,490	10,563	73	11,065	575	5.5
G23	Core		Secondary Habitat	8,618	7,134	-1,485	7,007	-1,611	-18.7
G23	Core		Non-critical Habitat	6,698	5,862	-836	5,387	-1,311	-19.6
G23	Core		Secondary Sink	13,396	12,363	-1,033	14,017	621	4.6
G23	Core		Primary Sink	38,546	41,827	3,281	40,272	1,726	4.5
G19	Secondary	73,118	Road Density	0.722	0.722	0.000	0.722	0.000	0.000
G19	Secondary		Primary Habitat	924	409	-515	387	-537	-58.1
G19	Secondary		Secondary Habitat	2,008	1,111	-896	1,484	-524	-26.1
G19	Secondary		Non-critical Habitat	19,481	18,671	-810	17,958	-1,523	-7.8
G19	Secondary		Secondary Sink	30,958	28,690	-2,267	32,075	1,118	3.6
G19	Secondary		Primary Sink	19,747	24,236	4,489	21,214	1,467	7.4

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Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G17	Core	68,139	Road Density	0.543	0.543	0.000	0.543	0.000	0.000
G17	Core		Primary Habitat	10,070	8,645	-1,425	8,891	-1,179	-11.7
G17	Core		Secondary Habitat	5,846	5,041	-805	4,841	-1,005	-17.2
G17	Core		Non-critical Habitat	5,679	5,261	-418	4,737	-942	-16.6
G17	Core		Secondary Sink	10,408	11,146	737	11,795	1,386	13.3
G17	Core		Primary Sink	36,136	38,046	1,911	37,875	1,739	4.8
G16	Core	50,700	Road Density	0.329	0.329	0.000	0.329	0.000	0.000
G16	Core		Primary Habitat	20,920	24,263	3,343	24,663	3,743	17.9
G16	Core		Secondary Habitat	15,824	13,798	-2,026	13,669	-2,155	-13.6
G16	Core		Non-critical Habitat	5,066	3,958	-1,108	3,686	-1,380	-27.2
G16	Core		Secondary Sink	2,459	2,132	-328	2,284	-175	-7.1
G16	Core		Primary Sink	6,430	6,549	119	6,397	-33	-0.5
G15	Secondary	23,072	Road Density	0.465	0.465	0.000	0.465	0.000	0.000
G15	Secondary		Primary Habitat	1,341	1,582	241	1,508	166	12.4
G15	Secondary		Secondary Habitat	813	1,141	328	1,381	568	69.8
G15	Secondary		Non-critical Habitat	8,931	8,163	-768	7,934	-997	-11.2
G15	Secondary		Secondary Sink	6,124	5,390	-735	6,553	429	7.0
G15	Secondary		Primary Sink	5,863	6,796	933	5,696	-166	-2.8
G14	Secondary	77,850	Road Density	0.639	0.639	0.000	0.639	0.000	0.000
G14	Secondary		Primary Habitat	633	147	-486	127	-506	-80.0
G14	Secondary		Secondary Habitat	988	529	-459	550	-438	-44.4
G14	Secondary		Non-critical Habitat	21,693	22,540	847	22,421	729	3.4
G14	Secondary		Secondary Sink	29,045	27,586	-1,458	31,137	2,092	7.2
G14	Secondary		Primary Sink	25,492	27,049	1,557	23,616	-1,876	-7.4

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time zero)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
G10	Secondary	73,252	Road Density	0.714	0.714	0.000	0.714	0.000	0.000
G10	Secondary		Primary Habitat	3,266	3,407	141	3,014	-253	-7.7
G10	Secondary		Secondary Habitat	4,099	4,442	343	4,268	169	4.1
G10	Secondary		Non-critical Habitat	18,945	19,145	200	19,829	884	4.7
G10	Secondary		Secondary Sink	27,436	22,234	-5,201	26,397	-1,039	-3.8
G10	Secondary		Primary Sink	19,506	24,024	4,518	19,745	239	1.2

Table 12 Grizzly Bear Habitat States Change for FMA #6900016

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time 0)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
FMA 6900016	Secondary	441,519	Primary Habitat	6,846	6,048	5,458	-798	-1,387	-20
	Secondary		Secondary Habitat	9,908	9,090	9,156	-818	-752	-8
	Secondary		Non-critical Habitat	194,617	192,228	192,681	-2,388	-1,935	-1
	Secondary		Secondary Sink	137,734	124,525	142,013	-13,209	4,279	3
	Secondary		Primary Sink	92,415	109,629	92,211	17,213	-204	0
	Core	407,281	Primary Habitat	120,318	125,023	126,131	4,706	5,813	5
	Core		Secondary Habitat	67,591	60,380	60,152	-7,211	-7,439	-11
	Core		Non-critical Habitat	34,717	31,301	30,051	-3,416	-4,666	-13
	Core		Secondary Sink	46,159	44,656	48,459	-1,503	2,300	5
	Core		Primary Sink	138,496	145,920	142,488	7,424	3,992	3

Table 13 Grizzly Bear Habitat States Change for FMU G16

Area of Interest	Habitat Zone	Area (ha)	Index	Current (time 0)	Future 10 yr	Difference (+/-)	Future 20 yr	Difference (+/-)	% Change
FMU G16	Secondary	448,377	Primary Habitat	6,846	6,048	-798	5,459	-1,387	-20.3
	Secondary		Secondary Habitat	9,910	9,092	-818	9,158	-751	-7.6
	Secondary		Non-critical Habitat	200,313	197,939	-2,374	198,393	-1,920	-1.0
	Secondary		Secondary Sink	138,431	125,208	-13,223	142,705	4,274	3.1
	Secondary		Primary Sink	92,877	110,090	17,213	92,662	-215	-0.2
	Core	445,841	Primary Habitat	147,380	152,088	4,708	153,191	5,810	3.9
	Core		Secondary Habitat	71,246	64,035	-7,211	63,812	-7,433	-10.4
	Core		Non-critical Habitat	38,183	34,767	-3,416	33,517	-4,666	-12.2
	Core		Secondary Sink	46,654	45,151	-1,503	48,954	2,300	4.9
	Core		Primary Sink	142,378	149,800	7,422	146,367	3,989	2.8

Appendix II Watershed ECA (Table 14)

Watershed ID	Years from now																																								
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
WS_1	1	1	10	16	16	22	19	17	12	7	10	10	10	9	6	5	7	6	7	20	27	26	21	14	9	6	4	4	10	10	9	7	12	21	28	27	20	15	10	8	6
WS_10	26	23	20	20	18	16	15	11	8	8	11	11	14	18	22	24	26	27	28	24	19	14	10	7	10	9	9	7	10	19	22	25	25	25	27	22	17	12	9	11	6
WS_100	33	31	31	30	30	30	30	30	30	31	30	30	30	30	29	29	28	30	29	30	29	27	26	25	25	24	25	26	25	25	27	28	29	27	29	28	30	30	28	28	16
WS_101	12	11	10	9	7	6	4	5	4	4	3	3	3	3	3	2	2	7	11	18	27	26	24	21	17	12	9	6	5	4	4	3	5	6	8	11	13	15	15	14	10
WS_102	22	26	36	33	30	30	29	25	24	26	23	21	19	15	12	10	8	7	6	7	7	13	15	20	22	28	27	27	24	20	17	13	12	10	11	10	12	13	17	20	16
WS_103	4	3	3	4	5	4	4	3	3	2	2	6	11	10	9	8	6	4	3	2	2	2	3	3	3	3	3	4	5	5	5	4	4	3	3	3	3	3	2	2	1
WS_104	32	29	30	29	30	30	30	28	27	24	25	24	25	22	22	20	19	19	19	19	20	20	21	20	19	19	20	20	19	17	17	17	16	16	17	19	21	24	24	23	17
WS_105	29	32	31	30	28	27	25	25	23	23	22	23	24	24	23	24	27	30	30	30	28	27	27	28	27	27	26	24	25	25	24	26	28	29	28	27	29	28	29	29	18
WS_106	32	30	32	29	29	27	24	24	29	30	30	26	21	20	18	15	16	15	14	12	13	15	15	19	22	23	22	20	24	23	24	21	19	18	15	13	13	14	15	15	13
WS_107	7	19	34	32	29	24	18	13	9	7	5	4	3	8	13	15	16	14	12	9	7	8	9	10	10	12	11	9	8	9	9	10	11	11	11	10	9	9	11	11	10
WS_108	9	7	5	4	4	3	3	5	7	7	7	8	9	8	7	8	8	7	7	6	6	6	6	5	5	4	5	6	7	8	9	8	8	7	7	6	5	5	6	5	2
WS_109	32	33	35	31	30	27	25	25	24	23	20	17	14	12	11	9	9	8	8	8	9	10	13	16	17	19	19	17	15	12	10	11	10	10	10	11	12	12	13	14	11
WS_110	13	17	29	26	24	25	28	27	25	20	16	12	9	7	5	4	4	4	3	3	3	5	13	16	17	17	16	15	12	10	7	6	5	4	5	4	6	7	9	11	11
WS_111	2	3	3	3	2	2	2	2	2	2	2	2	2	9	16	16	15	12	9	7	5	3	3	2	2	2	2	2	4	7	10	11	11	10	9	7	5	4	3	3	1
WS_112	1	3	6	6	6	6	5	5	6	10	15	14	12	11	9	7	5	8	10	9	8	8	7	6	6	6	8	9	9	9	7	7	7	7	9	11	11	10	9	8	6
WS_113	22	27	27	27	26	26	25	24	26	27	26	28	27	25	23	24	25	26	28	27	27	26	26	28	27	27	27	26	25	23	22	23	25	27	27	26	24	25	24	24	18
WS_114	4	4	6	6	6	21	40	39	36	31	25	19	14	10	8	6	5	4	4	4	4	7	13	15	18	20	20	18	15	12	9	7	6	5	4	4	10	11	12	14	16
WS_115	4	4	3	3	3	3	2	9	14	14	12	10	8	9	10	17	20	19	16	14	15	12	10	9	8	7	7	8	9	9	14	14	15	15	14	13	12	11	10	9	6
WS_117	31	32	30	30	30	28	27	23	20	24	26	28	29	28	27	29	30	29	30	30	30	29	26	23	22	21	21	20	22	25	27	29	28	28	27	25	25	24	23	20	13

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WS_118	19	24	26	27	27	27	25	25	23	21	19	17	16	16	17	19	21	24	26	27	26	26	28	28	25	22	19	17	15	14	16	19	22	24	23	24	25	27	26	24	18
WS_119	31	36	45	39	32	29	25	22	17	14	11	9	8	6	6	7	7	6	6	7	7	12	14	15	17	15	14	11	9	7	7	7	7	6	6	8	12	14	15	15	11
WS_12	31	32	30	26	23	22	21	19	17	15	21	23	29	30	30	30	30	30	28	27	24	23	23	20	18	18	22	23	26	26	26	28	30	30	29	28	24	23	22	20	14
WS_120	2	2	2	2	2	19	38	37	34	28	22	16	11	7	5	4	3	3	2	2	2	5	8	11	15	16	15	12	10	7	6	5	4	4	4	5	6	10	11	12	13
WS_121	2	2	2	2	2	4	5	5	4	7	8	7	6	5	4	3	3	2	2	2	2	2	3	5	6	6	6	5	5	4	4	4	4	4	4	3	3	4	4	5	3
WS_122	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	8	14	14	13	12	9	7	5	3	2	2	1	1	1	1	2	3	6	8	10	10	9	7	6	4	2
WS_123	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	15	15	14	11	9	6	4	3	2	2	1	1	1	1	2	5	7	10	11	10	8	7	5	4	2
WS_124	1	1	1	1	1	9	16	16	14	12	9	6	3	2	2	1	2	2	2	2	1	2	5	6	6	6	5	4	3	3	2	3	3	4	4	3	3	3	5	5	4
WS_125	16	31	30	38	41	40	39	32	25	18	13	9	6	5	4	3	3	3	2	2	2	5	6	9	11	12	11	10	9	8	7	6	6	6	5	5	6	7	8	9	8
WS_126	2	2	2	1	1	1	1	1	1	1	1	3	4	3	3	7	17	17	16	13	10	7	5	4	3	3	3	3	3	3	3	4	8	12	13	13	12	10	8	6	3
WS_127	3	3	2	2	2	2	2	2	2	2	2	2	2	3	4	4	4	3	3	5	7	7	7	6	5	4	4	4	4	5	4	5	4	4	4	5	5	5	5	4	2
WS_128	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0
WS_129	33	31	30	27	25	21	21	19	18	29	29	30	30	28	28	28	28	29	28	27	24	22	21	19	19	18	23	25	28	28	29	27	26	26	25	25	23	21	19	17	11
WS_130	6	6	5	4	7	14	15	14	11	10	8	6	5	4	3	2	2	1	1	1	1	2	4	4	7	7	7	6	5	5	4	3	3	4	4	5	6	6	6	6	5
WS_131	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	5	4	4	4	4	5	5	5	5	4	4	5	5	5	5	4	2
WS_132	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	1	1	2	2	1	2	2	2	2	2	1
WS_134	1	1	1	1	1	4	5	8	12	23	36	33	29	24	23	18	13	11	9	7	5	5	5	5	6	5	7	12	19	21	21	18	14	13	10	8	7	7	7	7	7
WS_135	20	23	25	21	18	16	15	21	30	30	29	25	20	15	13	13	14	13	12	12	11	11	13	14	14	16	21	22	19	18	15	14	12	11	11	11	12	13	13	14	12
WS_136	6	6	5	4	4	3	3	3	3	3	3	3	3	5	9	9	9	8	7	6	5	5	5	4	4	4	3	3	3	4	6	7	7	8	7	6	6	5	5	4	2
WS_137	10	17	25	28	27	27	26	24	21	21	20	18	14	11	11	11	16	18	21	23	27	26	26	24	23	22	18	16	17	17	15	16	16	17	19	21	20	25	24	21	17
WS_138	15	10	7	5	4	4	3	3	3	3	3	3	3	21	38	38	35	29	22	16	11	9	7	6	5	4	4	3	6	12	16	20	23	23	20	16	12	9	7	6	2
WS_139	1	1	1	1	1	2	3	3	3	2	2	1	1	1	1	1	1	1	1	1	1	2	2	3	3	2	2	2	2	1	1	1	1	1	1	1	2	2	2	2	1
WS_14	20	19	19	25	25	26	22	20	17	16	14	18	23	23	26	26	27	27	25	22	18	17	17	16	19	17	18	23	23	26	25	28	25	27	23	21	20	17	16	15	9

WS_141	5	10	15	21	22	20	22	27	30	30	28	22	17	17	19	20	21	20	22	22	20	19	19	24	27	28	25	21	21	21	19	18	17	17	17	18	21	22	25	24	18
WS_142	1	1	1	1	1	0	0	0	0	0	0	0	0	6	10	10	10	9	7	5	4	3	2	2	2	1	1	1	1	2	3	5	7	8	7	6	5	4	3	2	1
WS_143	7	11	14	19	19	20	22	30	30	30	28	23	19	14	14	15	17	17	17	16	19	21	30	30	30	25	21	20	17	15	17	15	15	14	16	19	21	27	29	30	22
WS_144	14	13	13	13	13	13	13	13	13	13	13	13	13	20	23	23	21	20	18	16	15	14	14	14	13	13	13	13	14	15	16	18	20	20	19	18	17	15	15	14	1
WS_145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS_146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS_15	13	14	15	16	16	15	15	16	20	20	23	24	22	20	18	16	16	16	16	16	16	16	16	19	21	21	21	20	20	19	18	17	17	17	16	16	17	16	18	19	11
WS_150	13	9	9	11	12	12	23	26	29	25	26	21	17	20	30	29	26	23	21	18	19	18	20	26	26	27	23	24	21	20	18	19	20	18	17	18	21	22	23	23	19
WS_151	14	14	16	16	16	15	27	30	30	30	30	29	27	27	23	22	26	25	23	20	18	23	29	29	30	26	29	30	29	27	30	27	25	21	21	23	27	26	24	24	11
WS_157	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
WS_158	19	24	21	19	14	14	17	14	12	10	9	7	5	4	3	3	3	3	2	2	5	6	7	9	9	8	7	6	5	4	3	3	3	3	4	5	6	8	8	9	7
WS_16	15	22	21	23	19	16	15	15	14	17	16	18	16	16	17	17	18	18	20	20	20	20	20	18	16	20	19	20	17	17	16	18	16	17	19	17	20	23	22	22	18
WS_161	22	22	24	26	27	26	27	27	28	29	29	27	28	27	25	25	25	26	27	27	28	27	27	27	28	27	26	29	29	27	27	26	26	26	26	26	26	28	27	28	13
WS_162	10	10	14	15	19	24	29	28	24	23	21	19	20	19	17	15	16	17	19	19	19	18	18	16	21	21	25	23	21	18	18	19	20	20	19	19	16	17	16	18	18
WS_163	24	24	24	23	20	22	21	21	20	19	21	21	21	23	23	24	25	26	25	24	22	20	19	17	16	16	18	20	23	23	23	22	21	21	22	23	23	21	20	21	9
WS_164	6	11	18	19	23	21	21	17	17	16	15	13	11	10	10	15	16	18	18	18	22	21	19	16	15	14	12	11	10	15	14	17	17	21	21	23	23	19	18	16	11
WS_165	5	7	10	12	20	22	29	28	26	20	18	14	13	14	15	15	15	13	14	12	20	23	27	29	25	20	15	13	15	15	15	15	14	14	12	13	14	20	30	29	23
WS_166	9	11	17	24	29	30	28	25	24	23	21	18	17	16	16	18	19	24	26	26	25	27	25	23	24	20	19	18	18	17	16	20	23	26	26	27	25	25	23	20	10
WS_167	20	20	21	19	17	14	13	13	13	14	15	16	19	22	23	23	23	23	20	18	16	16	15	13	12	10	13	19	20	25	25	24	23	21	18	16	14	13	13	12	7
WS_168	10	11	16	18	20	18	17	14	13	15	18	17	15	15	14	12	12	14	18	18	26	24	22	18	14	12	19	21	19	15	12	12	15	18	18	20	19	19	17	19	16
WS_169	32	30	25	21	19	20	18	16	16	14	13	15	22	27	29	30	28	26	23	20	20	21	19	20	20	18	18	21	24	24	26	26	26	25	23	21	20	19	20	22	17
WS_17	15	13	11	11	12	14	13	16	21	23	22	22	24	23	20	19	16	14	14	13	14	13	14	16	19	21	25	25	27	25	23	19	17	16	15	14	13	15	15	17	10
WS_170	14	14	14	15	15	16	21	28	28	30	26	23	19	16	16	16	15	15	16	17	17	19	23	27	30	28	25	23	20	18	16	15	17	19	20	20	21	26	29	29	24

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WS_171	14	16	17	18	18	19	20	20	21	21	20	19	19	19	19	19	20	20	20	19	20	21	21	23	23	22	21	20	18	19	19	20	20	20	20	21	21	22	23	23	16
WS_172	13	19	18	16	13	12	14	15	17	18	18	16	16	18	18	18	18	17	16	15	14	16	18	21	22	21	18	16	17	17	17	16	15	14	16	17	18	21	20	22	17
WS_174	4	8	14	18	18	17	15	19	23	21	20	23	21	20	21	18	18	17	17	18	16	15	14	15	21	21	20	19	26	24	27	24	22	20	19	16	16	18	21	20	14
WS_175	23	21	20	20	23	22	23	22	25	26	27	27	29	28	28	27	28	26	27	26	25	28	26	29	30	29	30	27	28	27	28	25	24	25	24	26	24	27	30	29	17
WS_176	3	3	10	14	20	19	18	15	15	16	13	12	11	10	8	7	8	11	19	21	20	21	21	26	24	22	18	17	14	12	12	13	14	15	16	14	17	22	27	27	20
WS_178	22	21	16	11	11	9	10	12	14	14	18	18	23	23	28	26	22	17	14	12	10	10	9	11	13	25	24	29	26	23	20	21	18	15	12	11	11	12	16	22	19
WS_179	13	18	16	16	13	13	25	24	22	17	13	10	8	12	26	24	21	17	14	15	17	18	16	21	20	17	18	15	13	29	26	27	21	20	16	14	18	16	15	17	13
WS_18	16	16	14	13	12	11	11	11	14	17	20	21	28	27	25	20	16	13	12	12	11	10	12	13	17	28	29	30	26	21	17	13	12	10	11	11	11	13	16	19	20
WS_180	16	14	13	12	14	16	18	18	19	19	18	16	17	20	21	20	22	20	22	23	22	22	21	22	22	23	22	22	21	19	17	18	20	22	23	22	23	24	24	22	18
WS_182	9	11	16	24	25	28	25	25	24	23	21	22	23	22	21	20	21	24	24	26	30	28	28	25	26	26	23	20	19	17	17	22	22	22	25	29	30	30	26	25	14
WS_183	23	26	28	28	26	25	26	24	27	26	23	20	17	16	15	16	18	22	26	30	29	30	30	30	29	28	24	22	21	19	18	17	18	18	25	27	27	27	28	29	15
WS_184	17	20	21	26	27	25	24	22	20	20	19	20	21	21	23	23	27	27	28	27	24	25	24	25	23	21	20	20	23	24	25	24	22	26	26	25	24	23	24	24	13
WS_185	5	7	15	20	23	24	24	23	19	17	17	14	12	10	9	12	14	18	20	20	21	24	25	25	24	19	17	13	10	9	10	13	18	19	18	19	24	25	23	21	14
WS_186	7	12	14	15	17	18	20	19	17	17	15	15	15	14	15	16	17	17	21	22	23	21	27	25	21	23	18	18	17	17	17	18	17	16	16	18	23	24	25	22	16
WS_187	9	9	11	13	12	23	24	23	24	22	19	17	15	22	25	24	24	19	17	15	14	17	18	23	26	23	22	20	28	27	24	26	23	21	18	16	16	18	24	24	18
WS_19	16	21	22	23	25	23	21	20	20	22	24	24	22	21	19	21	23	26	26	25	24	22	22	23	23	24	23	23	22	21	21	23	27	26	24	24	21	20	21	24	14
WS_190	1	26	29	28	21	14	10	8	5	5	4	3	2	2	9	11	16	22	22	19	16	13	12	10	7	5	4	3	4	15	14	15	18	17	18	17	16	14	11	9	5
WS_192	1	5	8	15	22	20	16	18	14	21	25	21	16	12	11	10	11	9	12	14	22	27	26	26	25	26	25	20	15	10	8	7	9	15	13	21	30	30	29	29	22
WS_193	15	21	24	30	29	29	29	25	25	22	22	20	20	18	21	23	27	26	24	27	25	27	26	23	23	20	19	19	20	25	25	27	25	27	26	24	24	22	20	21	10
WS_194	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0
WS_195	16	15	14	21	20	30	29	30	30	30	26	22	18	20	24	25	23	18	23	24	26	28	28	30	26	24	20	23	25	26	25	25	21	21	19	25	23	25	28	27	17
WS_196	12	15	19	25	28	27	24	20	17	15	18	20	21	19	19	18	21	22	25	27	28	25	23	19	18	17	19	19	18	18	19	21	24	26	26	25	25	23	21	20	10
WS_197	15	17	20	21	24	23	22	22	22	29	30	30	29	27	23	21	19	18	22	25	25	23	20	26	30	30	29	30	30	29	25	26	23	23	22	24	22	22	24	30	18

WS_198	14	15	18	21	22	22	20	25	26	27	28	29	26	26	23	24	22	21	19	18	21	21	22	26	27	30	28	30	30	28	26	23	22	20	22	21	22	22	21	26	19
WS_199	21	19	22	22	21	23	22	23	21	22	25	26	27	27	25	24	22	20	21	21	22	23	23	22	21	22	22	22	23	25	25	25	23	22	21	22	23	22	23	23	13
WS_2	2	5	9	10	14	13	14	12	14	12	12	10	7	6	7	6	7	7	10	15	15	17	15	16	17	16	13	13	10	8	6	5	6	9	11	16	16	16	17	18	13
WS_20	12	16	16	16	16	16	17	18	22	22	19	15	12	11	12	13	15	15	15	16	17	17	17	16	18	17	17	17	18	17	15	16	16	15	14	14	14	14	14	15	12
WS_200	10	10	12	14	16	20	22	23	21	20	20	20	20	18	17	16	16	18	18	18	18	20	23	23	24	25	23	21	19	21	20	20	20	19	18	17	19	21	22	23	16
WS_201	23	26	24	22	19	18	18	20	20	20	20	21	22	22	23	23	23	23	22	22	21	21	21	22	22	22	21	21	21	21	22	21	21	21	21	21	21	21	22	24	14
WS_202	26	28	25	23	21	20	26	28	29	26	25	21	23	23	28	27	26	22	21	21	23	30	30	29	25	26	23	24	25	25	23	20	21	20	22	26	25	29	29	27	24
WS_203	14	20	22	22	22	20	19	19	18	16	16	16	16	17	18	18	20	22	22	23	22	22	22	20	19	18	17	16	15	15	16	19	22	22	22	21	21	21	19	18	9
WS_204	4	7	10	14	18	18	15	14	11	24	22	27	23	19	15	19	22	23	20	19	17	15	15	15	16	24	23	20	16	21	28	30	27	22	19	16	15	15	28	28	25
WS_205	10	14	18	18	28	30	28	24	19	15	14	15	18	18	18	18	19	24	30	29	26	25	20	19	16	17	19	20	17	20	18	21	21	30	29	25	25	20	19	17	12
WS_206	2	7	18	19	21	16	11	11	20	19	26	21	16	13	13	19	18	19	19	17	14	10	7	10	24	30	28	21	15	15	25	26	29	23	16	11	9	15	18	25	21
WS_21	19	19	18	21	22	23	21	18	15	14	13	13	16	20	20	21	21	22	23	23	23	21	20	18	16	17	16	15	18	20	19	21	20	22	22	21	21	19	19	18	13
WS_22	26	22	19	19	19	20	21	20	21	23	23	28	30	30	28	28	25	24	23	23	23	21	22	22	22	27	30	29	30	27	24	23	22	23	23	23	24	24	24	25	18
WS_23	28	27	26	24	22	23	23	21	19	17	15	13	14	16	18	18	18	17	17	18	18	21	21	22	20	18	16	16	16	17	16	16	17	17	17	17	18	19	20	21	16
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WS_25	41	36	31	25	19	15	12	10	9	8	7	10	15	16	22	22	20	18	15	12	11	11	12	12	10	10	9	10	10	15	17	20	21	18	16	14	12	11	13	12	8
WS_26	20	19	16	15	14	13	15	16	20	22	24	28	29	30	28	26	25	21	20	17	16	16	18	19	21	27	29	30	26	27	26	24	23	21	20	18	17	17	22	24	22
WS_27	24	25	22	22	22	22	20	22	25	27	26	29	29	29	29	30	27	25	28	27	26	24	23	25	30	29	28	28	28	27	25	26	25	27	27	28	30	29	29	29	16
WS_28	27	25	25	21	17	15	13	11	9	15	18	17	16	14	12	11	10	10	10	9	9	10	10	11	11	11	12	13	15	14	13	12	14	13	14	13	13	12	12	12	8
WS_29	35	32	31	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	29	30	30	30	30	30	30	30	30	30	30	6
WS_3	3	3	4	5	6	6	5	4	3	3	5	5	5	7	7	9	7	6	6	6	6	6	6	5	4	4	3	5	5	5	5	4	5	6	7	6	6	5	5	4	3
WS_30	24	22	21	20	18	18	19	20	20	19	21	21	24	29	30	28	26	22	22	20	20	19	21	22	22	22	23	27	27	27	26	23	21	20	19	19	20	21	23	24	12
WS_31	19	20	20	20	20	20	19	18	17	17	16	19	21	24	23	23	21	20	20	19	19	19	18	18	18	18	19	19	21	21	20	20	19	20	20	20	20	19	18	20	16

WS_32	43	45	42	34	26	19	14	10	8	8	8	7	6	6	5	5	5	4	4	4	4	5	7	8	9	9	8	8	7	7	6	6	6	5	5	7	9	10	10	10	6
WS_33	26	24	23	23	23	22	20	21	19	17	17	18	21	20	22	22	21	19	19	18	19	19	19	18	19	21	20	20	17	17	19	19	19	18	17	18	20	19	18	22	18
WS_34	35	37	31	24	18	13	9	7	6	9	15	15	14	11	9	7	5	4	4	4	4	4	5	6	6	6	8	10	12	13	12	10	9	7	6	6	6	5	5	5	2
WS_35	21	25	24	24	22	21	22	21	21	20	21	22	24	26	24	24	23	22	23	22	22	23	23	23	25	26	26	25	25	24	23	21	21	20	20	22	21	23	24	26	19
WS_36	15	17	22	25	28	27	23	19	19	15	13	13	17	17	19	19	19	19	21	25	25	24	23	19	16	13	19	21	23	21	16	16	17	18	23	23	21	22	18	17	9
WS_37	16	18	19	19	18	17	19	19	19	18	18	17	20	21	22	22	21	22	23	21	21	20	20	20	19	18	19	19	19	20	24	24	24	23	21	21	19	19	19	19	15
WS_38	49	45	42	35	28	22	16	13	10	8	7	7	7	6	6	7	7	7	6	6	5	6	6	6	6	6	6	6	6	7	7	7	7	6	7	7	7	8	7	7	2
WS_39	46	44	37	28	20	14	9	6	5	11	13	13	12	10	8	6	5	4	4	3	3	3	4	4	4	4	4	5	6	6	5	5	6	5	5	5	4	4	4	4	1
WS_4	25	27	30	30	30	30	30	30	30	31	30	30	30	30	30	30	30	29	30	30	30	29	30	29	30	30	29	29	29	29	30	30	30	29	30	30	30	29	30	30	4
WS_40	13	17	18	20	22	23	23	22	23	26	26	25	24	21	21	20	20	20	20	20	23	24	23	22	24	28	30	29	28	25	23	22	20	20	22	23	23	23	23	28	22
WS_41	17	16	18	22	21	24	24	28	29	29	27	23	24	23	27	25	26	23	21	19	20	21	24	29	30	28	30	27	30	25	25	22	20	18	17	16	16	19	29	30	20
WS_42	21	19	20	21	25	25	26	26	25	24	25	25	27	26	25	23	22	21	21	22	23	24	25	29	30	30	30	29	28	27	24	22	20	19	18	21	22	23	25	30	20
WS_43	24	22	21	19	16	16	19	17	21	20	19	23	23	24	25	23	23	23	25	23	22	20	21	20	22	20	19	20	19	19	21	24	27	27	26	24	21	20	19	20	16
WS_44	14	14	15	17	20	22	25	29	30	30	28	26	25	24	24	22	21	22	21	21	22	23	27	29	29	30	30	29	27	24	22	20	20	21	20	20	20	24	28	30	23
WS_45	40	34	30	27	22	20	17	15	14	13	11	11	9	10	10	11	11	11	12	14	14	15	15	15	13	12	10	9	10	11	11	13	15	15	16	17	16	15	16	14	9
WS_46	22	25	24	24	23	23	24	22	23	23	23	25	24	24	24	24	25	25	26	26	25	24	24	23	23	24	25	24	23	22	22	22	23	24	25	25	24	25	25	25	15
WS_47	22	27	28	26	22	19	23	25	26	27	24	25	28	28	26	25	23	24	25	24	23	24	26	25	28	27	28	27	26	25	27	26	25	23	24	25	24	25	27	26	19
WS_48	21	23	22	20	18	18	19	22	23	25	25	25	25	23	22	23	23	23	21	19	20	19	22	23	23	23	23	21	23	21	22	22	23	22	21	20	19	21	20	20	17
WS_49	33	29	27	23	20	20	20	21	19	18	17	18	22	27	29	28	27	26	24	22	19	23	25	26	26	23	23	20	19	22	23	25	25	24	25	23	24	28	26	25	20
WS_5	17	15	14	13	12	11	16	16	21	20	19	18	15	16	13	13	16	14	15	15	14	14	13	13	19	20	19	19	17	15	12	11	11	11	13	12	13	13	13	15	13
WS_50	42	44	39	31	22	15	10	6	4	3	3	3	2	2	2	2	2	2	2	2	2	3	3	4	4	4	3	3	3	3	3	3	3	3	4	4	4	4	4	4	2
WS_51	19	25	33	30	29	29	25	22	19	18	17	14	12	9	8	7	5	6	7	8	9	13	18	21	21	21	17	15	13	12	12	10	9	9	9	9	12	13	18	20	17
WS_52	21	24	25	24	21	20	20	19	18	17	17	19	18	18	18	18	19	22	22	22	21	24	23	23	20	20	18	16	16	18	17	20	21	22	24	24	26	25	24	22	17

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WS_53	28	26	24	20	19	18	18	18	24	26	26	26	25	25	24	25	25	23	22	21	21	19	18	20	22	25	26	26	24	22	22	20	21	21	20	19	19	18	18	19	14
WS_54	29	26	24	20	16	16	15	13	11	12	15	13	12	10	8	7	6	6	5	5	5	8	9	10	10	10	9	9	10	9	8	8	7	6	6	5	6	7	8	8	5
WS_55	22	23	24	25	23	24	24	24	23	21	19	19	19	19	23	24	25	26	27	26	25	25	25	25	23	21	19	19	18	19	22	24	27	27	26	24	23	23	22	21	16
WS_56	27	27	25	21	18	17	17	18	23	25	25	24	24	26	26	27	27	25	23	22	21	21	20	20	22	21	23	26	27	27	26	22	20	19	20	21	22	21	20	20	15
WS_57	6	8	16	22	27	29	28	25	24	21	18	15	12	10	11	12	14	16	20	22	23	26	25	24	21	18	18	16	15	13	14	15	17	17	16	18	18	21	20	19	16
WS_58	20	21	21	21	21	21	24	25	26	25	23	20	18	16	19	24	24	25	27	25	24	26	28	27	27	25	21	18	15	16	15	18	24	26	28	28	28	30	28	27	18
WS_59	1	6	18	22	27	29	30	30	30	29	27	25	20	16	12	9	11	13	15	21	25	28	30	29	30	29	26	22	20	16	15	13	14	17	19	21	21	25	28	29	26
WS_6	0	1	10	20	21	18	16	13	12	9	8	7	6	4	3	9	9	11	17	17	17	15	12	10	9	8	7	5	5	12	12	11	9	10	9	14	13	13	12	9	7
WS_60	27	26	26	25	26	24	24	23	23	21	21	21	21	20	19	24	25	26	26	28	25	26	25	23	21	20	20	19	19	22	22	24	23	23	23	24	23	23	21	21	18
WS_61	20	21	22	21	20	20	22	28	30	30	27	22	20	19	17	18	18	19	21	21	24	24	24	28	30	30	27	24	21	18	17	17	17	20	20	23	23	23	25	27	20
WS_62	50	46	37	30	25	26	25	26	23	22	21	18	17	18	19	30	30	30	30	30	28	29	26	30	28	25	22	20	19	18	21	20	24	26	25	23	26	23	21	18	10
WS_63	18	19	22	23	22	25	26	26	26	24	21	19	17	14	14	14	17	19	21	23	23	22	23	24	26	25	24	20	18	17	17	17	18	19	18	19	21	22	22	23	23
WS_64	25	24	22	19	19	18	17	21	24	29	30	28	26	26	27	27	25	23	22	21	20	19	20	25	26	27	26	23	23	24	24	24	23	22	20	20	20	21	20	21	16
WS_65	16	18	20	20	22	23	23	23	22	23	22	21	21	21	21	20	20	22	22	23	22	23	23	23	23	24	23	23	21	21	21	21	21	22	23	21	22	21	22	22	15
WS_66	23	27	27	27	27	26	22	20	17	23	24	23	22	26	26	28	28	26	26	24	24	22	22	21	19	17	18	20	23	27	30	29	26	24	22	21	22	23	22	18	10
WS_67	19	28	27	25	22	20	16	12	13	16	30	30	31	29	24	21	18	22	21	24	22	22	19	16	14	17	19	23	26	23	22	19	21	22	21	21	20	18	15	13	12
WS_68	21	20	22	23	23	23	20	20	20	23	25	25	22	23	22	21	21	20	22	22	21	20	20	20	22	24	24	23	20	18	17	20	21	20	21	21	21	20	20	19	15
WS_69	29	27	24	21	18	16	15	17	22	25	27	27	27	27	28	29	29	28	24	22	19	18	17	21	23	25	25	25	23	23	23	23	25	24	22	19	17	16	15	17	13
WS_70	28	27	26	22	20	17	18	21	26	27	26	24	23	23	25	26	27	26	25	23	20	19	22	23	22	23	24	23	21	22	26	25	25	23	22	21	19	17	17	18	14
WS_71	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	4	4	4	4	3	3	2	2	2	2	3	4	4	5	6	6	5	5	4	2
WS_72	23	29	26	23	22	23	21	18	16	21	23	25	27	29	27	27	24	23	21	19	19	17	16	17	16	16	21	25	27	27	28	26	28	25	24	21	19	16	17	16	9
WS_73	24	22	19	21	22	23	23	26	24	21	22	26	26	27	29	29	25	20	19	19	19	21	22	23	22	23	23	24	26	29	29	27	23	20	17	19	18	20	19	20	16
WS_74	39	34	29	24	20	19	17	18	20	27	27	26	28	28	30	30	30	29	26	24	21	20	19	18	18	19	19	24	26	27	29	28	26	23	20	19	19	18	17	16	12

WS_75	2	10	29	29	28	25	20	30	31	32	30	26	21	16	11	8	5	4	3	2	2	4	6	8	12	13	18	19	19	17	15	12	9	6	5	4	6	7	15	15	19
WS_76	20	47	48	43	33	29	23	17	13	9	6	4	3	3	5	7	11	12	11	9	10	9	10	10	10	9	8	7	6	7	8	8	8	9	10	10	9	9	9	9	10
WS_77	30	28	25	26	25	22	20	17	15	15	16	17	19	20	22	23	22	24	24	23	21	20	17	19	18	17	16	16	16	17	18	18	19	20	20	21	22	19	20	18	14
WS_78	28	28	29	30	29	30	30	28	25	28	30	29	30	27	28	28	26	27	27	27	28	30	28	28	25	24	24	25	27	25	26	27	26	25	26	27	27	28	26	25	16
WS_79	26	25	26	30	29	30	30	27	24	25	30	30	30	30	28	26	26	24	24	25	27	27	26	23	22	23	24	23	24	25	25	26	27	28	30	28	26	26	24	23	15
WS_80	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	3	4	15	25	27	27	24	20	15	10	7	6	5	4	4	3	4	5	8	11	14	17	16	15	12	7
WS_81	29	43	54	48	41	34	26	20	15	14	12	14	13	12	12	11	11	10	9	9	9	10	10	12	13	17	18	17	16	16	14	14	15	15	15	15	15	14	16	16	12
WS_82	31	22	14	9	6	4	3	3	3	2	2	20	32	32	28	21	15	10	7	5	4	3	3	3	3	3	3	6	9	13	20	20	18	15	12	9	7	5	4	3	1
WS_83	10	22	22	19	15	11	8	5	4	3	3	12	19	19	16	12	9	6	4	5	4	4	4	3	4	4	4	4	5	7	9	8	7	7	5	4	4	4	3	3	2
WS_84	26	25	24	23	22	20	20	22	23	25	26	27	29	30	29	27	26	24	22	21	20	20	20	20	25	27	28	27	27	26	26	26	24	23	23	23	23	23	22	24	16
WS_85	30	28	27	24	24	22	21	23	23	23	24	24	23	21	21	24	25	25	24	24	22	22	20	21	20	21	23	24	21	23	21	18	19	18	21	20	22	20	20	18	12
WS_86	8	12	17	19	22	20	19	16	14	11	9	8	7	6	6	8	10	13	18	21	23	23	21	19	16	16	13	11	9	8	8	10	10	11	13	14	15	16	16	15	13
WS_87	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17	24	24	21	17	13	9	7	9	11	10	9	7	5	4	3	10	12	15	14	12	8
WS_88	27	23	21	20	20	19	21	24	25	26	30	30	29	28	28	27	25	23	23	21	20	22	22	25	27	29	29	29	27	24	21	22	21	21	20	20	20	19	19	19	12
WS_89	25	17	12	8	6	5	5	4	4	4	4	17	35	35	31	24	17	12	8	6	5	5	4	4	4	4	5	9	12	15	19	18	16	13	10	8	7	6	5	5	1
WS_9	42	32	27	27	25	27	25	21	19	15	16	28	30	29	26	29	25	22	29	26	24	26	26	23	20	30	28	27	26	24	25	24	24	25	21	21	24	20	21	18	14
WS_90	19	24	27	28	27	25	26	29	30	30	30	28	26	24	21	20	21	21	23	22	22	22	24	28	28	30	30	29	27	25	25	24	25	25	27	26	25	25	25	27	19
WS_91	23	23	24	28	29	28	29	30	30	28	30	30	29	28	26	26	24	23	24	26	26	26	28	31	29	29	27	26	25	26	27	26	24	25	24	24	25	27	27	27	17
WS_92	2	2	2	2	2	2	2	2	2	14	21	21	19	15	11	15	18	24	28	25	21	16	12	8	6	4	6	11	11	13	14	14	14	16	22	22	20	17	13	10	6
WS_93	10	16	26	37	47	43	36	28	20	14	10	7	5	4	4	3	3	3	3	3	3	6	10	12	15	16	15	12	10	8	6	6	7	7	8	8	10	11	11	14	12
WS_94	18	20	20	23	23	22	23	25	26	25	25	26	23	22	22	19	18	17	18	19	20	21	23	26	27	28	26	24	22	20	21	20	19	19	20	22	22	22	24	26	21
WS_95	8	7	5	6	11	10	10	8	7	6	4	9	11	11	10	8	7	5	4	3	3	3	3	4	4	4	6	7	7	8	10	9	8	7	7	6	5	5	6	7	4
WS_96	23	19	16	14	12	11	14	22	28	28	29	30	30	27	24	21	17	15	14	14	12	13	16	17	19	24	26	26	25	23	22	19	16	15	12	11	13	14	14	16	13

WS_97	15	11	8	5	4	3	3	3	2	2	2	12	21	20	19	17	15	11	9	7	5	4	4	3	3	3	4	8	12	13	16	16	13	11	9	7	5	4	4	3	1
WS_98	15	12	10	8	7	6	4	19	31	30	28	24	20	15	10	8	6	5	4	3	3	4	5	7	8	9	11	15	15	13	13	11	8	9	8	8	8	7	7	6	4
WS_99	2	4	11	10	10	8	6	4	3	2	1	1	1	1	0	0	0	0	0	3	4	5	5	5	4	5	4	4	4	4	3	3	3	2	2	2	2	3	4	5	5

Weyerhaeuser Forest Management Plan

Annex 10: Detailed Timber Supply Review

AUTHOR: Jeremy Hachey

SUBMISION DATE: September 6, 2019

RESUBMISSION DATE: January 25, 2020

2019

WEYERHAEUSER COMPANY LIMITED

GRANDE PRAIRIE TIMBERLANDS

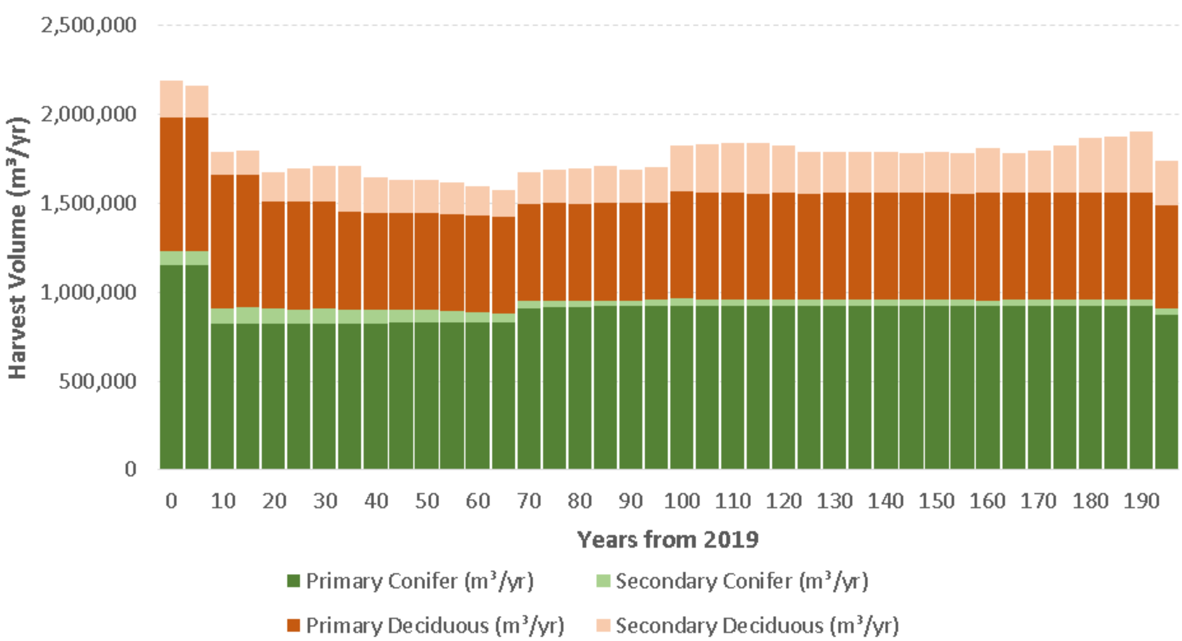
FMA #6900016

Executive Summary

This document describes the timber supply analysis (TSA) conducted as part of the 2019-2029 Forest Management Plan (FMP) developed for the Weyerhaeuser Grande Prairie Forest Management Agreement Area (FMA #6900016). The timber harvest forecast documented here explores several management strategies and associated sustainable rates of harvest over a 200-year planning horizon, while considering both timber and non-timber objectives. Through consultations with the Plan Development Team (PDT), the Public Advisory Group (PAG), and various stakeholder engagement events (documented elsewhere), the management strategy that best fit the desired outcomes was selected as the Preferred Forest Management Strategy (PFMS) for the 2019-2029 FMP. This scenario was used to develop the tactical 20-year Spatial Harvest Sequence (SHS) that guides operational planners in preparing their Forest Harvesting Plans (FMP) during the term of the FMP, assuring consistency with the modelled forecasts.

