Integrated Silviculture Strategy for the Mackenzie Natural Resources District

Situation Analysis

Version 1.2

November 17, 2015

Project 419-35

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Executive Summary

In support of government objectives to mitigate forest health impacts on mid-term timber supply, this Integrated Silviculture Strategy project aims to facilitate a respectful and collaborative planning process that supports the delivery of defined stewardship outcomes - which in turn improves business certainty for licensees operating within the Mackenzie Natural Resources District (MNRD).

The Situation Analysis is the first of nine documents to make up the Integrated Silviculture Strategy. It describes the status of the resources within the MNRD and the issues that affect their sustainable use.

The AAC was recently uplifted by 50% - from approximately 3.0 million m^3/year to 4.5 million m^3/year - to facilitate the salvage of, primarily, Mountain Pine Beetle (MPB) - killed pine stands. In past years, through 2007-2010 as a result of the sudden crash of the US housing market, the full allowable annual cut (AAC) has not been harvested. Markets have since rebounded and licensees have demonstrated their ability and willingness to utilize this increased AAC provided to salvage beetle-killed pine.

In the MNRD, the MPB infestation began in 2004, peaked in 2009, and has since declined sharply. District staff estimate that three quarters of the pine is dead and will continue to remain commercially viable for 15 years from when they were attacked (i.e., 2019 to 2024). This is based on the timber having primary value as sawlogs, then pulp and finally as biomass for energy. The declining dead pine values prompted a partition of the increased AAC to target the dead pine stands now and save green timber for harvesting after the salvage period comes to an end (i.e., the mid-term harvest period). By 2025, the harvest is expected to shift significantly to non-pine leading stands.

MPB-killed pine stands that are not salvaged in time will require assessments to determine whether to rehabilitate or leave them to regenerate naturally - since some stands may have sufficient advanced regeneration.

MBP is not the only forest health impact to these forests. Significant tree mortality is currently observed with spruce beetle infestation attacking live spruce trees, older decline of balsam trees likely due to a combination of factors, gall rust affecting regenerating pine stands and the ever-increasing risk of fire as the dead wood dries.

The MNRD is home or traditional territory to ten First Nations including: Tsay Keh Dene First Nation, Kwadacha Band, Takla Lake First Nation, McLeod Lake Indian Band, Nak'azdli First Nation, Tahltan First Nation, Halfway River First Nation, West Moberly First Nations, Saulteau First Nations, and Gitxan. MNRD forest licensees include Canfor, Conifex, BC Timber Sales, Duz Cho, OBO Forest Management, Three Feathers, East Fraser, and MacFibre. The First Nations, licensees, interest groups, and public stakeholders will play a vital role ensuring that all relevant and recent information is compiled for use in the planned analyses. In particular, we welcome First Nations' active participation to provide traditional knowledge on ecosystems, wildlife and lands and to help develop more robust and appropriate management scenarios that will be examined in future phases of this project.

While the last timber supply review (FLNR 2014) accounted for many factors in determining the AAC, exploring alternative land use options was outside its scope. In recent years, government agencies and licensees operating within the MNRD have developed an array of strategies and plans, including:

- Legal objectives set by government
- Provincial timber management goals and objectives
- Mackenzie area crown land plan
- Mackenzie Land and Resource Management Plan
- Muskwa-Kechika Management Area
- Sustainable Forest Management Plan

- Silviculture Strategies
- BC Mountain Pine Beetle model (BCMPB)
- Future Forest Products and Fibre Use Strategy
- Multiple Resource Value Assessment
- Provincial Stewardship/Timber Harvesting Land Base Stabilization
- Forest Health Strategy
- Ecosystem Restoration
- Whitebark Pine Tactical Recovery Plan
- Recovery Strategy for the Woodland Caribou, Southern Mountain Population in Canada
- Peace Northern Caribou Plan
- Fire Management

According to the BCMPBv12 model projections, approximately 64% or 74 million m^3 of the pine volume will be dead by 2020 while district staff estimate this figure to be closer to 75%. There will be a significant fall down in timber supply in the MNRD following this salvage period in short term when harvest levels are estimated to drop from the current 4.5 million to 2.5 million m^3/year. Mitigation strategies can help to alleviate this fall down throughout the mid-term beginning in 10 years.

This salvage period will continue to pose significant challenges to forest licensees who must:

- quickly respond to volatile market prices,
- address the many and significant forest health issues impacting these forests,
- consider biodiversity, wildlife, other values and resource users,
- introduce new harvest methods and equipment (i.e., cable) as salvage operations extend into steeper terrain, and
- carefully monitor and prioritize dead pine stands as they deteriorate beyond minimum harvest criteria and maximum haul distances.

Silvicultural strategies have been proposed to address log quality from future stands but specific product flow objectives are not defined. In the short term, the primary concern with timber quality is the shelf-life of MPB-killed pine stands.

One of the primary considerations for this project is to ensure that wildlife and biodiversity values are maintained while optimizing the timber harvesting opportunities during this critical salvage period and through the mid-term. Some wildlife habitat designations have already been legally established, while substantial habitat designations have reached the late proposal stage (e.g., ungulate winter range for northern caribou, Stone's sheep, and mountain goat), and still others are being drafted (e.g., wildlife habitat areas for caribou, fisher, and bull trout). Several Fisheries Sensitive Watersheds are also being proposed.

Over 940,000 hectares of the MNRD, 41% of that forested, has been designated as parks and protected areas and removed from the timber harvesting land base. These areas provide significant ecological and recreational value and contribute towards wildlife and biodiversity objectives.

Parks and wildlife habitat designations also contribute to maintaining biological diversity. However, more focused consideration is applied through the establishment of landscape- and stand-level reserves through old growth management areas, non-spatial old growth retention, wildlife trees/patches, and riparian areas. Other biodiversity considerations that are less developed include coarse woody debris management, patch size distribution, and landscape connectivity.

Risks to wildlife, biodiversity, and other resource uses must also be identified and understood to mitigate adverse, unintentional impacts to these values. Examples of these risks include increased

sedimentation from riparian disturbance and road surface siltation, increased use of pesticides, road density, loss of sufficient closed canopy or interior forest condition habitat, and increased access providing advantages for predators or hunters.

Specific changes in seasonal weather have been modelled and are available by region. Climate change adaptation strategies are being developed for the Province but specific silvicultural treatments for the MNRD are not available at this time.

First Nations interests and cultural heritage are an extremely important but at this time, are not well recognized among other resource users. Other key values identified in this document include visual quality, recreation, guide outfitters, trappers, watershed health, while specific issues considered are road density and access issues, herbicide use, and deciduous utilization.

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List of Acronyms

AAC	Allowable Annual Cut
BCMPB	BC Mountain Pine Beetle Model
BCTS	BC Timber Sales
BEC	Biogeoclimatic Ecosystem Classification
FLNR	BC Ministry of Forests, Lands and Natural Resource Operations
FLTC	Forest Licence To Cut
FPPR	Forest Planning and Practices Regulation
FRPA	Forest and Range Practices Act
GBPU	Grizzly Bear Population Unit
HEWR	High Elevation Winter Range
ISS	Integrated Silviculture Strategy
LRMP	Landscape Resource Management Plan
M-KMA	Muskwa-Kechika Management Area
MNRD	Mackenzie Natural Resources District
MoE	BC Ministry of Environment
MPB	Mountain Pine Beetle
MRVA	Multiple Resource Value Assessment
OBAC	Omineca Beetle Action Coalition
OGMA	Old Growth Management Area
PNCP	Peace Northern Caribou Plan
RESULTS	Reporting Silviculture Updates and Land status Tracking System
SERNbc	Society for Ecosystem Restoration in North-Central BC
THLB	Timber Harvesting Land Base
TSA	Timber Supply Area
TSR	Timber Supply Review
UWR	Ungulate Winter Range
WHA	Wildlife Habitat Area

Acknowledgements

The authors would like to acknowledge and thank the following individuals who contributed in the completion of this document:

- Alan Powelson, FLNR (Victoria)
- Barry Snowdon, FLNR (Victoria)
- Brian Smart, Forsite (Sechelt)
- Bryce Bancroft, Symmetree (Victoria)
- Cam Brown, Forsite (Salmon Arm)
- David Schwarz, FLNR (Mackenzie)
- Haojing Xie, Forsite (Salmon Arm)
- Heather Wiebe, FLNR (Mackenzie)
- James Jacklin, FLNR (Prince George)
- Jeremy Hachey, Forsite (Salmon Arm)
- Jim Thrower, Sophostats Data Services (Kamloops)
- Kat Gunion, Forsite (Salmon Arm)
- Kelly Osbourne, FLNR (Victoria)
- Leslie McKinley, FLNR (Prince George)
- Mei-Ching Tsoi, Bowhaus (Victoria)
- Michael Klaczek, FLNR (Prince George)
- Micheline Snively, FLNR (Mackenzie)
- Mike McLachlan, FLNR (Prince George)
- Miodrag Tkalec, FLNR (Mackenzie)
- Patience Rakochy, Forsite (Prince George)
- Patrick Bryant, Forsite (Salmon Arm)
- Paul Rehsler, FLNR (Victoria)
- Randy Spyksma, Forsite (Salmon Arm)
- Rick McCordic, FLNR (Mackenzie)
- Scott McNay, Wildlife Infometrics (Mackenzie)
- Shelley Desautels, Forsite (Salmon Arm)
- Stephen Smyrl, Forsite (Salmon Arm)
- Susan Zedel, FLNR (Victoria)