Implementing the PFMS assumptions resulted in the harvest forecast shown below and is summarized as follows:

- An average primary conifer harvest of 1,150,000 m³/year for the next 10 years of which 550,000 m³/year comes from the caribou range followed by an average of 825,278 m³/year from 10-70 years and then an average of 918,515 m³/year from 70-200 years of which 200,00 m³/year comes from the caribou range.
- An average secondary conifer harvest of 84,841 m³/year for the first 20 years and an overall 200-year average of 49,730 m³/year.
- An average primary deciduous harvest of 750,008 m³/year for the next 20 years followed by an average of 580,956 m³/year for the remaining 180 years.
- An average secondary deciduous harvest of 163,040 for the first 20 years and an overall 200-year average of 220,848 m³/year.



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1. Introduction

This document describes the timber supply analysis (TSA) conducted as part of the 2019-2029 Forest Management Plan (FMP) developed for the Weyerhaeuser Grande Prairie Forest Management Agreement Area #6900016. Many of the assumptions used for this analysis are described in more detail in other components of the FMP. For instance, assumptions for developing the input classified land base are detailed in *Annex IX*, assumptions used to develop predictions of how stands grow and develop are found in *Annex 5,* and the Preferred Forest Management Strategy (PFMS) is described in detail in Chapter 9.

Forest estate modelling was employed to assess timber supply and forecast forest-related indicators over time. Determining a sustainable timber supply involves consideration of a wide range of physical, biological, social, and economic factors that can influence the acceptable rate of timber harvesting within a management unit. The factors encompass both timber and non-timber values found in forests and ensure that timber harvesting objectives are balanced with non-timber objectives (i.e., concerns for wildlife, biodiversity, recreational opportunities, etc.).

The timber harvest forecast documented here explores several management strategies and associated sustainable rates of harvest over a 200-year planning horizon, while considering both timber and non-timber objectives. Through consultations with the Plan Development Team (PDT), the Public Advisory Group (PAG), and various stakeholder engagement events (documented elsewhere), the management strategy that best fit the desired outcomes was selected as the PFMS for the 2019-2029 FMP. This scenario is used to develop the tactical 20-year Spatial Harvest Sequence (SHS) that guides operational foresters in preparing their Forest Harvesting Plans (FMP) during the term of the FMP and will assure consistency with the modelled forecasts.

1.1 Location

This FMP covers a total Defined Forest Area (DFA) of approximately 1.178 million hectares and is defined by a single Forest Management Unit (FMU G16), which includes the Weyerhaeuser Grande Prairie FMA (#6900016), as well as, non-FMA areas within the FMU (Figure 1).

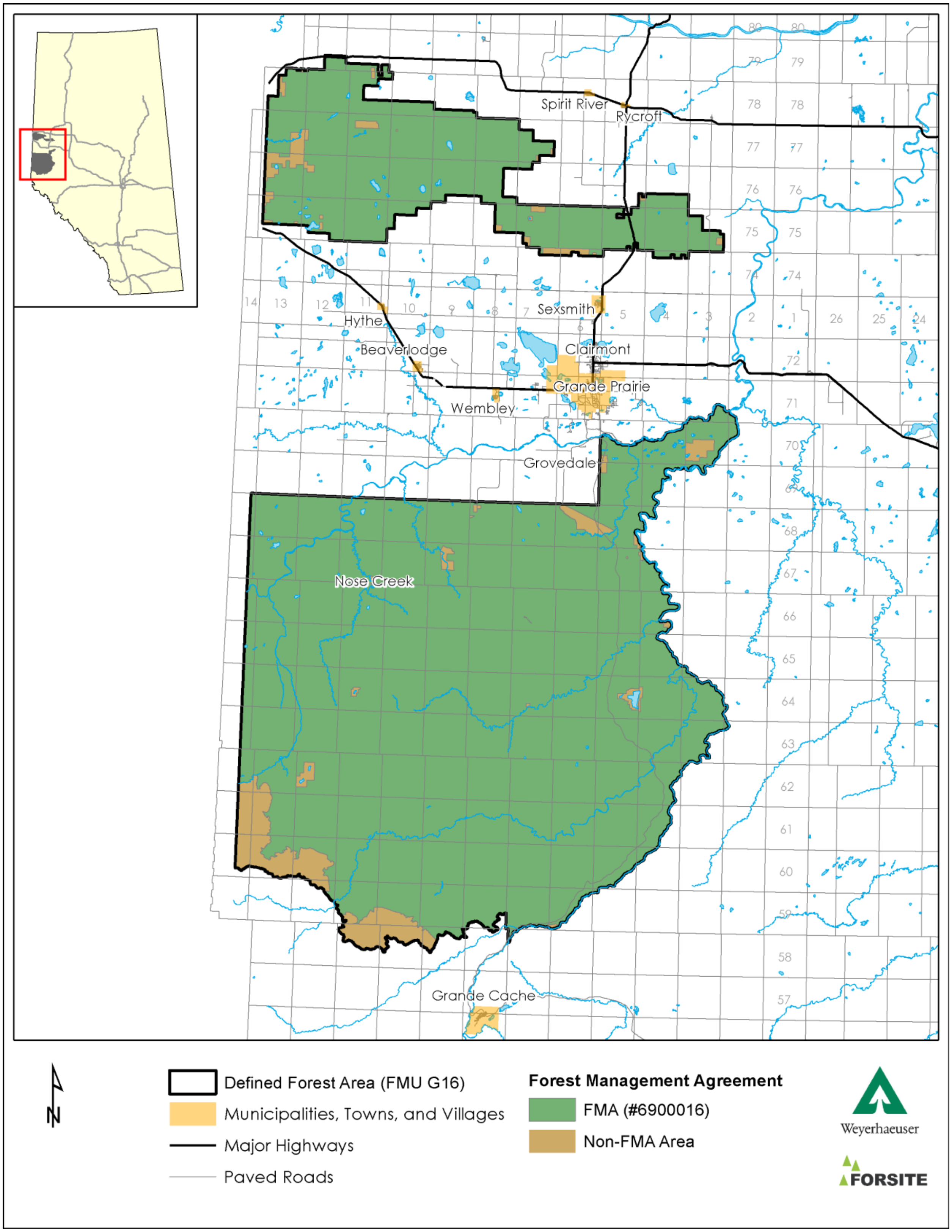


Figure 1 Weyerhaeuser Grande Prairie Defined Forest Area Location Map (FMU G16)

2. Land Base Assumptions Overview

This section and the following two sections provide an overview of the assumptions used to form the base case scenario. This section provides an overview of the outcomes from classifying the land base for the TSA. Five key land base definitions were made:

Gross Classified Land Base: The total area within the DFA.

Net Forested Land Base: The subset of the Gross Classified Land Base that is crown forested land. It is defined by removing all non-forested areas from the total area within the DFA.

Net Classified Forested Land Base: The subset of the Net Forested Land base under forest management purview. It is defined by removing administrative removals where other licensees have rights to specified resources and where timber harvest rights are excluded.

Contributing Net Classified Land Base: This is the subset of the Net Classified Forested Land base where forest harvesting is expected to occur. It is defined by removing riparian buffers, non-merchantable forest types, and other subjective removals where timber harvesting is not expected to occur.

Effective Contributing Net Classified Land Base: This is the effective area contributing to timber supply after aspatial reductions have been applied. In this case, a 4% in-block retention factor was applied and assumed in the TSA to account for operational stand-level retention.

Land base summaries are provided in Table 1, Figure 2, and Figure 3.

Table 1 Classified Land Base Summary

Netdown Reason	Net Area			
	DFA (ha)	Non-FMA / Non-GRL (ha)	Grazing Lease (GRL) (ha)	FMA (ha)
Gross Classified Land Base	**1,178,018**	**49,362**	**11,347**	**1,117,309**
Less Non-Forested	94,423	4,746	2,050	87,628
= Net Forested Land Base	**1,083,594**	**44,616**	**9,297**	**1,029,681**
Less Administrative Removals	48,269	43,113	18	5,137
= Net Classified Forested Land Base	**1,035,326**	**1,503**	**9,278**	**1,024,544**
Less Riparian Buffers	80,518	180	600	79,738
Less Non-Merchantable	104,120	170	1,054	102,896
Less Subjective	16,499	6	213	16,281
less Productive Area within Seismic Lines	8,026	22	138	7,866
= Contributing Net Classified Land Base	**826,163**	**1,126**	**7,273**	**817,764**
Contributing Land base by Broad Cover Group				
1. Pure Conifer (CX)	432,330	100	651	431,579
2. Conifer Leading (CD)	61,787	35	287	61,465
3. Deciduous Leading (DC)	52,385	104	302	51,979
4. Pure Deciduous (DX)	236,275	705	6,033	229,538
5. 'Switch' Stands (D_US)	43,385	182	0	43,203
less aspatial removals	**33,047**	**45**	**291**	**32,711**
= Effective Contributing Net Classified Land Base	**793,117**	**1,081**	**6,983**	**785,053**

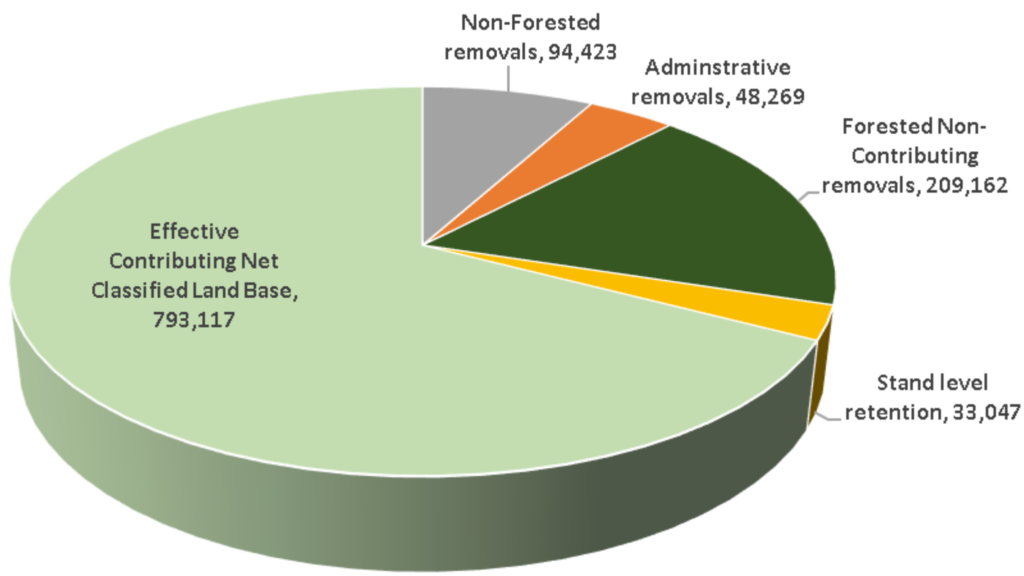


Figure 2 Classified Land Base Summary

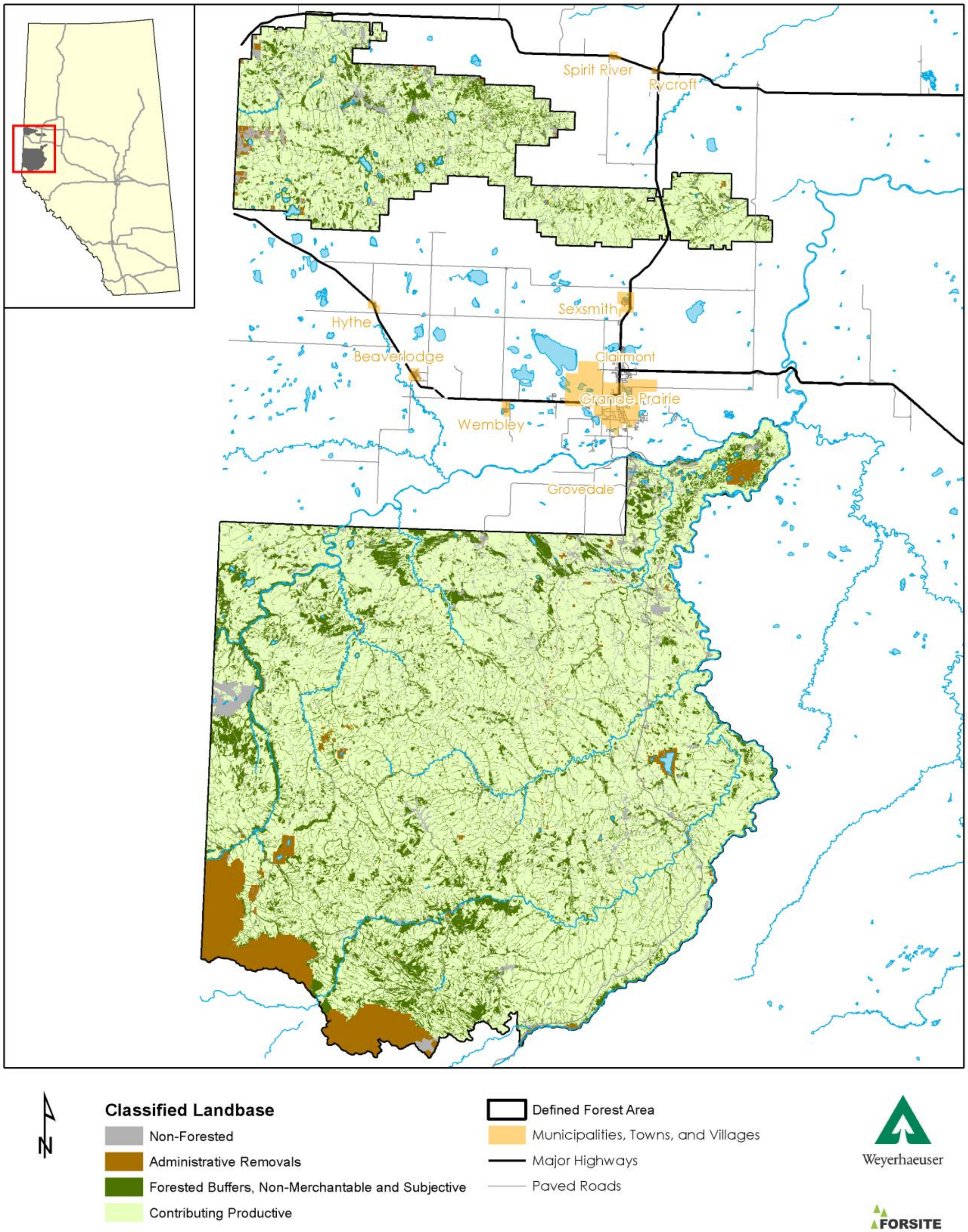


Figure 3 Classified Land base Overview Map

3. Growth and Yield Assumptions Overview

3.1 Yield Curve Development

Weyerhaeuser Company Ltd. developed 38 new yield curves for this FMP. The yield curve development process was based on permanent sample plots from natural fire-origin and pre-1991 managed stands and Reforestation Standard of Alberta (RSA) performance survey data collected across the defined forest area. Gross merchantable volumes were compiled to 10 cm top diameter inside bark and 15 cm minimum stump diameter at 15 cm stump height for the FMA baseline utilization of both deciduous and conifer species groups. Adjustment for stand decline on the deciduous stand component was implemented using an age-based mortality constant. Cull and stand retention were not accounted for during the yield curve development but were instead applied as yield reduction factors in the model.

Weyerhaeuser identified three main groups of stands within the net land base for yield curve development:

Natural stands (NAT): includes all fire-origin stands. Modelling was based on GYPSY in semi-empirical fashion whereby observed top height and basal area were used to constrain model projections using natural stand PSPs. Strata were based on the AVI polygon.

Pre-1991 managed stands (M91): includes all openings that were harvested prior to March 1, 1991. Modelling was based on GYPSY in semi-empirical fashion whereby observed top height and basal area were used to constrain model projections using pre-1991 managed stand PSPs. Any yield strata with insufficient number of plots were defaulted to the respective natural stand yield curve. Strata were based on the AVI polygon.

Post-1991 managed stands (MGD): represents all existing openings that were harvested on or after March 1, 1991. Stand-level modelling was based on Alberta's Growth and Yield Projection System (GYPSY) projection of RSA performance survey data. The projections were averaged by yield strata using the proper sample weights by RSA program year and population areas, as per RSA protocols. Alberta Vegetation Inventory (AVI) attributes were used for stratifying openings harvested prior to March 1, 1995 based on the AVI polygon. Strata were based on the RSA strata at the sampling unit (SU) level for all surveyed openings. Silviculture declaration and treatment information from the Alberta Regeneration Information System (ARIS) were used to stratify the rest of the blocks at the opening-level.

Weyerhaeuser also developed tree improvement (genetic) yield curves for Regions B1 and B2 lodgepole pine and Region G1 white spruce to reflect yield increases resulting from the deployment of genetically improved seed stock from controlled parentage programs.

Table 2 provides a summary of the contributing land base by yield strata. See Annex V: Yield Curve Development for further details on the yield curve development.

Table 2 Yield Stratification Summary

Yield Type	Yield Strata	Yield Strata Description	DFA (ha)	FMA (ha)	Non-FMA / Non-GRL (ha)	GRL (ha)
Natural Stands	D_AB	Pure Deciduous with A or B Density (ESRD 1)	50,974	49,335	169	1,470
	D_CD	Pure Deciduous with C or D Density (ESRD 1)	134,200	129,520	455	4,225
	D_US	Pure Deciduous Overstory managed for Understory	38,051	37,869	182	0
	DC_PL	Hardwood with Pine (ESRD 2)	7,825	7,825	0	0
	DC_SX	Hardwood with Spruce (ESRD 3)	38,901	38,495	104	302
	CD_SX	White Spruce or Black Spruce with Hardwood (ESRD 4,6)	34,868	34,555	30	283
	CD_PL	Pine with Hardwood (ESRD 5)	10,380	10,371	5	4
	C_SW_AB	Pure White Spruce (>= 80%) with A or B Density (ESRD Base 7)	58,501	58,125	25	351
	C_SW_CD	Pure White Spruce (>= 80%) with C or D Density (ESRD Base 8)	17,302	17,247	6	49
	C_SWOC	White Spruce Leading (<=80%) (ESRD Base 8)	35,005	34,857	8	140
	C_PL_AB	Pure Pine (>= 80%) with A or B Density (ESRD Base 8)	33,897	33,894	3	0
	C_PL_CD	Pure Pine (>= 80%) with C or D Density (ESRD Base 8)	56,958	56,954	3	0
	C_PLOC	Pine leading (< 80%) (ESRD Base 8)	68,894	68,885	8	0
	C_SB	Black Spruce pure or leading (ESRD Base 9)	15,291	15,135	46	111
		Sub-Total	**601,049**	**593,068**	**1,046**	**6,936**
Managed Stands Established Prior to March 1, 1991	PL	Pure Pine or pine leading (ESRD 8)	21,742	21,742	0	0
	SW	Pure White Spruce or leading (ESRD 7)	3,705	3,705	0	0
	CD_PL	Mixed Pine (ESRD 5)	4,115	4,115	0	0
	DC_PL	Mixed Pine (ESRD 2)	1,817	1,817	0	0
	CD_SX	Mixed Spruce (ESRD 4 or 6)	1,924	1,924	0	0
	DC_SX	Mixed Spruce (ESRD 3)	1,415	1,415	0	0
	D_AB	Pure Deciduous with A or B Density (ESRD 1)	7,745	7,745	0	0
	D_CD	Pure Deciduous with C or D Density (ESRD 1)	4,836	4,836	0	0
	D_US	Pure Deciduous Overstory managed for Understory	5,334	5,334	0	0
	C_SB	Pure Black Spruce or leading (ESRD 9)	240	240	0	0
		Sub-Total	**52,873**	**52,873**	**0**	**0**
Managed Stands Established After March 1, 1991	Hw	Pure deciduous in RSA SUs	86	86	0	0
	HwPl	ARIS DC declared - HwPl block or HwPl RSA SU	795	795	0	0
	HwSx	ARIS DC declared - HwSx block or HwSx RSA SU	1,632	1,632	0	0
	PlHw	ARIS CD declared - PlHw block or PlHw RSA SU	2,294	2,294	0	0
	SwHw	ARIS CD declared - SwHw block or SwHw RSA SU	8,207	8,207	0	0
	Pl	ARIS C declared - Pl block or Pl RSA SU	74,740	74,740	0	0
	Sw	ARIS C declared - Sw block or Sw RSA SU	19,021	19,021	0	0
	C_SB	ARIS C declared - Sb or ESRD Base 9	1,024	1,024	0	0
	D_CD	ARIS D declared blocks	38,434	38,015	80	338
	PL_G147p1	ARIS C declared - Pl block or Pl RSA SU identified as genetic	21,329	21,329	0	0
	SW_G351p1	ARIS C declared - Sw block or Sw RSA SU identified as genetic	4,679	4,679	0	0
		Sub-Total	**172,241**	**171,823**	**80**	**338**
		Grand Total	**826,163**	**817,764**	**1,126**	**7,273**

3.2 Operability Windows

In the forest estate model, the earliest age that a stand is considered eligible for a management action is defined as the minimum harvest age. The minimum harvest age was assigned based on a minimum volume threshold, as well as, a default minimum age of 70 years for conifer-leading yield strata, and 60 years for deciduous-leading yield strata (Table 3). These default minimum harvest ages were assigned if the minimum harvest volume threshold was reached prior to these respective default minimum ages. The default minimum ages were submitted to GoA for consideration on September 27, 2018 (TSA-0004). In addition to these minimum harvest ages, stands with inventory heights <14 m were deferred from harvest for the first 20 years of the planning horizon. Both the minimum harvest age and minimum height criteria were ignored for pre-blocked harvest areas.

Table 3 Minimum Harvest Ages by yield group

Yield Type	Yield Group	Culmination MAI Age	Minimum Volume Criteria (m^3/ha)	Volume Component Assessed	Age at Which Min. Vol is achieved	Minimum Harvest Age
NAT	CD_PL	90	125	Conifer	76	**76**
NAT	C_PLOC	105	100	Conifer	63	**70**
NAT	CD_SX	125	125	Conifer	108	**108**
NAT	C_SWOC	125	100	Conifer	77	**77**
NAT	C_SW_AB	90	100	Conifer	59	**70**
NAT	D_AB	75	125	Deciduous	55	**60**
NAT	C_SW_CD	90	100	Conifer	59	**70**
NAT	D_US2	180	125	Conifer	128	**128**
NAT	C_PL_AB	90	100	Conifer	59	**70**
NAT	C_PL_CD	110	100	Conifer	66	**70**
NAT	D_US	130	125	Conifer	158	**158**
NAT	DC_PL	90	125	Conifer	76	**76**
NAT	DC_SX	115	125	Conifer	117	**117**
NAT	D_CD	75	125	Deciduous	53	**60**
NAT	C_SB	180	100	Conifer	109	**109**
M91	CD_PL	90	125	Conifer	76	**76**
M91	CD_SX	125	125	Conifer	108	**108**
M91	SW	90	150	Conifer	78	**78**
M91	D_CD	75	125	Deciduous	53	**60**
M91	DC_SX	115	125	Conifer	117	**117**
M91	D_US	130	125	Conifer	158	**158**
M91	C_SB	180	150	Conifer	140	**140**
M91	D_AB	75	125	Deciduous	55	**60**
M91	DC_PL	90	125	Conifer	76	**76**
M91	PL	95	150	Conifer	62	**70**
MGD	HwSx	105	150	Conifer	82	**82**
MGD	PlHw	95	150	Conifer	67	**70**
MGD	Sw	105	150	Conifer	68	**70**
MGD	Hw	80	125	Deciduous	60	**60**
MGD	D_CD	75	125	Deciduous	53	**60**
MGD	SwHw	100	150	Conifer	71	**71**
MGD	Sb	180	150	Conifer	140	**140**
MGD	HwPl	100	150	Conifer	80	**80**
MGD	Pl	95	150	Conifer	63	**70**

Yield Type	Yield Group	Culmination MAI Age	Minimum Volume Criteria (m^3/ha)	Volume Component Assessed	Age at Which Min. Vol is achieved	Minimum Harvest Age
MGD	C_SB	180	150	Conifer	140	**140**
MGD	PL_G147p1	95	150	Conifer	62	**70**
MGD	PL_G147p2	95	150	Conifer	61	**70**
MGD	PL_G303	95	150	Conifer	62	**70**
MGD	SW_G351p2	105	150	Conifer	67	**70**
MGD	SW_G351p1	105	150	Conifer	67	**70**
MGD	PL_G804	95	150	Conifer	60	**70**

3.3 Transition Assumptions

Transition assumptions describe how stands regenerate in the forest estate model after a harvest treatment is applied (Table 4). All harvest treatments result in transitions back to the same broad cover group, except for deciduous-dominated mixedwoods (DC) that transition to conifer-dominated mixedwoods (CD). Only pure pine and pure spruce stands are eligible for regeneration with improved seed and is further constrained geographically for identified breeding regions (See Section 3.6 for more detail on improved seed deployment).

Table 4 Transition Assumptions

Yield Type		Current Yield Group	Net Area (ha)	Net Area (%)	Regenerate To Basic	Regenerate To Genetic
NATURAL	NAT	D_AB	51,386	6.2	D_CD	
	NAT	D_CD	134,420	16.2	D_CD	
	NAT	D_US	38,398	4.6	SwHw	
	NAT	DC_PL	7,943	1.0	PlHw	
	NAT	DC_SX	39,042	4.7	SwHw	
	NAT	CD_SX	35,071	4.2	SwHw	
	NAT	CD_PL	10,634	1.3	PlHw	
	NAT	C_SW_AB	58,800	7.1	Sw	Sw_G351p2
	NAT	C_SW_CD	17,495	2.1	Sw	Sw_G351p2
	NAT	C_SWOC	35,795	4.3	Sw	Sw_G351p2
	NAT	C_PL_AB	34,320	4.1	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_PL_CD	57,348	6.9	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_PLOC	69,546	8.4	Pl	Pl_G147p2, Pl_G804, Pl_G303
	NAT	C_SB	17,023	2.1	C_SB	
PRE-1991 MANAGED	M91	PL	21,779	2.6	Pl	Pl_G147p2, Pl_G804, Pl_G303
	M91	SW	3,699	0.4	Sw	Sw_G351p2
	M91	CD_PL/DC_PL	5,929	0.7	PlHw	
	M91	CD_SX/DC_SX	3,331	0.4	SwHw	
	M91	D_AB	7,747	0.9	D_CD	
	M91	D_CD	4,844	0.6	D_CD	
	M91	D_US	5,366	0.6	SwHw	
	M91	C_SB	240	0.0	C_SB	
POST-1991 MANAGED	MGD	Hw	86	0.0	D_CD	
	MGD	HwPl	719	0.1	PlHw	
	MGD	HwSx	1,566	0.2	SwHw	
	MGD	PlHw	5,974	0.7	PlHw	
	MGD	SwHw	4,565	0.6	SwHw	
	MGD	Pl	73,864	8.9	Pl	Pl_G147p2, Pl_G804, Pl_G303
	MGD	Sw	18,715	2.3	Sw	Sw_G351p2
	MGD	Sb	24	0.0	C_SB	
	MGD	C_SB	972	0.1	C_SB	
	MGD	D_CD	41,393	5.0	D_CD	
	MGD	Pl_G147p1	17,398	2.1		Pl_G147p2, Pl_G804
	MGD	Sw_G351p1	4,402	0.5		Sw_G351p2

Genetic:

Tree Improvement, genetic stock planted in the B1, B2 (Pl) or G1(Sw) seed zones in Weyerhaeuser openings. Must be conifer declared openings based on caps and deployment schedules in the TSA.

3.4 Successional Pathways and Breakup ages

Successional pathways define a stand's development following its breakup age. Stand breakup ages were assigned at 200 years for deciduous-leading yield strata and 300 years for coniferous-leading strata. Once a stand reaches its breakup age, it was assumed to undergo succession and regenerate to its natural stand counterpart with a reset age of zero. These succession rules were not applied to the classified non-contributing forest where stands continued to age and contribute to non-timber targets (i.e., barred owl, grizzly bear, seral).

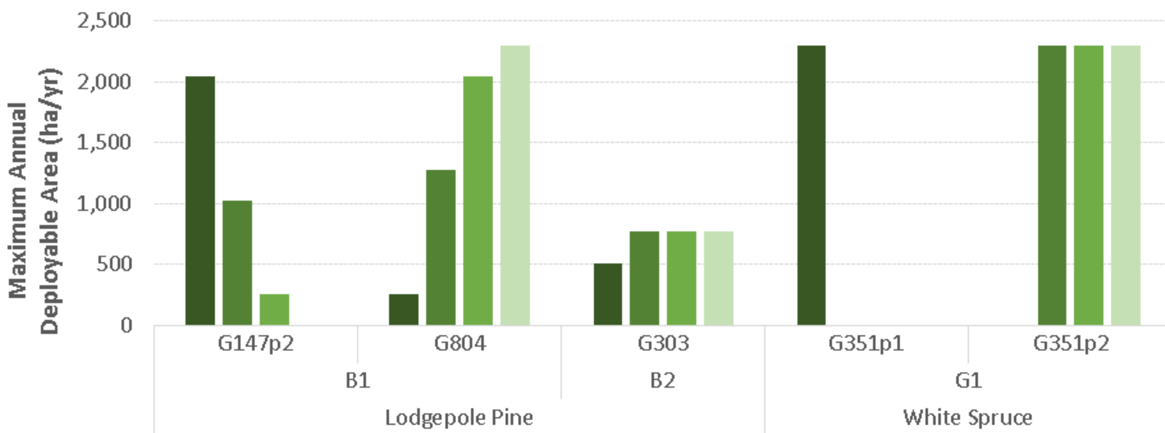
3.5 Regeneration Delay

A two-year regeneration delay was modelled after all harvest treatments.

3.6 Improved Seed

Weyerhaeuser developed tree improvement (genetic) yield curves for Region B lodgepole pine (B1 & B2) and Region G white spruce (G1), which reflected yield increases resulting from the deployment of improved seed from controlled parentage programs (CPP). White spruce genetic curves were applied to future harvested stands located in the G1 breeding region in the Sw regeneration stratum and lodgepole pine genetic curves were applied to future harvested stands located in the B1 and B2 breeding regions in the Pl regenerating stratum – subject to seed availability and deployment schedules. For the baseline scenario, maximum genetic deployment targets were controlled in the model using treatment type accounts according to the seed availability forecasts (Figure 4).

See Annex 5 and Chapter 6 for more detail on improved yield curves and seed availability forecasts, respectively.



	G147p2	G804	G303	G351p1	G351p2
2019-2024	2,041	255	510	2,296	0
2024-2029	1,020	1,276	765	0	2,296
2034-2219	255	2,041	765	0	2,296
2034-2219	0	2,296	765	0	2,296

■ 2019-2024 ■ 2024-2029 ■ 2034-2219 ■ 2034-2219

Figure 4 Maximum Annual Improved seed deployable area (ha/year)

4. Management Assumptions

4.1 Objectives for Timber Values

4.1.1 Harvest Flow objectives

The Alberta Forest Planning Standard (ABFPS) Section 5.8Aii specifies a change tolerance for the harvest flow over the 200-year planning horizon of +/- 5%, with exceptions for accelerated harvesting. Rather than first generating an even flow (0% change between periods), the model allows for up to 5% change from the last period (taken as the average) using a flow ratio account (Patchworks functionality), whereby every period is compared against the last period and setting the tolerance to +/- 5%, with the exception of the first decade. Due to the significant curtailment of coniferous harvest within the caribou range (see Section 4.2.1), the base case scenario utilized two flow control period ranges to control the harvest flow of primary softwood: a) 0-10 years (first two periods), and b) 10-200 years. The last period in each range was used to compare the change (i.e., Patchworks PIN file as evenacclSwd = new FlowSpec().even(2,3,3).even(4,41,41)).

Since very little primary deciduous stands exist within the caribou range, the base case scenario only utilized one flow control period for the entire planning horizon (i.e., even = new FlowSpec().even(2,41,41)). For the first 10-year period, primary conifer harvest targets were set at 1,150,000 m^3/year and afterwards set at the calculated Long-Run Sustainable Yield (LRSY - see Section 5 for LRSY calculation). Primary deciduous targets were set at the calculated LRSY for primary deciduous.

4.1.2 Non-Declining growing stock constraints

To promote long-term sustainability, the forest estate model was configured to maintain a stable operable primary coniferous and deciduous operable growing stock over the last 50 years of the planning horizon. This constraint was applied in all modelled scenarios presented in this report. Depending on the scenario, the relative weighting of this target had to be adjusted.

4.2 Objectives for Non-Timber Values

This section summarizes all non-timber values and objectives actively managed within the forest estate model.

4.2.1 Woodland Caribou

Management of Woodland Caribou habitat is primarily achieved through access timing constraints applied to spatial access units over the first century of the 200-year planning horizon, plus maximum allowable harvest rates within the caribou range. Provincial Caribou Range planning and GoA direction supports an allowable harvest of 550,000 m^3/year from within the CMZ over the first 10 years, followed by rate of 200,000 m^3/year.

Overarching management objectives within the caribou range are to maintain large tracks of undisturbed habitat and, where harvesting is allowed, to create large aggregated harvest openings. These large openings will create and foster future large tracks of habitat for the caribou. Weyerhaeuser identified “Priority 1” caribou access units with approximately 5.5 million m^3 of softwood over the next 10 years but since harvest operability is still uncertain within these units, additional ones were identified as “Priority 2 Reserves”. Weyerhaeuser will focus on creating aggregated harvest within the Priority 1 Access Units for the first decade. If shortfalls exist within these due to operational bypass, the identified Priority 2 Reserve Access Units can be accessed within the first decade only. These “reserves” were treated as harvested for assessing non-timber metrics (i.e., Grizzly bear, marten, songbirds, barred owl, and watershed disturbance) but the extra volume available in these units was not included in the reported harvest flows because Weyerhaeuser is limited to harvesting up to 5.5 million m^3 of softwood over the first decade.

Access to the units within Caribou Range was controlled in the model using access timing constraints, which designated priority 1 (green) and priority 2 reserves (yellow) for the first decade and the sequence for remaining access units over the first century of the planning horizon (Figure 5). In this analysis, access was not controlled after the first century (i.e., harvest could occur anywhere within the caribou range), but the harvest limit of 200,000 m³/year remained active.

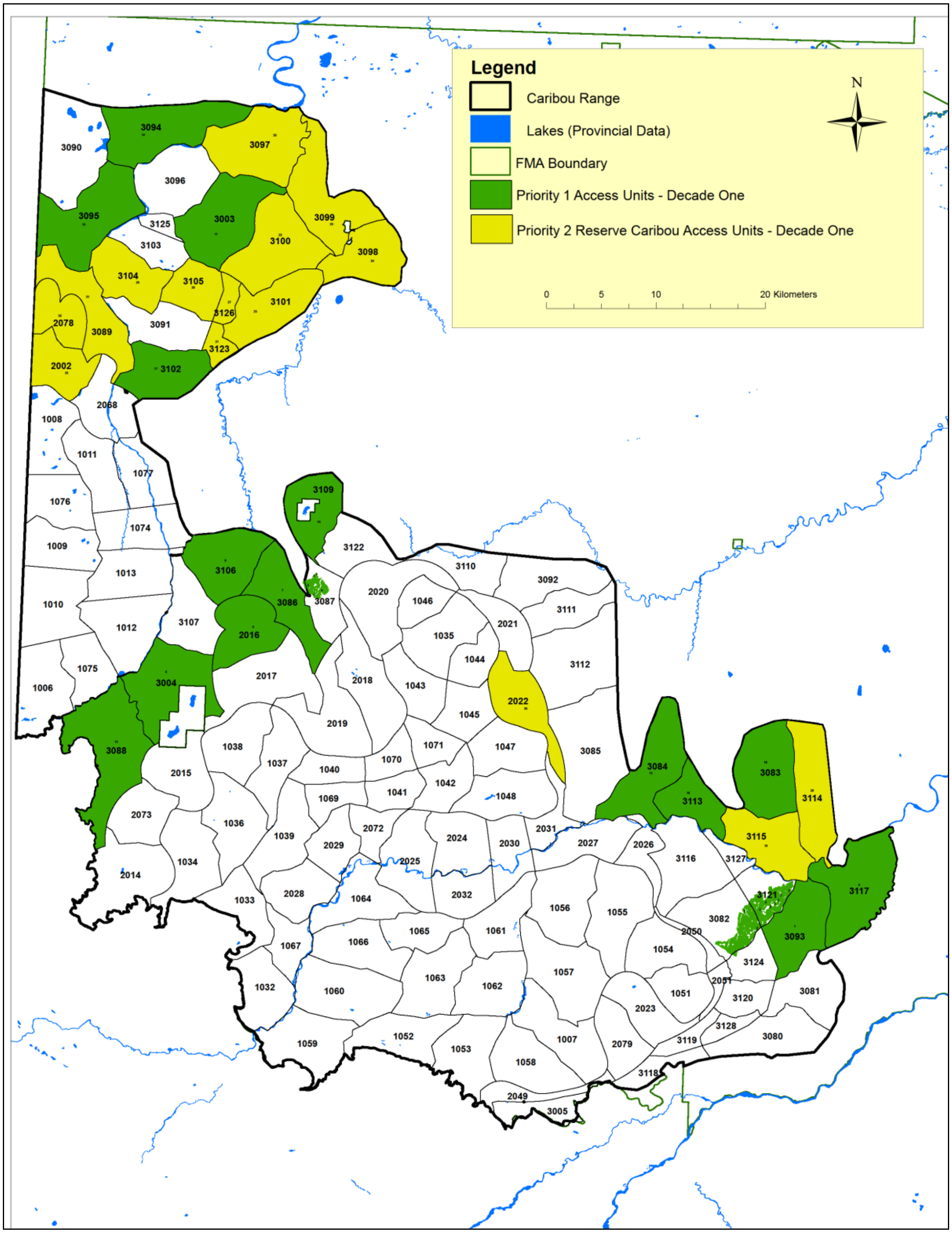


Figure 5 Caribou Range Access Plan

4.2.2 Seral Retention (Objective 1.1.1.1)

Managing landscape-level biodiversity was achieved by retaining targeted amounts of seral representation for five distinct forest cover classes. Accounts and features were configured in the forest estate model to dynamically track:

- the area of classified and contributing forest in seral states (young seral (<20 years), mature seral (80-120 years), old (> 120 years), and very old (> 180 years)),
- for each of the five cover classes: Pine-dominated conifer (Cx-Pl), Spruce-dominated conifer (Cx-Sw), other-conifer dominated (Cx-Sb/Lt/Fd), mixedwood-dominated (MW), deciduous-dominated mixedwood (DC), and deciduous-dominated stands (Dx).

Targets were set for both the contributing net land base and the total classified forested land base (Table 5).

Table 5 Active Seral Targets for Contributing and Classified Land Base by Cover Class and Seral Stage

Cover Class	Contributing			Classified		
	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)	Maximum Young Target (%)	Minimum Mature Target (%)	Minimum Old+Very Old Target (%)
Pine-dominated conifer (CxPl)	46	2.5	16.5	31	4	18
Spruce-dominated conifer (CxSw)	37	2	7.5	27.5	3.5	26
Other Conifer Dominated (Cx-Sb/Lt/Fd)	46	1.5	15	9	1	35.5
Mixedwood stands (MW)	46.5	1.5	3.5	40	3	13.5
Deciduous Dominated (DX)	38.5	1.5	3.5	31.5	2.5	3.5

4.2.3 Patch Size (Objective 1.1.1.2a)

A patch is defined as a forest stand in the same seral stage that is not split by a linear feature greater than 8m wide. The Values, Objectives, Indicators and Targets (VOITs) table specified targets for five patch size classes (Table 6). To actively control patch size distribution in the TSA, a patch account was created in the forest estate model for young seral class (<20 years old) and a topology distance of 8m.

Table 6 Young Seral Patch Size Targets

Patch Size Class	Target
0-5 ha	Maximum of 5%
6-19 ha	Maximum of 20%
20-99 ha	Maximum of 50%
100-250 ha	Minimum of 15%
>250 ha	Minimum of 10%

4.2.4 Stand-Level Retention (Objective 1.1.2.1)

Managing stand-level biodiversity was achieved by retaining stand structure within harvested openings. Mapped insular retention areas were deferred from harvesting in the forest estate model for 60 years using a timing constraints file (see section 6.3 in Annex 4, Classified Land Base document). Built-in retention functionality was also used to apply a 4% aspatial stand-level retention factor (reflected in the netdown table). This allowed the stand-level retention to contribute to landscape-level targets (i.e., seral targets for the classified land base).

4.2.5 Watersheds / Fisheries (Objective 1.1.2.1e / 3.2.1.1)

A watershed assessment was required under the ABFMPS in the timber supply analysis section (Section 5.9.13) and VOIT Objectives 1.1.2.1e and 3.2.1.1. The purpose of watershed assessment was to:

- Determine the potential for water yield increases that would result from forest harvesting
- Use Equivalent Clearcut Area (ECA) as a measure of disturbance and an indicator of potential water yield increase.
- Constrain, using timber supply analysis, forestry operations to minimize the potential for adverse changes in water yields.

Hydrologic recovery curves and coefficients developed by GoA were incorporated into the forest estate model to track and control ECAs. Current permanent anthropogenic disturbance outside the classified forest was calculated for each watershed and added to the ECA values reported in the model – for only the classified forest.

4.3 Reporting Non-Timber Values

This section summarizes how reporting was conducted for objectives that were not actively controlled within the forest estate model.

4.3.1 Old Interior Forest (Objective 1.1.1.2b)

Interior forest is defined as a forested area, greater than 100 hectares in size, located beyond edge effect buffer zone along a forest edge, and not split by a linear feature greater than 8m wide. The edge effect buffer zone is:

- 60m where adjacent stands are non-forested or <40 years old,
- 30 m where adjacent forest is >= 40 years and less than mature seral age definition (80 year), and
- 0 m where the adjacent forest is mature or older (>80 years).

This metric is not dynamically tracked within the forest estate model but assessed through a post-processing exercise using a python script at 0, 10, 20, and 50 years.

4.3.2 American Marten (Objective 1.1.2.1c)

Marten Habitat Suitability Index is a numerical value that represents the capacity of a given habitat to support Marten; in this case, winter habitat (cover and foraging). Higher values mean that the habitat can support more Marten. The GoA provided methodology (Appendix H of Non-Timber Assessments in Forest Management Planning) for developing marten HSI curves that were used to dynamically track and report habitat suitability indices directly in the forest estate model. The methodology requires age-to-height curves to be converted into marten HSI-age curves using the following formula:

$$HSI = S4 * \sqrt{S1 * S2 * S3}$$

Where:

- S1 is a value between 0 and 1 assigned based on percent tree canopy closure
- S2 is a value between 0 and 1 assigned based on percent spruce + fir in the tree canopy
- S3 is a value between 0 and 1 assigned based on tree canopy height
- S4 is a value between 0 and 1 assigned based on percent pine + spruce + fir in the tree canopy

These relationships are depicted graphically in Figure 6. HSI calculations result in values between 0 and 1 (inclusive) depending on the four variables above.

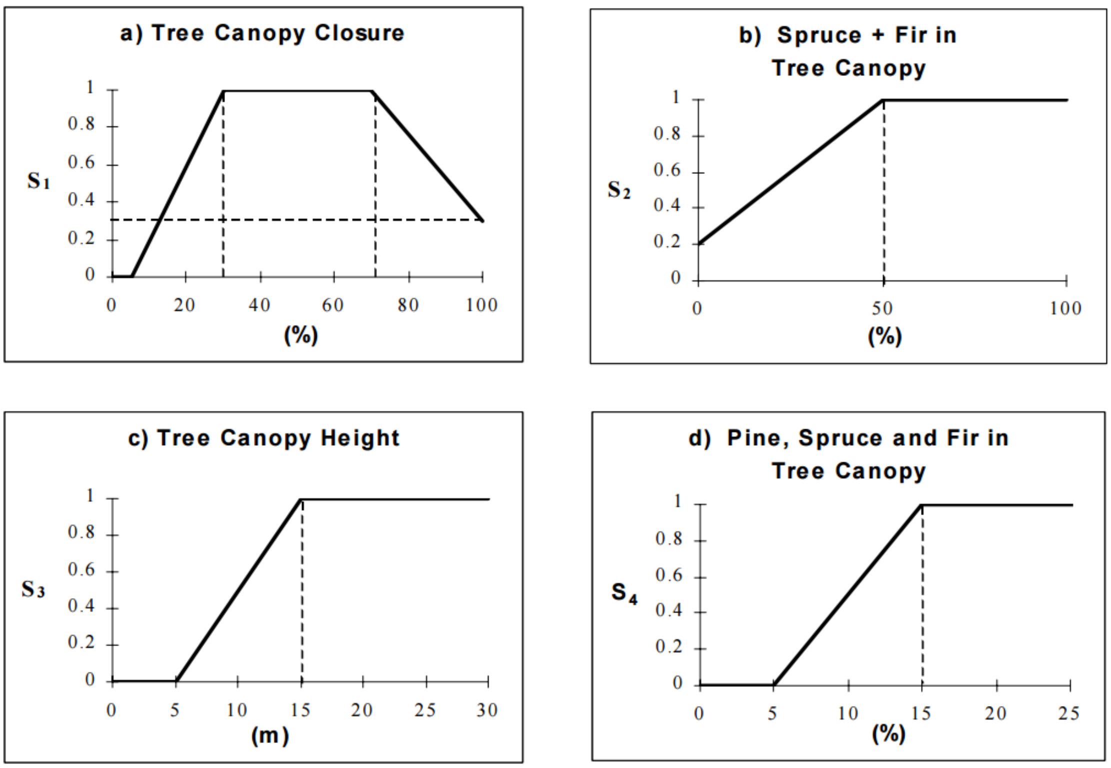


Figure 6 Relationships between habitat variables and HSI components in the marten model (Takats et al. 1999[1])

4.3.3 Songbirds (Objective 1.1.2.1d)

The GoA provided songbird Resource Availability (RA) values (RA to Age curves) that were integrated directly into the forest estate model for five songbird species commonly found in Alberta: Canada Warbler, Brown Creeper, Black-Throated Green Warbler, Ovenbird, and Varied Thrush. The curves were mapped to the company-specific yield curve strata (option 2 of step 3 of Appendix F in the document “Non-timber Assessments in Forest Management Planning”). Stand-level RA values were normalized by the polygon areas to generate RA map snapshots that resemble the raster output from the provided snapshot tools.

[1] Takats, L, Stewart, R., Todd, M., Bonar, R., Beck, J., Beck, B., Quinlan, R., 1999. American Marten: Habitat Suitability Index Model v5. Edmonton, AB

4.3.4 Grizzly Bear (Objective 1.2.1.1a)

The Foothills Research Institute (fRI) Grizzly Bear Research Program produced a package that included, among other models, the 2018 Habitat States Model. This model was used to generate current habitat metrics for Grizzly Bear within the FMU G16, involving a combination of the Grizzly Resource Selection Function (RSF) and mortality risk models. Positive values generated identify potential sources of primary and secondary habitat, while negative values indicate potential sinks (i.e., areas where mortality risks are greater). A zero value identifies non-critical habitat.

This habitat model was applied to the area intersecting the Grizzly Bear zone and the DFA and the Grande Cache population was selected to ensure the appropriate coefficients were used. Since the inventory surface available was current only to 2018, recent cutblocks were used to reflect harvesting since 2018 and an age of 1 year was then assigned for the current snapshot to forecast crown closure attributes for regenerating cutblocks. No other optional user inputs were used (i.e., New pipelines, new roads, reclaimed roads, and deletions).

The spatial harvest sequence was used as development inputs for future scenarios at various time periods (0, 10, and 20 years) along with their respective start years (1, 11, 21 years for 2019, 2029, and 2039).

4.3.5 Barred Owl (Objective 1.1.2.1c)

The GoA provided a Resource Selection Function (RSF) model developed for barred owl[2] that produces habitat metrics (value) proportional to the probability of use for each resource unit. Barred owl are more likely found in areas with higher values. The model required five variables to determine the habitat suitability metric, as described below:

MODEL = Exp((0.442 * [UPSW]) - (.057 * [UPSW] * [UPSW]) + (0.408 * [HW]) - ([HW] * [HW] * 0.028) + (0.222 * Ln([ATOP] + 1)) + (0.152 * Ln([DISTOPEN] + 1)) - (0.104 * Ln([DISTOLD] + 1)) - 3.862)

Where:

- UPSW - Proportion of upland softwood within 150m (multi-stand)
- HW - Proportion of hardwood within 150m (multi-stand)
- ATOP - Area to perimeter ratio of all contiguous older stands (>30 years old)
- DISTOPEN – Euclidean distance to nearest patch <30 years old
- DISTOLD – Distance to nearest stand older than 89 years

The GoA has not yet developed its approach for incorporating barred Owl RSF tracking directly in a forest estate model. The Barred Owl Model uses spatial analyst tools to create proximity metrics (Euclidian Distance) and raster features to calculate relative habitat importance. These distance metrics cannot be easily calculated dynamically within a forest estate model so for now, the only way to assess barred owl habitat changes over time is to conduct future 'snapshots' using projected growth and disturbance features. The Foothills coefficients were used to run these future snapshots at 0, 10, 20, 50, 100, 150, and 200 years, using age attribute tables produced by the model and linked to the original input planning file.

4.4 Wildfire Risk

The GoA prepared a wildfire threat assessment for FMU G16 in April 2019 aimed to create a landscape that minimizes catastrophic fires. This assessment produced spring, summer, and fall fire behaviour potential (GIS raster features) that was incorporated into the modelling land base using GIS zonal statistics. A single fire behaviour value was calculated for each stand using the maximum mean fire behaviour potential from all three seasons. If the consolidated maximum mean fire behaviour potential for all three seasons was greater than 30.5, the stand was identified as a high fire behaviour potential and prioritized for harvest in the first 10 years of the

[2] Russell, M.S. 2008. Habitat selection of barred owls (*Strix varia*) across multiple spatial scales in a boreal agricultural landscape in north-central Alberta. MSc Thesis. University of Alberta (Canada)

planning horizon. In addition, Norbord's planned FireSmart blocks were prioritized for harvesting to reduce wildfire risk.

4.5 Forest Health

The Mountain Pine Beetle (MPB) - the dominant forest health concern of the last FMP - has largely run its course in the DFA. Harvesting over the past decade has been concentrated in susceptible pine-leading stands. Stands severely impacted by the MPB and not subsequently harvested were removed from the contributing land base.

More recently, forest health overview information provided by GoA showed significant mortality with trembling aspen. This information was integrated into the classified land base and used to develop a group summary account that was subsequently used to target harvesting within these aspen mortality zones over the first 10 years of the planning horizon.

4.6 Incorporating Public and First Nations Consultation Feedback

Local public and First Nations were provided opportunities to review interim spatial harvest sequence plans and provide feedback throughout the development phase of this FMP. From the feedback received through this process, Weyerhaeuser agreed to defer harvest on three specific areas for the next 20 years. These areas were incorporated into the model's timing constraints file to make them unavailable to the scheduler for the duration of the SHS (i.e., 20 years).

5. Long-Run Sustained Yield (LRSY) Calculation

The Long Run Sustained Yield (LRSY) calculated for the DFA is provided in Table 7, while Table 8 shows the LRSY calculation for the FMA only.

Table 7 Long-Run Sustained Yield Calculation for FMU G16

Yield Group	Max Conifer MAI (m^3/ha/year)	Max Deciduous MAI (m^3/ha/year)	Contributing Area (ha)	Primary Conifer LRSY (m^3/year)	Primary Deciduous LRSY (m^3/year)
C_SB	1.1100	0.0300	15,894	17,642	0
D_CD	0.2600	2.9635	226,824	0	672,194
Pl	3.2680	0.4883	266,458	870,783	0
PlHw	2.6997	1.4901	26,137	70,562	0
Sw	2.9120	0.5049	132,686	386,381	0
SwHw	2.6005	1.3860	125,119	325,371	0
			793,117	**1,670,739**	**672,194**

Table 8 Long-Run Sustained Yield Calculation for FMA #6900016

Yield Group	Max Conifer MAI (m^3/ha/year)	Max Deciduous MAI (m^3/ha/year)	Contributing Area (ha)	Primary Conifer LRSY (m^3/year)	Primary Deciduous LRSY (m^3/year)
C_SB	1.1100	0.0300	15,743	17,475	0
D_CD	0.2600	2.9635	220,356	0	653,025
Pl	3.2680	0.4883	266,443	870,737	0
PlHw	2.6997	1.4901	26,128	70,538	0
Sw	2.9120	0.5049	132,130	384,762	0
SwHw	2.6005	1.3860	124,253	323,119	0
		Total	**785,053**	**1,666,631**	**653,025**

6. Modelling Assumptions

This section provides a broad overview of modelling assumption associated with the forest estate model. Additional technical details are provided in Section 10.

6.1 Forest Estate Model

The Patchworks™ (www.spatial.ca) forest estate model used to conduct this analysis is a spatially explicit model that employs computational heuristics to find solutions. The model was run for a 202-year planning horizon split into a single 2-year transition period (2017-2018) and forty 5-year planning periods (2019-2219). The approved planning inventory (GIS resultant file) for the FMA was used to create blocks (groups of Classified Land Base fragment polygons that are within 20 m of each other), the base unit in Patchworks™ of stands with similar ages (i.e., within 10 years of each other) and the same yield strata.

6.2 Treatments

All harvest treatments utilized in the model were configured as clearcut with reserves. The only difference between the treatments listed in Table 9 involve transition assumptions. Harvest treatments planted with improved seed material were controlled in the base scenario using the maximum genetic deployment targets provided in Figure 4 (section 3.6).

Table 9 Harvest treatments

Treatment Label	Description
__CC__	Harvest treatment with transition to regular managed yield strata.
__CC_F	Harvest treatment for planned harvest. Planned harvest was fixed-scheduled in model either in the 2-year transition period (2017-2019) or in the first regular 5-year period (2019-2024). This treatment has no minimum operability limits because in some cases, the composition of block ages was less than minimum harvest ages assumed for the FMP.
G147p2	Harvest treatment with transition to improved Lodgepole pine (G147p2). Only eligible within the B1 breeding region
_G804_	Harvest treatment with transition to improved Lodgepole pine (G804). Only eligible within the B1 breeding region.
_G303_	Harvest treatment with transition to improved White spruce (G303). Only eligible within the B2 breeding region
G351p1	Harvest treatment with transition to improved White spruce (G351p1). Only eligible within the G1 breeding region
G351p2	Harvest treatment with transition to improved White spruce (G351p2). Only eligible within the G1 breeding region

6.3 Timing Constraints

Timing constraints were implemented at the block level for the following reasons:

- Transition period to limit scheduler to harvested blocks only,
- Timing constraints for planned harvest,
- Deferrals for identified insular retention of 60 years since adjacent block harvest,
- Deferrals for First Nations location-specific concerns,
- Deferrals for Forest Grazing Lease (FGL810006), and
- Deferrals for stands with inventory heights <14m tall for the first 20 years.

6.4 Relative Target Weightings

Patchworks™ uses a goal programming formulation to represent multiple objectives simultaneously within the planning process. A goal programing problem operates by trying to minimize the difference between outcomes and target values for a series of sub-objectives. A complete list of targets set for each scenario and their relative target weightings are provided in the technical submission, with details in Section 10.

6.5 Scenario Sets and Thresholds

Scenario sets were employed to set targets and their relative weightings and thereby provide enhanced transparency and repeatability. Scenarios were considered complete after the global improvement in the objective function stopped improving by more than 0.5% over 400,000 iterations, with sub-targets active for primary rank harvest products (i.e., Primary Conifer and Primary Deciduous harvest targets at both the TSA level and Caribou Range level), which were also applied with improvement thresholds of 0.5% over 400,000 iterations.

Harvest flow, patch, and ratio targets were turned on only after the first set of 400,000 iterations. Targets and weightings were not adjusted while the scenario was running. These are specified in the *scenarioSet.bsh* file and scenario targets are specified in the associated *targetdescriptions.bsh* file included as part of the technical submission (see Section 10).

7. Scenario Development

Several calibration and exploratory scenarios were developed throughout the FMP development process prior to settling on the scenarios presented in this report. The land base, growth and yield, and management assumptions presented in Sections 2, 3, and 4, respectively describe the base case scenario assumptions, while Table 10 provides a summary of other scenarios and key assumption changes related to those investigated as part of this analysis.

Table 10 Summary of modelled scenarios

Scenario	Intent/purpose of Scenario	Details
Fundamental Even Flow #8122	Satisfies Section 5.8 A of the Alberta Forest Management Planning Standard.	Implements a maximum allowable tolerance in the periodic harvest of +/- 0% of the planning horizon average. The planning standard allows for a +/- 5% tolerance.
Base Case #8109	This is the base scenario from which all other scenarios are assessed against. Caribou Range management assumptions are incorporated.	See Assumptions in Sections 2, 3, and 4
No Caribou Management #8112	What is the impact if caribou range management was not considered?	Remove all access unit locks, reserve harvest in transition period, and harvest caps within the caribou range
Back-to-Natural #8111	What is the impact if assumed gains from managed stands are not realized and harvest treatments transition stands back to yields developed for natural stands?	All yield strata mapped to curves developed for natural stand strata. In cases where yields were stratified by density, the CD yield strata was selected.
DC to DC Transition #8113	What is the impact if the DC to CD transition assumed in the base is unsuccessful and DC stand types transition back to DC types?	Remove DC to CD transition. DC_PL strata transition to M91-CD_PL Strata and DC_SX strata transition to M91-CD_SX strata as there were no Post '91 (RSA based) managed CD curves developed for the FMP
Accelerated Deciduous #8110	What is the impact of implementing accelerated primary deciduous harvest (i.e., 125% of base for 20 years)?	Target primary deciduous harvest set at 125% of 200-year average of base scenario
Preferred Forest Management Scenario (PFMS #8110)	This is the scenario put forth as the Preferred Forest Management Scenario. In this case, the PFMS is the Accelerated Deciduous scenario.	Target primary deciduous harvest for first 20 years set at 125% of 200-year average of base scenario.

8. Scenario Results

This section highlights the results of the scenarios investigated for this analysis, while the following section (Section 9) provides additional details on harvest and forest outcome associated with the Preferred Forest Management Scenario (PFMS #8110).

8.1 Fundamental Even flow (Scenario #8122)

Section 5.8 of the Alberta Forest Management Planning Standard requires a fundamental even flow scenario with a maximum allowable periodic tolerance +/- 5% of the planning horizon average (i.e., 200-year average). This scenario implemented all of the assumptions described above with a harvest flow policy of 0% tolerance on primary conifer and primary deciduous harvest flows but due to the first period fixed-scheduled planned harvest and caribou range harvest control assumptions (i.e., 550,000 m³/yr for the first 10 years), the primary conifer harvest for the first period is 5.6% above the 200-year planning horizon average.

The results of this scenario can be summarized as follows (depicted in Figure 7 and Figure 8):

- An average primary conifer harvest of 897,923 m³/yr for the 200-year planning horizon of which 550,000 m³/year comes from the caribou range for the 1st decade followed by a 200,000 m³/year contribution from the caribou range for the remainder of the planning horizon.
- An average secondary conifer harvest of 68,464 m³/year for the first 20 years and an overall 200-year average of 50,485 m³/year.
- An average primary deciduous harvest of 572,435 m³/year (FMA only; 585,232 m³/yr for the DFA) for the 200-year planning horizon.
- An average secondary deciduous harvest of 148,493 m³/yr for the first 20 years and an overall 200-year average of 222,615 m³/year.

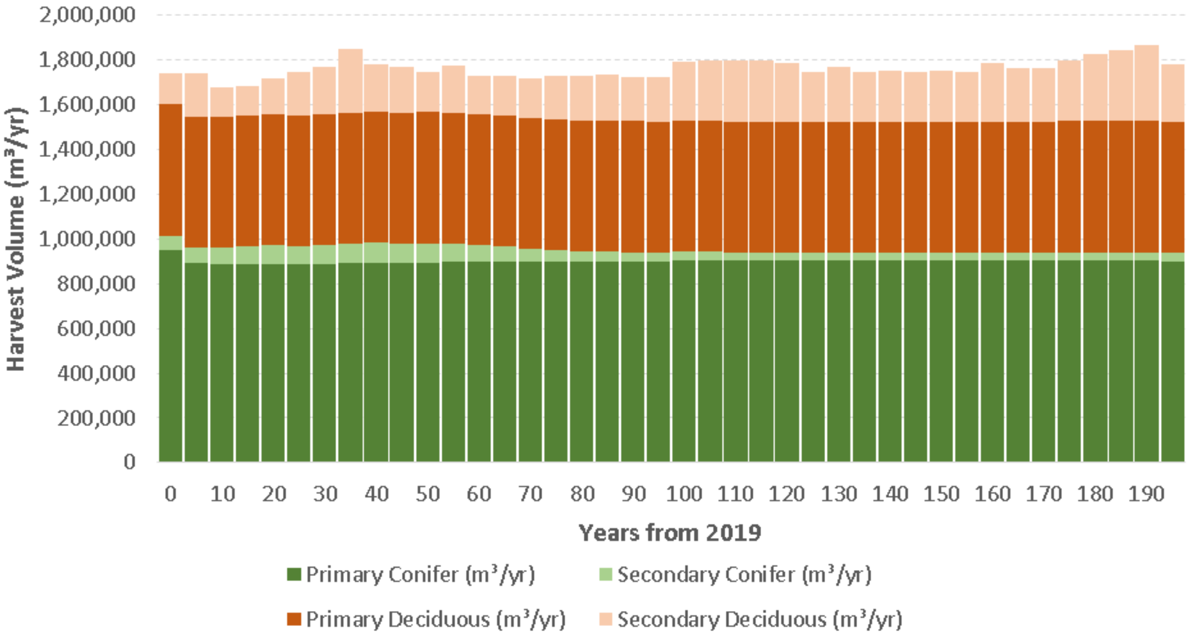


Figure 7 Harvest flow (m^3/year) by species rank for the fundamental even flow scenario #8122

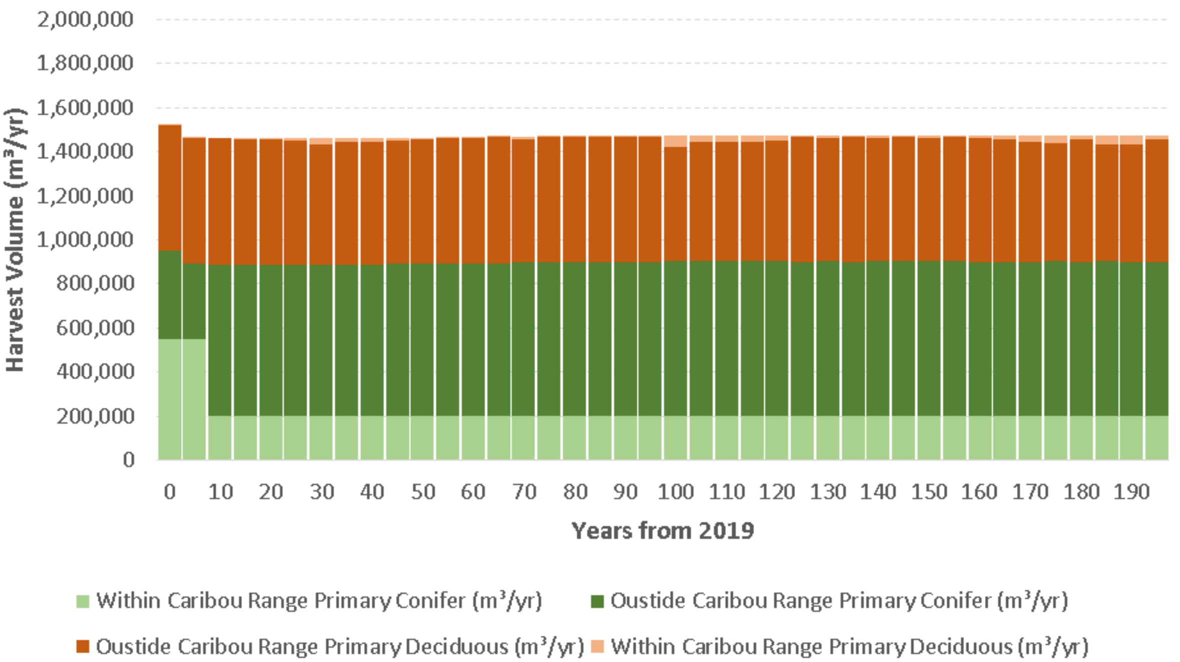


Figure 8 Harvest flow (m^3/year) for primary rank conifer and deciduous within and outside the Caribou range for the fundamental even flow scenario #8122

8.2 Base Case (Scenario #8109)

Implementing the base assumptions documented above produced the harvest forecast shown in Figure 9 and Figure 10 that is summarized as follows:

- An average primary conifer harvest of 1,150,000 m³/year for the next 10 years of which 550,000 m³/year comes from the caribou range followed by an average of 823,990 m³/year from 10-70 years and then an average of 916,385 m³/year from 70-200 years of which 200,00 m³/year comes from the caribou range.
- An average secondary conifer harvest of 76,576 m³/year for the first 20 years and an overall 200-year average of 50,439 m³/year.
- An average primary deciduous harvest of 603,848 m³/year for the first 70 years and an overall 200-year average of 600,013 m³/year.
- An average secondary deciduous harvest of 220,116 for the first 20 years and an overall 200-year average of 164,466 m³/year.

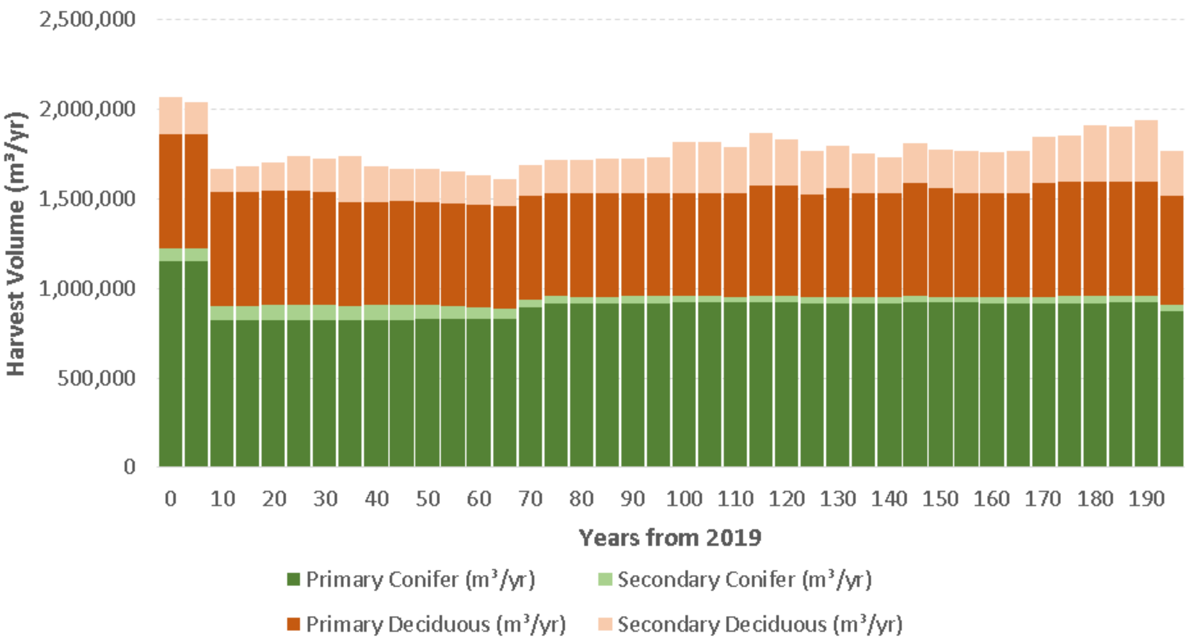


Figure 9 Harvest flow (m³/year) by species rank for the base case scenario #8109

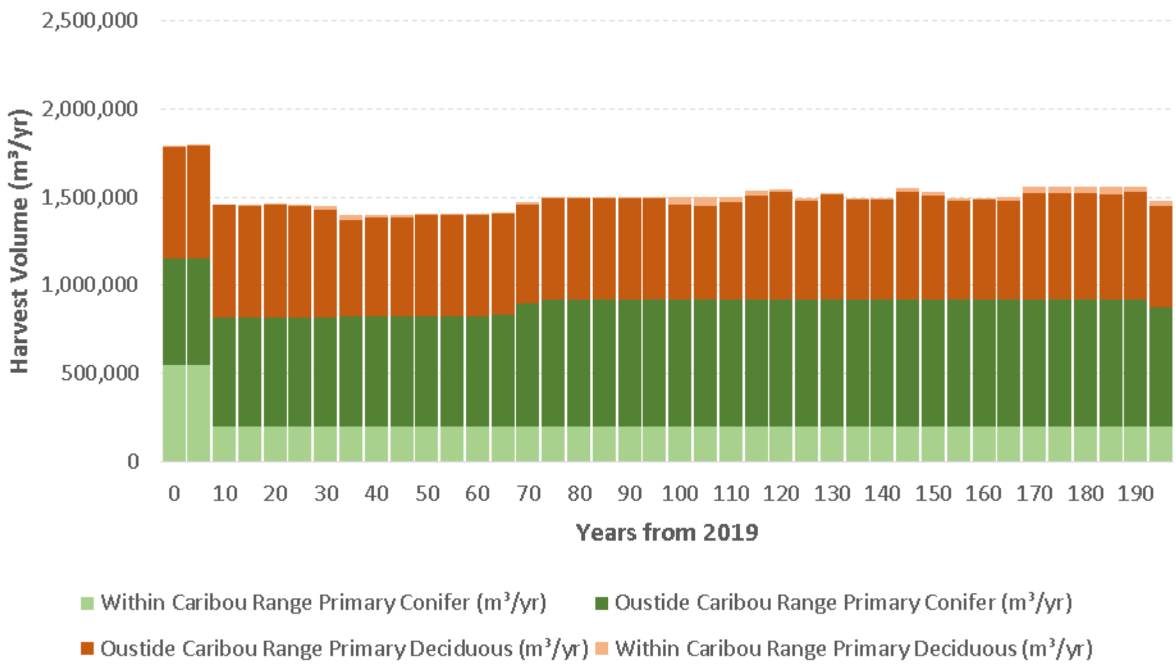


Figure 10 Harvest flow (m³/year) for primary rank conifer and deciduous within and outside the Caribou range for the base case scenario #8109

The total growing stock declines over the first 60 years of the planning horizon before gradually recovering (Figure 11). This recovery is largely attributed to the mandatory harvest flow controls implemented (i.e., +/- 5% change tolerance over the planning horizon), which prevents future harvest levels from increasing and balances harvest and growth of future managed stands with the caribou range harvest curtailments imposed after the first decade (limited to 200,000 m³/year). The slight decline in primary conifer volume after 160 years is primarily due to the unharvested conifer stands in the caribou range undergoing assumed succession events after they reach an age of 300 years. Implementing young seral patch controls caused the model to repeat the similar harvest sequence from first century over the second century, so much of the first century caribou range deferrals were left unharvested in the second century.

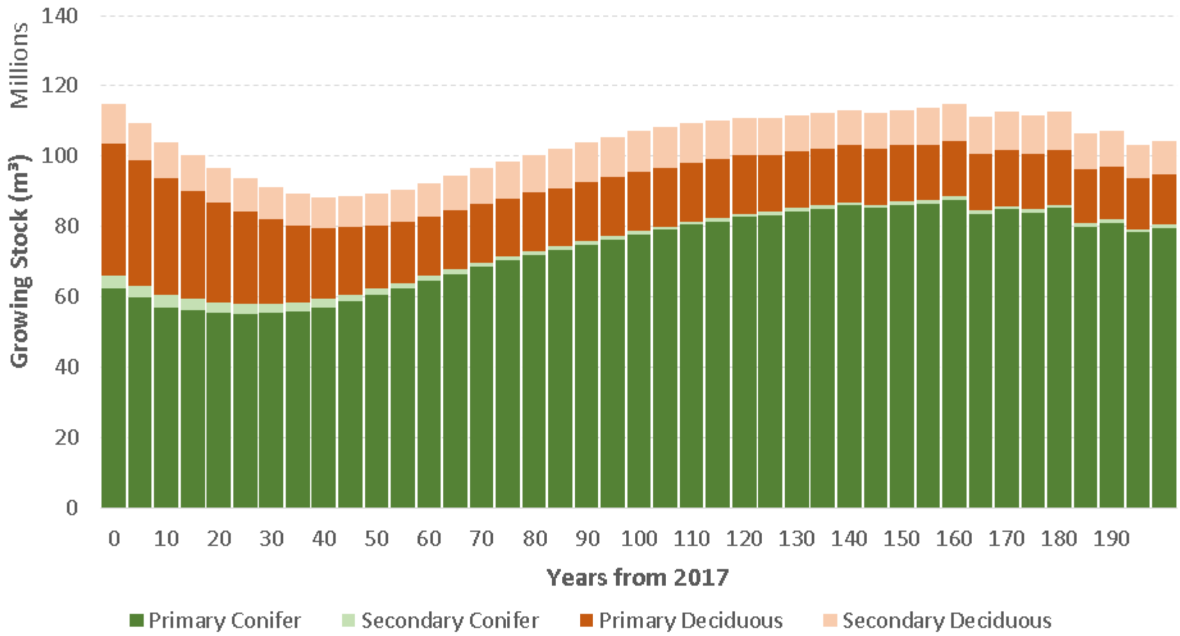


Figure 11 Growing stock (m^3) by species rank for conifer and deciduous for the base case scenario #8109

8.3 No Caribou Management (Scenario #8112)

Base case scenario results reflect a forest management approach focused primarily on caribou management by implementing significant harvesting constraints to conserve caribou habitat. The No Caribou Management scenario was prepared to demonstrate the impacts of caribou management on timber supply. When caribou management constraints were removed, the resulting primary conifer harvest averaged 1,240,673 m^3/year over the first century (a 40.4% increase over the base case on average for the same time period) followed by an average of 1,373,932 m^3/year over the second century (Figure 12), an increase over the base case of 49.8%. Since there is relatively little primary deciduous stands within the caribou range, the impact to primary deciduous harvest levels (Figure 13) was relatively small, with a 200-year average harvest level of 611,603 m^3/year (about a 2% increase relative to the base case).

Figure 12 Primary conifer harvest flow (m³/year) comparison – Base Case #8109 vs. No Caribou Management #8112

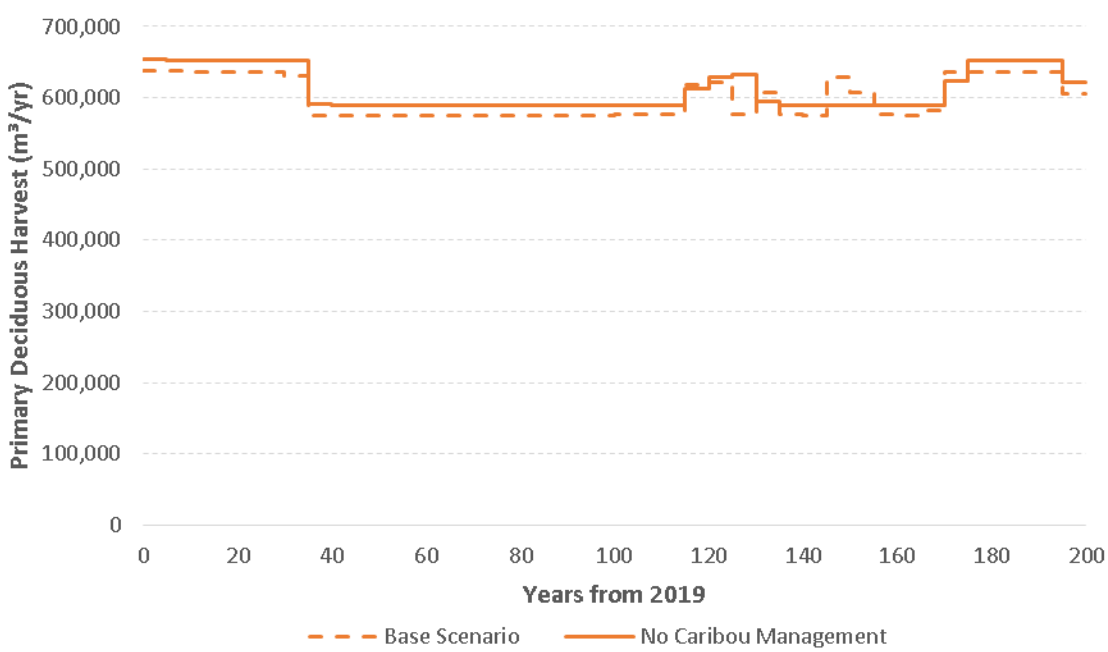


Figure 13 Primary deciduous harvest flow (m³/year) comparison - Base Case #8109 vs. No Caribou Management #8112

Without the caribou harvest constraints, the growing stock continued to decline for a longer duration, stabilized, and then recovered slightly before stabilizing at around 37 million m^3 over the last century (Figure 14). The initial growing stock was slightly higher under this scenario because "Priority 2 Reserve" Access Units within the caribou range were no longer depleted over the transition period.

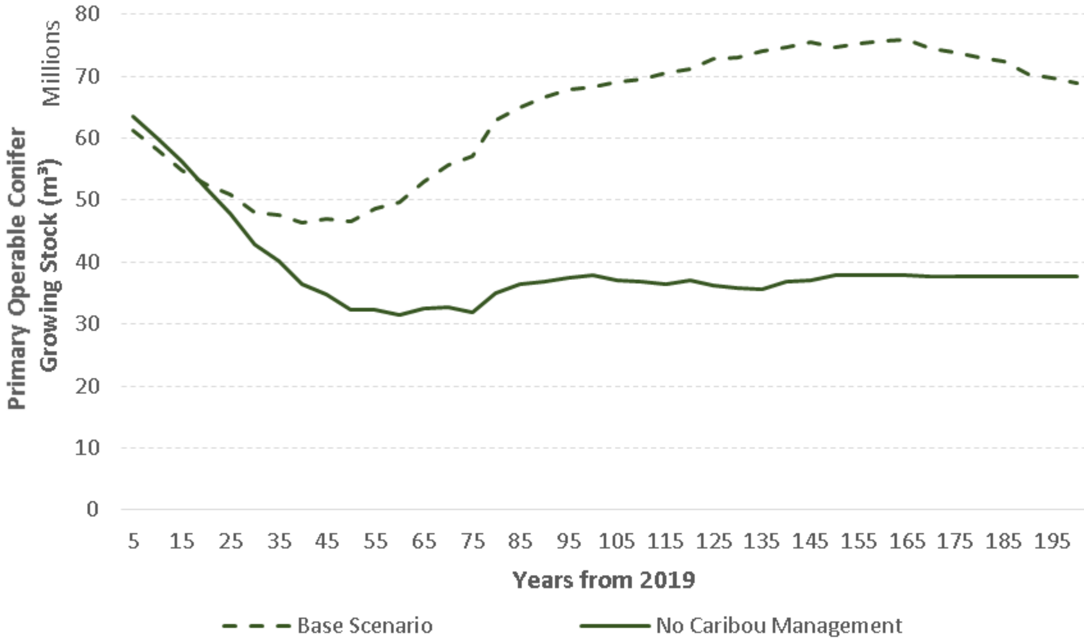


Figure 14 Primary operable conifer growing stock (m^3) comparison – Base Case #8109 vs. No Caribou Management #8112

Again, since there are relatively fewer deciduous stands within the caribou range, impacts to deciduous growing stock was not as pronounced as the primary conifer growing stock (Figure 15).

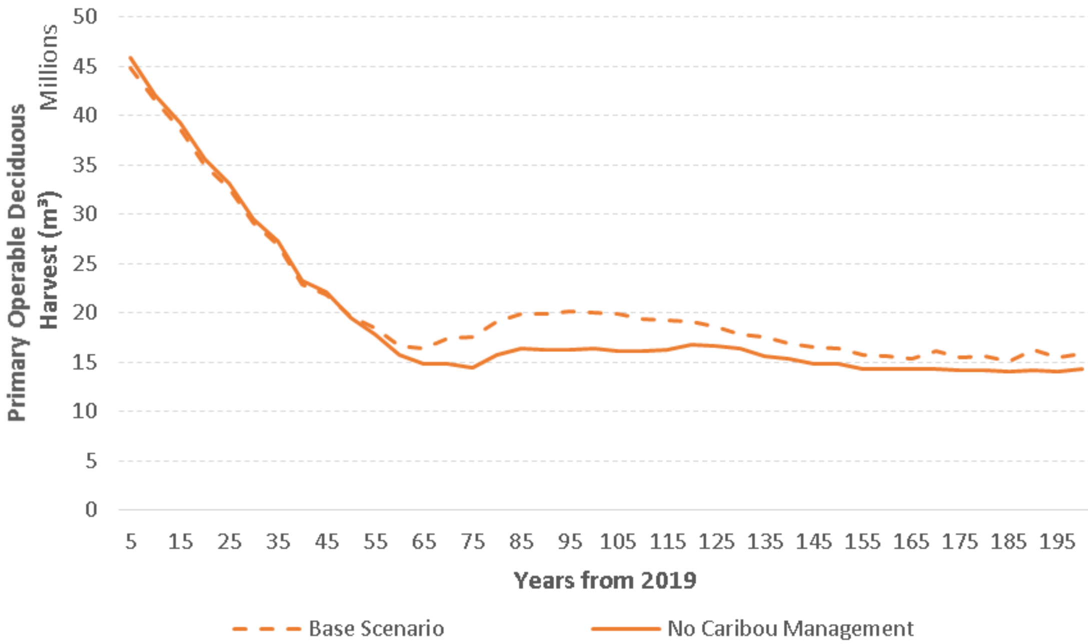


Figure 15 Primary operable deciduous growing stock (m³) comparison - Base Case #8109 vs. No Caribou Management #8112

8.4 Back-to-Natural (Scenario #8111)

The Back-to-Natural scenario transitioned all managed stands to natural stand yield curves, which also raised minimum harvest ages to 70 and 80 for deciduous and conifer, respectively. The impact on harvest flows from this scenario is depicted in Figure 16 and Figure 17. As in the base case, two flow period ranges were used for primary conifer harvest so the harvest over first 20 years was essentially identical to the base case scenario. However, the average primary conifer harvest over the remaining 180 years dropped by 278,494 m³/year or 31.4%. The average harvest of primary deciduous dropped by 49,136 m³/year or 8.2% over the 200-year planning horizon.

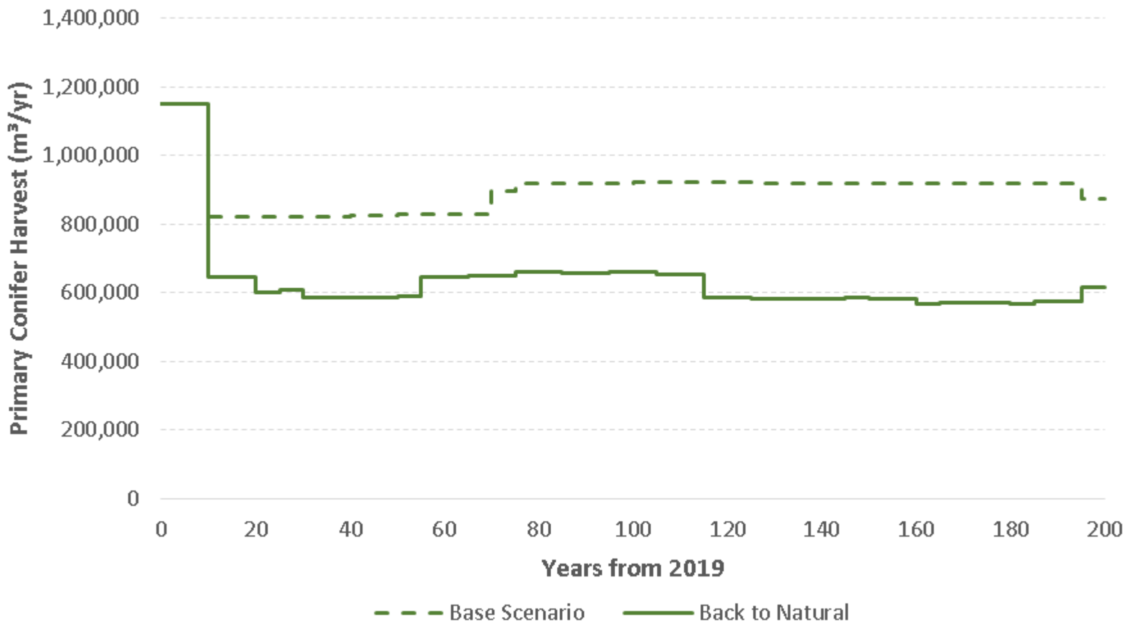


Figure 16 Primary conifer harvest flow (m^3/year) comparison – Base Case #8109 vs. Back to Natural #8111

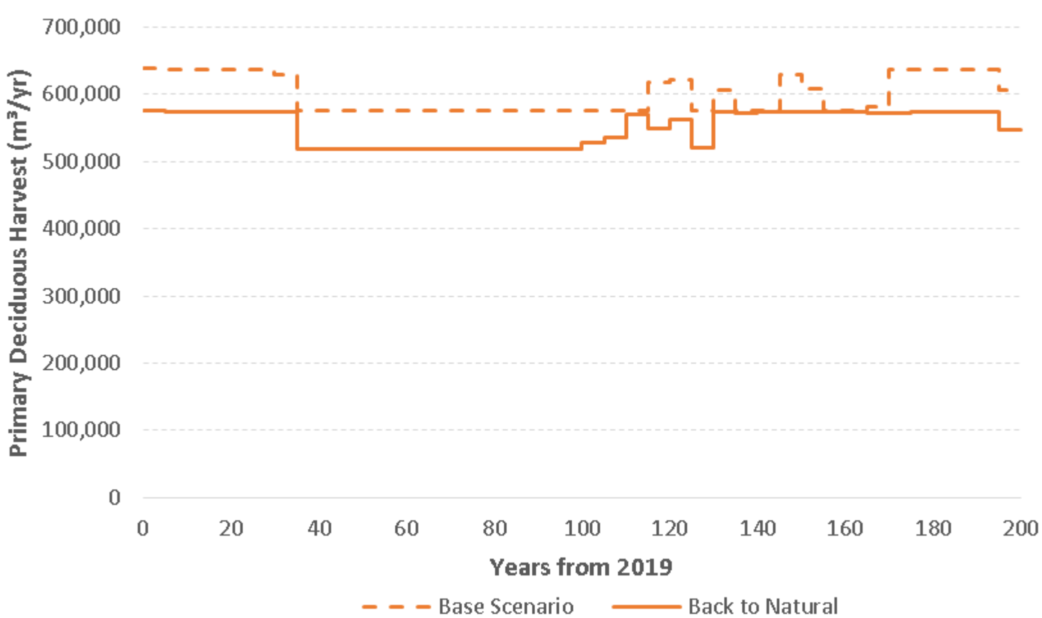


Figure 17 Primary deciduous harvest flow (m^3/year) comparison - Base Case #8109 vs. Back to Natural #8111

Since harvest levels were significantly different under this scenario, the target weight placed on maintaining a stable growing stock over the last quarter of the planning horizon had to be increased by 100 times (Figure 18 and Figure 19).

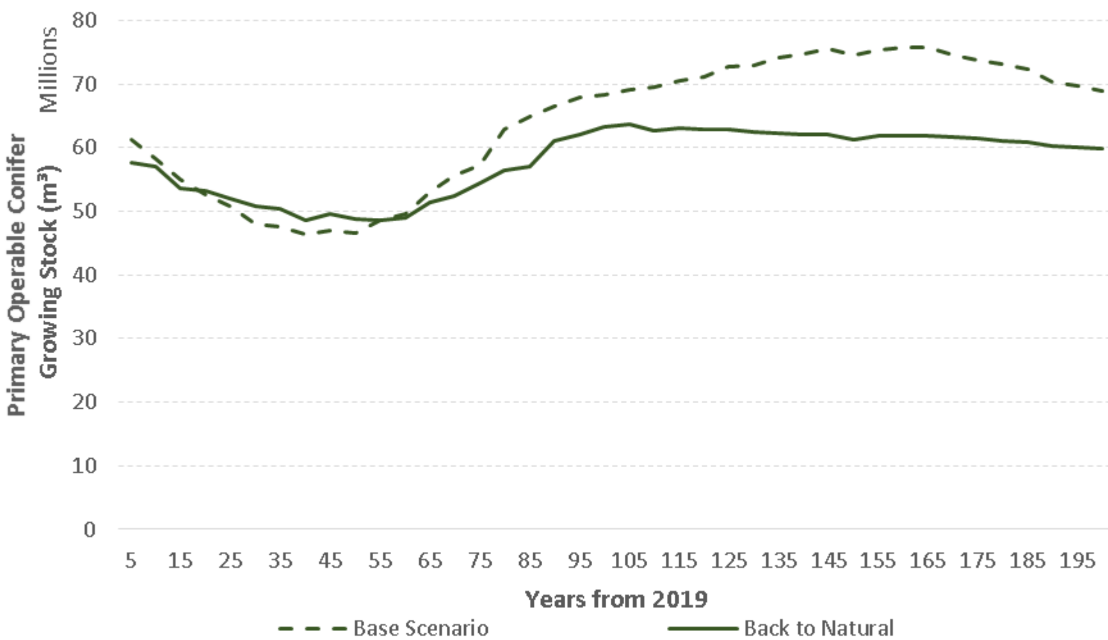


Figure 18 Primary operable conifer growing stock (m³) comparison - Base Case #8109 vs. Back to Natural #8111

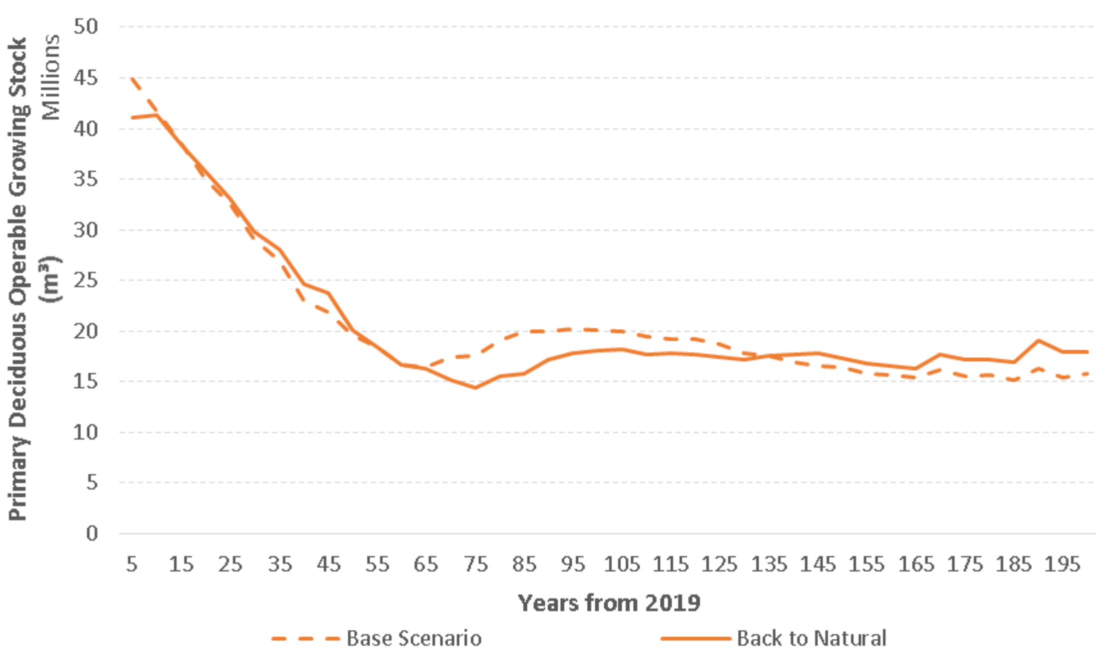


Figure 19 Primary operable deciduous growing stock (m³) comparison - Base Case #8109 vs. Back to Natural #8111

With the change in default minimum harvest ages under the back-to-natural scenario, harvesting of stands less than 70 years old no longer occurred over the mid- and long-terms (Figure 20).

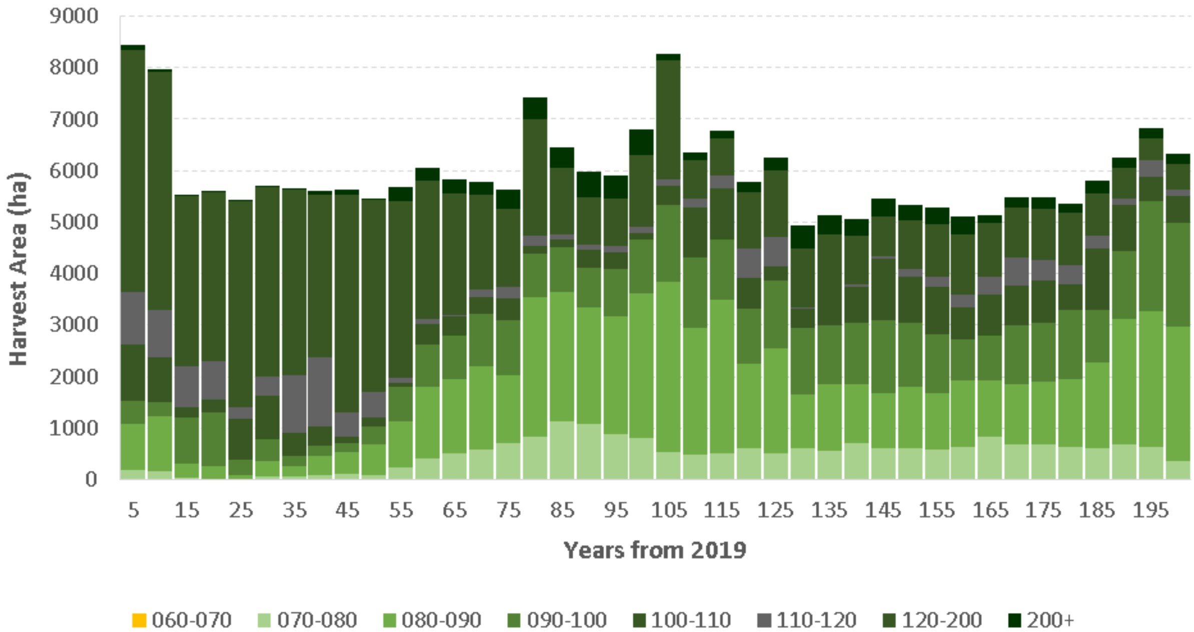


Figure 20 Annual harvest area (ha/year) by age class for the Back to Natural scenario #8111

Since harvesting in the next 20 years dominantly relies upon natural stands types under both scenarios, average harvest yield (m^3/ha) under the back-to-natural scenario was quite similar to the base case (Figure 21 and Figure 22). Average harvest yields began to diverge as harvesting transitioned from existing natural stands to existing managed stands (on natural yield trajectories) and subsequently on future managed stands. This divergence is more pronounced with conifer yields and not as great with deciduous yields with similar natural and managed yield curves.

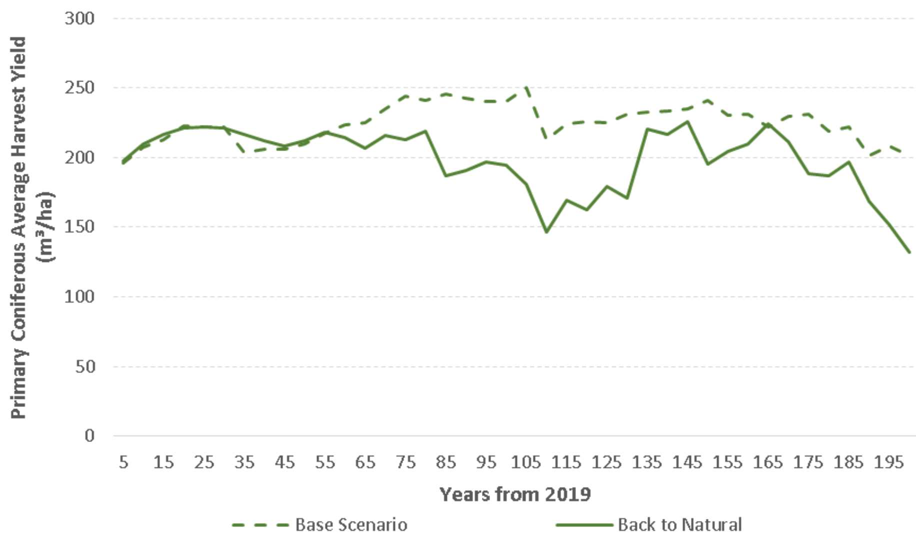


Figure 21 Primary conifer average harvest yield (m^3/ha) comparison - Base Case #8109 vs. Back to Natural #8111

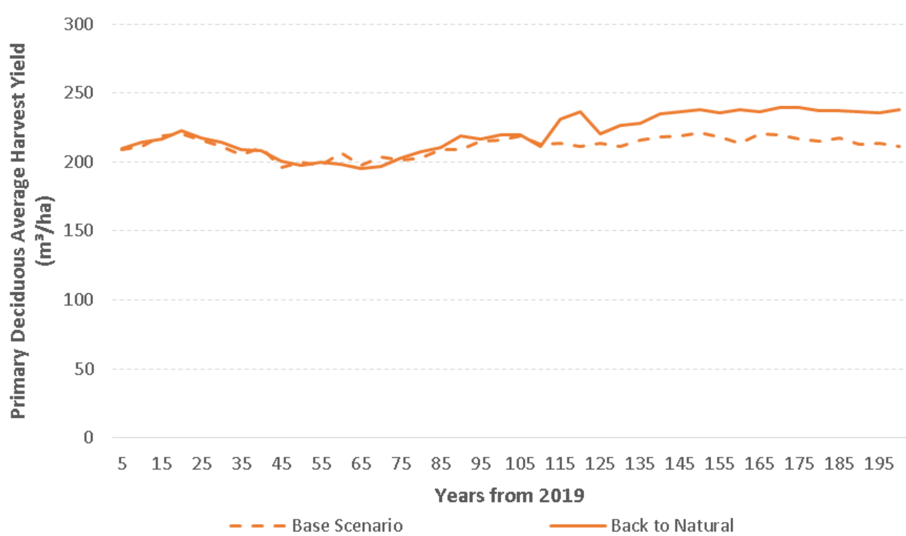


Figure 22 Primary deciduous average harvest yield (m^3/ha) comparison - Base Case #8109 vs. Back to Natural #8111

8.5 Deciduous Mixedwood to Deciduous Mixedwood Transition (Scenario #8113)

Removing the deciduous mixedwood (DC) to coniferous mixedwood (CD) transition had very little impact (<1% reduction on average over the planning horizon) on both conifer and deciduous harvest flows (Figure 23 and Figure 24).

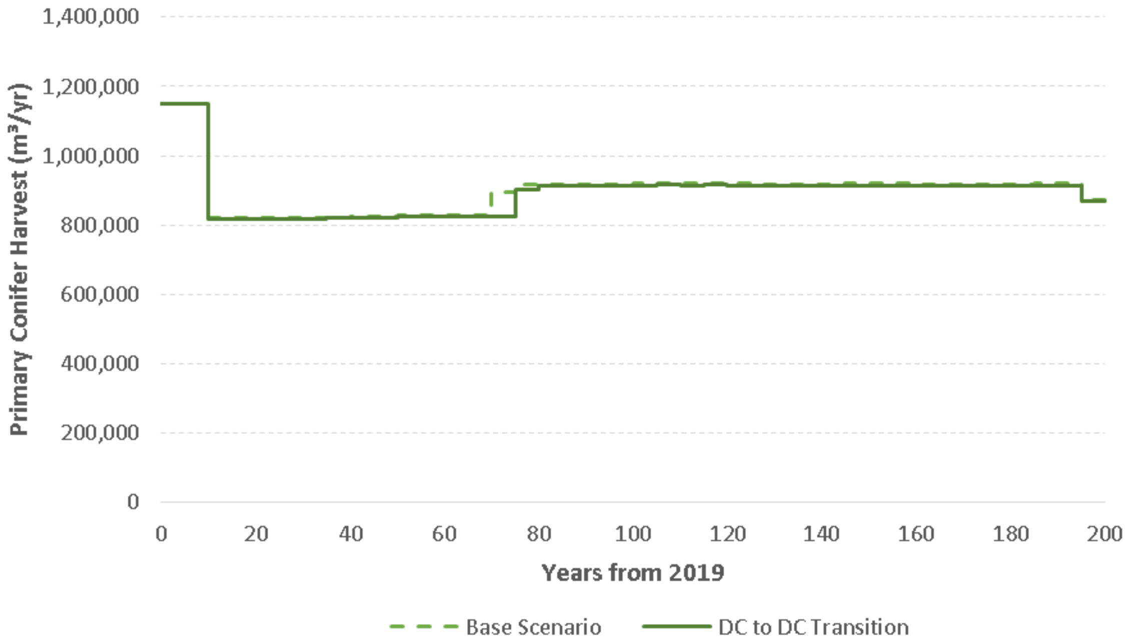


Figure 23 Primary conifer harvest flow (m³/year) comparison – Base Case #8109 vs. DC to DC transition #8113

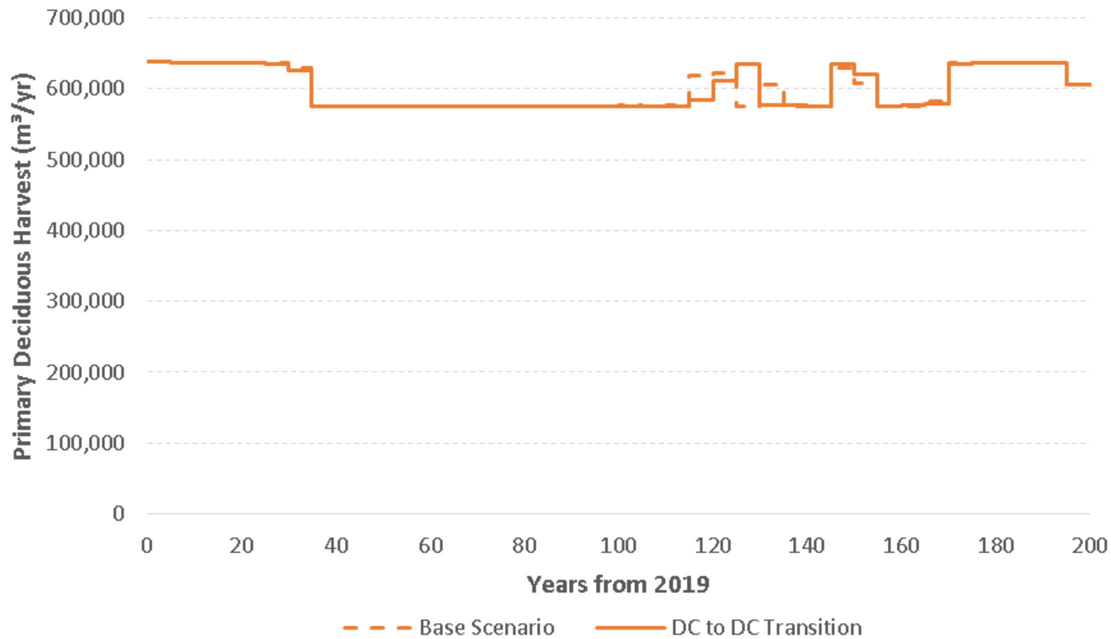


Figure 24 Primary deciduous harvest flow (m^3/year) comparison - Base Case #8109 vs. DC to DC transition #8113

Under the DC to DC Transition scenario, the relative proportion of DC broad cover groups (BCG) is maintained similar throughout the planning horizon (Figure 25).

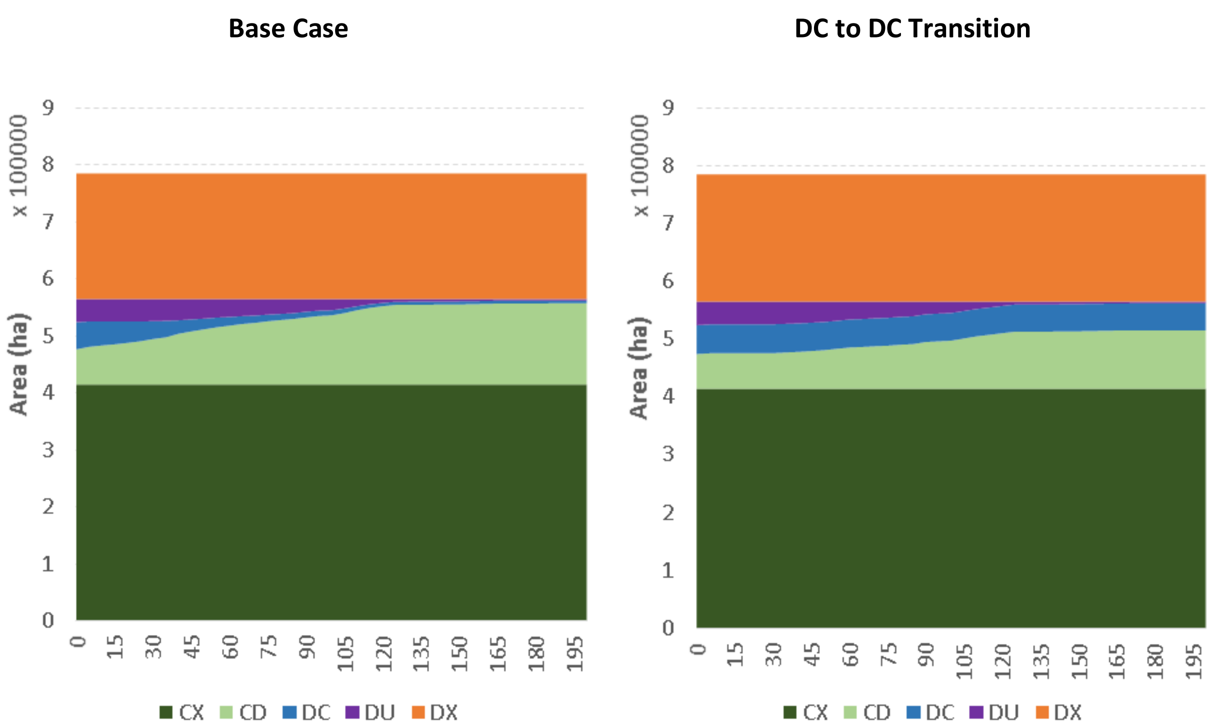


Figure 25 Broad Cover Group Distribution over time – Base Case #8109 vs. DC to DC transition #8113

8.6 Accelerated Deciduous Harvest (PFMS #8110)

Under an accelerated harvest of primary deciduous stands the harvest target changed to 125% for the first 20 years of the 200-year average in the base case scenario (i.e., 600,013 m^3/year *1.25 = 750,016 m^3/year). Under the ABFMPS rules for accelerated harvest, the average harvest level cannot be less than 90% of the un-accelerated harvest (i.e., 600,013 m^3/year *0.9 = 540,012 m^3/year). This condition was also met in this scenario, as the remaining 180-year average harvest level was 576,896 m^3/year (Figure 26). Changing the primary conifer harvest under this scenario was negligible, hence no comparison was provided.

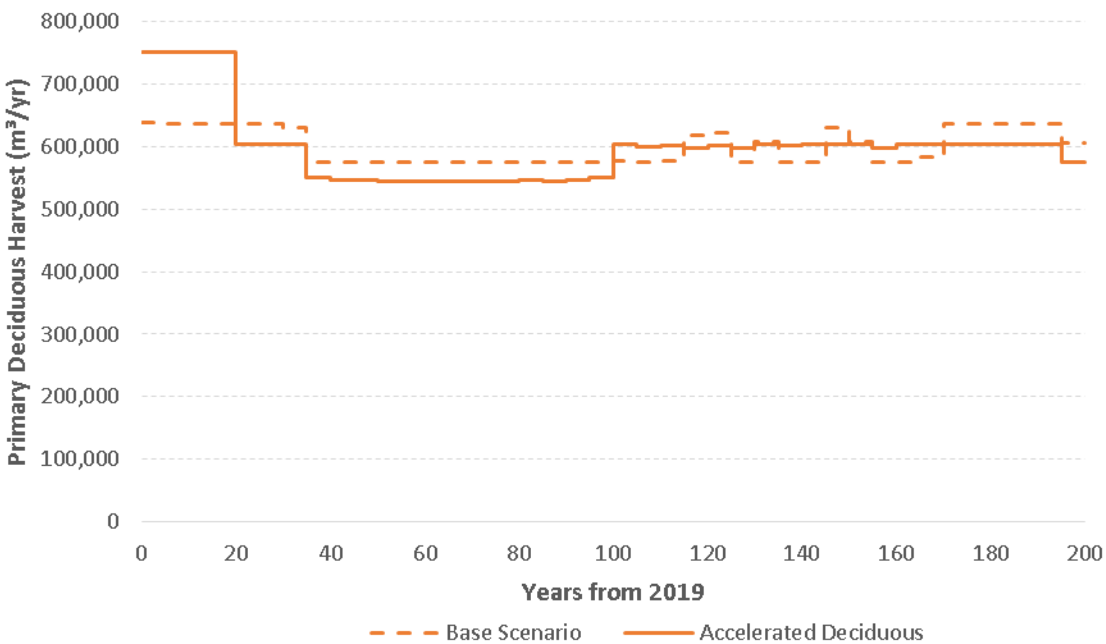


Figure 26 Primary deciduous harvest flow (m^3/year) comparison – Base Case #8109 vs. Accelerated Deciduous #8110

Figure 27 compares the operable growing stock for primary deciduous under this scenario and the base case. The primary deciduous growing stock declined faster with the accelerated harvest rate but also recovered at a faster rate and actually surpassed the base case levels due the quicker conversion of older, decadent deciduous stands to thriftier, younger managed deciduous stands.

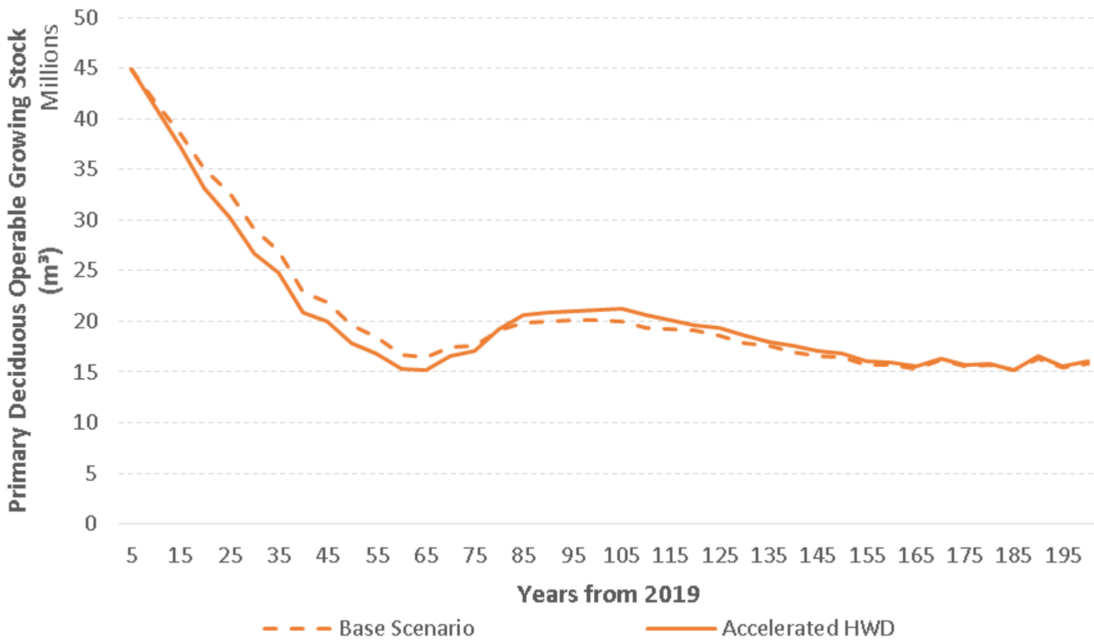


Figure 27 Primary operable deciduous growing stock (m³) comparison - Base Case #8109 vs. Accelerated Deciduous #8110

9. Preferred Forest Management Strategy (PFMS #8110)

This section presents the Preferred Forest Management Strategy (PFMS) and provides more detailed reporting for harvest attributes and forest-level outcomes than the previous scenario summaries. The PFMS is the accelerated deciduous harvest scenario. The only differences between the base case scenario and the PFMS involved the deciduous harvest targets set for the first 20 years and the two flow periods implemented for that scenario. All other assumptions and targets remained the same as the base case.

The values, figures, and tables presented in this section are filtered to the FMA portion of the DFA except for Section 9.3, which shows the harvest level outside the FMA. For the FMP harvest decisions and AAC recommendations, all values will be reported to the DFA level (i.e., FMA plus Non-FMA harvest).

9.1 Harvest Attributes

The following subsections describe various harvest attributes associated with the PFMS.

9.1.1 Harvest Volume

Implementing the PFMS assumptions resulted in the harvest forecast shown in Figure 28 and Figure 29 and can be summarized as follows:

- An average primary conifer harvest of 1,150,000 m³/year for the next 10 years of which 550,000 m³/year comes from the caribou range followed by an average of 825,278 m³/year from 10-70 years and then an average of 918,515 m³/year from 70-200 years of which 200,00 m³/year comes from the caribou range.
- An average secondary conifer harvest of 84,841 m³/year for the first 20 years and an overall 200-year average of 49,730 m³/year.
- An average primary deciduous harvest of 750,008 m³/year for the next 20 years followed by an average of 580,956 m³/year for the remaining 180 years.
- An average secondary deciduous harvest of 163,040 for the first 20 years and an overall 200-year average of 220,848 m³/year.

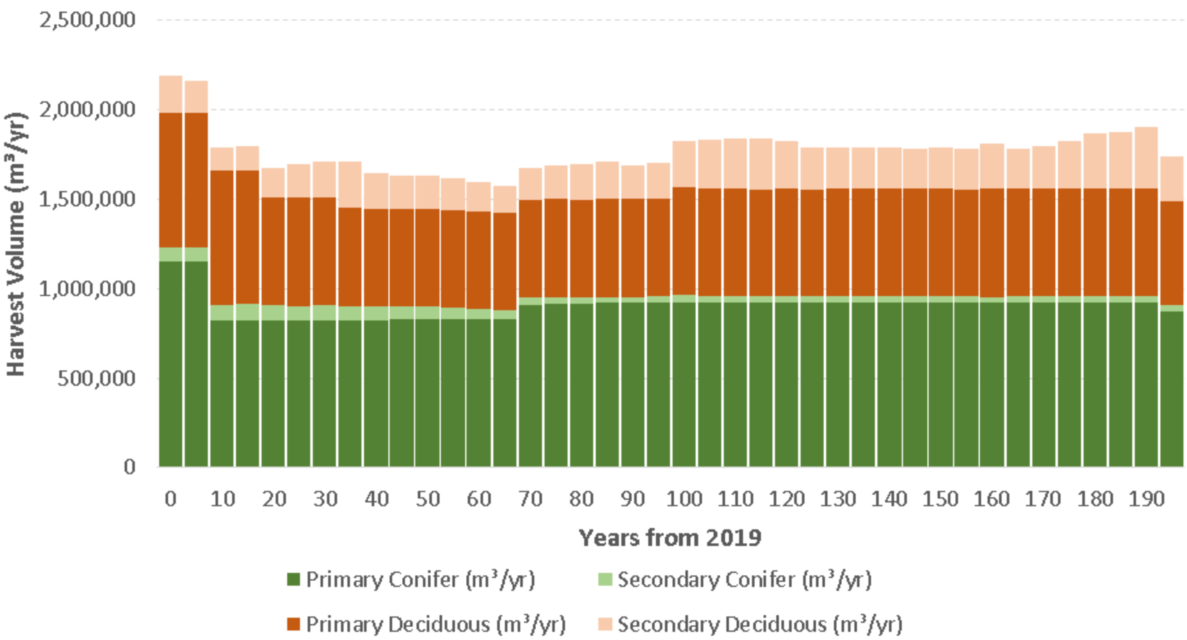


Figure 28 Harvest flow (m³/year) by species rank for the PFMS #8110

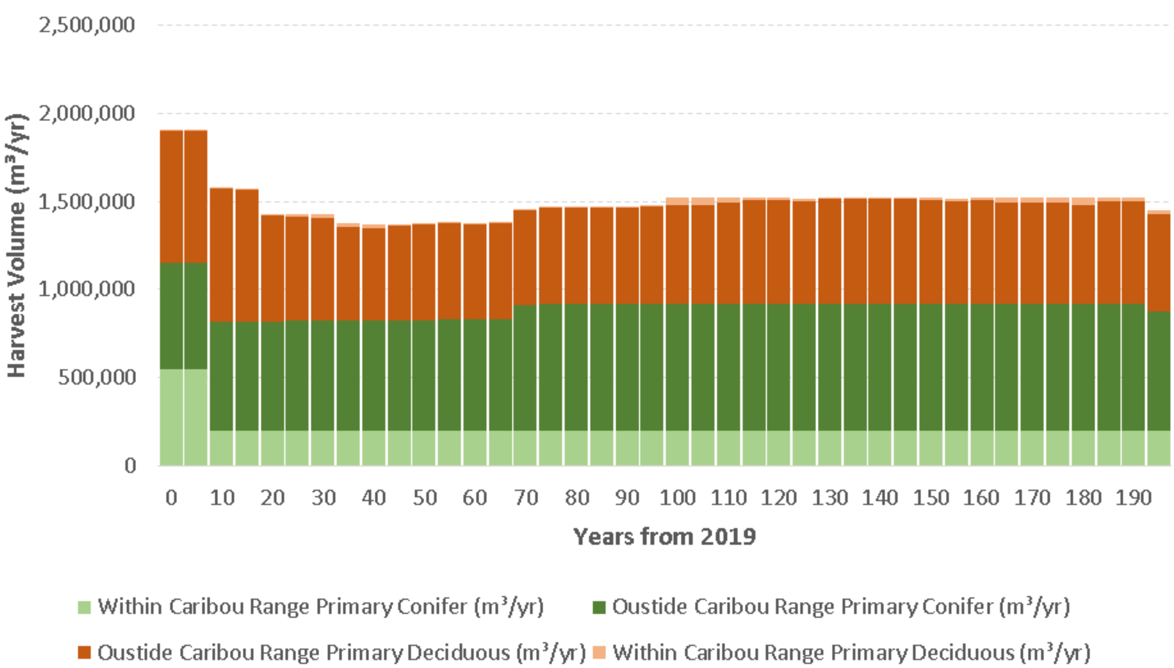


Figure 29 Harvest flow (m³/year) for primary rank conifer and deciduous within and outside the Caribou range for the PFMS #8110

Relative to the fundamental even flow scenario, the 10-year primary conifer harvest for the PFMS is 28.1% higher for the primary conifer harvest level, 8.1% lower between 10 and 70 years, and about 2.5% higher for the rest of the planning horizon (Figure 30). For primary deciduous harvest, the first 20 years is 31% higher than the fundamental even flow scenario, 5.3% higher from 20-35 years, 4.6 % lower from 35-100 years and about 5.1% higher for the last 100 years.

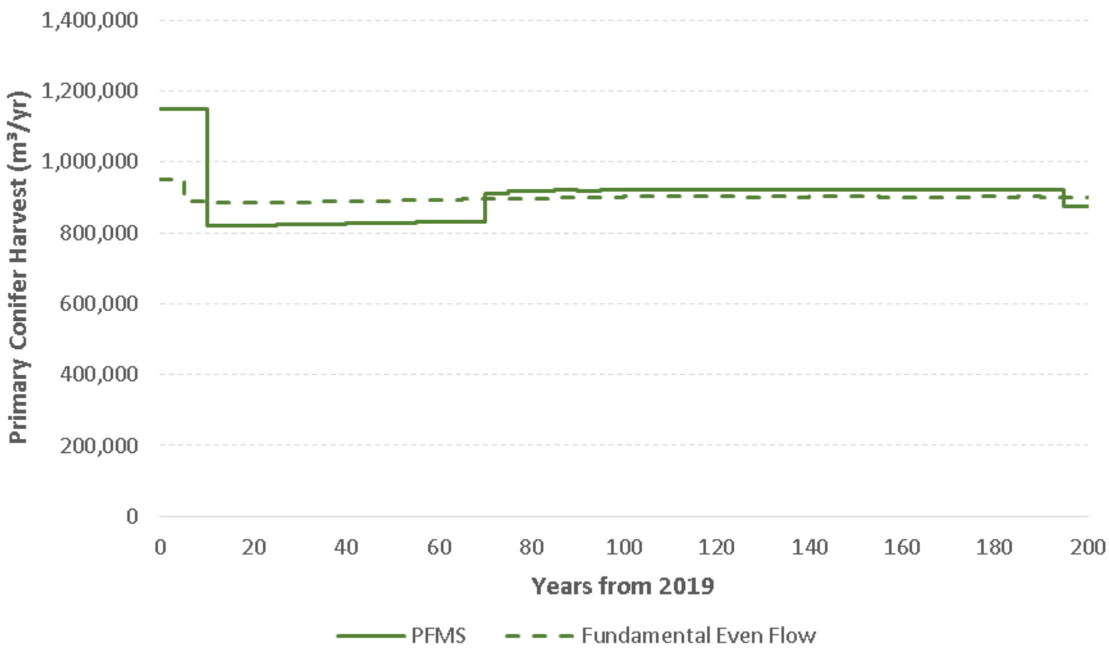


Figure 30 Primary conifer harvest flow (m^3/year) comparison – PFMS #8110 vs. Fundamental Even Flow #8122

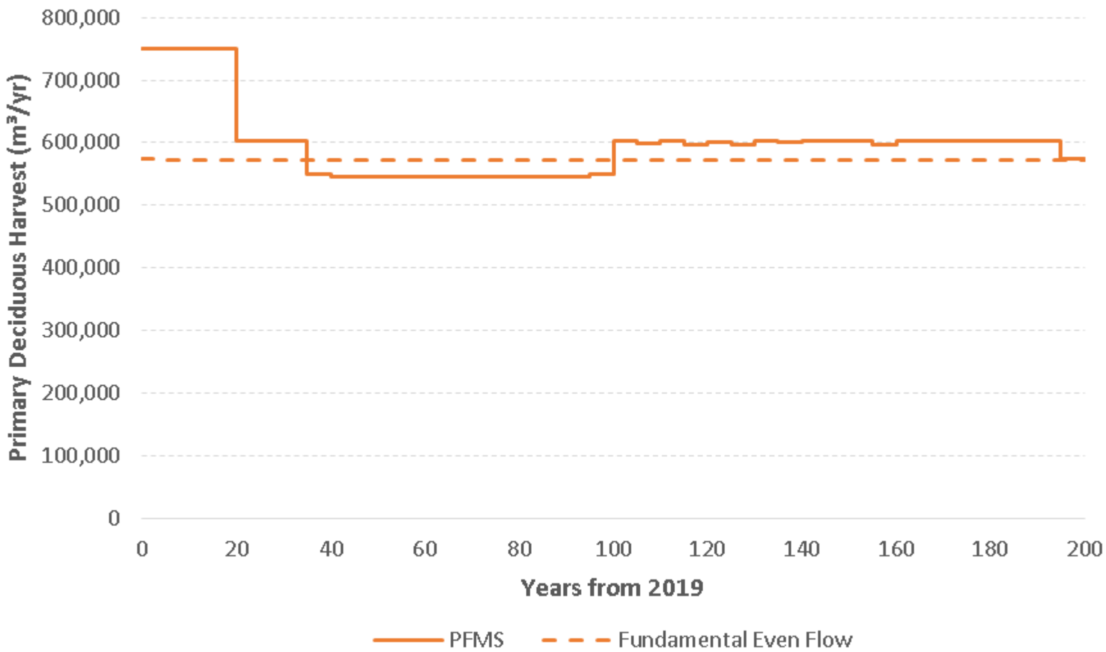


Figure 31 Primary decid harvest flow (m^3/year) comparison – PFMS #8110 vs. Fundamental Even Flow #8122

9.1.2 Harvest by Yield Era

The transition of harvest volume between yield eras are shown for primary conifer and deciduous harvest volumes in Figure 32 and Figure 33, respectively. Over the first 25 years, primary conifer harvest was entirely from existing natural stands and increasingly more from existing managed stands over the next 30 years. The harvest of existing natural stands between 60 and 100 years reflected implementation of access timing constraints to control the harvest within the CMZ, which is dominated by natural origin stand types. In contrast, the transition from natural to managed stands for the primary deciduous harvest was more smooth and abrupt than the primary conifer harvest, as relatively little DX stands occur within the caribou range. After the first 60 years, most of the primary deciduous harvest came from existing managed stands and after another 20 years, from future managed stands.

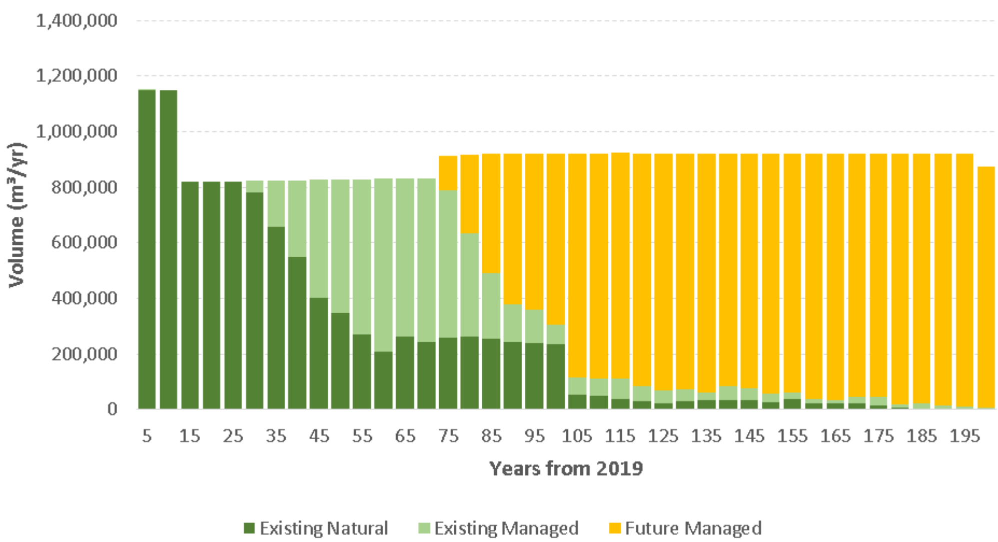


Figure 32 Primary conifer harvest flow (m³/year) by yield era for the PFMS #8110

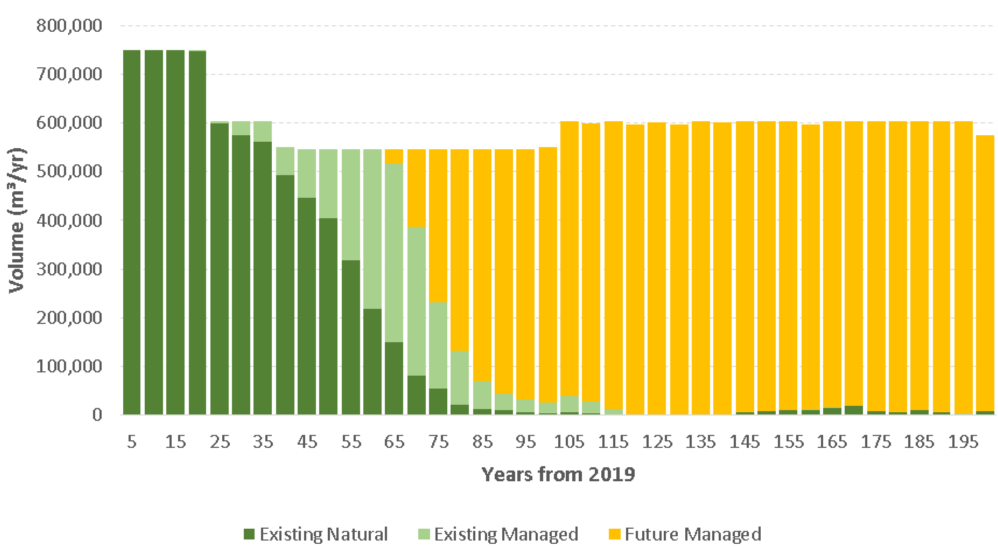


Figure 33 Primary deciduous harvest flow (m³/year) by yield era for the PFMS #8110

9.1.3 Average Harvest Yield

The average harvest yield for both primary conifer and deciduous stands (Figure 34) was relatively stable over the planning horizon, at approximately 225 m^3/ha for conifer harvest volume from primary conifer stands and around 212 m^3/ha for deciduous harvest volume from primary deciduous stands. This graph does not include secondary volume yields (i.e., deciduous volume yield from primary conifer stands and conifer volume yield from primary deciduous stands).

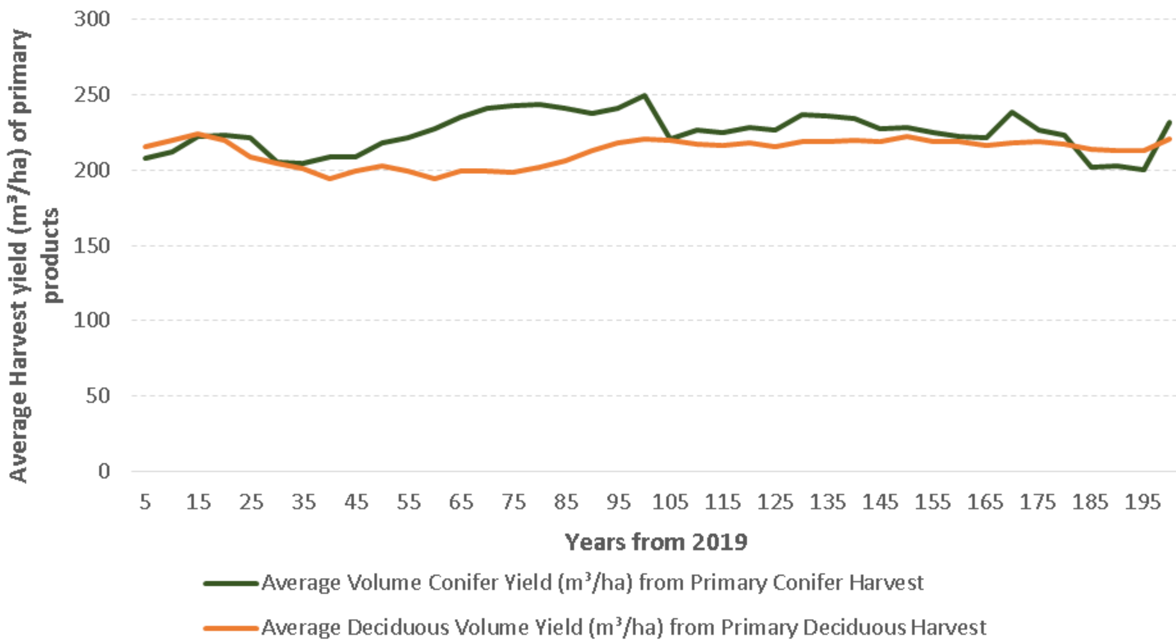


Figure 34 Average Primary conifer and Primary deciduous harvest yield (m^3/ha) for the PFMS#8110

9.1.4 Harvest Area

The annual harvest area by treatment type is shown in Figure 35 while Figure 36 shows the annual harvest by Broad Cover Group (BCG). Over the next 10 years, the overall average annual harvest rate was approximately 9,000 ha/year followed by an average annual harvest rate of 6,900 ha/year for the remaining 190 years.

Harvest treatments that resulted in enhanced future managed curves were controlled in the model through maximum annual allowable genetic deployment targets presented in Section 3.6. No specific minimum targets were applied to allow the model to determine the near-optimal timing for improved seed to meet harvest flow targets.

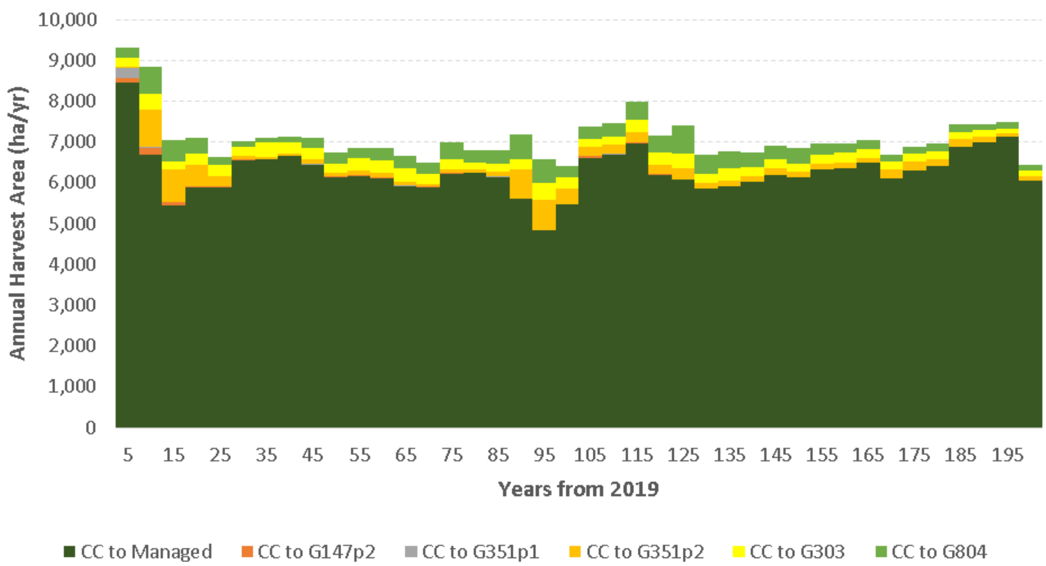


Figure 35 Annual harvest area (ha/year) by treatment type for the PFMS#8110

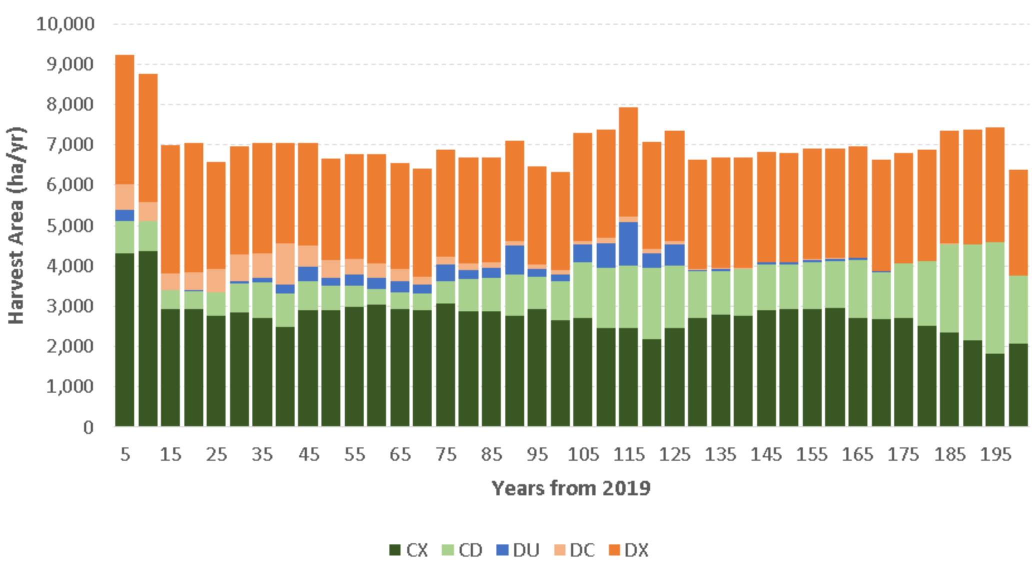


Figure 36 Annual harvest area (ha/year) by broad cover group for the PFMS#8110

9.1.5 Average Harvest Age

Over the first 20-30 years, average harvest ages actually climbed for both primary conifer and deciduous stands (Figure 37), as harvesting relied on older natural stands. Afterwards, average harvest ages gradually decreased to stable levels at around 100 years into the harvest forecast. This reflected the caribou access controls implemented on conifer harvest over the first century. After 100 years, the average harvest age stabilized at approximately 88 years for primary conifer stands and approximately 80 years from primary deciduous harvest.

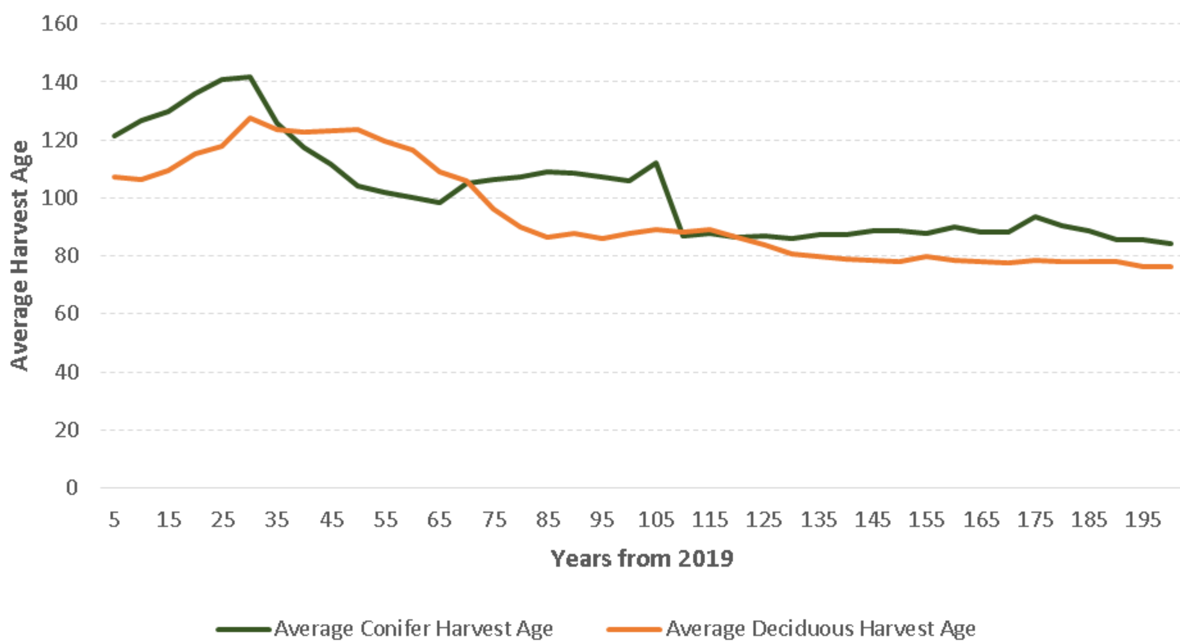


Figure 37 Average harvest age for primary conifer and primary deciduous harvest for the PFMS#8110

9.1.6 Harvest Area by Age Class

After about 45 years, the average annual harvest area by age class (Figure 38) shows significant amount of harvest from stands in the 70-80-year age class, even though the average is over 80 years over this period (section 9.1.5). All harvest in the 60-70-year age class are from primary deciduous stands, since the MHA for all primary conifer yields was greater than 70 years.

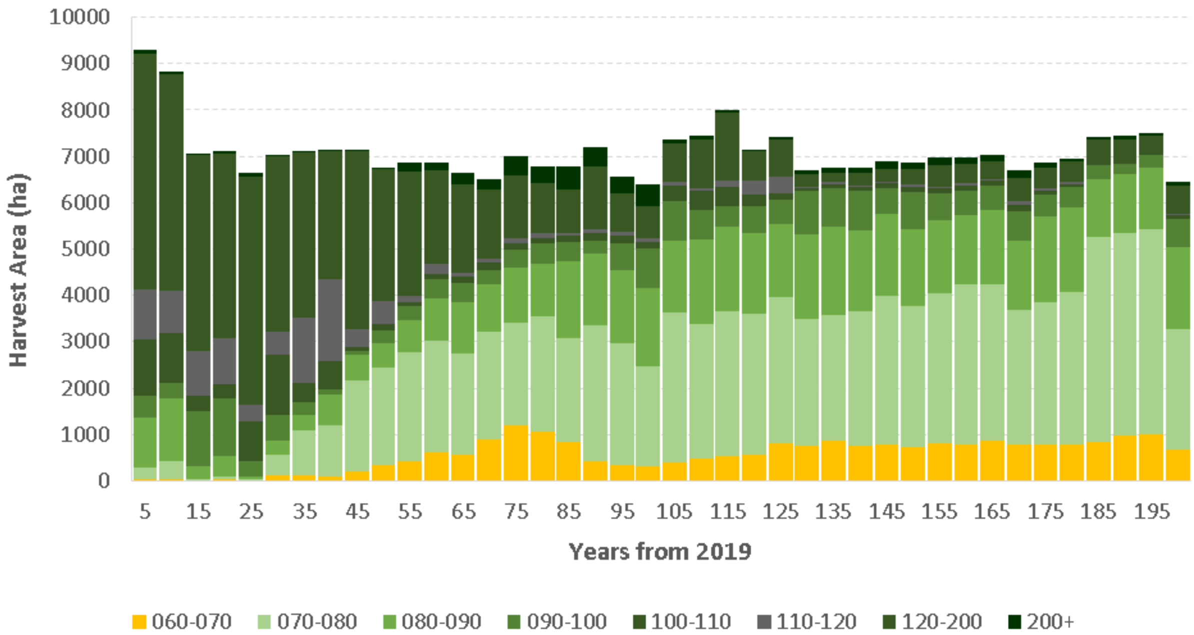


Figure 38 Annual harvest area (ha/year) by age class for the PFMS#8110

9.1.7 Average Harvested Piece Size

Trends in average harvested piece size (m³/tree) for both conifer and deciduous (Figure 39) closely resemble average harvested age trends (Figure 37). Conifer piece size remains above 0.4 m³/tree (or 2.5 trees/m³) for the next 35 years before starting to decline to around 0.25 m³/tree (or just under 4 trees/m³) for the latter half of the planning horizon. Similarly, deciduous piece sizes remain above 0.6 m³/tree (or 1.67 trees/m³) for the next 25 years before dropping to a relatively stable level of around 0.35 m³/tree (or 2.85 trees/m³).

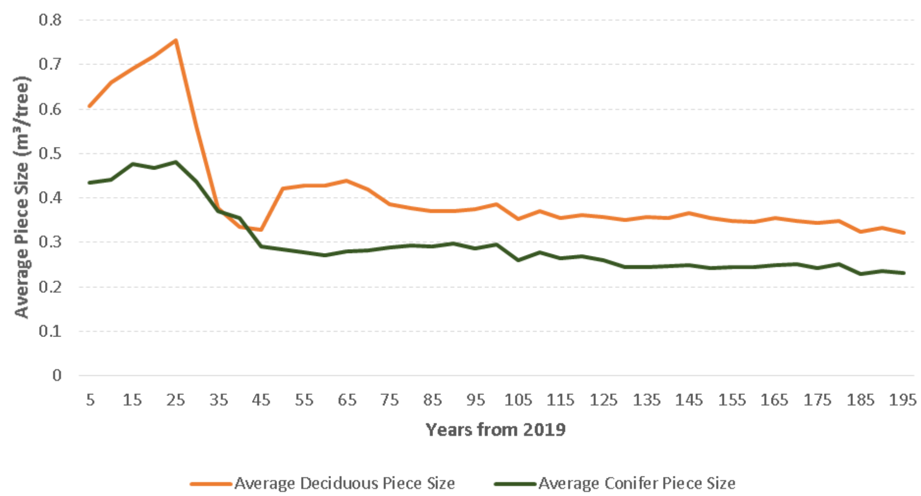


Figure 39 Average harvested piece size (m³/tree) by species type for the PFMS#8110

The average piece size resulting from the base scenario is compared with the PFMS scenario in Figure 40. The piece size trends for both coniferous and deciduous harvest are very similar throughout the planning horizon with a greater difference in the deciduous piece sizes, due to the accelerated deciduous harvest associated with the PFMS.

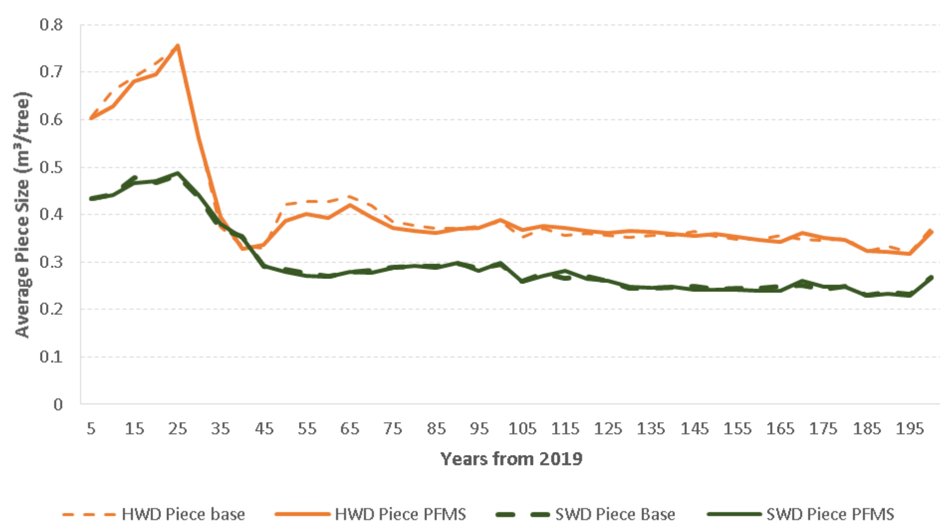


Figure 40 Average harvested piece size (m³/tree) by species type for the PFMS #8110 compared to the Base Scenario

9.2 Forest Attributes

The following subsections describe forest-level outcomes associated with the PFMS, with a focus on timber-related metrics.

9.2.1 Growing Stock

As with the base case, the primary conifer growing stock under the PFMS declined slightly over the last 50 years of the planning horizon (Figure 41), as unharvested stands in the caribou range underwent succession (Figure 42). To keep the overall FMA-wide operable conifer growing stock stable, the model was forced to allow an increase in the primary conifer growing stock outside the caribou range. Over the first century, stands within deferral areas of the caribou range remained largely unharvested. It was then easier for the model to maintain similar young seral patch distribution over the second century by simply repeating the harvest pattern established in the first century.

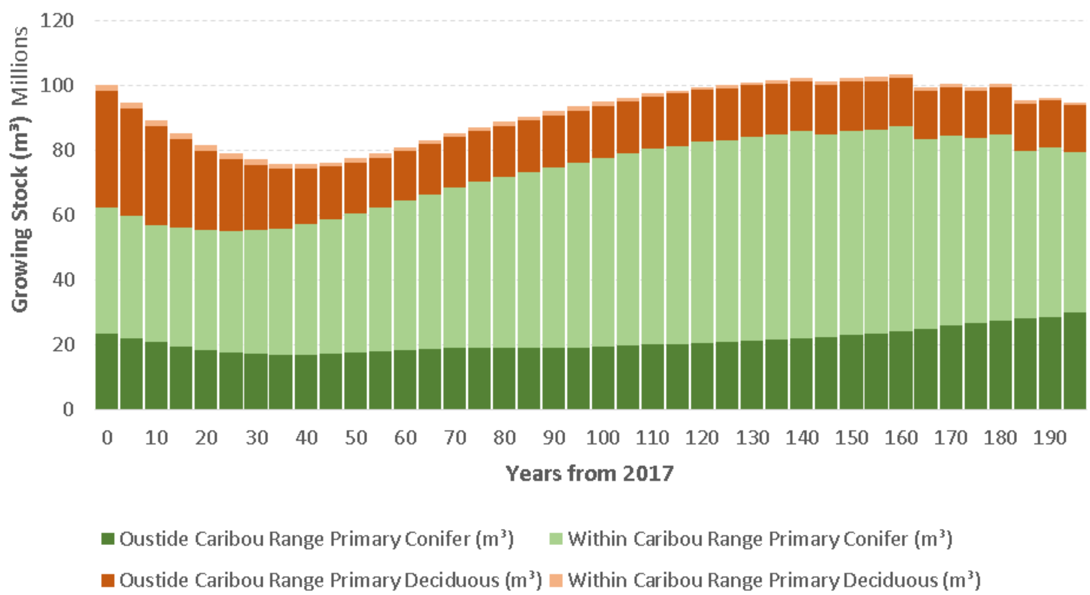


Figure 41 Primary conifer and primary deciduous growing stock within and outside the Caribou range for the PFMS #8110

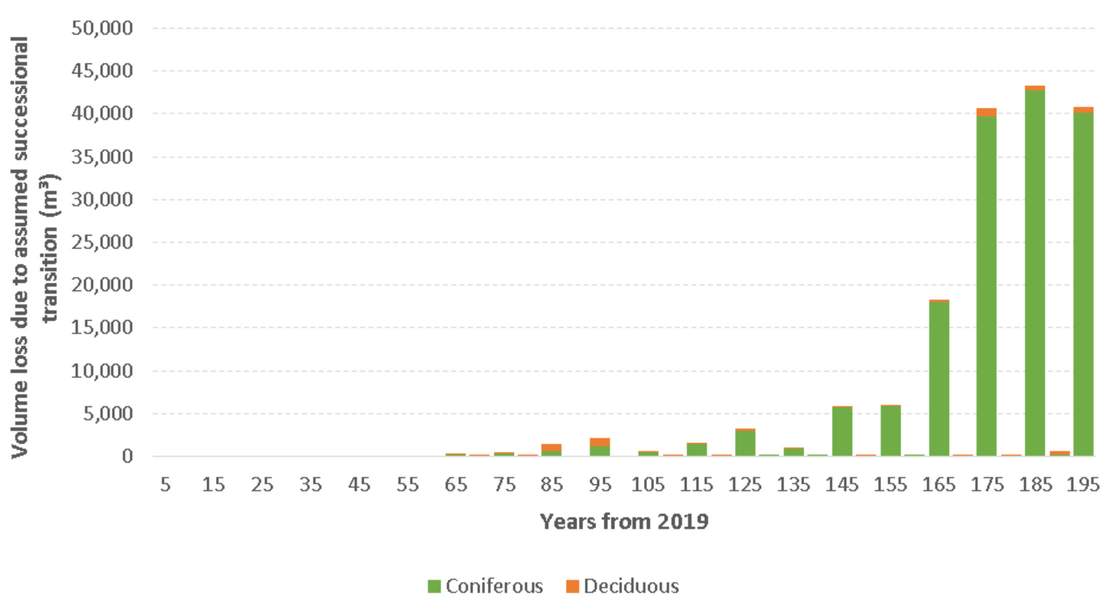


Figure 42 Conifer and Deciduous volume loss due to assumed successional transition for the PFMS #8110

9.2.2 Age Class Distribution

Age class distributions are shown in Figure 43 for the contributing land base at 0, 50, 100, and 200 years. Initially, a significant age class gap exists in the 20-60 age classes with relatively little area is greater than 140-year-old. Constraints applied for caribou access and seral stage targets resulted in a build-up of stands area over 140 years. Eventually, the distribution of age classes became more evenly distributed – particularly stands less than 80 years, while a significant portion of the land base continued to become very old.

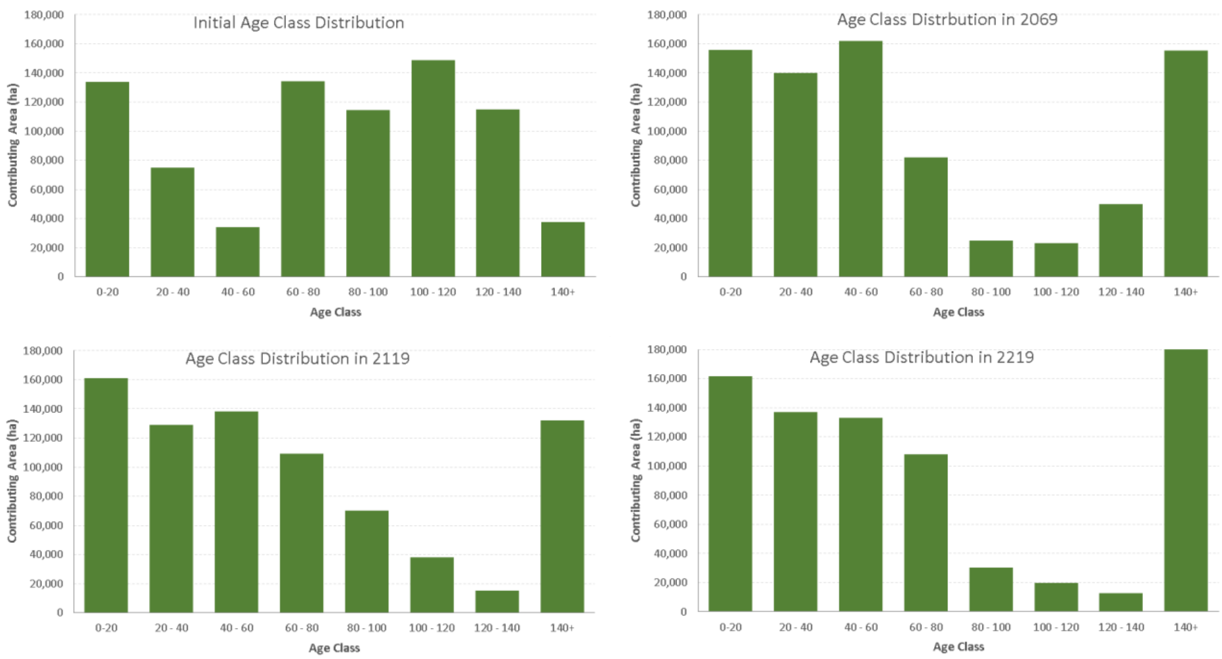


Figure 43 Contributing Age Class Distribution snapshots (0, 50, 100, & 200 years from now) for the PFMS #8110

9.2.3 Yield Type Composition

The composition of yield type across the contributing land base (Figure 44) shows the persistence of existing natural stands and existing managed stands throughout the planning horizon. This was due to the caribou access constraints over the first century and the repeated harvest pattern for young seral patch size targets over the second century. Old and very old seral retention targets also contributed towards maintaining these yield types on the land base.

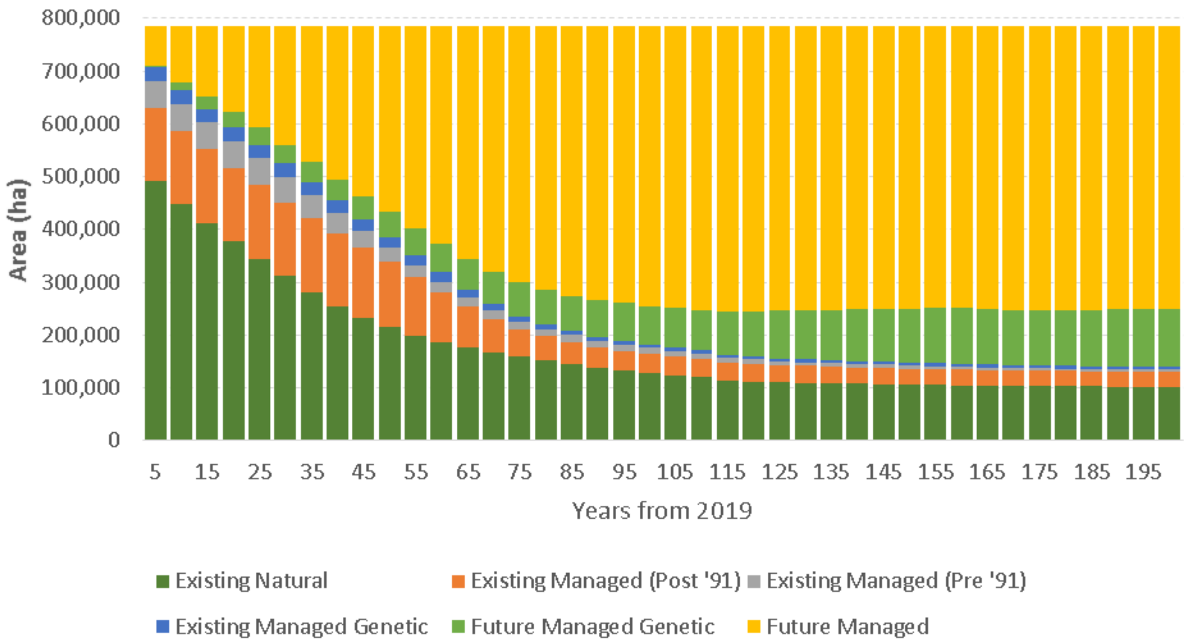


Figure 44 Contributing forest area yield type composition for the PFMS #8110

9.2.4 Area by Broad Cover Group

The gradual disappearance of the DC BCG (Figure 45) reflected the DC to CD harvest transitions applied in both the base case and PFMS scenarios. This figure also reflects the gradual conversion of deciduous-leading stands with conifer understory (DU), to conifer-leading stands with deciduous understory beginning in 40 years.

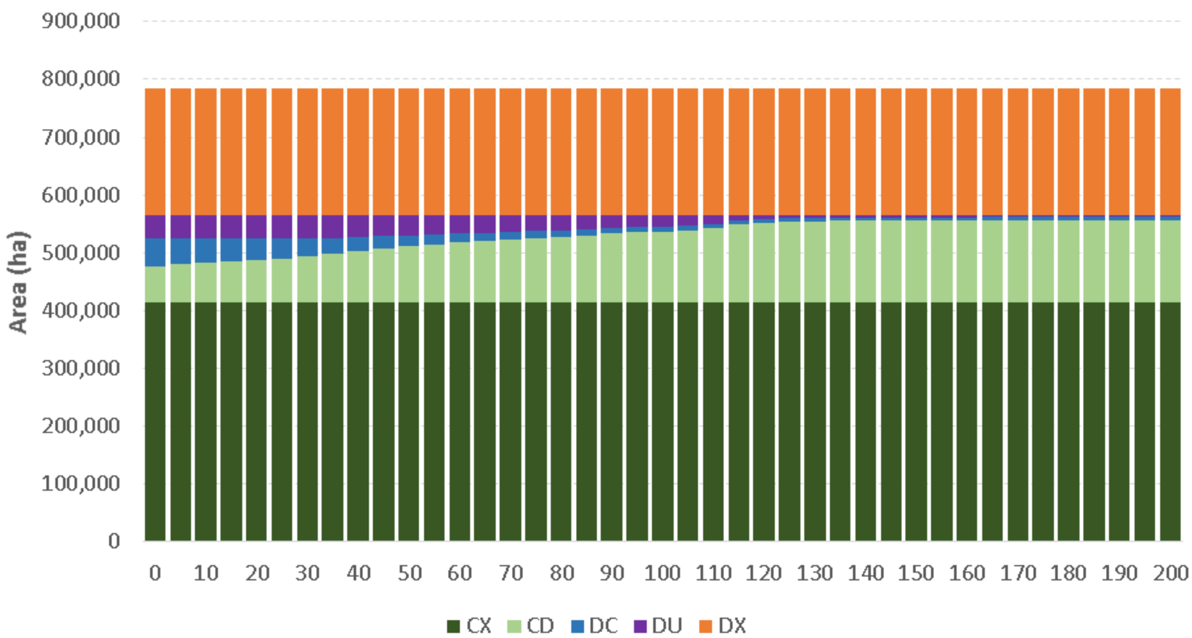


Figure 45 Area (ha) by Broad Cover Group for the PFMS #8110

9.3 Non-FMA Harvest

Harvesting outside the FMA was controlled and tracked for deciduous quota conveyed to Weyerhaeuser. Some primary conifer stands exist within non-FMA areas but remains unallocated at this time. The harvest flow presented in Figure 46 and resulting growing stock (Figure 47) was developed to assist the GoA in awarding volume to small tenure holders.

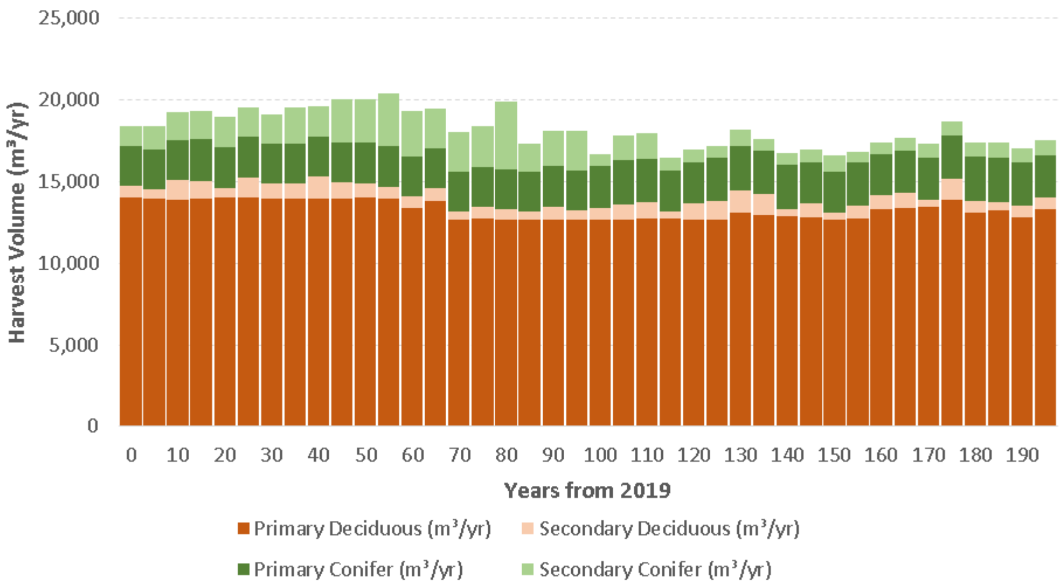


Figure 46 Harvest flow (m³/year) by species rank outside the FMA for the PFMS #8110

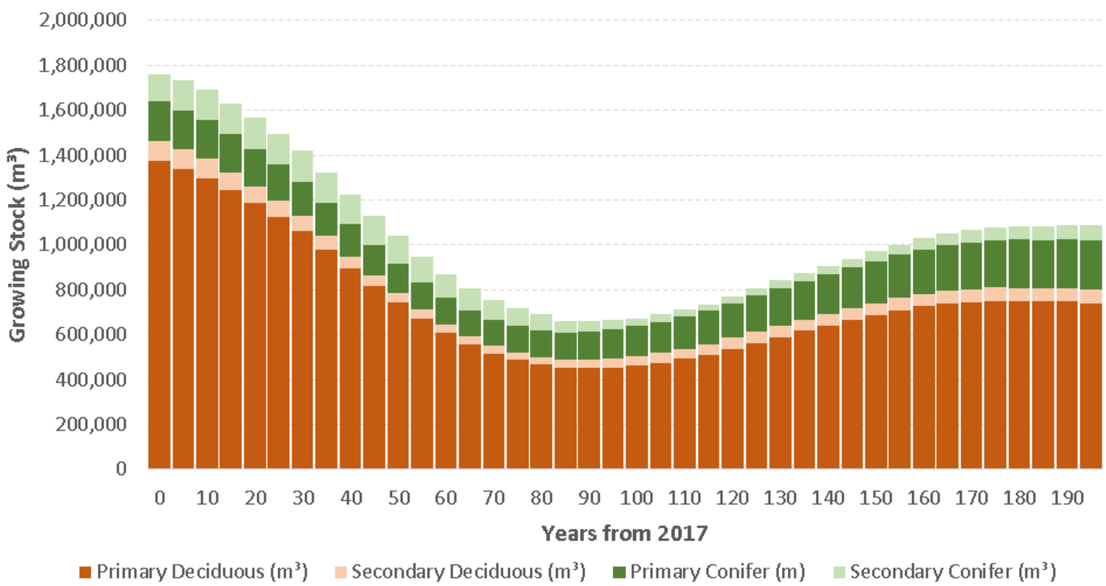


Figure 47 Growing stock by species rank outside the FMA for the PFMS #8110

9.4 Non-Timber Values

Non-timber reporting is provided for the base case and the PFMS as two separate reports.

9.5 Spatial Harvest Sequence

An overview map of the 20-year spatial harvest sequence (SHS) associated with the PFMS (PFMS#8110_TwentyYearSHS_8110) is provided in Figure 48. A data dictionary of the submitted SHS file geodatabase is included in Appendix I.

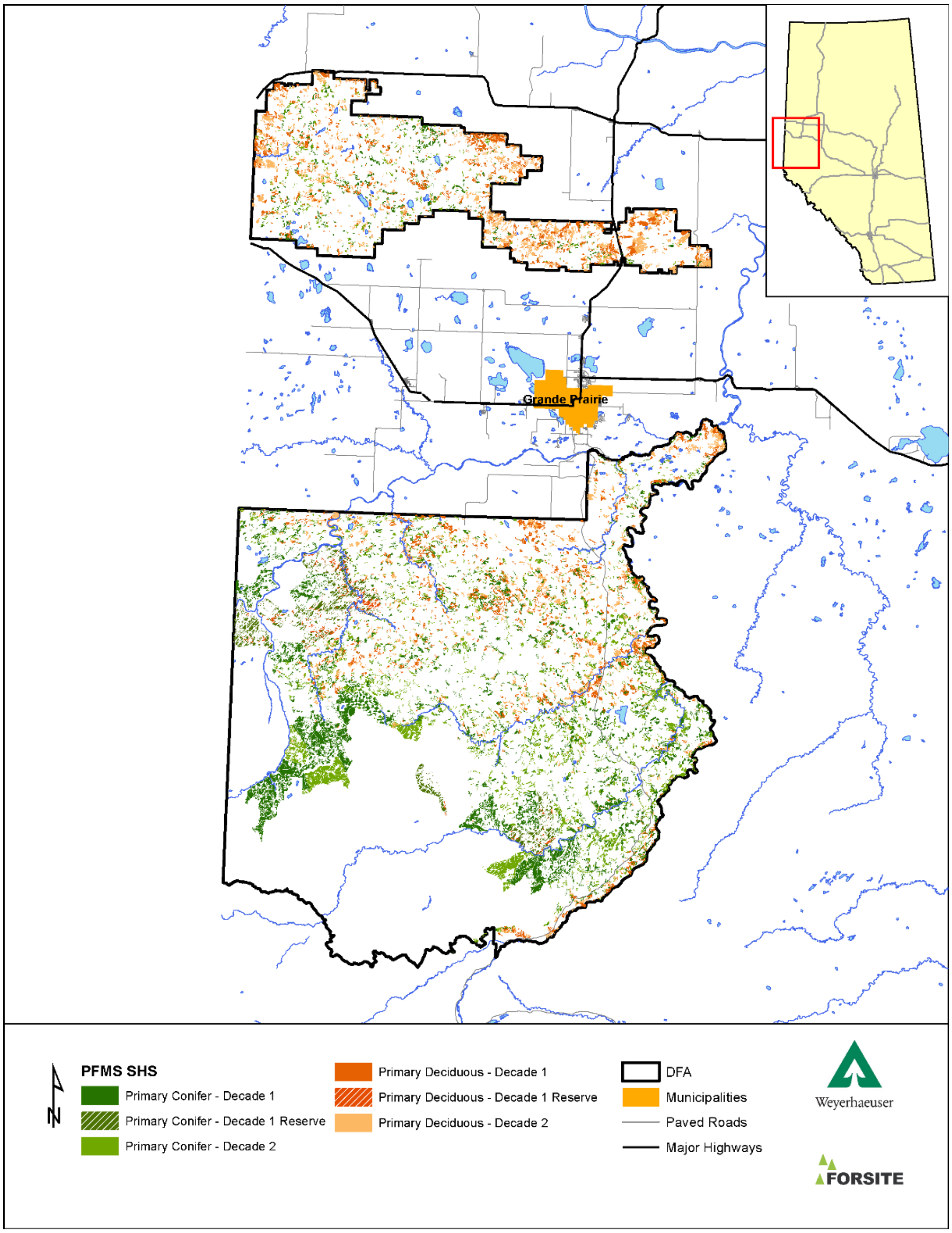


Figure 48 Spatial Harvest Sequence (SHS) overview map for the PFMS #8110_TwentyYearSHS_8110)

10. Technical Submission Details

Table 11 describes the PFMS input and output Patchworks model files. These files were only submitted digitally to Alberta Forest Management Branch technical review staff.

Table 11 Technical Submission Details

Description	File Name \ Location	Purpose
Patchworks XML	..\XMLcreation\04_FMP\CSV\GP_2019_FMP.xml	Main file used to create Patchworks Matrix track files in conjunction with fragments
Fragments	..\Spatial\Fragments\fragments20190620.shp	Classified Land Base file used to create Track file in conjunction with XML
Fragment Topology	..\Spatial\Fragments\fragments20190620_topology.csv	Used to group similar and near fragments into blocks
Blocks	..\Spatial\Blocks\blocks_20190620.shp	Grouped fragments file, used to create block topology and for display purposes in the model
Block Topology	..\Spatial\Blocks\block_20190620_topology.csv	Used to control patch size targets
Tracks (multiple files)	..\Model\7000_FMP\Tracks_base	Base model files, built using Patchworks Matrix builder, XML, and fragments file
Pre-Block Schedule	..\Model\7000_FMP\schedule_planned_20190624.csv	Contains transition period harvest and planned blocks in first 5-year period
Timing Constraints	..\TimingConstraints_20190703.csv	Used to control various deferrals
Patchworks PIN	..\Model\7000_FMP\WeycoGP_2018_FMP_base.PIN	Patchworks initiation file
Watershed Factors	..\Model\7000_FMP\WS_FACTOR.csv	Used to in PIN to adjust watershed targets to factor targets to account for permanent anthropogenic disturbances
Summary Accounts	..\Model\7000_FMP\Tracks_base\summaryAccounts.bsh	Used to create summary accounts to apply targets and as well as generate reporting on various metrics
Ratio Accounts	..\Model\7000_FMP\Tracks_base\ratioAccounts.bsh	Used to create ratio accounts to apply targets as well as generate reporting on various metrics
FMA boundary	..\Spatial\FMA_6900016.shp	Used for display purposes only in model
Access Units	..\Spatial\AccessUnits.shp	Used for display purposes only in model
Forest Attribute Reports	..\Model\7000_FMP\reports_Forest_Attributes.bsh	Contains multiple forest attribute reports
Harvest Attribute Reports	..\Model\7000_FMP\reports_Harvest_Attributes.bsh	Contains multiple harvest attribute reports
Harvest by Age Class Reports	..\Model\7000_FMP\reports_Product_Base_AgeClass_Area.bsh	Contains harvest attribute reports
Non-Timber Reports (multiple files)	..\Model\7000_FMP\reports_NonTimber_Attributes.bsh ..\Model\7000_FMP\reports_MapPineMarten_HSI.bsh ..\Model\7000_FMP\reports_MapYoungSeral.bsh ..\Model\7000_FMP\reports_MapSongbird_CAWA.bsh ..\Model\7000_FMP\reports_MapSongbird_BTGW.bsh ..\Model\7000_FMP\reports_MapSongbird_BRCR.bsh ..\Model\7000_FMP\reports_MapSongbird_OVEN.bsh	Creates multiple reports related to non-timber assessments

Description	File Name \ Location	Purpose
	..\Model\7000_FMP\reports_MapSongbird_VATH.bsh ..\Model\7000_FMP\reports_TwentyYearPlanDetailsGRIZZLY.bsh	
Twenty Year Plan Details report	..\Model\7000_FMP\reports_TwentyYearPlanDetails.bsh	Report used to generate 20-year spatial harvest sequence.
Target Descriptions	..\Model\7000_FMP\targetDescriptions.bsh	Used to create targets utilized and called from the scenario set
Scenario Sets	..\Model\7000_FMP\scenarioSet.bsh	Used for generating scenario and relies on targets defined in the target descriptions file
PFMS Scenario Outputs	..\Model\7000_FMP\Output\8110	Contains all outputs generated by the scenario and reports listed in this table
PFMS 20-year SHS	..\Model\7000_FMP\Output\8110\TwentyYearSHS_8110.gdb	The raw 20-year spatial harvest Sequence generated by linking scenario schedule with block file
PFMS 70-year SHS	..\Model\7000_FMP\Output\8110\SeventyYearSHS_8110.gdb	The raw 70-year spatial harvest Sequence generated by linking scenario schedule with block file

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Spatial Planning Systems. Patchworks User Guide. January. 2017. 748p.

Weyerhaeuser

Appendix I PFMS SHS Data Dictionary (PFMS#8110_TwentyYearSHS_8110)

File: TwentyYearSHS_8110.gdb\TwentyYearPlan
Description: Scenario schedule linked to blocks file to display SHS
Number of Records: 60,442

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
1	OBJECTID	OBJECTID	OID	4		
2	Shape	Shape	Geometry	0		
3	BLOCK_ID	BLOCK_ID	Integer	4	[73, 320043]	Block ID Key field
4	FIRST_YLD_	FIRST_YLD_	Integer	4	[101, 521]	Numerical yield strata
5	FIRST_CONT	FIRST_CONT	String	1	['C']	Contributing classification, C stands for contributing
6	FIRST_CARI	FIRST_CARI	Integer	4	[0, 1]	Caribou range flag
7	FIRST_SUBU	FIRST_SUBU	String	50	['Redrock-Prairie Creek', ' ', 'Narraway']	Caribou range subunit
8	FIRST_UNIT	FIRST_UNIT	String	15	['MainBlock', 'SaddleHills']	Forest unit description
9	FIRST_NSRN	FIRST_NSRN	String	25	['Lower Foothills', 'Subalpine', 'Upper Foothills', 'Central Mixedwood', 'Dry Mixedwood', 'Montane']	Natural Subregion
10	FIRST_G1_B	FIRST_G1_B	Integer	4	[0, 1]	G1 breeding region flag
11	FIRST_B1_B	FIRST_B1_B	Integer	4	[0, 1]	B1 breeding region flag
12	FIRST_B2_B	FIRST_B2_B	Integer	4	[0, 1]	B2 breeding region flag
13	FIRST_STD_	FIRST_STD_	String	4	['CX', 'CD', 'DC', 'DX']	Initial Broad Cover Group Assignment
14	FIRST_WS_K	FIRST_WS_K	Integer	4	[0, 206]	Watershed Key ID
15	FIRST_NSR_	FIRST_NSR_	Single	4	<skipped>	
16	FIRST_RETE	FIRST_RETE	Integer	4	[0, 2]	Retention flag for stand-level retention
17	FIRST_DEFE	FIRST_DEFE	Integer	4	[0, 60]	Insular retention duration
18	FIRST_FMA_	FIRST_FMA_	String	100	['Weyerhaeuser Company Limited (Grande Prairie)', ' ']	FMA flag
19	FIRST_GRAZ	FIRST_GRAZ	String	3	[' ', 'FGL', 'GRL']	grazing flag
20	FIRST_NSR1	FIRST_NSR1	Single	4	<skipped>	Not used

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Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
21	FIRST_ACCE	FIRST_ACCE	Integer	4	[0, 3126]	Caribou access ID
22	FIRST_PLAN	FIRST_PLAN	Integer	4	[0, 3029]	Planned block Key ID
23	FIRST_SYMP	FIRST_SYMP	String	25	[' ', 'Mortality']	Deciduous mortality flag
24	LT_FLAG	LT_FLAG	Integer	4	[0, 1]	larch flag
25	Compartmen	Compartmen	String	8	['COM_3004', 'COM_3088', 'COM_2017', 'COM_2016', 'COM_3107', 'COM_2015', 'COM_3086', ' ', 'COM_3084', 'COM_2022', 'COM_3094', 'COM_3097', 'COM_3003', 'COM_3090', 'COM_3095', 'COM_3096', 'COM_3104', 'COM_3089', 'COM_3100', 'COM_3101', 'COM_3126', 'COM_3105', 'COM_3123', 'COM_2002', 'COM_2078', 'COM_3102', 'COM_3106', 'COM_3109', 'COM_2068', 'COM_1074', 'COM_3099', 'COM_3092', 'COM_3111', 'COM_3087', 'COM_3122', 'COM_3110', 'COM_3098', 'COM_3113', 'COM_3115', 'COM_3083', 'COM_3114', 'COM_3093', 'COM_3117', 'COM_3121', 'COM_2050', 'COM_3082', 'COM_3124']	Caribou Access Unit name
26	WATERSHED	WATERSHED	String	254	['WS_86', 'WS_99', 'WS_107', 'WS_93', 'WS_111', 'WS_95', 'WS_81', 'WS_103', 'WS_110', 'WS_142', 'WS_112', 'WS_89', 'WS_98', 'WS_101', 'WS_83', 'WS_96', 'WS_150', 'WS_85', 'WS_75', 'WS_23', 'WS_28', 'WS_12', 'WS_45', 'WS_51', 'WS_59', 'WS_63', 'WS_76', 'WS_54', 'WS_158', 'WS_32', 'WS_25', 'WS_34', 'WS_38', 'WS_39', 'WS_50', 'WS_14', 'WS_9', 'WS_31', 'WS_22', 'WS_35', 'WS_37',	Watershed Key ID Name

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
					'WS_16', 'WS_21', 'WS_33', 'WS_43', 'WS_49', 'WS_52', 'WS_55', 'WS_56', 'WS_60', 'WS_62', 'WS_74', 'WS_77', 'WS_67', 'WS_82', 'WS_10', 'WS_26', 'WS_53', 'WS_69', 'WS_70', 'WS_19', 'WS_30', 'WS_29', 'WS_36', 'WS_42', 'WS_57', 'WS_18', 'WS_27', 'WS_40', 'WS_41', 'WS_44', 'WS_46', 'WS_47', 'WS_48', 'WS_58', 'WS_61', 'WS_65', 'WS_66', 'WS_68', 'WS_79', 'WS_94', 'WS_118', 'WS_17', 'WS_24', ' ', 'WS_64', 'WS_72', 'WS_73', 'WS_78', 'WS_84', 'WS_88', 'WS_90', 'WS_91', 'WS_100', 'WS_104', 'WS_105', 'WS_113', 'WS_117', 'WS_119', 'WS_129', 'WS_135', 'WS_137', 'WS_143', 'WS_141', 'WS_102', 'WS_106', 'WS_109', 'WS_151', 'WS_114', 'WS_125', 'WS_120', 'WS_130', 'WS_15', 'WS_20', 'WS_161', 'WS_193', 'WS_166', 'WS_171', 'WS_163', 'WS_200', 'WS_201', 'WS_165', 'WS_195', 'WS_183', 'WS_172', 'WS_175', 'WS_178', 'WS_179', 'WS_180', 'WS_198', 'WS_162', 'WS_169', 'WS_170', 'WS_197', 'WS_199', 'WS_202', 'WS_203', 'WS_194', 'WS_167', 'WS_190', 'WS_196', 'WS_4', 'WS_1', 'WS_2', 'WS_3', 'WS_5', 'WS_6', 'WS_184', 'WS_186', 'WS_182', 'WS_204', 'WS_187', 'WS_176', 'WS_164', 'WS_168', 'WS_174', 'WS_185', 'WS_192', 'WS_205', 'WS_206']	
27	SUM_FB	SUM_FB	Single	4	0	Summer fire behaviour potential
28	SPRI_FB	SPRI_FB	Single	4	0	Spring fire behaviour potential
29	FAL_FB	FAL_FB	Single	4	0	Fall fire behaviour potential

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
30	ALL_FB	ALL_FB	Single	4	0	Consolidated Fire behaviour potential
31	FIRE_TAR	FIRE_TAR	Integer	4	[0, 1]	Target Fire behaviour flag
32	Shape_Length	Shape_Length	Double	8	[12.875004111582589, 41192.536416373783]	
33	Shape_Area	Shape_Area	Double	8	[10.459906162800142, 2551960.2448969427]	
34	TREATMENT_YEAR	TREATMENT_YEAR	Integer	4	[0, 20]	Year of treatment in model
35	PERIOD	PERIOD	Integer	4	[0, 4]	Period of treatment
36	TREATMENT	TREATMENT	String	25	['__CC__', '_G804_', 'G147p2', '_G303_', '__CC_F', 'G351p1', 'G351p2']	Treatment type
37	PRIMARY_PRODUCT	PRIMARY_PRODUCT	String	3	['SWD', 'HWD']	Primary product produced from harvest treatment
38	TREATMENT_AGE	TREATMENT_AGE	Double	8	[21.0, 239.0]	Age of stand at treatment
39	PRIMARY_SWD_VOL_HA	PRIMARY_SWD_VOL_HA	Double	8	[0.0, 338.40940054478324]	Primary conifer harvest volume yield (m^3/ha) generated by treatment
40	PRIMARY_HWD_VOL_HA	PRIMARY_HWD_VOL_HA	Double	8	[0.0, 259.27870149327708]	Primary deciduous harvest volume yield (m^3/ha) generated by treatment
41	SECONDARY_SWD_VOL_HA	SECONDARY_SWD_VOL_HA	Double	8	[0.0, 53.630025626040926]	Secondary conifer harvest volume yield (m^3/ha) generated by treatment
42	SECONDARY_HWD_VOL_HA	SECONDARY_HWD_VOL_HA	Double	8	[0.0, 141.7825089013692]	Secondary deciduous harvest volume yield (m^3/ha) generated by treatment
43	TOTAL_VOL_HA	TOTAL_VOL_HA	Double	8	[0.17544456024093369, 345.56697433756068]	Total volume yield (m^3/ha) generated by treatment
44	TOTAL_VOL	TOTAL_VOL	Double	8	[0.0025289544864790514, 64681.3798828125]	Total volume (m^3) generated by treatment
45	PRIMARY_SWD_VOL	PRIMARY_SWD_VOL	Double	8	[0.0, 29995.2890625]	Total primary conifer volume (m^3) generated by treatment

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Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
46	PRIMARY_HWD_VOL	PRIMARY_HWD_VOL	Double	8	[0.0, 59629.22265625]	Total primary deciduous volume (m^3) generated by treatment
47	SECONDARY_SWD_VOL	SECONDARY_SWD_VOL	Double	8	[0.0, 5052.1572265625]	Total secondary conifer volume (m^3) generated by treatment
48	SECONDARY_HWD_VOL	SECONDARY_HWD_VOL	Double	8	[0.0, 10790.0732421875]	Total secondary deciduous volume (m^3) generated by treatment
49	MANAGED_AREA	MANAGED_AREA	Double	8	[0.0010030600242316725, 240.74980163574219]	Net polygon classified area (reduced by stand-level retention factor)
50	CX_AREA	CX_AREA	Double	8	[0.0, 103.10279846191406]	Total CX area of block
51	CD_AREA	CD_AREA	Double	8	[0.0, 45.911220550537109]	Total CD area of block
52	DC_AREA	DC_AREA	Double	8	[0.0, 79.325790405273437]	Total DC area of block
53	DU_AREA	DU_AREA	Double	8	[0.0, 53.242328643798828]	Total DU area of block
54	DX_AREA	DX_AREA	Double	8	[0.0, 240.74980163574219]	Total DX are of block
55	PrimarySWD_id	PrimarySWD_id	Double	8	[-1.0, 49437.0]	Primary conifer Patch ID
56	PrimaryHWD_id	PrimaryHWD_id	Double	8	[-1.0, 25391.0]	Primary deciduous patch ID
57	PRIMARY_OPERATOR	PRIMARY_OPERATOR	String	50	['WEYERHAEUSER', 'NORBORD', 'UNALLOCATED', 'LOCAL USE', 'TOLKO']	Primary Operator Tag
58	SECONDARY_OPERATOR	SECONDARY_OPERATOR	String	50	['NORBORD', 'WEYERHAEUSER', 'UNALLOCATED', 'TOLKO', 'LOCAL USE']	Secondary Operator Tag

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File: TwentyYearSHS_8110.gdb\TwentyYearPlanPatch
Description: simplified (dissolved on Patch ID) version of SHS
Number of Records: 9,708

Index	Field Name	Alias Name	Data Type	Field Length	Values / Range	Description
1	OBJECTID	OBJECTID	OID	4		
2	Shape	Shape	Geometry	0		
3	PrimarySWD_id	PrimarySWD_id	Double	8	[-1.0, 49437.0]	Primary conifer Patch ID
4	PrimaryHWD_id	PrimaryHWD_id	Double	8	[-1.0, 25391.0]	Primary deciduous patch ID
5	FIRST_TREATMENT_YEAR	FIRST_TREATMENT_YEAR	Integer	4	[0, 20]	Year of treatment
6	FIRST_PERIOD	FIRST_PERIOD	Integer	4	[0, 4]	Treatment type
7	SUM_PRIMARY_SWD_VOL	SUM_PRIMARY_SWD_VOL	Double	8	[0.0, 487928.74585203826]	Total primary conifer volume (m^3) generated by treatment
8	SUM_PRIMARY_HWD_VOL	SUM_PRIMARY_HWD_VOL	Double	8	[0.0, 149250.15312954783]	Total primary deciduous volume (m^3) generated by treatment
9	SUM_SECONDARY_SWD_VOL	SUM_SECONDARY_SWD_VOL	Double	8	[0.0, 12251.974544612691]	Total secondary conifer volume (m^3) generated by treatment
10	SUM_SECONDARY_HWD_VOL	SUM_SECONDARY_HWD_VOL	Double	8	[0.0, 52272.477041217498]	Total secondary deciduous volume (m^3) generated by treatment
11	SUM_TOTAL_VOL	SUM_TOTAL_VOL	Double	8	[0.034544048947282129, 519047.68723645096]	Total volume yield (m^3/ha) generated by treatment
12	SUM_MANAGED_AREA	SUM_MANAGED_AREA	Double	8	[0.0010099660139530897, 2154.5985048774164]	Net polygon classfied area (reduced by stand-level retention factor)
13	FIRST_FIRST_CARI	FIRST_FIRST_CARI	Integer	4	[0, 1]	Caribou range flag
14	FIRST_FIRST_STD_	FIRST_FIRST_STD_	String	4	['DX', 'CX', 'CD', 'DC']	Initial Broad Cover Group Assignment
15	FIRST_FIRST_PLAN	FIRST_FIRST_PLAN	Integer	4	[0, 3029]	Planned block key
16	SUM_CX_AREA	SUM_CX_AREA	Double	8	[0.0, 2024.9962201165035]	Total CX area of block

17	SUM_CD_AREA	SUM_CD_AREA	Double	8	[0.0, 261.8221720312722]	Total CD area of block
18	SUM_DC_AREA	SUM_DC_AREA	Double	8	[0.0, 111.10253994166851]	Total DC area of block
19	SUM_DU_AREA	SUM_DU_AREA	Double	8	[0.0, 92.815597027540207]	Total DU area of block
20	SUM_DX_AREA	SUM_DX_AREA	Double	8	[0.0, 656.28001982229762]	Total DX are of block
21	FIRST_PRIMARY_PRODUCT	FIRST_PRIMARY_PRODUCT	String	3	['HWD', 'SWD']	Primary product produced from harvest treatment
22	Shape_Length	Shape_Length	Double	8	[12.875004111582589, 265370.49434681796]	Shape Length
23	Shape_Area	Shape_Area	Double	8	[10.520480980695083, 22529432.071463607]	Shape Area
24	PRIMARY_SWD_VOL_HA	PRIMARY_SWD_VOL_HA	Double	8	[0.0, 318.66809300922114]	Primary conifer harvest volume yield (m^3/ha) generated by treatment
25	PRIMARY_HWD_VOL_HA	PRIMARY_HWD_VOL_HA	Double	8	[0.0, 259.27870138090418]	Primary deciduous harvest volume yield (m^3/ha) generated by treatment
26	SECONDARY_SWD_VOL_HA	SECONDARY_SWD_VOL_HA	Double	8	[0.0, 53.620976420705894]	Secondary conifer harvest volume yield (m^3/ha) generated by treatment
27	SECONDARY_HWD_VOL_HA	SECONDARY_HWD_VOL_HA	Double	8	[0.0, 141.7825084842917]	Secondary deciduous harvest volume yield (m^3/ha) generated by treatment
28	TOTAL_VOL_HA	TOTAL_VOL_HA	Double	8	[16.646313315073488, 327.15378061002718]	Total volume yield (m^3/ha) generated by treatment
29	PRIMARY_OPERATOR	PRIMARY_OPERATOR	String	50	['NORBORD', 'UNALLOCATED', 'TOLKO', 'WEYERHAEUSER', 'LOCAL USE']	Primary Operator Tag
30	SECONDARY_OPERATOR	SECONDARY_OPERATOR	String	50	['WEYERHAEUSER', 'LOCAL USE', 'NORBORD', 'UNALLOCATED', 'TOLKO']	Secondary Operator Tag


Legend
Caribou Range
Lakes (Provincial Data)
FMA Boundary
Priority 1 Access Units - Decade One
Priority 2 Reserve Caribou Access Units - Decade One
N
0
5
10
20 Kilometers

Grande Prairie 2019-2029 Forest Management Plan

Preferred Forest Management Strategy
20-Year Spatial Harvest Sequence

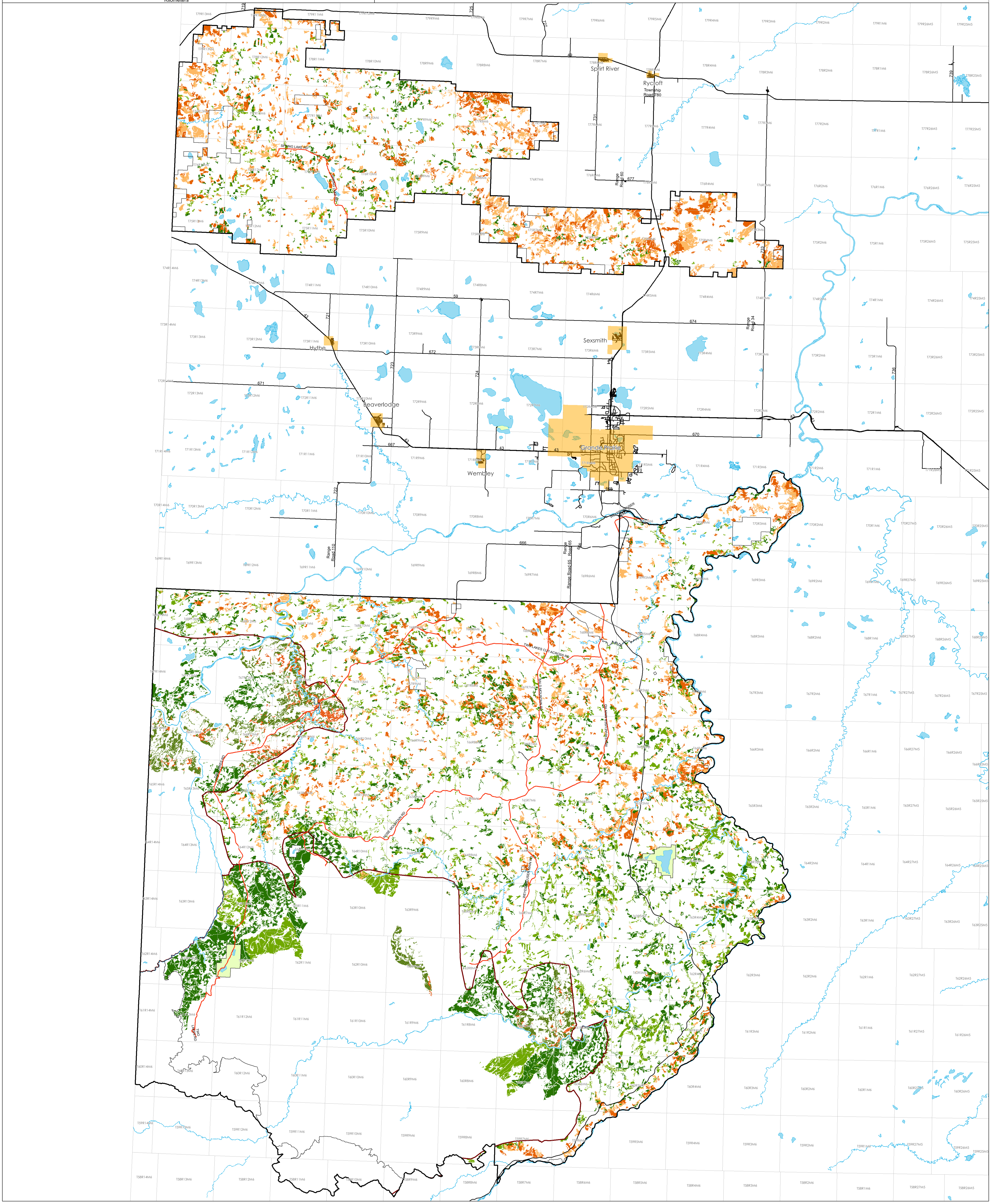
Weyerhaeuser

1:200,000
0 5 10 20
Kilometers

FORSITE
Drawn on: 1/2/2020

FMU (G16)
FMA (#6900016)
Caribou Range
Major Highways
Paved Roads
Mainline Roads (LOC)
Rivers and Lakes
Municipalities, Towns, and Villages
Provincial Parks & Recreation Areas

20-year Spatial Harvest Sequence (Scenario 8110)
Primary Conifer - Decade 1
Primary Conifer - Decade 1 Reserve
Primary Conifer - Decade 2
Primary Deciduous - Decade 1
Primary Deciduous - Decade 1 Reserve
Primary Deciduous - Decade 2



Public Involvement Process

2019-2029
Detailed Forest Management Plan

Weyerhaeuser Company Limited
Grande Prairie Alberta Timberlands
FMA#6900016

Submitted September 21, 2017

Table of Contents

1.0 Introduction

The goal of this Public Involvement Process (PIP) is to provide a framework to solicit stakeholder and general public input into the development of the next (2019–2029) Detailed Forest Management Plan (DFMP, The Plan) for Weyerhaeuser Grande Prairie's Forest Management Agreement Area (FMA) and associated non-FMA areas.

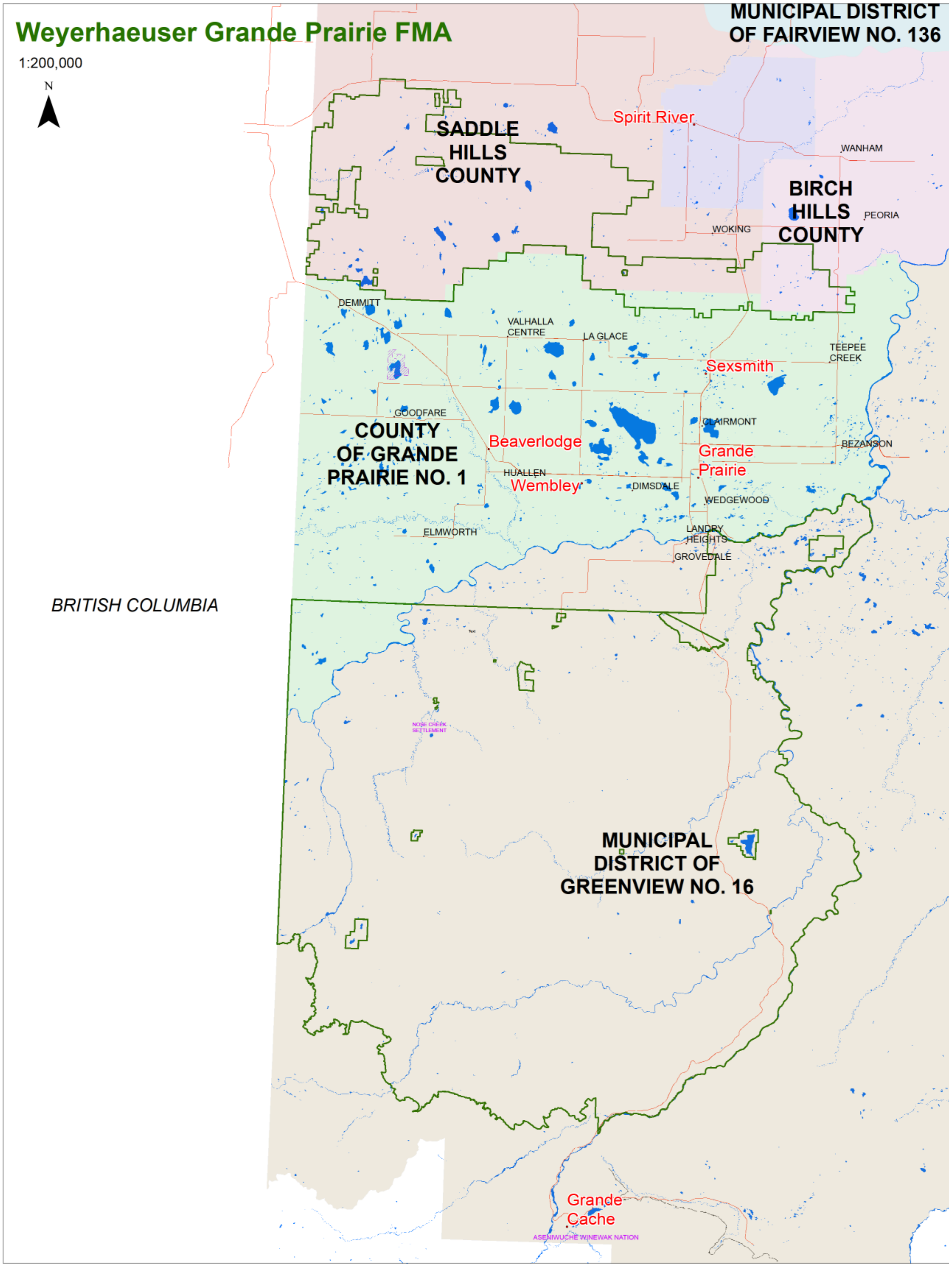
The process is intended to show that Weyerhaeuser has engaged the general public and stakeholders appropriately in its development of the DFMP, has tracked all responses accordingly, and has attempted to address issues brought forward in the DFMP itself.

Key elements for success in this public consultation process will be to:

- ✓ Establish a Public Advisory Group (PAG) that will provide a forum for members of the general public, local stakeholders and municipality representatives to provide meaningful input into the DFMP.
- ✓ Identify members from the above populations and give them the opportunity to bring forward a wide range of knowledge and cultural or economic interest in the forest.
- ✓ Establish supportive relationships with stakeholder groups and rural communities and engage them in a manner that is most convenient and appropriate for them.
- ✓ Educate the general public on sustainable forest management practices occurring in their local forest.
- ✓ Record input received and track how such input was addressed in the development of the DFMP.
- ✓ Record all efforts to contact stakeholders, regardless of their response.

2.0 Scope

The Area associated with and near FMA#6900016



3.0 Types of Stakeholders

There are a number of stakeholders groups that may be impacted by the DFMP. These stakeholder groups can be separated into three categories: Primary, Secondary, and the General Public. Each of these groups will be offered different opportunities to provide input into the DFMP.

Additionally, Weyerhaeuser will meet with any other stakeholder group or individual not currently identified if they express a desire for a meeting.

3.1 First Nations

A separate process that follows the Provincial Consultation Guidelines has been developed for First Nations in the area. This process will occur concurrently with the PIP process and may likely impact some of this plans goals, objectives, and/or strategies moving forward.

3.2 Quota Holders

Quota holders on the FMA will be directly involved in the development of the DFMP through their participation as core members of the Plan Development Team.

3.3 Primary Stakeholders

Primary stakeholder groups are those that are part of a local or provincial associations that may be directly impacted by forest management activities.

These may include:

- International Paper
- grazing lease or grazing license holder
- trappers/ trapper associations
- off road vehicle clubs

3.4 Secondary Stakeholders

Secondary stakeholders are those that may be indirectly impacted by forest management activities. These may include:

- Municipal entities
    - ❖ Regional government members from surrounding Communities; Counties; MD's
    - ❖ Members of local environmentally focused community groups
- Current Weyerhaeuser Timberlands Contractors
- Private Recreational Sites
    - ❖ Spring Lake Recreation Area (campsite & ski hill)
    - ❖ Nitehawk Ski hill

3.5 General Public

This includes any other group or individual not currently listed as being either a primary or secondary stakeholder.

4.0 External Communication

4.1 Primary and Secondary Stakeholders

Weyerhaeuser will undertake the following:

- Mail-outs will be sent out in the first quarter of 2018 to overlapping trappers, grazing lease/ license holders, as well as vested associations and clubs with a brief description of the Forest Management planning and Public Involvement processes.
- Weyerhaeuser will also solicit representation from the stakeholder group in the Public Advisory Group membership.
- Weyerhaeuser will provide information sessions when requested by primary stakeholder groups

See Appendix B for a current list of known Stakeholders for the FMA.

4.2 General Public

Weyerhaeuser will solicit representation from the general public in the Public Advisory Group membership.

Ideally members would have direct ties to the community and may be indirectly impacted by the DFMP.

This may include persons from:

- School boards or school trustees
- Law or bylaw enforcement
- Emergency service groups (fire halls, search & rescue, emergency response)

Weyerhaeuser will provide information sessions when requested by general public groups or associations to share information about the Forest Management Plan renewal process.

4.3 Public Advisory Group (PAG)

Weyerhaeuser will establish a small, diverse group of public representatives as an advisory committee to provide Weyerhaeuser with its primary strategy in seeking involvement from the general public in the development of the DFMP.

This advisory committee will be established approximately one year out from Plan submission (January 2018) and <u>may</u> only be in place up to DFMP approval. Outside of FMP renewal, Weyerhaeuser has moved away from maintaining a traditional PAG in favour of 1:1 relationships and communication with focused public groups to address specific concerns.

Weyerhaeuser will strive to get membership for this committee from across the entire geographic area if possible and will include individuals from the primary and secondary stakeholder list as well as members of the general public. Ideally, members will understand forestry and forestry related issues and will be able to effectively provide input into the DFMP. Representation from the local Agriculture and Forestry office will be required.

See Appendix C for a list of Public Advisory Group members.

4.4 Presentations

Weyerhaeuser will offer to attend formal meetings of established communities and community groups to share information about Weyerhaeuser and the forest management planning process. The intent is to provide groups with a specific interest in Weyerhaeuser, the FMA or the planning process information pertaining to their individual needs.

Offers of a presentation will be made to at least:

- The City of Grande Prairie
- The Town of Beaverlodge
- The Town of Grande Cache
- The MD of Greenview
- The County of Grande Prairie #1
- Birch Hills County
- Saddle Hills County
- The Alberta Trappers Association (Grande Prairie Chapter)
- The Swan City Snowmobile Club
- Grande Prairie River Rats Association
- The Stewards of Webster
- The Weyerhaeuser Timberlands Contractor Group
- International Paper

4.5 Open Houses

Weyerhaeuser will hold (an) Open House(s) to provide the general public an opportunity for input into the Detailed Forest Management Plan development.

The open house(s) will be held in Grande Prairie but may also include scheduled events in smaller, outlying communities based on general public input.

Weyerhaeuser will follow these general guidelines when hosting an open house:

- Held in a venue that is easy to access by the general public
- Well-advertised using varying sources to get the information out to the general public (newspaper, social media, radio, etc.)
- Mailed invites will go out to the known primary and secondary stakeholders
- Information sharing visual aids and handouts will be clear, concise and accessible to attendees
- Attendance, comments and concerns will be documented and follow up tracked to completion

4.6 Field Tours

Field tours are an effective way to show the general public how the forest resources are managed. Weyerhaeuser may utilize field tours as a means of showing stakeholders its business and to increase knowledge.

5.0 Timelines

The following details an approximate timeline and items to be reviewed with all stakeholder and general public groups during the development of the DFMP. The intent is to illustrate the general flow of information, not identify hard dates.

January 2018 (12 months from submission)

- Administrative Review including Terms of Reference, Tracking and remuneration
- Introduction to Weyerhaeuser
- Introduction to Forest Legislation Policy and Tenure
- Sustainable Forest Management & Certification
- Detailed Forest Management Planning Process

March 2018 (10 months from submission)

- Landbase Determination and Landbase Assessment
- Yield Curves

May 2018 (8 months from submission)

- Values, Objectives, Indicators and Targets (VOITS)

July 2018 (6 months from submission)

- Wildlife Populations and Habitat
- Hydrology
- Tree Retention

September 2018 (4 months from submission)

- Overview of Operations, Reforestation, Monitoring and Research
- Footprint and Cumulative Effects
- Natural Range of Variation
- Wildfire

July –December 2018 (4 -6 months from submission)

- Primary & secondary stakeholder group presentations
- Open Houses (Net Landbase determination, the landscape assessment, VOITS, final SHS)

December 2018 (1 month from submission)

- Wrap up and outstanding item review
- Present Tracking summaries
- Review 20 year Spatial Harvest Sequence
- Review Final Document

March 2019 (post approval)

- Review approval conditions

6.0 Document Tracking and Reporting

Weyerhaeuser will record all issues as they arise during the public input process and where appropriate, may re-direct inquiries to the Province.

Public Advisory Group

The minutes of meetings will record all concerns/issues brought forward as well as Weyerhaeuser's response to these concerns/issues.

General Public

Weyerhaeuser will record all concerns/issues brought forward by members of the general public as well as Weyerhaeuser's response to these concerns/issues using our documented "Responding to Public Concerns" Environmental Management System Guideline (see Appendix D).

All responses to comments or concerns brought forward to Weyerhaeuser by any PAG member, stakeholder, association/ club or member of the general public will be documented and delivered in writing.

Table 1: Public Input Tracking (template)

Date	Venue or Meeting#	Tracking Number	Issue	Response or Action Item	Completion Date (as required)

A summary report of all general public input:

- will be regularly reported to the Plan Development Team,
- will be provided as a component of the final DFMP submission
- will be addressed in the DFMP where appropriate

7.0 Access to Information and Resources

In addition to Alberta Agriculture and Forestry (GOA or the Province) requirements, Weyerhaeuser's own policy will influence the development of the DFMP. This includes Weyerhaeuser's Environmental Core Policy, Sustainable Forestry Policy, and Weyerhaeuser's commitment to certification under the Sustainable Forestry Initiative. (See Appendix A).

The flow of information to the general public will be uninhibited, unless it is deemed by Weyerhaeuser to be proprietary (i.e. financial or business related).

8.0 Conflict of Interest

Persons who may be in a conflict-of-interest must disclose this, and Weyerhaeuser has the option of excluding such individual(s) from any further discussions on the matter. Although Public Advisory Group members may be able to offer points of view relating to their geography, recreation, or place of employment, these viewpoints are opinions only. PAG members will only officially represent their own self interests.

9.0 Dispute Resolution Mechanism

In order for meaningful discussions to occur throughout the DFMP planning process, public members must be able to express individual views during the development of the DFMP. It is the intent of the process to allow for the resolution of all issues through education and awareness before needing to implement a dispute resolution process.

However, if this is not successful, the following outlines the process for dispute resolution:

Public Advisory Group

- Step #1: The public member and Weyerhaeuser will commit to finding the best solution possible and acknowledge that this will often lead to a compromise rather than an uncompromising win by one point of view.
- Step #2: The public member and Weyerhaeuser will seek to identify the root issues and work towards a solution in a positive environment.
- Step #3: The public member will seek clarification of information when needed to better understand the issue. Weyerhaeuser will provide further information, technical advisors, field tours and other reasonable efforts to provide a higher level of understanding to the group.
- Step #4: If the issue is unresolved after step #3, then Weyerhaeuser will summarize the issue and bring it to the Plan Development Team for their consideration and resolution. This resolution will be communicated to the PAG to close the loop.

Members of the General Public

- Step #1: Weyerhaeuser will commit to providing clarification of the issue brought forward by providing further information, technical advisors, field tours and other reasonable efforts to provide a higher level of understanding of the issue.
- Step #2: If the issue remains contentious Weyerhaeuser will summarize the issue and bring it to the Plan Development Team for their consideration and resolution. This resolution will be communicated to the public member to close the loop.

10.0 Public Advisory Group Terms of Reference

This section will serve as a guide for the group's proceedings as well as help facilitate the group towards meeting the goals and objectives for which it was convened.

10.1 Objectives

In order to develop an informed plan, Weyerhaeuser will use a variety of methods to seek public input including the formation of Public Advisory Group (PAG). The members of this group will be formally invited to participate based on both affiliation and capacity to add significant value to the process.

10.2 The Process

The PAG will meet approximately 6-8 times between January and December of 2018. Weyerhaeuser will ensure that all meeting logistics are looked after and that ample advance notice of location and time be provided.

Weyerhaeuser will present a framework to guide discussions however ultimately members will guide the agenda and schedules allowing emphasis to be placed on the areas of greatest interest to membership.

Weyerhaeuser's commitment to the membership is to educate, listen, record and respond to the feedback provided and will be looking to the group for prioritizing issues and recommendations preferably with consensus.

Differences of opinion on substantive issues will be resolved by members seeking clarification as needed and working together to compromise. If consensus cannot be reached then the Dispute Resolution process will engage.

10.3 Roles of the PAG

The Weyerhaeuser Grande Prairie Timberlands Forest Management Plan Public Advisory Group is an advisory group that operates on the understanding that Weyerhaeuser will seriously consider and respond to all PAG recommendations on matters that fall within its sphere of influence as it relates to Timberlands.

The PAG will have the opportunity to review Weyerhaeuser's 2019-2029 Detailed Forest Management Plan as it is developed for submission to GOA in 2019. It remains, however, Weyerhaeuser's sole responsibility to make decisions regarding sustainable forest management on its FMA.

Any recommendations concerning the regulatory environment, under which the DFMP operates, including primary land-use decisions will be shared with the appropriate level of government.

Facilitation and administration of the meeting proceedings will be supported by Weyerhaeuser, Grande Prairie Timberlands.

10.4 Etiquette

The Public Advisory Group will use the following guidelines when holding documented meetings.

- Notice of at least 30 days will be given when scheduling a documented PAG meeting
- Meeting format will be standard and will include at a minimum: introductions, review of previous minutes and follow-up, new business and new follow-up
- Members will be punctual and fully engaged during the time allotted
- Cell phone and tablet use will be respectful
- There will be a strong agenda and members will gate keep the time
- Thoughtful, prepared, constructive and respectful discussions are expected
- Minute keeping will be accurate and shared in a timely manner

10.5 Expenses

Expenses incurred by members will be reimbursed as per the criteria detailed below:

- Members who are not paid by an organization to attend meetings are eligible to receive a per diem rate of $35/ hr for meetings and travel time.
- Travel costs to the formal meetings will be reimbursed by Weyerhaeuser at a kilometer rate of $0.52 per km from their home to the meeting location.
- With prior approval by Weyerhaeuser, members may receive money for out-of-pocket expenses such as hotels and meals when travelling greater than 250km to attend a meeting.
- With prior notice, conference call-in options will be made available for members unable to physically attend a meeting.
- For reimbursement, members are expected to invoice Weyerhaeuser for expenses after each meeting using a standard provided “Remuneration Claim” form.

COMPANY POLICY

Weyerhaeuser

ENVIRONMENTAL

PURPOSE

It is Weyerhaeuser's policy to be responsible stewards of the environment wherever we do business. We are committed to managing natural resources responsibly to create products that meet society's needs. We practice sustainable forestry, reduce pollution, conserve natural resources and energy and continually improve our environmental performance.

EXPECTATIONS

We hold ourselves accountable for understanding our environmental obligations and meeting our environmental responsibilities:

- We meet or exceed all applicable environmental laws and regulations.
- We assess our practices and find ways to reduce our impact on the environment.
- We adopt and follow best practices and guidelines to protect the environment.
- We employ environmental management systems sufficient for each site's size & complexity.
- We work to minimize risks and liabilities associated with the materials we purchase and the products we create.
- We mitigate liabilities from our legacy operations and sites.
- We apply environmental due diligence to real estate transactions.
- We audit compliance with environmental laws, policies, regulations, and company requirements and resolve non-compliance conditions promptly.
- We meet external requirements to which the company commits.
- We track and publicly report on our environmental performance.

ASSOCIATED POLICIES, GUIDANCES AND PROCEDURES

- Asbestos Containing Materials Policy
- Chemical Management Policy
- Environmental Management Systems Guidelines
- Product Stewardship Guidelines
- Real Property Transactions Guidelines
- Corporate Funding of Remediation Projects Procedure
- Land Application of Residuals and Solid Wastes Containing Dioxins Policy and Land Application Procedure

OWNER

Vice President, Corporate Affairs & Public Policy

Weyerhaeuser

SUSTAINABLE FORESTRY POLICY

PURPOSE

It is a Weyerhaeuser policy to manage its forests for the sustainable production of wood and wood products that meet our customers' needs without compromising the ability of future generations to meet their needs. We are committed to independent certification of our forest practices and to meeting the principles and objectives of globally accepted forest certification standards. This policy applies to company-owned and managed lands worldwide.

EXPECTATIONS

We will:

- Maintain healthy and productive forests and minimize losses caused by fire, insects, and disease.
- Reforest promptly after harvest by planting within the first available planting season, not to exceed twenty-four months, or by planned natural regeneration methods within five years or as provided in an applicable license.
- Harvest at sustainable rates over the long term.
- Minimize waste in our harvesting practices.
- Encourage the use of non-timber products and ecosystem services from the forest.
- Use forest practices and technology to retain organic matter and soil nutrients.
- Protect soil stability and long-term soil productivity by using equipment and practices appropriate to the soil, topography, and weather to minimize erosion and harmful soil disturbance.
- Protect water quality and water resources by practicing sound road construction and maintenance.
- Use best management practices (BMPs) and meet or exceed applicable laws to protect water quality, waterbodies, wetlands, and riparian areas.
- Employ reliable processes in using forest chemicals to meet our silvicultural and environmental objectives in compliance with applicable laws, BMPs, label directions, and certification standards.
- Provide a diversity of habitats for wildlife and contribute to conservation of biological diversity through practices and programs that address habitat diversity and conservation of plants and animals at multiple scales, in accordance with certification and other locally accepted standards.
- Protect threatened and endangered species and cooperate with government agencies to determine how our forestlands can contribute to their conservation.
- Consider aesthetic values by identifying sensitive areas and adapting our practices accordingly.
- Where safe and appropriate, provide the public with opportunities to recreate on our lands.
- Identify sites of special ecological, geological, cultural, and historical importance and manage them in a manner appropriate for their unique features.

RESOURCES

- Threatened and Endangered Species – Forestry and Timber Harvesting Operations Policy
- Weyerhaeuser Wood Procurement Policy

APPROVAL

Vice President, Sustainable Forests, January 28, 2015 (V1_28_15)

CERTIFICATE OF REGISTRATION

This is to certify that

Weyerhaeuser Company Limited

Canadian Timberlands (Central Office)
12 kms South Resources Road P.O Bag 1020 Grande Prairie, Alberta T8V 3A9 Canada

Refer to Attachment to Certificate of Registration dated February 1, 2016 for additional certified sites

complies with the requirements of

SFI 2015-2019 FOREST MANAGEMENT STANDARD

for the following scope of registration

Forest management activities - planning, harvesting, transportation and silviculture on Canadian Crown tenures in Princeton in British Columbia, Grand Prairie and Drayton Valley in Alberta, Hudson Bay in Saskatchewan and Kenora in Ontario.

The SFI certificate covers both the 2015-2019 SFI Forest Management Standard and the 2010-2014 SFI Standard (Section 2). Fiber sold under this certificate counts as 100% SFI and PEFC certified forest content.

Certificate No.:	CERT-0091762	Original Certification Date:	February 22, 2010
File No.:	1612129	Current Certification Date:	February 4, 2016
Issue Date:	February 1, 2016	Certificate Expiry Date:	February 3, 2019

Heather Mahon

Heather Mahon
Acting Head of
Policy, Risk and Certification

Registered by:
SAI Global Certification Services Pty Ltd, 680 George St, Level 37-38, Sydney, NSW, 2000, Australia with QMI-SAI Canada Limited, 20 Carlson Court, Suite 200, Toronto, Ontario M9W 7K6 Canada (SAI GLOBAL). This registration is subject to the SAI Global Terms and Conditions for Certification. While all due care and skill was exercised in carrying out this assessment, SAI Global accepts responsibility only for proven negligence. This certificate remains the property of SAI Global and must be returned to them upon request.
To verify that this certificate is current, please refer to the SAI Global On-Line Certification Register: www.qmi-saiglobal.com/qmi_companies/

Appendix B Stakeholder List

Stake Holder Type	Organization
Education	GPRC: Faculty of Agriculture, Life & Environmental Sciences
Education	Grande Prairie Catholic School District
Education	Grande Prairie Public School District
Education	Peace Wapiti School District
Education	W.O.L.F
First Nations	Aseniwuche Winewak Nation
First Nations	East Prairie Metis Settlement
First Nations	Grande Prairie Friendship Center
First Nations	Horse Lake First Nations
First Nations	Metis Nation of Alberta
First Nations	Sucker Creek First Nation
Forest Government	Alberta Agriculture and Forestry
Forest Industry	Agriculture & Forestry- CTP Program
Forest Industry	Agriculture & Forestry- Grazing Licenses & Leases
Forest Industry	Foothills Forest Products
Forest Industry	Norbord
Forest Industry	Tolko-High Prairie
Forest Industry	International Paper
Municipal Organization	Birch Hills County
Municipal Organization	Chamber of Commerce Grande Prairie & District
Municipal Organization	City of Grande Prairie
Municipal Organization	The County of Grande Prairie
Municipal Organization	MD of Greenview
Municipal Organization	Rotary Club of Grande Prairie
Municipal Organization	Saddle Hills County
Municipal Organization	Town of Beaverlodge
Municipal Organization	Town of Grande Cache
Recreation Association	Grande Prairie River Rats Association
Recreation Association	Nitehawk Ski Hill
Recreation Association	Snowmobile Club
Recreation Association	Spring Lake Campsite and Recreation Area
Recreation Association	Wapiti Corridor Planning Society
Recreation Association	Webster Community (Stewards of Webster)
Timberlands Contractor	Weyerhaeuser Current Timberlands Contractor List
Trappers	Weyerhaeuser FMA Current Trapper List

Appendix C Public Advisory Group Members (to be determined)

NAME	AFFILIATION	RESPONSE

Appendix D Grande Prairie Responding to Public Concerns Guideline

Responding to Public Concerns Guideline

Weyerhaeuser Grande Prairie Timberlands

Last Revised:	April 2017 (Traci Carter)
Next Review:	April 2018
What's Changed?	Refer to red font

Purpose

To provide a process for responding to questions and concerns regarding Weyerhaeuser's Environmental Policy, Forest Stewardship Principles, Sustainable Forest Management practices and forest operations.

Scope

This process applies to all public concerns reported to Weyerhaeuser regarding environment principles and practices.

Responsibility

- Weyerhaeuser is responsible for documenting any concern they are notified about and reporting the concern to their Team Leader.
- Team Leaders are responsible for responding to public concerns and ensuring follow up occurs.

Process

- This process is meant to capture public communication outside of existing processes.
- This process does not include concerns brought forward during industrial stakeholders, Trapper or First Nations consultation. Concerns brought forward during Public Advisory Group meetings may also be tracked under a different process.
- All concerns received by Timberlands staff, as well as all follow-up, will be documented. The suggested format is outlined on the attached Consultation Form.
- This form will be used by the respective Team Leader to coordinate other resources to address the issue (complex issues) and any follow-up required.
- The Team Leader will ensure follow up actions are tracked to completion.
- The Team Leader will give the completed forms to the Long Term Planner for document tracking.
- The EMS Leader and or site Team Manager will request support and direction from the Alberta Public Relations Department as required.

Click here to take you to the form: Attachment A – Consultation Form

Printed Documents Are Not Controlled Page 1 of 1
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Last Revised:	April 2017
What's Changed?	See red font

Public Concerns Document

DATE: COMPANY/ GROUP:

NAME:

PHONE:

ADDRESS:

GEOGRAPHICAL AREA/ COST ZONE:

SPECIFIC LOCATION/ LEGAL:

TYPE OF LOCATION:

ACTIVITY:

- ☐ Layout
- ☐ Forest Management
- ☐ Harvesting
- ☐ Log Hauling
- ☐ Road Construction
- ☐ Road Deactivation
- ☐ Herbicide
- ☐ Site Preparation
- ☐ Planting
- ☐ Burning
- ☐ Other:

CONCERN DETAILS:

RESOLUTION OR IMMEDIATE ACTION ITEMS:

FURTHER FOLLOW-UP:

TASK:	TASK OWNER:	DUE DATE:	DATE COMPLETED:

REPORT GENERATED BY: ______________________________

PRINTED DOCUMENTS ARE NOT CONTROLLED
C:\Users\CarterTr\Desktop\Consultation Form.docx

Page 1 of 1

Agriculture and Forestry

Ministry of Agriculture and Forestry
Grande Prairie Forest Area
Provincial Building, Second Floor
10320 - 99 Street
Grande Prairie, Alberta, Canada
T8V 6J4
Telephone: 780-538-8080
Fax: 780-538-1941
www.alberta.ca

COMMUNITY TIMBER PROGRAM STEWARDSHIP REPORT 2014-2019

July 4, 2019
Prepared By: Shannon Rogolino, Area Forester

Introduction

This stewardship report summarizes the Community Timber Permit Program (CTP) activities operated in Forest Management Unit G16, managed under FMA #6900016.

This report covers the period of May 1, 2014 – April 30, 2019 and contains the requirements as per section 2.5 of the *Forest Management Planning Standard Interpretive Bulletin: Stewardship Reporting Requirements*.

1. Approved SHS Variance Reporting (Section 3.2.3)

Available polygons for permits are provided by the FMA holder, Weyerhaeuser Grande Prairie. The CTP program operates those polygons, as provided, and does not track SHS variance. Yearly the FMA holder is notified of which openings have been operated, and provided shapefiles.

2. AAC Review (Section 3.2.5)

	Coniferous		Deciduous	
Year	Projected (Calculated) Volume (m3/ha)	Delivered Volume (m3/ha)	Projected (Calculated) Volume (m3/ha)	Delivered Volume (m3/ha)
2014	12,044	14,250	1939	2168
2015	16,493	15,085	2953	1420
2016	3994	3239	1393	1460
2017	3185	3228	751	825

3. FGRMS Monitoring Requirements (Section 3.2.8)

FRIAA (Forest Resource Improvement Association of Alberta) is the service provider for the CTP program with regards to reforestation activities. FRIAA reforests the openings digitally provided by Agriculture and Forestry then reports to ARIS.

FRIAA only generates digital files for areas planted with improved stock. For this reporting period, no openings were reforested with improved stock.

Alberta Agriculture and Forestry

Ministry of Agriculture and Forestry
Grande Prairie Forest Area
Provincial Building, Second Floor
10320 - 99 Street
Grande Prairie, Alberta, Canada
T8V 6J4
Telephone: 780-538-8080
Fax: 780-538-1941
www.alberta.ca

FGRMS Stream 1 (Wild) Seed Deployment Reporting

Species	Stream 1 Seed Zone	Year	Area Planted: Regular Est (ha)	Seedlings Planted (count)
Pl	Central Mixwood	2014	33.3	44,380
Sw	Lower Foothills	2014	61.2	90,860
Pl	Lower Foothills	2015	14.32	10,730
Sw	Lower Foothills	2015	85.92	87,840
Sw	Lower Foothills	2016	24.4	38,940
Sw	Central Mixwood	2016	12.1	18,800
Sw	Lower Foothills	2017	52.9	46,800
Pl	Lower Foothills	2018	42.3	66,960
Sw	Lower Foothills	2018	8.1	10,460

4. **Company Specific Monitoring Programs**

   The CTP program has not been running any specific monitoring programs.

5. **Company Specific Action Plans for Deficiencies**

   The CTP program did not have any specific actions plans for deficiencies.

6. **Spatial Representation of Harvested Blocks, Including Retention and Variance**

   Spatial files have been provided to Weyerhaeuser Grande Prairie. As noted prior, the CTP program has not been tracking variance nor had planned retention.

Norbord Inc.

DTAG160001

May 1 2014 – April 30 2019

Stewardship Report

August 30 2019

Contents

3.2.3 Approved SHS variance reporting from Period 1 (2014-2019)

2014/15 GDP

Final Harvest Plan Variances Summary

DTL	*FHP*	*Total SHS Area (ha)*	*Variance*		*Additions > 10 Year SHS (ha)*	*Total FHP Area (ha)*
			(ha)	%		
DTLG910005	Beach	806.0	104.2	12.9	132.9	734.8
	Burnt River	1695.3	239.2	14.1	217.4	1673.5
	Chaleur Valley	992.6	400.3	40.3	192.7	785.0
	Henning Line	474.1	95.0	20.0	20.6	396.3
	Jackfish Lake East	932.0	211.8	22.7	244.6	1040.3
	Musreau North	698.1	224.4	32.1	715.0	514.0
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1
	Pinto North	1711.4	371.0	21.7	309.8	1676.1

2015-2016 GDP

Final Harvest Plan Variances Summary

DTL	*FHP*	*Total SHS Area (ha)*	*Variance*		*Additions > 10 Year SHS (ha)*	*Total FHP Area (ha)*
			(ha)	%		
DTLG910005	Beach	806.3	140.7	17.5	153.6	734.8
	Burnt River	1768.0	216.34	12.2	308.59	1673.5
	Chaleur Valley	992.6	367.0	37.0	122.8	749.4
	Henning Line	474.3	95.8	20.2	20.6	395.6
	Jackfish Lake East	931.5	211.9	22.7	244.6	1040.1
	Musreau North	698.1	238.8	34.2	62.2	493.4
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1
	Pinto North	1711.7	442.6	25.9	311.6	1618.9
	Muddy Creek	1718.1	296.8	17.3	230.7	1704.3
	Odum Ridge	1092.8	218.2	20.0	129.8	967.2
	Hilltop Lake	1745.1	297.6	17.1	225.6	738.1
	Smoky North	436.1	97.6	22.4	73.7	396.3

2016-2017 GDP

Final Harvest Plan Variances Summary

DTL	FHP	Total SHS Area (ha)	Variance		Additions > 10 Year SHS (ha)	Total FHP Area (ha)
			(ha)	%		
DTLG910005	Beach	806.3	140.7	17.5	153.6	734.8
	Burnt River	1768.0	216.34	12.2	308.59	1673.5
	Calahoo*	1849.7	329.1	17.8	130.6	1552.5
	Chaleur Valley	992.6	367.0	37.0	122.8	749.4
	Jackfish Lake East	931.5	211.9	22.7	244.6	1040.1
	Musreau North	698.1	238.8	34.2	62.2	493.4
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1
	Pinto North	1711.7	442.6	25.9	311.6	1618.9
	Muddy Creek	1718.1	296.8	17.3	230.7	1704.3
	Odum Ridge	1092.8	218.2	20.0	129.8	967.2
	Hilltop Lake	1745.1	297.6	17.1	225.6	738.1
	Smoky North	436.1	97.6	22.4	73.7	396.3
	Wapiti*	3847.9	791.6	20.6	186.6	928.4

Note:

2017-2018 GDP

Final Harvest Plan Variances Summary

DTL	FHP	Total SHS Area (ha)	Variance		Additions > 10 Year SHS (ha)	Total FHP Area (ha)
			(ha)	%		
DTLG910005	Beach	806.3	140.7	17.5	153.6	734.8
	Burnt River	1768.0	216.34	12.2	308.59	1673.5
	Calahoo	1849.7	329.1	17.8	130.6	1552.5
	Chaleur Valley	992.6	367.0	37.0	122.8	749.4
	Jackfish Lake East	931.5	211.9	22.7	244.6	1040.1
	Musreau North	698.1	238.8	34.2	62.2	493.4
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1

	Pinto North	1711.7	442.6	25.9	311.6	1618.9
	Muddy Creek	1718.1	296.8	17.3	230.7	1704.3
	Gordondale	2277.7	426.5	1.87	162.9	2440.6
	Odum Ridge	1092.8	218.2	20.0	129.8	967.2
	Hilltop Lake	1745.1	297.6	17.1	225.6	738.1
	Smoky North	436.1	97.6	22.4	73.7	396.3
	Wapiti	3847.9	791.6	20.6	186.6	928.4

2018-2019 GDP

Final Harvest Plan Variances Summary

DTL	***FHP***	***Total SHS Area (ha)***	***Variance***		***Additions > 10 Year SHS (ha)***	***Total FHP Area (ha)***
			(ha)	**%**		
DTLG910005	Beach	806.3	140.7	17.5	153.6	734.8
	Burnt River	1768.0	216.34	12.2	308.59	1673.5
	Boone	1887	127.2	6.7	21.4	875
	Calahoo	1849.7	329.1	17.8	130.6	1552.5
	Chaleur Valley	992.6	367.0	37.0	122.8	749.4
	Jackfish Lake East	931.5	211.9	22.7	244.6	1040.1
	Musreau North	698.1	238.8	34.2	62.2	493.4
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1
	Pinto North	1711.7	442.6	25.9	311.6	1618.9
	Muddy Creek	1718.1	296.8	17.3	230.7	1704.3
	Gordondale	2277.7	426.5	1.87	162.9	2440.6
	Gold Creek	402.8	56.4	14	120.3	318.8
	Stony Creek	2466.7	437.3	17	42.8	2310.4
	Odum Ridge	1092.8	218.2	20.0	129.8	967.2
	Hilltop Lake	1745.1	297.6	17.1	225.6	738.1
	Smoky North	436.1	97.6	22.4	73.7	396.3
	Wapiti	3847.9	791.6	20.6	186.6	928.4

2019-2020 GDP

Final Harvest Plan Variances Summary

DTL	FHP	Total SHS Area (ha)	Variance		Additions > 10 Year SHS (ha)	Total FHP Area (ha)
			(ha)	%		
DTLG910005	Beach	806.3	140.7	17.5	153.6	734.8
	Burnt River	1768.0	216.34	12.2	308.59	1673.5
	Boone	1887	127.2	6.7	21.4	875
	Calahoo	1849.7	329.1	17.8	130.6	1552.5
	Chaleur Valley	992.6	367.0	37.0	122.8	749.4
	Jackfish Lake East	931.5	211.9	22.7	244.6	1040.1
	Musreau North	698.1	238.8	34.2	62.2	493.4
	Nose Mountain Basin	958.2	239.1	25.0	224.3	845.1
	Pinto North	1711.7	442.6	25.9	311.6	1618.9
	Muddy Creek	1718.1	296.8	17.3	230.7	1704.3
	Gordondale	2277.7	426.5	1.87	162.9	2440.6
	Gold Creek	402.8	56.4	14	120.3	318.8
	Stony Creek	2466.7	437.3	17	42.8	2310.4
	Odum Ridge	1092.8	218.2	20.0	129.8	967.2
	Hilltop Lake	1745.1	297.6	17.1	225.6	738.1
	Smoky North	436.1	97.6	22.4	73.7	396.3
	Wapiti	3847.9	791.6	20.6	186.6	928.4
	West Iroquois Creek	877.7	364.7	41	499.8	983.0
	Jackfish Lake West	792.9	440.7	60	81.0	441.1

3.2.5 AAC Review

Norbord Summary of Timber Production Report for years 2014-2019

AAC Review - FMP Projected and Harvested Volume Annual Comparison

Year	Coniferous		Deciduous	
	Projected (Calculated) Volume (m3)	Delivered Volume (m3)	Projected (Calculated) Volume (m3)	Delivered Volume (m3)
2014			1,199,041	599,870
2015			1,199,041	871,995
2016			1,199,041	724,829
2017			1,199,041	671,416
2018			1,199,041	874143*

*Unaudited

3.2.8 FGRMS Monitoring Requirements

Species	Stream1 Seed Zone	Year	Area Planted: Regular Est. (ha)	Seedlings Planted (count)	Area Planted: Re-treat or under-Plant (ha)	Seedlings Planted (count)
PB	10-69-5-6-02-DM1.3	2014	3.25	6400	N/A	N/A
PB	14-68-10-6-10-CM3.4	2014	28.5	60600	N/A	N/A
PB	15-66-5-6-11-LF1.4	2014	5.05	10100	N/A	N/A
PB	21-76-9-6-12-LF1.2	2014	1.98	3960	N/A	N/A
PB	22-78-12-6-05-LF1.2	2014	135.13	27460	N/A	N/A
PB	26-68-5-6-09-DM1.3	2014	2.95	5900	N/A	N/A
PB	29-66-10-6-06-LF1.4	2014	16.25	32500	N/A	N/A
SW	NWB1-80-9-6-1979	2014	2.29	4580	N/A	N/A
SW	NWB1-80-9-6-1979	2014	9.72	19432	N/A	N/A
PB	14-68-10-6-10-CM3.4	2015	109.51	78800	N/A	N/A
PB	15-66-5-6-11-LF1.4	2015	3.76	4950	N/A	N/A
PB	15-66-5-6-11-LF1.4	2015	40.4	44510	N/A	N/A
PB	21-76-9-6-12-LF1.2	2015	13.79	13630	N/A	N/A
PB	26-68-5-6-09-DM1.3	2015	9.43	17700	N/A	N/A
SW	NWB1 73-12-6-1979	2015	4.34	8496	N/A	N/A

SW	NWB1-80-9-6-1979	2015	8.34	23274	N/A	N/A
PB	14-68-10-6-10-CM3.4	2016	45.1	87247	N/A	N/A
PB	15-66-5-6-11-LF1.4	2016	33.2	52635	N/A	N/A
PB	21-76-9-6-12-LF1.2	2016	16	33960	N/A	N/A
PB	26-68-5-6-09-DM1.3	2016	7.3	5763	N/A	N/A
SW	WEG-64-4-6-1987-CM3.4	2016	1.9	3924	N/A	N/A
SW	WEG-76-12-1979-LF1.2	2016	35.38	74201	N/A	N/A
SW	PRP8-87-10-6-1983	2016	1.5	2160	N/A	N/A
PB	21-76-9-6-12-LF1.2	2017	37.56	56260	N/A	N/A
PB	26-68-5-6-09-DM1.3	2017	14.33	23540		
PB	AINS 11-68-10-6-2010/2011 PB	2017	8.7	9720	N/A	N/A
PB	AINS 5-67-7-6-2014 PB	2017	20.32	28460	N/A	N/A
SW	WEG 66-6-1979 SW	2017	23.35	38070	N/A	N/A
SW	WEG-76-12-6-1979-LF1.2	2017	13.56	21420	N/A	N/A
PB	AINS 11-68-10-6-2010/2011 PB	2018	43.9	67925	N/A	N/A
SW	AINS 66-6-6-1979 SW	2018	42.6	176665	N/A	N/A

VOIT Reporting

VOIT 2: Size of Harvest Opening by Operating Sub-Unit

Operating Sub-Unit	Count	Total Area	Average Block Size
Bald Mountain	16	462	28.93
Beach	1	18.3	18.3
Boone	17	444	26.12
Burnt River	28	1028.3	36.73
Calahoo	42	1640.9	39.07
Chaleur Valley	23	707.4	30.76
Gordondale	22	1032	46.92
Henning Line	5	142.5	28.5
Hilltop	28	696.1	24.86
Jackfish East	10	628.3	62.83
Muddy	46	1406.6	30.58
Musreau North	12	188.9	15.74
Nost Mountain	26	810.5	31.17
Odum Ridge	36	958.8	26.63
Pinto North	17	351.5	20.68
Stony Creek	19	543.1	28.58
Wapiti	35	911.4	26.04
Total (Period 1)	**383**	**11970.6**	**30.731765**

Block Size Range (ha)	Count	Total Area (ha)	% Area
0-5ha	18	66.9	1%
5-10ha	57	461.1	4%
11-40ha	191	4157.97	35%
41-100ha	66	4076.1	34%
101-500ha	11	1705.1	14%
>500ha	0	0	0%

VOIT 5: Kilometers of Temporary (inter-block) Access Road Still Open After 5 Years

Operating Sub-Unit	Associated Block	Road Number	Length (Km)	Date of Construction	Age of Road
N/A	N/A	N/A	N/A	N/A	N/A

VOIT 9: Riparian Management Zones

Date	Non-Conformance	Location	Cause	Impact
2015	Watershed Protection 6.0 – Table 2 – Roads, Landings, Decking, and Bared Areas "Not permitted within 30m of the high water mark or water source areas within the riparian management zone unless specifically approved in the AOP".	opening 6060650799	Interior road was constructed without company knowledge. Road was within 30 meters of a transitional watercourse	Potential increased sediment risk to watercourse. However it happened in the winter so risk was minimal.

VOIT 10: Percent of Retain Merchantable Volume

Year	Volume Harvested(ha)	Retention Volume	% vol retention
G16			
2014/15	381708	12229	3.203757846
2015/16	914798	42846	4.683656938
2016/17	555510	18287	3.291929938
2017/18	516,808	19853	3.841465302
2018/19	483,037	15183	3.143237475
Total	**2368824**	**93215**	**3.935074957**
Average			**3.6328095**

VOIT 13: Forestry Water Crossings in Compliance with Code of Practice Watercourse Crossings

100% of Norbord crossings are in compliance with Code of Practice Watercourse Crossings.

VOIT 18: Stakeholder Consultation

Type	Open House	PAC Meeting	GDP First Nations	FHP's Consultation	Total
2014/15	1	2	3	5	11
2015/16	1	2	3	6	12
2016/17	1	2	3	4	10
2017/18	1	2	5	4	12
2018/19	1	2	6	5	14

VOIT 19: Annual Percent of Area of SR from Regeneration Surveys

Percent SR Openings	
2014/15	100%
2015/16	100%
2016/17	100%
2017/18	100%
2018/19	100%

VOIT 20: Cumulative Percent of Reforested Area That Meets the Reforestation Target

Percent of Area that Meets Reforestation Requirements	
2014/15	100%
2015/16	100%
2016/17	100%
2017/18	100%
2018/19	100%

VOIT 24: Compliance with OGR’s Regarding Roading and Bared Areas in Forest Operations

Date	Location	Cause
2015	opening 6060650799	Road percent was 4.9%. Contractor extended the interior block road without notifying the Norbord contract supervisor. The result was 5.9% road disturbance
2015	opening 6060650708	Road percent was 4.9%. Contractor extended the interior block road without notifying the Norbord contract supervisor. The result was 5.5% road disturbance

VOIT 25: Incidence of Soil Erosion and Slumping as per OGR’s

None

VOIT 27: Riparian Buffers Maintained as Per OGR’s

All buffers were maintained as per OGR’s

VOIT 31-36: The Integration of Timber Management Activities with Other Users, Direct Consultation with the Public Regarding Plans for and Activities on the FMA, Meet Alberta’s Expectations for Aboriginal Consultation, Public Review of Plans and Operations.

Norbord meets these targets by:

1) Attending an annual Open House for the public
2) Consulting with all Registered Fur-Management Holders during FHP development and harvest operations
3) Receiving Alberta Agriculture and Forestry Adequacy on all consultations with all First Nations whose traditional land overlaps with DTLG910005 at the GDP stage as well as at the FHP stage
4) Holding Public Advisory Committee meetings bi-annually
5) Consulting with local bird watching club

Weyerhaeuser Forest Management Plan

ANNEX XII STEWARDSHIP REPORT

2014-2019

AUTHOR: Traci Carter, RPFT, Weyerhaeuser Company Limited

DATE: May 27, 2019

Revision Date: May 27, 2019

Weyerhaeuser

WEYERHAEUSER COMPANY LIMITED

GRANDE PRAIRIE TIMBERLANDS

FMA #6900016

Table of Contents

1. Introduction

This Stewardship Report summarizes our performance towards achieving the objectives described in the 2011-2021 Detailed Forest Management Plan for FMA #6900016, as well as other activities that have a direct effect on Forest Management Unit G16.

This report documents the strategies and commitments through implementation of the FMP monitoring programs in compliance with the Alberta Forest Management Planning Standard (FMPS) and its supporting guidelines.

2. Deciduous Timber Allocations

There are two companies with Deciduous Timber Allocations imbedded into FMA#6900016.

Tolko Industries Ltd. has a fixed volume allocation in VSA2-Saddle Hills.

Norbord Inc. has a volume allocation for FMU16.

Both quota holders will be submitting a Stewardship for their operations based on the reporting requirements in section 2.5 of the directive.

3. Preparation and Validation Compliance

Preparation of this Stewardship Report is as per the standardized template described in the Forest Management Plan Stewardship Reporting Directive (June 15, 2017) as well as the Values, Objectives, Indicators and Targets (VOITs) identified in Appendix 15 of the 2011 DFMP.

This report has been prepared by Traci Carter, RPFT, Strategic Planning Forester and validated by Lyle Dechief, RPF, Senior Planning Manager.

4. Reporting Period

This report covers Period 2 of the Spatial Harvest Sequence (May 1, 2014-April 30, 2019) for Spatial Harvest Sequence and the Preferred Forest Management Strategy as described in the 2011 Forest Management Plan.

Some of the VOITS in this report are summarized slightly differently than what the 2011 VOIT requested due to changes in how the landbase is defined in the 2019 FMP. In each case, the intent of the VOIT is met.

5. Alberta FMP Stewardship Reporting Content Requirements

There are three parts to this FMP Stewardship Report.

1) Mandatory Components
2) VOIT Reporting
3) Other FMP Commitments

5.1. Mandatory Components

The mandatory components are outlined in the directive and include:

		Source Info
5.1.1	Review and Status of FMP Approval Decision Conditions	FMP Approval Conditions
5.1.2	Regional or DFA-specific Management Objectives	2019 Forest Management Plan
5.1.3	Approved FMP SHS Variance Assessment	2019/2020 Annual Operating Plan
5.1.4	Landbase Changes	2014-2019, Forest Tenure, Trade and Policy Branch
5.1.5	AAC Review	Quadrant 1 through 6
5.1.6	G&Y Program Maintenance	May 1, 2011-April 30, 2019
5.1.7	Seed Availability and Usage	2019 Forest Management Plan
5.1.8	FGRMS Reporting	May 1, 2014-April 30, 2018

5.1.1. Review and Status of FMP Approval Decision Conditions

Approval Condition	Section	Requirement	Comments (2019)
6.1 (i)	Public Consultation	written documentation of all issues and comments raised by the public as well as the company's responses and actions	ongoing • Public consultation activities are documented including event details, who attended and noted concerns. • Weyerhaeuser has a documented process for addressing Public Concerns.
6.2 (i) (ii) (iii)	First Nations Consultation	continue to consult with AWN and HLFN; adhere to Alberta's First Nations Consultation Guidelines on Land Management and Resource Development for plan development and approvals; document consultation efforts and activities	ongoing • Indigenous consultation is conducted and documented as per the ACO Proponent Guide.
7.1 (i)	Mountain Pine Beetle	work with Smokey Area to coordinate efforts on MPB control, timber salvage and forest renewal activities	ongoing • Weyerhaeuser has worked with local Forest Health officers to coordinate level 1, 2 & 3 MPB Mitigation work.

Approval Condition	Section	Requirement	Comments (2019)
9.1 (i)	Spatial Harvest Sequence	follow the mapped 20 yr harvest sequence as presented in the FMP	ongoing
9.1 (ii)	Spatial Harvest Sequence	authorized to modify the SHS by deleting/ replacing from the net land base no more than 20% of the total sequenced area in each compartment per decade, while harvesting no more than 100% of the total; area within the SHS by compartment, by decade. preference will be given to stands from (1) period 2 of the SHS (2) other approved high-risk Pine stands.	• Weyerhaeuser operates from the approved SHS unless deviations from the approved plan are required for FireSmart Activities; to meet MPB control PFMS or where designed wood did not meet merchantability targets.
9.1 (iii)	Spatial Harvest Sequence	if the variance exceeds 20%, this may require a Compartment Assessment and may lead to AAC adjustment	
9.1 (iv)	Spatial Harvest Sequence	Variance from the SHS must be reported annually. The 5 yr Stewardship Report will analyze the cumulative variance from the SHS and will describe the potential impacts of the actual variance on the forecasts in the FMP	• Deviations from the approved sequence > 20% are discussed with local AAF Area foresters and are well documented through the SHS variance tracking process.
9.1 (v)	Spatial Harvest Sequence	SRD will not request a modification of the approved harvest sequence for the 1st 15 years of the planning period unless there is a change in legislation or policy	
11.1 (i)	Stand Level Structure Retention	structure retention contributing to meeting the target (coniferous 2.5% and deciduous 3%) will be merchantable, and reflect the species composition and timber profile of the original stand	ongoing • Structure retention targets have been met and operational practices have improved through awareness.

Approval Condition	Section	Requirement	Comments (2019)
12.1 (i, ii, iii)	Grazing Timber Agreement	in advance of operations, develop Grazing Timber Agreements with potentially affected disposition holders. GTA's will include a reviewed AOP. Non-harvested areas within Forest Grazing Licenses will be monitored and reported as variance from the SHS.	Ongoing • Planned blocks within FGL will have a Grazing Timber Agreement in place. • Non-harvested areas within FGL's are tracked as variance (deferred or unplanned).
12.1 (iv)	Grazing Timber Agreement	The net land base and TSA prepared for the next DFMP will address grazing issues	• This condition will be addressed through the renewal of the 2019 FMP.
13.1 (i)(a)	Silviculture Strategies	Amend with a recalculation of each of the seed supplies per tree species per deployment zone to be reforested using the appropriate unit amounts per kg as directed by ATISC	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
13.1 (i)(b)	Silviculture Strategies	amend with an adjustment to the amount of seed required to be collected to meet planting requirements of the 10-year SHS. Include specific details for each timber year where seed collection is planned, including links to planned harvesting in specific compartments	completed • Delivered through the AOP. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
13.1 (ii)	Silviculture Strategies	reconcile the number of regenerated yield curves proposed in the TSA with the regenerated yield trajectories listed within the Silviculture Matrix. Clarify how the distinct yield curves (84) align with the regenerated yield trajectories (6). Requires a formal agreement to the reconciliation with each of the operators.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.

Approval Condition	Section	Requirement	Comments (2019)
14.1 (ii)	Regenerating Land base-ARIS Records Validation	Inconsistent ARIS records and regenerating land base data will be resolved, and ARIS updated. Adhere to procedures outlined in "Regenerating Land base-ARIS records validation procedures"	Unresolved • This condition will remain unresolved and will be addressed through the renewal of the 2019 FMP (as per a letter from the Province on February 22, 2017.
15.1 (i)	Enhanced Silviculture	genetic gain other than approved in this FMP requires a full review and approval of controlled parentage program plans.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated Oct. 11, 2013.
16.1 (i)	Primary and Secondary Volume Tracking	develop and implement a method to monitor and report primary and secondary harvested volumes	Completed. • The Province released Weyerhaeuser from this condition in a letter dated July 12, 2012.
17.1 (i, ii)	Industrial Timber Salvage	all timber depleted by non-forest activities will be reported and accounted for. Exception- low impact seismic. Volumes used will be those published in the TDA tables or otherwise agreed to	ongoing • Volumes were reported as per the TDA tables until 2016 when the process changed to report using the weigh scale method.
18.1 (i)	Delivered Timber Volume Monitoring Program	develop a program that will compare actual delivered timber volumes to volumes anticipated by yield projections from harvested areas.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated July 12, 2012.
19.1 (i)	Growth and Yield Plan	provide a revised G&Y plan that includes sufficient data and analysis to validate natural and regenerated stand yields.	Completed. • The Province released Weyerhaeuser from this condition in a letter dated February 2, 2016.

Approval Condition	Section	Requirement	Comments (2019)
20.1 (i)	Performance Monitoring	submit annual and stewardship reports that document the operational performance of each company's activities implementing the DFMP. Where variances exist, an analysis will provide reasoning and a corrective action plan	ongoing • Annual reporting is accomplished through the Annual Operating Plan, the General Development Plan, ARIS reporting and operational block monitoring reports (agreed to with local area foresters)
20.1 (ii)	Performance Monitoring	Submit a Stewardship Report current to May 1, 2015	completed • The Stewardship report was submitted December 1, 2016.
21.1 (i)	Future Forest Management Plans	Complete a DFMP that meets forest management planning standards by April 30, 2021	• The renewed Forest Management Plan will be submitted in 2019

5.1.2. Regional or DFA-Specific Management Objectives

The 2011 DFMP addresses two main strategies:

1. The reduction of highly susceptible Mountain Pine Beetle stands.
2. The protection of Caribou habitat within the identified Caribou Management Zones.

5.1.2.1. Mountain Pine Beetle

Weyerhaeuser's FMA 6900016 was hit by mountain pine beetle (MPB) inflight from BC in 2006 and again in 2009. The MPB strategy for the 2011 plan focused on a forest management approach that resulted in long term healthy forests both from regeneration and a wildlife habitat perspective. Harvest strategies for period 1 were focused in the Saddle Hills first and then moving to the northernmost part of the main block of the FMA. By the end of the second period, the plan focused harvest on the mid to southern portions of the FMA where the risk of infestation, although less than in the north, was still present.

In 2007, the Province of Alberta developed a pine strategy that directed FMA holders to amend their management plans to reduce the amount of susceptible pine on their operating landbase by 75% over the next 20 years. Using the MPB strategies in the 2011 plan, 66,845 hectares of pine leading stands were sequenced for harvest in period 1 and 2. By the end of the 2018 harvest year, 21,996 hectares were deferred or deleted because of landbase removals, mistyping or slivers and 33,395 hectares were harvested. By the end of the 2018 harvest season, Weyerhaeuser has accounted for 83% of the at-risk pine stands identified in the 2011 FMP.

5.1.2.2. Woodland Caribou

The following refers to our agreed to planned activities and harvest activities to date within the Caribou Management Zones. As agreed in the FMP, stands in the Lingrell CMZ were prioritized for harvest over the other zones in response to the threat of Mountain Pine Beetle.

CMZ	SHS Area (Ha) Period 1 & 2	Harvested Area (Ha) Cut Period 1	Harvested Area (Ha) Cut Period 2	% Completed
Lingrell	6,671	5,022	160	78%
Narraway	2,420	689	443	47%
Redrock/ Prairie Creek	8,915	2,972	2,331	60%
TOTAL	**18,006**	**8,683**	**2,933**	**65%**

When the 2009 SHS was developed, operational constraints were relaxed to guide the model to select all "at risk" pine and give operational planners the flexibility needed to react to the threat of MPB infestation. As layout progressed, FHPs showed high levels of variance as stands were swapped to create an operational harvest plan. The Province was aligned with this strategy and approved the variance as described in the rationale in the Final Harvest Plans.

In hindsight, more care should have been given to ensuring that the approved sequence in the CMZ was indeed fully operational. Unlike outside the CMZ, Weyerhaeuser could not freely adjust the SHS in order to make it operational through the regular variance process of deletions, deferrals and additions. Trades were scrutinized by the province which resulted in 35% of the sequenced volume not being operated by the end of Period 2.

5.1.3. Approved FMP SHS Variance Assessment

This Stewardship Report assesses operational deviation from the current approved DFMP 10-year Spatial Harvest Sequence (SHS) as per OGR 3.4.1 and this information relates to the approved Spatial Harvest Sequence for cut periods 1 and 2 which has an effective date of May 1, 2009 through April 30, 2019. Variance is calculated in each submitted and approved Final harvest Plan and summarized for the cut period(s) in each AOP.

When the 2009 SHS was developed, operational constraints were relaxed to guide the model to select all “at risk” pine and give operational planners the flexibility needed to react to the threat of MPB infestation. As stands were ground truthed and layout progressed, Final Harvest Plans (FHPs) showed high levels of variance as operational planners bypassed sequenced spruce and non-merchantable stands in order to salvage truly at-risk pine stands that were not originally sequenced. The Province was aligned with this strategy and approved the variance as described in the rationale in the Final Harvest Plans.

Many of the additions in this SHS are attributed to AVI mistypes, as well as errors in the 2011 SHS which caused the model to not include pine leading at risk stands. Stands determined to be at a lower risk for MPB mortality, or non-operational due to slope, merchantability, etc, were dropped (deferred/ deleted) in favor of targeting higher risk pine leading stands. Minimal Spruce has been added, where this has occurred it was to operationalize block packages, avoid isolation of a stand(s), and minimize re-entry for small area and/or a Pine/Spruce stand.
In the 2019/2020 AOP and moving forward, accounting for SHS Variance by Cost Zone changed slightly, including:

- SHS spruce and mixedwood stands were previously tracked as a deferral in the variance to focus on the reduction of stands susceptible to mountain pine beetle. As remaining unplanned pure pine stands on the FMA decreases and Weyerhaeuser transitions to the SHS to be locked into the 2019 FMP, SHS spruce and mixedwood stands are being laid out for harvest.
- Stands with pine/deciduous splits or pulp stands with severe mountain pine beetle attack were previously tracked as a deletion in the variance to focus on the reduction of stands susceptible to mountain pine beetle. Some of these stands are now being considered for pulp harvest. The transition to 100% cut-to-length has resulted in increased sawlog production in small diameter stands.
- 2018 layout in the caribou zone that was not part of the previous SHS. These blocks will be harvested under the 2019 DFMP and will be hardwired into the new SHS.

SHS Variance by Cost Zone for Cut Periods 1 and 2

	SHS Variance by Cost Zone for CP 1/2					
	SHS	Within SHS	Out SHS	Total	Del/Def	
Cost Zone	ha	ha	ha	ha	ha	%
SADDLEHILLSNORTH	1,193	368	920	1,287	384	32
SADDLEHILLSEAST	1,300	377	814	1,191	451	35
WAPITI	2,422	910	380	1,290	1,340	55
WILSONLAKE	414	91	26	117	137	33
SADDLEHILLSSOUTH	3,389	1,429	2,998	4,426	1,394	41
PINTOCUTACROSS	2,768	622	1,101	1,723	1,968	71
KAKWATOWER	5,614	3,115	2,315	5,430	1,915	34
LINGRELL	5,274	3,032	1,354	4,386	1,150	22
CALAHOO	4,350	1,760	1,694	3,454	2,006	46
PINTO	7,319	2,224	2,301	4,525	4,743	65
NARRAWAY	2,373	1,022	79	1,101	1,161	49
BULLCREEK	9,714	5,460	1,375	6,835	3,646	38
HAMMERHEAD	3,561	2,286	515	2,801	1,023	29
MUSREAU	7,112	3,980	2,713	6,693	1,800	25
MA2GPNORTH	5,685	2,514	2,088	4,602	2,287	40
BOWEN	140	103	21	124	37	27
KAKWAWEST	504	-	-	-	197	39
PINERAT	9,311	5,521	2,178	7,698	3,110	33
1800TIMBERBERTH	1,119	577	384	960	369	33
SHERMAN	21	-	604	604	-	-
NOSEMOUNTAIN	6,202	4,137	1,422	5,558	1,573	25
CHICKENCREEK	881	607	23	629	131	15
WANYANDIE	1,163	544	476	1,021	417	36
LYNXCREEK	-	-	-	-	-	-
PRAIRIECREEK	3,931	1,400	2,065	3,465	1,725	44
DANIELCREEK	8	-	-	-	-	-
REDROCK	3,133	1,945	348	2,294	882	28
SOUTHEASTKAKWA	6,085	4,133	1,550	5,683	1,519	25
Totals	94,984	48,156	29,742	77,898	35,364	

Source info: 2019/2020 AOP

5.1.4. Land Base Changes

The following is a summary of major changes in the DFA land base from May 1, 2014 through April 30, 2018[1].

Source information= FMA Net Area Exclusions Report by year

***note a negative net change means more area has been withdrawn than cancelled and returned to the landbase.*

*** A positive net change means more area has been cancelled and returned to the landbase than withdrawn from.*

	Description	2014	2015	2016	2017	2018	NET_CHANGE 2014 to 2018
	Gross Area	**1,117,140.0**	**1,117,139.9**	**1,117,152.4**	**1,117,863.0**	**1,117,151.64**	**11.64**
	Private Lands	41,556.9	43,608.8	45,033.4	45,408.1	47,039.45	**5,482.51**
	DIDs Dispositions	10,411.1	10,408.6	10,407.6	10,402.8	10,400.72	**-10.41**
	Hydrology Buffers	**1,065,171.9**	**1,063,122.6**	**1,061,711.3**	**1,061,340.8**	**1,059,711.48**	**-5,460.46**
	Net Area	15,504.9	15,326.2	15,336.9	16,000.2	15,769.54	**264.62**
	Non-Combustible AVI Polygons	**1,049,667.0**	**1,047,796.4**	**1,046,374.4**	**1,045,340.6**	**1,043,941.95**	**-5,725.09**
	Holding and Protection Area	67,473.0	69,343.5	70,778.0	72,522.4	73,209.70	**5,736.73**
Code	**Description**						
FDS	Farm Development Sale	2,125.1	2,125.2	2,151.8	2,093.8	2,139.45	**14.33**
DRS	Disposition Reservation	0.0	0.0	0.0	0.0	0.00	**0.00**
MTS	Miscellaneous Townsite Lease	0.0	0.0	0.0	0.0	0.00	**0.00**
PLS	Public Land Sale	48.2	48.2	51.0	74.9	77.56	**29.41**
RDS	Provisional Roadway	0.0	0.0	0.0	0.0	0.00	**0.00**
Code	**Description**	9,555.3	10,096.6	10,358.7	10,462.7	10,761.05	**1,205.73**
MSL	Mineral Surface Lease (AER)	50.5	50.5	50.5	49.9	49.93	**-0.53**
DMS	Mineral Surface Lease (ESRD)	9,473.1	9,635.2	9,812.7	10,288.4	10,587.86	**1,114.75**
LOC	License of Occupation (AER)	3,577.4	3,558.1	3,305.7	2,819.2	2,886.90	**-690.48**
DLO	License of Occupation (ESRD)	12,085.8	13,154.5	13,775.8	13,901.3	13,579.82	**1,493.97**

[1] As per Peter Whyte, Forest Tenure GIS Analyst, Forest Tenure and Policy Section. 2019 Net Area Package is not yet complete.

Code	Description	2014	2015	2016	2017	2018	NET_CHANGE 2014 to 2018
PLA	Pipeline Agreement (AER)	105.0	162.7	230.0	319.3	1,156.47	**1,051.49**
DPL	Pipeline Agreement (ESRD)	203.5	220.6	224.0	239.9	247.14	**43.60**
PIL	Pipeline Installation Lease	1,093.8	1,095.2	1,120.2	1,124.8	1,157.92	**64.09**
EZE	Easement	56.2	55.2	55.2	55.2	54.12	**-2.10**
VCE	Vegetation Control Easement (AER)	2.2	2.2	2.2	4.1	4.12	**1.91**
RVC	Vegetation Control Easement (ESRD)	0.4	0.4	0.4	0.4	0.45	**0.00**
REA	Rural Electric Association Easement	367.1	523.4	717.8	737.4	978.15	**611.02**
MLL	Miscellaneous Lease (AER)	373.7	447.6	642.4	668.6	759.51	**385.77**
DML	Miscellaneous Lease (ESRD)	64.4	60.0	54.9	54.9	54.92	**-9.48**
MLP	Miscellaneous Permit	1,049.6	1,049.6	1,140.0	1,177.2	1,219.12	**169.48**
SML	Surface Material Lease	0.0	3.9	19.4	21.5	8.97	**8.97**
SMC	Surface Material License	0.0	0.0	0.0	0.0	0.00	**0.00**
FDL	Farm Development Lease	1,058.8	1,058.9	1,060.3	1,060.2	1,060.24	**1.42**
RRD	Registered Roadway	171.9	166.0	165.8	164.2	161.02	**-10.86**
ROE	Right-of-Entry Agreement	0.0	0.0	0.0	0.0	0.00	**0.00**
ROW	Right-of-Way Lease	52.8	52.8	52.8	52.8	52.80	**0.02**
FRD	Forestry Road	41.9	41.9	41.9	41.9	41.91	**0.00**
REC	Recreation Lease	0.0	0.0	0.0	0.0	0.00	**0.00**

5.1.5. AAC Review

This report will assess FMP approved AAC sustainability by monitoring the volume of timber drained from the AAC through harvest, retention, crossings, and TDA. The data is presented by quadrant as approved in the FMA Agreement and has been audited by the GoA.

<table>
<tr><th colspan="9">FMA6900016 Timber Production - Audited</th></tr>
<tr><th>FMU</th><th>Species Group</th><th>Cut Type</th><th>Quadrant</th><th>Start</th><th>End</th><th>Authorized Volume (m3)</th><th>Production Volume (m3)</th><th>%</th></tr>
<tr><td rowspan="6">G16</td><td rowspan="3">Coniferous</td><td>Primary</td><td rowspan="6">5</td><td rowspan="6">1-May-08</td><td rowspan="6">30-Apr-13</td><td>10,230,008</td><td>8,425,480</td><td>82.36%</td></tr>
<tr><td>Secondary</td><td>424,229</td><td>0</td><td>0.00%</td></tr>
<tr><td>Total</td><td>10,654,237</td><td>8,425,480</td><td>79.08%</td></tr>
<tr><td rowspan="3">Deciduous</td><td>Primary</td><td>618,784</td><td>685,541</td><td>110.79%</td></tr>
<tr><td>Secondary</td><td>121,216</td><td>0</td><td>0.00%</td></tr>
<tr><td>Total</td><td>740,000</td><td>685,541</td><td>92.64%</td></tr>
<tr><td rowspan="7">G16</td><td rowspan="3">Coniferous</td><td>Primary</td><td rowspan="7">6</td><td rowspan="7">1-May-13</td><td rowspan="7">30-Apr-18</td><td>10,965,950</td><td>8,004,491</td><td>72.99%</td></tr>
<tr><td>Secondary</td><td>424,610</td><td>141,175</td><td>33.25%</td></tr>
<tr><td>Total</td><td>11,390,560</td><td>8,145,666</td><td>71.51%</td></tr>
<tr><td rowspan="4">Deciduous</td><td>Primary</td><td>336,825</td><td>353,505</td><td>104.95%</td></tr>
<tr><td>Secondary</td><td>199,395</td><td>293,071</td><td>146.98%</td></tr>
<tr><td>Primary (D Only)</td><td>165,000</td><td></td><td></td></tr>
<tr><td>Total</td><td>740,000</td><td>646,576</td><td>87.38%</td></tr>
</table>

Apparent overcutting of primary and secondary deciduous in Q6 is because the 33,000m3/ year was not harvested as Pure D (wording in FMA agreement allows for it to “may come from”). The overall D cut does not exceed 740,000.

5.1.6. Growth and Yield (G&Y) Program Maintenance

The following summarises the establishment & measurement of PSPs for both coniferous and deciduous stands from 2011-2019 as set out in the FMP.
Weyerhaeuser does not establish TSPs.
All planned activities were completed. Weyerhaeuser's Growth and Yield program includes PSPs for coniferous and deciduous stand types.

2019 activities have not been completed at the time of reporting.

	TSP Establishment		PSP Establishment		PSP Re-Measurement	
Year	**Natural**	**Managed**	**Natural**	**Managed**	**Natural**	**Managed**
PLANNED						
2011	-	-	-	1	72	25
2012	-	-	-	-	75	60
2013	-	-	-	24	79	26
2014	-	-	-	19	19	37
2015	-	-	-	15	26	64
2016				21	33	10
2017				0	134	8
2018				27 (RGT)	72	78
2019					*10*	*37*
ACTUAL						
2011	-	-	-	1	72	25
2012	-	-	-	-	75	60
2013	-	-	-	24	79	26
2014	-	-	-	19	19	37
2015	-	-	-	15	26	64
2016				21	33	10
2017				0	134	8
2018				27 (RGT)	72	78
2019						

5.1.7. Seed Availability and Usage

The following tables summarize the current and expected inventories for enhanced stock and wild seed. Weyerhaeuser has enough seed inventory to meet reforestation requirements for at least the next 20 years and beyond and we also collect seed annually.

5.1.7.1. Seed Availability and Deployment Schedule for Enhanced Stock

Deployment of orchard stock will comply with Forest Genetic Resource Management and Conservation Standards 2016 (FGRMS 2016) and will consider cumulative diversity levels of stock deployed together with the limits on deployment outlined in Appendix 21A (FGRMS 2016).[2]

Orchard G147 and G804 Low Elevation Pine

Species	Orchard	Phase	Height Gain %	Date Approved	Comments
Pl	G147	1	4.00	2011 DFMP	seed is almost used up, only a couple of kg's left in inventory- not scheduling
Pl	G147	1	6.17	21-Jul-17	initial parent forest after rogueing
Pl	G804	2	9.26	21-Jul-17	new phase 2 orchard, just starting to produce enough seed to collect, as of 2018

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	6.17	4,000,000	2,857,143	10,204	10,204
	9.26	500,000	357,143	1,276	1,276
2	6.17	2,000,000	1,428,571	5,102	15,306
	9.26	2,500,000	1,785,714	6,378	7,653
3	6.17	500,000	357,143	1,276	16,582
	9.26	4,000,000	2,857,143	10,204	17,857
4			0	-	
	9.26	4,500,000	3,214,286	11,480	29,337
5			0	-	
	9.26	4,500,000	3,214,286	11,480	40,816
6			0	-	
	9.26	4,500,000	3,214,286	11,480	52,296
7			0	-	
	9.26	4,500,000	3,214,286	11,480	63,776
8			0	-	
	9.26	4,500,000	3,214,286	11,480	75,255

[2] S.E.T. John, Ph.D.; Isabella Point Forestry Ltd.-August 30, 2018

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
9			0	-	
	9.26	4,500,000	3,214,286	11,480	86,735
10			0	-	
	9.26	4,500,000	3,214,286	11,480	98,214
11			0	-	
	9.26	4,500,000	3,214,286	11,480	109,694
12			0	-	
	9.26	4,500,000	3,214,286	11,480	121,173
13			0	-	
	9.26	4,500,000	3,214,286	11,480	132,653
14			0	-	
	9.26	4,500,000	3,214,286	11,480	144,133
15			0	-	
	9.26	4,500,000	3,214,286	11,480	155,612
16			0	-	
	9.26	4,500,000	3,214,286	11,480	167,092
17			0	-	
	9.26	4,500,000	3,214,286	11,480	178,571
18			0	-	
	9.26	4,500,000	3,214,286	11,480	190,051
19			0	-	
	9.26	4,500,000	3,214,286	11,480	201,531
20			0	-	
	9.26	4,500,000	3,214,286	11,480	213,010

Orchard G303 High Elevation Pine

Species	Orchard	Phase	Height Gain %	Date Approved
Pl	G303	1	2.18	21-Jul-17

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	2.18	1,000,000	714,286	2,551	2,551
2	2.18	1,500,000	1,071,429	3,827	6,378
3	2.18	1,500,000	1,071,429	3,827	10,204
4	2.18	1,500,000	1,071,429	3,827	14,031
5	2.18	1,500,000	1,071,429	3,827	17,857
6	2.18	1,500,000	1,071,429	3,827	21,684
7	2.18	1,500,000	1,071,429	3,827	25,510
8	2.18	1,500,000	1,071,429	3,827	29,337
9	2.18	1,500,000	1,071,429	3,827	33,163
10	2.18	1,500,000	1,071,429	3,827	36,990
11	2.18	1,500,000	1,071,429	3,827	40,816
12	2.18	1,500,000	1,071,429	3,827	44,643
13	2.18	1,500,000	1,071,429	3,827	48,469
14	2.18	1,500,000	1,071,429	3,827	52,296
15	2.18	1,500,000	1,071,429	3,827	56,122
16	2.18	1,500,000	1,071,429	3,827	59,949
17	2.18	1,500,000	1,071,429	3,827	63,776
18	2.18	1,500,000	1,071,429	3,827	67,602
19	2.18	1,500,000	1,071,429	3,827	71,429
20	2.18	1,500,000	1,071,429	3,827	75,255

Orchard G351 Spruce

Species	Orchard	Phase	Height Gain %	Date Approved	Comment
Sw	G351	1	2.60	2011 DFMP	original Sw orchard
Sw	G351	2	5.04	2-Mar-18	phase 1 after rogueing

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
1	2.60	4,500,000	3,214,286	11,480	11,480
	5.04	0	0	-	
2	2.60	0	0	-	
	5.04	4,500,000	3,214,286	11,480	11,480
3	2.60	0	0	-	
	5.04	4,500,000	3,214,286	11,480	22,959
4			0	-	
	5.04	4,500,000	3,214,286	11,480	34,439
5			0	-	
	5.04	4,500,000	3,214,286	11,480	45,918
6			0	-	
	5.04	4,500,000	3,214,286	11,480	57,398
7			0	-	
	5.04	4,500,000	3,214,286	11,480	68,878
8			0	-	
	5.04	4,500,000	3,214,286	11,480	80,357
9			0	-	
	5.04	4,500,000	3,214,286	11,480	91,837
10			0	-	
	5.04	4,500,000	3,214,286	11,480	103,316
11			0	-	
	5.04	4,500,000	3,214,286	11,480	114,796
12			0	-	
	5.04	4,500,000	3,214,286	11,480	126,276
13			0	-	
	5.04	4,500,000	3,214,286	11,480	137,755
14			0	-	
	5.04	4,500,000	3,214,286	11,480	149,235

Period	Gain	Seeds per year	Seedlings per year	Plantable Area (ha) at 1400/ha per 5-year period	Cumulative Area (ha) per 5-year period
15			0	-	
	5.04	4,500,000	3,214,286	11,480	160,714
16			0	-	
	5.04	4,500,000	3,214,286	11,480	172,194
17			0	-	
	5.04	4,500,000	3,214,286	11,480	183,673
18			0	-	
	5.04	4,500,000	3,214,286	11,480	195,153
19			0	-	
	5.04	4,500,000	3,214,286	11,480	206,633
20			0	-	
	5.04	4,500,000	3,214,286	11,480	218,112

5.1.7.2. Wild Seed Availability and Cone Collection Program

Weyerhaeuser has enough wild seed inventory to meet reforestation objectives and the seed orchard continues to produce as expected. However, we intend to continue annual collections in the seed zones we are operating with a heavier focus on increasing inventories in seed zones with a lower current inventory, or seed zones we anticipate higher than historical harvest levels, such as the Caribou Management Zone.

Lodgepole Pine

Seed Zone	KG	Seedlings	Hectares
CM3.4	12.36	1,662,717	1,188
DM1.3	25.22	3,393,783	2,424
LF1.2	32.53	4,376,909	3,126
LF1.4	518.87	69,811,227	49,865
M2.1	1.92	258,328	185
SA1.1	15.36	2,066,354	1,476
UF1.3	753.24	101,345,796	72,390
Total	**1359.50**	**182,915,113**	**130,654**

Black Spruce

Seed Zone	KG	Seedlings	Hectares
CM3.4	0.64	277,242	198
LF1.4	3.53	1,530,356	1,093
UF1.3	1.95	844,080	603
Total	**6.12**	**2,651,679**	**1,894**

White Spruce

Seed Zone	KG	Seedlings	Hectares
CM3.4	125.88	30,413,466	21,724
LF1.2	612.68	148,031,126	105,737
LF1.4	513.77	124,132,546	88,666
LF2.1	48.62	11,746,868	8,391
SA1.1	10.17	2,457,905	1,756
SA2.1	8.25	1,993,288	1,424
UF1.3	32.13	7,763,675	5,545
Total	**1351.51**	**326,538,874**	**233,242**

Grand Total	**2,717.13**	**512,105,665**	**365,790**

Assumptions for use

Average seeds per kg: Pine= 269,092; White spruce= 483,221; Black spruce= 867,058

Seedlings = kg of seed x average seeds per kg/ 2 seeds per cavity

Hectares to plant= seedlings/ 1400 trees per hectare

5.1.7.3. Seed Availability for Conifer Replacement on Deciduous Landbase

Deciduous operators purchase seed from Weyerhaeuser's inventory to reforest conifer within FMU G16.

5.1.8. FGRMS Reporting

Alberta Forest Genetic Resource Management and Conservation Standards (FGRMS) Reporting

Stream 1 (Wild) Seed Deployment Reporting

Species	Stream 1 Seed Zone	Year	Area Planted: Regular Est. (ha)	Seedlings Planted (count)	Area Planted: Re-Treat or Under Plant (ha)	Seedlings Planted (count)
Sb	UF 1.3	2014	73.8	109,890.00		
Sb	LF 1.4	2014	62.5	88,695.00	5.7	8,100.00
Sw	UF 1.3	2014	227.5	300,240.00		
Pl	LF 1.4	2014	1,642.13	2,175,537.00	36.24	50,728.00
Pl	SA 1.1	2014	385.5	477,126.00	15.34	21474
Pl	UF 1.3	2014	823.5	1,119,366.00	56.68	79,341.00
Sw	UF 1.3	2015	55.4	70,672.00		
Sw	SA 1.1	2015	37.7	48,600.00	1.1	1620
Sw	LF 1.4	2015	24.7	35,168.00		
Pl	LF 1.4	2015	2,071.80	2,910,002.00	82.4	113,200.00
Pl	SA 1.1	2015	151.3	232,981.00	32.5	47009
Pl	UF 1.3	2015	2,117.64	2,861,746.00	225.2	325607
Pl	CM 3.4	2015	139.9	203,230.00		
Sb	UF 1.3	2016	16.4	22,950.00		
Sb	LF 1.4	2016	173.5	246,780.00		
Sw	UF 1.3	2016	432.1	630,000.00	11.47	16065
Sw	LF 1.4	2016	45.6	69,390.00		
Sw	SA 1.1	2016	10	11,925.00		
Pl	LF 1.4	2016	1,676.15	2,402,705.00	212.83	297,880.00
Pl	SA 1.1	2016	66	70,470.00	9.79	13770
Pl	UF 1.3	2016	2451.8	3,547,715.00	380.29	532,640.00
Pl	CM 3.4	2016			8.49	11,880.00
Pl	DM 1.3	2016	28.4	42,120.00		
Sb	UF 1.3	2017	1.1	1,620.00		
Sw	UF 1.3	2017	656.7	963,225.00	14.27	19980
Sw	SA 1.1	2017	22.7	27,135.00	8.49	11880
Sw	LF 1.2	2017	5.42	7,560.00		
Pl	LF 1.4	2017	1,054.23	1,509,165.00	124.96	174,960.00
Pl	LF 1.2	2017	202.69	283,770.00		
Pl	UF 1.3	2017	1,330.52	1,870,560.00	146.48	205065
Pl	M 2.1	2017	4.9	7,020.00		

Stream 1 (Wild) Seed Deployment Reporting continued...

Species	Stream 1 Seed Zone	Year	Area Planted: Regular Est. (ha)	Seedlings Planted (count)	Area Planted: Re-Treat or Under Plant (ha)	Seedlings Planted (count)
Sw	UF 1.3	2018	263.18	250,020.00		
Sw	LF 1.4	2018	40.26	49,320.00		
Pl	LF 1.4	2018	1,636.80	1,321,515.00	109.91	34,560.00
Pl	SA 1.1	2018	30.81	16,875.00	12.03	5400
Pl	UF 1.3	2018	2084.2	1,530,360.00	91.78	63,990.00
Pl	LF 1.2	2018	386.91	300,240.00		

Stream 2 (Seed Orchard) Seed Deployment Reporting

Species	Stream 2 CPP Region	Year	Area Planted: Regular Est. (ha)	Seedlings Planted (count)	Area Planted: Re-Treat or Under Plant (ha)	Seedlings Planted (count)
Sb	L2	2014			10	14,040.00
Sw	G1	2014	1,084.90	1,374,745.00	157.58	220,535.00
Pl	B1	2014	1,804.47	2,339,171.00	54.16	75839
Pl	B2	2014	211.1	267,000.00		
Sb	L2	2015	197	289,890.00		
Sw	G1	2015	549.1	736,077.00	28.6	45943
Pl	B1	2015	620.4	819,836.00	11.9	17054
Pl	B2	2015	354	437,670.00	7.4	10260
Sb	L2	2016	0	0		
Sw	G1	2016	808.00	1,109,970.00		
Pl	B1	2016	0.00	0.00		
Pl	B2	2016	349.4	504,875.00	2.1	2970
Sb	L2	2017	262.78	402,030.00		
Sw	G1	2017	1281.08	1,787,130.00	148.86	208440
Pl	B1	2017	1034.9	1,577,610.00	74.08	103680
Pl	B2	2017	279.33	429,165.00		
Sb	L2	2018	360.93	476550		
Sw	G1	2018	3,862.91	2,190,085.00	139.58	65,880.00
Pl	B1	2018	3,090.91	2,612,180.00	229.46	7560
Pl	B2	2018	174.62	219,780.00		

5.2. Reporting VOITs

Appendix 15; Weyerhaeuser Grande Prairie 2011 DFMP VOITs

5.2.1. Biodiversity; cover types and seral stages

Objective	1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages
Indicator	1) Area and percent of young, mature and late (old) seral stages by broad cover group [BCG] (CX, CD, DC, DX) in the net and gross landbase Young: 0-80 years for all NSR's Mature: 81-120 years for MIX & LF 81-140 years for UF & SA Old: 120+ years for MIX & LF 140+ years for UF & SA
Target	Table showing 1946 % area by NSR by young, mature and old verses 200-year PFMS average. From the 2011 FMP-Year 10
Means of achieving Objective and Target	Follow the Spatial Harvest Sequence (SHS), including input from the forest condition assessments.
Acceptable Variance	By DFA, area (ha) of old and mature seral stage forests shall be between 90% and 100% of target areas. By DFA, area of young seral stage forest shall not exceed 110% of target area

	Young (0-80)	Mature (81-120)	Old (120+)
Cx	26%	17%	15%
CD	4%	1%	1%
DC	6%	3%	1%
DX	13%	12%	1%

Year 0	Young (0-19)	Mature (80-119)	Old + Very Old (120+)
Cx-Pl	24.8	32.3	22.9
Cx-Sw	11.3	34.2	39.0
Cx-other	2.5	42.1	44.5
MW	10.0	29.8	18.5
DX	12.1	41.6	7.3

NOTE: Since the 2011 FMP, the definitions for the seral stage classes have changed, the CD and DC stands are classified together as mixed woods (MW) and the results are summarized for the Classified Landbase as a whole, not by Natural Sub Region.

Overall, the stands represented by the young seral stages appear to be within range of what was targeted.

Stands representing the mature seral stages at year 0 of the 2019 FMP are far higher than what was targeted for year 10 of the 2011 FMP. This is largely due to an overall underproduction of the DX stands by the deciduous operators as well as an underproduction of the conifer sequence in the Caribou Management Zone.

This same logic applies to why there is an overabundance of the old + very old age classes throughout all cover types. Another reason for this is successful fire suppression over the past 2 decades.

5.2.2. Biodiversity; landscape fragmentation

Objective	1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation
Indicator	2) Size of harvest opening by cost zones
Target	Range of harvest areas [ha] in the approved SHS 0-5 – 4% / 11-40 – 44% / 100-500 -15% 5-10 - 16% / 41-100 – 21% / >501 - 0%
Means of achieving Objective and Target	Follow the SHS
Acceptable Variance	<20% of the target for each size category

Young Seral Patch Sizes	Year 0 (2019)
0-5 ha	2.8%
6-19 ha	17.7%
20-99 ha	47.9%
100-250 ha	20.4%
>250 ha	11.1%

This assessment s using the definitions described in the VOITS for the 2019 FMP. Although the patch size breakdown is slightly different from the one in the 2011 FMP, the evidence shows the desired trend was achieved. Medium to large patch sizes (> 20ha) are preferred over small patch sizes as is a representative range.

5.2.3. Permanent Road Density-Grizzly Bear Zone

Objective	1.1.1.3 Maintain biodiversity by minimizing access
Indicator	4) Permanent forestry road density by grizzly bear zone
Target	Core area: 0.6 km/km2 Secondary area: 1.2 km/km2
Means of achieving Objective and Target	Timber operators will continue coordinated access plans with energy sector when possible. Roads no longer required by oil and gas are decommissioned and rehabilitated.
Acceptable Variance	A variance not exceeding 20% of target density

This evidence shows that the amount of permanent road within the Grizzly Bear Zones are within the target densities as set in the 2011 DFMP.

Information as of May 9, 2019

Grizzly Zone	Area (km2)	Forestry Roads (km)	Non-Forestry Roads (km)	All Roads (km)	Target Density (km/km2)	Actual Density (km/km2)
Core	4,074.9	322.9	1,318.1	1,641.0	0.6	0.40
Secondary	2,901.7	183.6	1,617.8	1,801.4	1.2	0.62

5.2.4. Temporary Access Roads

Objective	1.1.1.3 Maintain biodiversity by minimizing access
Indicator	5) Kilometers of temporary (Inter-block) access roads still open after 5 years
Target	Zero km
Means of achieving Objective and Target	Block layout, road construction, maintenance and reclamation activities.
Acceptable Variance	<20% must be achieved

As per the 2019/20 Annual Operating Plan (AOP) Appendix 7, there are approximately 25 km of temporary access roads that have been open longer than 5 years (construction date >May 1, 2014). Local GoA area foresters are aware of each of the roads as well as reclamation plans.

Compartment	Blk Assn	Season	Construct Date	Length (m)	comments
South East Kakwa	6050612862	Non-Frozen	2/20/2002	371	scheduled for reclamation 2019
South East Kakwa	6050613308	Non-Frozen	2/20/2002	806	scheduled for reclamation 2019
Nose Mountain	6100641300	Non-Frozen	8/14/2009	740	Scheduled for reclamation 2019
Nose Mountain	6100641008	Marginal	11/10/2009	3,285	Left open for access to 6100640954, 6100641032, 610641005
Nose Mountain	6100641102	Marginal	11/10/2009	1,649	Left open for access to 6100640954, 6100641032, 610641005
Nose Mountain	6100641005	Frozen	11/10/2009	1,009	Left open for access to 6100640954, 6100641032, 610641005
Nose Mountain	6100640954	Frozen	12/1/2009	2,340	Left open for access to 6100640954, 6100641032, 610641005
Nose Mountain	6100642138	Frozen	7/1/2012	1,102	Left open for access to 6100640954, and south checkerboard blocks
MA2 GP North	6120642326	Frozen	9/1/2013	614	Scheduled for reclamation 2019
Wanyandie	6040611655	Non-Frozen	9/30/2013	1,068	Required to remain open for Isley stranded wood
Wanyandie	6040610896	Non-Frozen	9/30/2013	2,067	Required to remain open for Isley stranded wood
Wanyandie	6040612192	Non-Frozen	10/10/2013	275	Required to remain open for Isley stranded wood
Wanyandie	6040611655	Non-Frozen	10/10/2013	1,433	Left open for Norbord, scheduled for reclamation 2019
Wanyandie	6040611655	Non-Frozen	10/10/2013	835	Required to remain open for Isley stranded wood
Wanyandie	6040610896	Non-Frozen	10/20/2013	1,693	Left open for Norbord, scheduled for reclamation 2019
Musreau	6040632621	Frozen	10/25/2013	2,142	Left open for access to block 6040632621, partially reclaimed
MA2 GP North	6120650565	Marginal	11/1/2013	1,788	Pre-build 2018/19 scheduled for reclaim 2019/20
Bull Creek	6090651450	Frozen	2/1/2014	318	Scheduled for reclaim 2019

5.2.5. Uncommon Plant Communities

Objective	**1.1.1.4 Maintain plant communities uncommon in DFA**
Indicator	6) Unique biological or physical areas
Target	100% of identified sites are protected. Plant community sites identified through the ANHIC website are excluded from forest development
Means of achieving Objective and Target	Follow OGR for protection of unique habitat features – rare plant communities
Acceptable Variance	None; 100% of all known sites are protected from disturbance.

Unique areas identified in the 2011 FMP were protected from harvest by being removed from the contributing area when the Classified Landbase was defined for the 2011 FMP. Unique areas that were previously identified have been carried forward in the 2017 landbase update.

5.2.6. Unique Habitat-wildfire

Objective	**1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events**
Indicator	7) Area of unsalvaged burned forest
Target	Live trees: Retain all unburned trees in green islands and retained patches Burned trees: Retain >10% of area with merchantable black trees in salvage areas greater than 10 ha in size. Harvest Area Scale: Retain >5% of area with merchantable black trees in salvage areas less than or equal to 10 ha. in size
Means of achieving Objective and Target	Salvage planning
Acceptable Variance	At the end of the DFMP term the target is achieved or exceeded

In the past decade, 4,494 hectares have burned on the FMA.
Most of these fires were small (<5ha) with only a handful between 5-100ha. None of these burned areas were salvaged and the small burned islands were left for landscape and habitat biodiversity.

The Red Deer Creek fire (2014) burned 95% of this area. This fire was within the Narraway CMZ and salvage was not considered safe nor feasible. Burned stands were left for landscape and habitat biodiversity.

Regenerating cutblocks that were part of the burned areas were replanted.

5.2.7. Unique Habitat-blowdown

Objective	**1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events**
Indicator	8) Area of unsalvaged blowdown forest
Target	In areas of blowdown exceeding 2 ha. in size, an average of 10% of the area will be left unsalvaged
Means of achieving Objective and Target	Salvage planning
Acceptable Variance	At the end of the DFMP term the target is achieved or exceeded

A blowdown patch of approximately 70 ha was mapped in the South East Kakwa compartment during the 2018 forest health flights conducted by the province. This area has been scheduled for salvage harvest in period 1 of the 2019 FMP to minimize the threat of spruce beetle infestation. We anticipate 10% will be left unsalvaged due to merchantability and operability constraints.

5.2.8. Riparian Management Zones- compliance with OGRs

Objective	**1.1.1.6 Retain ecological values and functions associated with riparian zones**
Indicator	9) Riparian Management Zones
Target	Full compliance with the OGRs
Means of achieving Objective and Target	Silviculture AOP; OGR DFMP buffers riparian areas [see NLB doc]
Acceptable Variance	There is no variance from what is identified in self reporting.

The following table is a summary of incidents between May 1, 2014 and April 30, 2019 that had the potential to negatively impact Riparian Management Zones. Each incident was reported to local area foresters. Mitigative strategies assigned have been completed.

Occur Date	Description of Environmental incident
10/1/2014	Contractor drove outside boundary across a mapped ephemeral
1/14/2015	Skidder crossed ephemeral
8/5/2015	road built through ephemeral
8/11/2015	Herbicide excursion into bag lines
8/13/2015	Herbicide excursion into bag lines
8/17/2015	RoW cut too wide at a small perm.
10/22/2015	skidding through intermittent
12/9/2015	bunched into transitional buffer
10/17/2016	bunched into transitional buffer
8/11/2017	disturbance to intermittent channel
1/20/2018	road construction less than 30m from intermittent watercourse
2/22/2018	dozer crossed ephemeral
3/2/2018	Grader pushed snow and dirt into an intermittent creek
3/7/2018	road built too close to intermittent
6/18/2018	Built berm through ephemeral
9/25/2018	ditched through ephemeral
1/22/2019	road built too close to intermittent

5.2.9. Retention

Objective	1.1.2.1 Retain stand level structure
Indicator	10) Percent of retained merchantable volume
Target	Maintain 2.5% of merchantable conifer volume and 3% deciduous volume across the landscape
Means of achieving Objective and Target	OGR and Structure Retention Monitoring Program and operational adjustment to meet target
Acceptable Variance	The acceptable variance for the 5-year rolling average will be +/-25% of the target Timeframe is term of DFMP.

Merchantable tree retention for Weyerhaeuser Grande Prairie has been monitored since 2006 using air photo interpretation. Retention was surveyed on three levels:

1) Area Retention (ha)
2) Volume Retention (m3)
3) Snag Retention (stems/ha)

Retention results for the 10-year period between 2006-2016 show 5.13% for volume and 6.50% for area.
The overall proportion of conifer volume (m3)/ area (ha) retention and deciduous volume/ area retention is 43%/ 51% and 57%/ 49%, respectively.

The apparent overachievement of retention targets is a result of the way the contributing landbase was defined in the 2011 FMP. Stands that were considered marginally merchantable were included to give operators the flexibility needed to react to the MPB infestation. A portion of these stands were deemed inoperable or unmerchantable and deleted/ deferred by operational planners which resulted in an increase in the amount of retention represented in some of the stands. The process to accurately tag the reason stands, or portions of stands, were being left after harvest was not developed and consistently used until well into period 2 of the 2011 FMP. Improvements have been made in how these stands are tagged and tracked so that retention data reflects only stands that were truly intended to be left as retention.

Retention for the 2016/17 and 2017/18 harvest seasons was monitored and reported using the cutblock update process as per the spatial data directive. Data for the 2018/19 harvest season has not yet been collected (May 10, 2019).

In 2016/17 6,400 ha were harvested and 415.5ha remains as retention within these harvested areas for a total 6.5% retention that is representative of the harvested area (coniferous and deciduous). Of this, 5.6% is merchantable and 0.9% is considered non merchantable.

In 2017/2018, 6,907 ha were harvested and 327.2ha remains as retention within these harvested areas for a total 4.7% retention that is representative of the harvested area (coniferous and deciduous). Of this, 1.4% is merchantable and 3.4% is considered non merchantable.

5.2.10. Sensitive Sites

Objective	**1.1.2.2 Maintain integrity of sensitive sites**
Indicator	12) Unique biological or physical sites
Target	100% of sites we or the public advisory group identify are protected from traditional harvest practices.
Means of achieving Objective and Target	Inventory of unique sites for use in operational planning; avoidance; OGRs, training
Acceptable Variance	All known sites protected
Response	Adjust strategies in subsequent AOPs

Unique areas identified in the 2011 FMP were protected from harvest by being removed from the contributing area when the Classified Landbase was defined for the 2011 FMP. Unique areas that were previously identified have been carried forward in the 2017 landbase update.

Heritage Resources Impact Assessments are performed where forestry operations occur in areas of high historic resource potential. The first stage of the heritage management process is to conduct the Heritage Resources Overview of Weyerhaeuser's proposed harvest blocks and access roads. The heritage overview is referred to as "screening" of development plans. The screening process recognizes conflicts with existing or predicted historical resources, determines which forestry operations or developments will likely impact the historical resources and finally provides heritage prescriptions along with comments to minimize the chances of impacting those heritage resources. During this screening process, our contracted permit archaeologist, who acts as the liaison between Weyerhaeuser and Alberta Culture, reviews all the proposed developments (blocks and access roads) submitted for Final Harvest Plans and assigns heritage prescriptions for each proposed harvest block and road. This determines what level of archaeological inspection is required for each development. Two basic heritage prescriptions are recommended:

(1) **No Concern**- The proposed developments will not require any form of archaeological field inspection or attention.

(2) **Pre-Impact Assessment-** The proposed development requires an archaeological field inspection prior to any forest activities.

As a result of the screening of the Weyerhaeuser proposed developments, a document is created and submitted to Alberta Culture, along with the permit application. The fieldwork is started when the permit application and related documents are approved by AC personnel and the permit is issued.

The fieldwork involves intensive pedestrian survey supplemented with subsurface shovel testing of high archaeological potential areas. The objectives of the field assessments are: (1) to identify and evaluate any archaeological sites located within proposed developments, (2) to identify and assess possible impacts of the proposed developments on any identified archaeological sites, (3) to provide recommendations regarding the need and appropriate scope of further archaeological studies prior to the initiation of any proposed developments, and (4) to recommend viable alternatives for managing adverse impacts.

The majority of surveys are done prior to harvest however, occasionally, in some instances such as: (1) the blocks do not have access, (2) a sudden change in plans, and (3) the ground is frozen before the archaeologist can make his way to the field, the surveys are done post-harvest. In these cases, the archaeologist submits the proposed developments with post-impact audit prescription to Alberta Culture and with their approval the blocks are deemed as post-impact and will be surveyed the following year.

The results of the fieldwork are communicated to the Weyerhaeuser planning staff, and the results either show sites found or no sites found. If there are no sites found, then harvesting can proceed as per usual. If there are sites found, then the archaeologist flags a buffer around the site with red "Machine free zone" ribbon. Weyerhaeuser then updates the block maps and block books to reflect the sites found.

5.2.11. Water crossings- compliance with OGRs

Objective	1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings
Indicator	13) Forestry water crossings in compliance with Code of Practice for Water Course Crossings within each Subunit
Target	100% of designs meet standards of the Code of Practice for Water Course Crossings
Means of achieving Objective and Target	Road construction, maintenance and reclamation activities
Acceptable Variance	None

The following table is a summary of incidents between May 1, 2014 and April 30, 2019 where forestry crossings were not built according to what was planned and approved and had the potential to negatively impact water quality and or the integrity of the channel or the bank. Each incident was reported to local area foresters. Mitigative strategies assigned have been completed.

Occur Date	Description of Environmental incident
9/15/2015	missed crossing
9/29/2016	built crossing not classified on map
11/6/2017	bridge stake in channel
9/25/2018	missed crossing
10/20/2018	damage to ephemeral channel
12/5/2018	built road and 2 crossings in wrong location
1/28/2019	crossed ephemeral without crossing

5.2.12. Landscape Level Habitat

Objective	**1.2.1.1 Maintain landscape level habitat for naturally occurring species of plants and animals**
Indicator	14) Area of suitable habitat for Caribou, Grizzly Bear & Barred Owl [Output of forest condition assessment and the TSA]
Target	Maintain habitat for caribou [DFMP caribou sub-committee determined level of harvest in caribou zone for the 20-year SHS]. Grizzly Bear-meet road density targets [core .6 km/km2 and secondary 1.2 km/km2]. Analysis for Grizzly Bear and Barred Owl completed by SRD. Targets to be determined after analysis.
Means of achieving Objective and Target	Forest Condition Assessments, SHS, road construction, OGRs, adherence to provincial wildlife guidelines.
Acceptable Variance	10-year term

20-year SHS harvest levels within the **Caribou Management Zone** is reported in mandatory component 5.1.2.

Road density targets in **Grizzly Bear zones** are reported in Indicator #4.

Barred Owl management strategies were set out in the 2011 FMP in section 7.3.
We perform **owl surveys** every 3 years (2007, 2010, 2013, 2016…).

Retention targets are set at 2.5% merchantable coniferous and 3% merchantable deciduous volume. Retention strategies are to leave a mosaic on the landscape of patches, clumps, single trees and snags which is representative of what was there before harvest. A report in Indicator 10 shows that we are meeting these targets.
In order to minimize negative impacts to **nesting songbirds and other species** during the breeding season, operators adhere to the following practices during spring and summer harvesting.

- In order to minimize negative impacts to nesting songbirds during the breeding season, forest operators will, if falling trees in the period of May 1 to August 10:
  - Use the AVI-based risk assessments, as shown on the bird survey maps for each block, to understand which stands may require surveys.
  - Contact the bird survey consultant to arrange for nest sweeps in those blocks where the bird survey maps indicate areas of high, very high, or extreme risk. Nest sweeps are valid for seven days.
  - Maintain 100 m buffers on all stick nests and 30 m on songbird nests observed by harvest crews or survey consultants. Ensure that sweeps are kept current to harvest plans.
  - Buffers on songbird nests (30 m) are temporary and will be flagged with summer grade yellow and red striped ribbon.
  - Buffers on stick, or raptor, nests (100 m) are permanent and will be flagged in boundary ribbon.
  - Avoid harvest of extreme risk stands between May 1 and August 10 (typically, these are hardwood dominated mixed wood stands, with Sw as the leading conifer in the overstory)
  - Limit, where possible, the harvest of old growth white spruce leading and mixedwood stands from May 1 to August 10. This will further lessen the impact to breeding birds and other species dependent on older conifer and mixedwood stands for habitat.
- If falling trees in the period of March 15 to April 15, owl surveys are required with possible nest sweep. Owl nest sweeps are valid for 10 days. Contact the bird survey consultants to complete the surveys.
- These actions will complement other programs, such as riparian buffers and in-block structure retention, to minimize the risk to breeding birds, nests and other species during the time of year when they are most vulnerable.

5.2.13. Reforestation Standards

Objective	**1.2.1.3 Meet the Provincial reforestation standards for all corresponding stand types**
Indicator	15) Percentage of species with locally occurring species
Target	100% of reforestation is with locally occurring species
Means of achieving Objective and Target	AOP, silviculture program
Acceptable Variance	None; report on species used in reforestation program or approved for research
See Mandatory Component 6.1.8 (FGRMS Report)	

5.2.14. Wild Forest Populations & Genetics

Objective	**1.3.1.1 Retain "wild forest populations" for each tree species in each seed zone through establishment of in-situ reserves by the organization with an approved controlled parentage program or in cooperation with Alberta**
Indicator	16) Number and area (ha)of in situ genetic conservation areas
Target	Number of genetic conservation areas for each seed zone conforming with Section 20 of the Green Area section of Standards for Tree Improvement in Alberta (yet to be determined by SRD)
Means of achieving Objective and Target	Conservation areas are designated by a notation (PNT, CNT, ISP)
Acceptable Variance	None; provincial policy will be followed
Objective	**1.3.1.2 Retain wild forest genetic resources through ex-situ conservation**
Indicator	17) Number of provenances and genetic lines in ex-situ gene banks and trials
Target	Active ex-situ conservation program for all Controlled Parentage Program plan species and other species in cooperation with Alberta
Means of Achieving Objective and Target	FGRMS
Acceptable Variance	Confirmed program plan
These VOITs are n/a as per letter from Doug Sklar dated April 20, 2004.	

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Government of Alberta
2001 & 2002 IPAC Gold Award for Innovative Management

Public Lands and Forests Division
Forest Management Branch

7th Floor 9920 - 108 Street
Edmonton, Alberta
Canada T5K 2M4

Telephone (780) 427-8474
Fax (780) 427-0085

April 20, 2004

TO: Distribution List

RE: ESTABLISHMENT OF *IN SITU* FOREST GENETIC RESOURCE CONSERVATION AREAS

Due to concerns regarding the duplication of effort related to establishing *in situ* forest genetic resource conservation areas by industry and government as outlined in Standards for Tree Improvement in Alberta (STIA) section 20.0, the department is recommending the following:

- That companies continue to review and identify suitable candidate stands and areas that would meet their conservation obligations;
- Until regional gene conservation needs are identified and direction on implementation is provided through the provincial plan, companies with planning and reporting requirements under STIA refer to co-ordination with the provincial conservation plan implementation schedule.

The provincial genetic resource conservation plan is presently being developed in cooperation with Parks and Protected Areas Division and implementation is currently scheduled to begin in 2005.

Sincerely,

D. (Doug) A. Sklar
Executive Director
Forest Management Branch

cc: Scott Milligan, Senior Manager, Harvesting and Renewal Section
Leonard Barnhardt, Site Manager, Alberta Tree Improvement and Seed Centre

5.2.15. Reforestation Targets

Objective	2.1.1.1 Meet reforestation targets on all harvested areas
Indicator	19) Annual % of area for SR regeneration surveys
Target	95% on an annual basis for regeneration surveys
Means of achieving Objective and Target	Silviculture program
Acceptable Variance	None
Objective	**2.1.1.1 Meet reforestation targets on all harvested areas**
Indicator	20) Cumulative % of reforested areas that meet the reforestation target
Target	95% of harvest areas that were harvested on or after May 1, 2001 meet Prov. or approved reforestation standards
Means of achieving Objective and Target	Silviculture program
Acceptable Variance	None; all areas meet reforestation standards

Annual and Cumulative % of Area for SR Regeneration Surveys
May 1, 2014- April 30, 2019

Year	Total Blocks Surveyed	Total ha surveyed	Total ha Satisfactorily Stocked	% Satisfactorily Stocked (ha)
2014	114	5,458.19	5,457.34	99.98%
2015	223	5,456.61	5,453.4	99.94%
2016	185	5,243.7	5,219.9	99.55%
2017	192	4,751.74	4,749.34	99.95%
2018	185	4,931.26	4,922.47	99.82%
Total	**899**	**25841.5**	**25802.45**	**99.85%**

Cumulative SR = 99.85%
Cumulative NSR= 0.15%

5.2.16. Minimize Loss of Forest

Objective	2.1.2.1 Forests on the DFA will be managed so as to minimize losses to non-forest uses.
Indicator	21) Changes in DFA Landbase
Target	A program to maintain forest landbase
Means of achieving Objective and Target	Maintain current forest cover inventory and land use updates
Acceptable Variance	None
See Mandatory Component 6.1.4	

5.2.17. Forest Health

Objective	2.1.2.2 Recognize lands affected by insects, disease or natural calamities
Indicator	22) Amount of area affected
Target	Report on presence or absence, or area affected by significant outbreaks, infestations, natural calamities
Means of achieving Objective and Target	Maintain up-to-date information
Acceptable Variance	None
See Mandatory Component 6.1.2 “Mountain Pine Beetle”	

5.2.18. Invasive Plants

Objective	**2.1.3.1 Control non-native plant species (weeds) Alberta Weed Regulations to identify invasive plant species.**
Indicator	23) Noxious weed program
Target	Reduction in the occurrence or spread of invasive plants
Means of achieving Objective and Target	Co-operative programs; Report number of sites/ ha treated
Acceptable Variance	None

Weyerhaeuser conducts regular inspections during all operations phases; MD of Greenview as well as GoA also conduct their own inspections and issue Weed Notices when required.

Each September, approximately 581 kms of Weyerhaeuser's main road infrastructure (DLO); temporary camps and staging yards (DML) and gravel pits (SML) are inspected for invasive plants (noxious weeds). If found, sites are sprayed with Milestone 24D Combination, Tordon 22K or Pyralid chemical (all approved). The spray window lasts for 20-30 days, weather dependent. The most common weeds found and treated are Scentless chamomile, Sow Thistle, Canada Thistle, Bull Thistle, Meadow Hawkweed and Oxeye Daisy.

Noxious Weeds were controlled by Weed Busters, a contracted company in Grande Prairie, AB, from 2014-2017.
From 2018 to present noxious weeds were controlled by KLON Services, a contracted company from Grande Prairie

Actual sites and/ or kms sprayed as well as specifics on the weeds found are kept with contractor invoices at the Weyerhaeuser Grande Prairie Timberlands office.

General summaries of activities are below:

2014	Sites were treated along Weyerhaeuser's road infrastructure and around the Musreau Lake campsite and an MLP at White Mountain
2015	Sites were treated along Weyerhaeuser's road infrastructure and around the Musreau Lake campsite and an MLP at White Mountain
2016	Sites were treated along Weyerhaeuser's road infrastructure and around the Musreau Lake campsite; Nose Mountain Tower and an MLP at White Mountain
2017	Sites were treated along Weyerhaeuser's road infrastructure and around the Musreau Lake campsite; Nose Mountain Tower, 69km compound and an MLP at White Mountain
2018	221 hectares were treated including Weyerhaeuser's road infrastructure, (19) DMLs, and (6) SMLs.

5.2.19. Minimize Roading Impacts

Objective	**3.1.1.1 Minimize impact of roading and bared areas in forest operations**
Indicator	24) Compliance with Grande Prairie OGR's
Target	All blocks will have less than 5% soil disturbance unless prior approval is received from SRD
Means of achieving Objective and Target	Compliance with the OGRs, Soil Guidelines
Acceptable Variance	None
Response	Immediate remedial action to correct

There were no incidents reported between May 1, 2014 and April 30, 2019 were planned roads exceed 5% without prior approval from the province.

<u>Operational Planning and Harvest Operations:</u> If planned roads exceed 5% blocks are approved with an approval condition encouraging operations to minimize roading where possible. If planned roads are close to the 5% and operational roads are added which exceeds the 5% approval is requested and granted via TFA prior to construction.

5.2.20. Minimize Ground Disturbance

Objective	3.2.1.2 Minimize incidence of soil erosion and slumping
Indicator	25) Incidence of soil erosion and slumping
Target	Complete compliance
Means of achieving Objective and Target	Compliance with the OGRs
Acceptable Variance	None;

The following table is a summary of incidents between May 1, 2014 and April 30, 2019 that had the potential to negatively impact soil integrity through erosion and/ or rutting. Each incident was reported to local area foresters. Mitigative strategies assigned have been completed.

Occur Date	Description of Environmental incident
9/16/2014	ground disturbance (skidding)
3/14/2015	ground disturbance
3/24/2015	ground disturbance
6/11/2015	ground disturbance
4/4/2016	ground disturbance
8/4/2016	ground disturbance
10/12/2016	ground disturbance
10/19/2016	ground disturbance
11/17/2016	ground disturbance
7/30/2017	ground disturbance (site prep)
8/11/2017	ground disturbance
9/6/2017	ground disturbance (buncher)
11/9/2017	ground disturbance (skidding)
5/3/2018	erosion on arrowhead road
5/10/2018	water runoff into small perm
8/21/2018	ground disturbance
10/10/2018	ground disturbance
11/19/2018	ground disturbance (buncher)
1/17/2019	ground disturbance (buncher)

5.2.21. Riparian Buffers- compliance with OGRs

Objective	3.2.2.1 Minimize impact of operations in riparian areas
Indicator	27) Riparian buffers maintained as per OGR's
Target	Complete compliance
Means of achieving Objective and Target	Effective planning and supervision of operations
Acceptable Variance	None

The following table is a summary of incidents between May 1, 2014 and April 30, 2019 that had the potential to negatively impact Riparian Management Zones. Each incident was reported to local area foresters. Mitigative strategies assigned have been completed.

Occur Date	Description of Environmental incident
10/1/2014	Contractor drove outside boundary across a mapped ephemeral
1/14/2015	Skidder crossed ephemeral
8/5/2015	road built through ephemeral
8/11/2015	Herbicide excursion into bag lines
8/13/2015	Herbicide excursion into bag lines
8/17/2015	RoW cut too wide at a small perm.
10/22/2015	skidding through intermittent
12/9/2015	bunched into transitional buffer
10/17/2016	bunched into transitional buffer
8/11/2017	disturbance to intermittent channel
1/20/2018	road construction less than 30m from intermittent watercourse
2/22/2018	dozer crossed ephemeral
3/2/2018	Grader pushed snow and dirt into an intermittent creek
3/7/2018	road built too close to intermittent
6/18/2018	Built berm through ephemeral
9/25/2018	ditched through ephemeral
1/22/2019	road built too close to intermittent

5.2.22. Sustainable Harvest

Objective	5.1.1.1 Harvesting to be at a sustainable harvest level
Indicator	28) Level of harvest. Following consultation with FMA quota holders and ASRD and a review of the preliminary and sensitivity analysis, a preferred scenario that best represented the collective goals and objectives was modeled to estimate sustainable harvest levels for the FMA.
Target	Compliance with the SHS.
Means of achieving Objective and Target	GDP/AOP approvals
Acceptable Variance	Overproduction/ underproduction applied to the following period to balance periodic harvest levels
See Mandatory Component 6.1.5	

5.2.23. Reduce Wildfire Threat

Objective	**5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing the suppression capability**
Indicator	29) Percentage reduction in fire Behaviour Potential area (ha) within the Fire Smart Community Zone and DFA over the 20-year SHS
Target	Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories 6% across the FMA and by 4% within the Fire Smart Community Zones
Means of achieving Objective and Target	Spatial harvest sequence, thinning, partial harvest techniques, prescribed burns
Acceptable Variance	Issue Specific

Community Zone	Planned Area (ha)	Harvested Area (ha)	Deferred Area (ha)	Deleted Area (ha)	Remaining Unharvested Area (ha)	Reduced Area %
Grovedale Aspen Grove	297.7	89.2	118.3	21.5	67	30%
Gundy Saddle Oak	316.1	135.4	187.6	3.1	71.3	43%
Nose Creek	3696.7	2689.9	930.5	463.8	314.8	73%
Wanyandie Flats East	352.6	103.5	135.2	26.2	96	29%
Woking	101.8	0	0	3.3	95	0%
TOTAL (ha)	**4,764.90**	**3,018.00**	**1,371.60**	**517.9**	**644.1**	**63%**

DEFERRALS

Community Zone	Operational Concern	Utilization Review	Immature	Caribou	Total Area (ha)
Grovedale Aspen Grove	4.6	113.7			
Gundy Saddle Oak		187.6			
Nose Creek	56.3	691.8	86.9	95.4	
Wanyandie Flats East	19.9	115.3			
TOTAL DEFERRED	**80.8**	**1108.4**	**86.9**	**95.4**	**1371.5**

DELETIONS

Community Zone	Operational Concern	AVI Mistype	Non-Merch	Cutblock Slivers	Buffer	Inoperable	Total Area (ha)
Grovedale Aspen Grove			13.6	7.9			
Gundy Saddle Oak				3.1			
Nose Creek		62.6	30.9	250.9	114.6	4.8	
Wanyandie Flats East	9.2			17			
Woking			3.3				
TOTAL DELETED	**9.2**	**62.6**	**47.8**	**278.9**	**114.6**	**4.8**	**517.9**

Operational Concern: Leave for 2nd pass, land use considerations or watercourses
Utilization Review: stands do not meet current utilization standards, <17 m in height
Caribou: part of trading exercise in Caribou Management Zones; may be sequenced in the future
Immature: Stand is too immature for harvest; could be classified under utilization
Cutblock Slivers: small (<1ha) and scattered timber patches, contributes to landscape retention values
Non-Merch: Does not meet merchantability specifications; could be classified under utilization
AVI Mistype: Stand type is incorrect from AVI classification to field check
Buffer: part of a riparian, archeological or traditional land use buffer

5.2.24. Reduce MPB Susceptibility

Objective	5.2.1.2 To reduce susceptible pine forests to MPB
Indicator	30) Reduction of MPB Susceptible Stands
Target	Follow the approved SHS from the MPB management plan
Means of achieving Objective and Target	SHS
Acceptable Variance	+-20% of the SHS by LMU by decade
See Mandatory Component 6.1.2 “Mountain Pine Beetle”	

5.2.25. Maintain LRSYA

Objective	5.2.3.1 Maintain Long Run Sustained Yield Average
Indicator	34) Regenerated stand yield compared to natural stand yield
Target	No net decrease from the natural stand productivity
Means of achieving Objective and Target	Growth and yield monitoring program and implementation
Acceptable Variance	N/A
See Mandatory Component 6.1.6	

5.2.26. Stakeholder Involvement

Objective	**1.4.1.1 Integrate transboundary values and objectives into forest management**
Indicator	18) Stakeholder consultation
Objective	**5.2.2.1 Maintain a forest management system that accommodates a variety of values and users**
Indicator	31) The integration of timber management activities with other uses.
Indicator	33) Direct consultation with the public regarding plans for and activities on the FMA
Objective	**6.2.1.1 Implement public participation plan**
Indicator	36) EAC review of Weyerhaeuser plans and operations
Targets	Ongoing consultations with relevant protected areas agencies Known affected stakeholders will be asked to review all harvest plans that impact their activities Address issues as they arise during the consultation processes
Means of achieving Objective and Target	Documentation of consultation processes (open houses, EAC, trappers, aboriginals…)
Acceptable Variance	None; All issues identified through the consultation process will be addressed

EAC Committee was active from 2009-2017 when we amalgamated CSA PAG and DFMP EAC in 2009/10 to form 1 Public Consultation committee. Participation from Timberlands, Cellulose Fibres and Lumber businesses. In 2016 the cellulose fibre business was sold to International Paper and it was no longer appropriate to have a joint Public advisory group. In 2017 Weyerhaeuser formed an independent PAG as part of the public consultation requirements for the FMP renewal. **Attendance, presentations, meeting minutes and follow up communication has been provided to the province and copies are also kept on file in Grande Prairie.**

Weyerhaeuser participates in annual joint Open Houses in Grande Prairie with Norbord, CanFor and GoA. Operations are presented for discussion at the AOP level. The Open House is advertised via newspaper, radio and social media. It is reasonable to assume a 300km radius is reached with these methods. Stakeholders are individually invited with written letters. **Invitations, Attendance, presented material and follow up communication is kept on file in Grande Prairie.**

Trappers are invited to the Open House via the Stakeholder Notification process. Prior to AOP submission Trappers are also sent a Trapper Notification package via registered mail which includes a letter and map specific to proposed activities affecting their trapline. All trapper communication is tracked in a Stakeholder Database and documented through resolution where necessary. **Invitations, copies of mailed packages and follow up communication is kept on file in Grande Prairie.**

Aboriginal Consultation refer to 6.1.1.1 Indicator 35

Weyerhaeuser has a documented "Responding to Public Concerns" guideline as part of the Environmental Management System. This process provides a system for responding to questions and concerns regarding Weyerhaeuser's Environmental performance and operations.
Records of communication as well as all follow up activities is kept on file in Grande Prairie.

5.2.27. Indigenous Consultation

Objective	**6.1.1.1 Forest management planning and activities will reflect First Nations rights, interests and traditional uses in the land and natural resources. Implementation of Public Involvement Plan including participation**
Indicator	35) Meet Alberta's expectations for aboriginal consultation
Target	Consult at the community level with designated representatives of affected aboriginal communities.
Means of achieving Objective and Target	DFMP, GDP, Implementation of the public participation plan
Acceptable Variance	None

Weyerhaeuser submits an annual request for a pre-consultation assessment and is directed by the province which Indigenous and Metis communities we have a responsibility to consult with.

Weyerhaeuser consults at the GDP/ AOP level annually in the Spring
Process is Map Review; concerns trigger a field visit or buffer/ exclusion request; mitigation plan is mutually agreed upon
3-5 years of activity

- Harvest openings + 200 m buffer
- Long Term camps > 0.5ha + 200 m buffer
- Long term staging yards > 0.5ha + 200m buffer
- All external & proposed upgrade road systems + 200m buffer
- Herbicide operations- no buffer

AOP approval (whole or block specific) is not received without consultation completed

Consultation activities are tracked in the planned cutblock layer and Record of Consultation Log and shapefile is sent to GoA

Consultation information is confidential.

5.3. Other FMP Commitments

5.3.1. Deciduous Landbase Conversion Requirement (January 31, 2011)

DFMP Appendix 4, Section 2.
Landbase and strata balancing affected approximately 1,750 hectares. Weyerhaeuser retains full reforestation responsibility of these stands. Of those stands, 1,075 hectares of conifer stands will be transitioned to Dx. Pure deciduous transition will take place in selected stands if (DX_TRANSIT) was identified as "AW". These APL stands were carried into the SHS using required DX transition adjustments.

Current status:
Weyerhaeuser has transitioned 1,073.9 of the 1,075 hectares required[3].
As agreed between Weyerhaeuser and Norbord (formerly Ainsworth), the following chart describes how the 1,073.9 hectares have been transitioned to date.

Hectares	Converted
1,075.0	Ha to convert to a deciduous land base (starting point)
-144.0	Coniferous shortfall (Jan 31, 2011)
-398.6	Coniferous blocks cut by Norbord through CTP and converted
0	Ha converted through the 2010/11 silviculture landbase balancing process (polygon swap)
0	Ha converted through the 2011/12 silviculture landbase balancing process (polygon swap)
-50.9	Ha converted through the 2012/13 silviculture landbase balancing process (polygon swap)
-80.8	Ha converted through the 2013/14 silviculture landbase balancing process (polygon swap)
-159.5	Ha converted through the 2014/15 silviculture landbase balancing process (polygon swap)
0	Ha converted through the 2015/16 silviculture landbase balancing process (polygon swap)
-129.6	Ha converted through the 2016/17 silviculture landbase balancing process (polygon swap)
-110.5	Ha converted through the 2017/18 silviculture landbase balancing process (polygon swap)
-1073.9	**Subtotal ha converted**
1.10	**Ha remaining to convert**

Transition Process:
As agreed to with Norbord, the remaining 1.1 ha will continue to be transitioned on a polygon by polygon basis through the silviculture landbase balancing process.

Following the harvest season, each polygon harvested by both Weyerhaeuser and by Norbord is assigned a stratum based on the Yield Strata Simplification table from the current FMP (approval condition 13.1ii). The hectares are totaled for each stratum and it is determined how many hectares of Pure D polygons were cut within Weyerhaeuser's cutblocks and how many hectares of conifer leading hectares Norbord cut. Weyerhaeuser reforests the deciduous hectares that we cut to conifer leading and Norbord reforests the conifer leading hectares that they cut to deciduous. This is process, including a running tally of the balance owing in the shortfall, is reported annually (usually August) to the Public Lands & Forests Division.

[3] Silviculture records, Weyerhaeuser, May 9, 2019