Revision History

Version	Date	Notes/Revisions
1.0	Oct 19, 2015	First version distributed for review and comment.
1.1	Oct 30, 2015	Revised sections 2.2, 2.6 and 4; also updated references in section 12.
1.2	Nov 17, 2015	Minor edits throughout the document with more significant changes to the Executive Summary and the following sections: 2.3, 2.5, 2.8, 4.1, 4.3, 5.2.5, 5.3.1 (shelf life), 5.8, 7.1, 7.2, 7.3, 7.4, 8, 8.2, 12

1 Introduction

The British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNR) has initiated an Integrated Silviculture Strategy (ISS) for the Mackenzie Timber Supply Area (MNRD), as one component of a Mackenzie Stewardship Initiative (MSI). The ISS is an evolving planning process that aims to provide context for management decisions necessary to achieve forest level objectives. It integrates other planning processes that have historically been separate or disjointed, such as:

- wildfire management planning,
- forest health,
- wildlife habitat designations planning,
- biodiversity habitat planning,
- cumulative effects, and
- silviculture strategies.

Aligning these plans and strategies within a common process will better enable focused landbase investments, improved planning outcomes, and enhanced communications with stakeholders and First Nations and stakeholders – resulting in increased efficiency and effectiveness to stewardship planning relative to status quo.

1.1 Integrated Silviculture Strategy Objectives

In support of government objectives to mitigate forest health impacts on mid-term timber supply, this ISS project aims to:

Facilitate a respectful and collaborative planning process that supports the delivery of defined stewardship outcomes - which in turn improves business certainty for licensees operating within the Mackenzie Natural Resources District.

This improved certainty will be achieved through the creation of:

1. A common understanding among participants of the goals, values, issues, and challenges facing the MNRD.
2. A well designed Landscape Reserve Strategy that minimizes impacts to the timber harvesting land base (THLB) while addressing as many stewardship issues as possible. This includes First Nation's interest and will ultimately help indicate the areas of the landbase that are currently suitable for harvesting by licensees.
3. A Silviculture Strategy that provides clear direction on how to achieve improved timber and habitat outcomes in the future through investments in silviculture.
4. A coordinated Harvest Strategy that identifies approaches to harvest scheduling aimed at addressing common interests (MBP salvage, equitable access to green timber, landscape level fuel breaks, etc.).
5. A plan for monitoring and evaluating progress and effectiveness towards meeting key goals and objectives that support future management decisions in the MNRD.

These objectives are meant to align with Provincial Timber Management Goals and Objectives (FLNR 2014), the Chief Forester's *Provincial Stewardship Optimization/Timber Harvesting Land Base (THLB) Stabilization Project* (FLNR 2015) and FLNR staff.

1.2 Context

The situation analysis is the first of nine documents developed through the ISS process:

1. **Situation Analysis** – describes in general terms the situation for the unit – this could be in the form of a PowerPoint presentation with associated notes or a compendium document.
2. Landscape Reserve Strategy – review and analyze existing and proposed management zonation and develop strategy options that provide for the sustainable management of non-timber values.
3. Landscape Harvest Strategy – review and analyze current and planned timber harvesting plans, infrastructure, and capabilities in the context of the distribution of MPB-killed pine salvage opportunities and the landscape reserve strategy. This must consider the current salvage period and the transition into the mid-term timber supply.
4. Silviculture Strategy –provides treatment options, associated targets, timeframes and benefits to minimize the impact of the MPB infestation over the mid-term timber supply.
5. Data Package - describes the information that is material to the analysis including the model used, data inputs and assumptions.
6. Analysis Report –provides modeling outputs and rationale for choosing a preferred scenario.
7. Operational plan – direction for the implementation of the preferred scenario.
8. Final Report – summary of all project work completed.
9. Monitoring Plan – direction on monitoring the implementation of the ISS; establishing a list appropriate performance indicators, developing monitoring responsibilities and timeframe and a reporting format and schedule.

This particular document aims to provide brief summaries of the current situation for a very wide range of forest resource values and issues of concern that pertain to the MNRD. Ultimately this reference is not expected to provide answers but rather invite questions and stimulate ideas for the next phases of the ISS project.

In some cases the authors have extracted or paraphrased sections from existing material and referenced the appropriate sources for the reader to explore further. This list of topics was limited to those being considered - at this time - for the project as other topics may be currently outside of the project scope.

1.3 Project Area

The MNRD is situated in north-eastern British Columbia (Figure 1). It is the fourth largest timber supply area in the province, covering 6.41 million hectares, and is one of three TSAs in the FLNR Omineca Region. It is administered from the MNRD office located in the town of Mackenzie. The Williston Reservoir, covering approximately 1.5 million hectares, is the dominant geographic feature of the area. The Rocky Mountain Trench runs north-south through the center of the district with the Rocky Mountains bordering the trench along the eastern side. The more rounded Omineca Mountains are found along the western side of the trench. Forests are comprised largely of mixed stands, with lodgepole pine (35%), Engelmann and white spruce (31%), sub-alpine fir (27%), and deciduous (7%) as the major tree species.

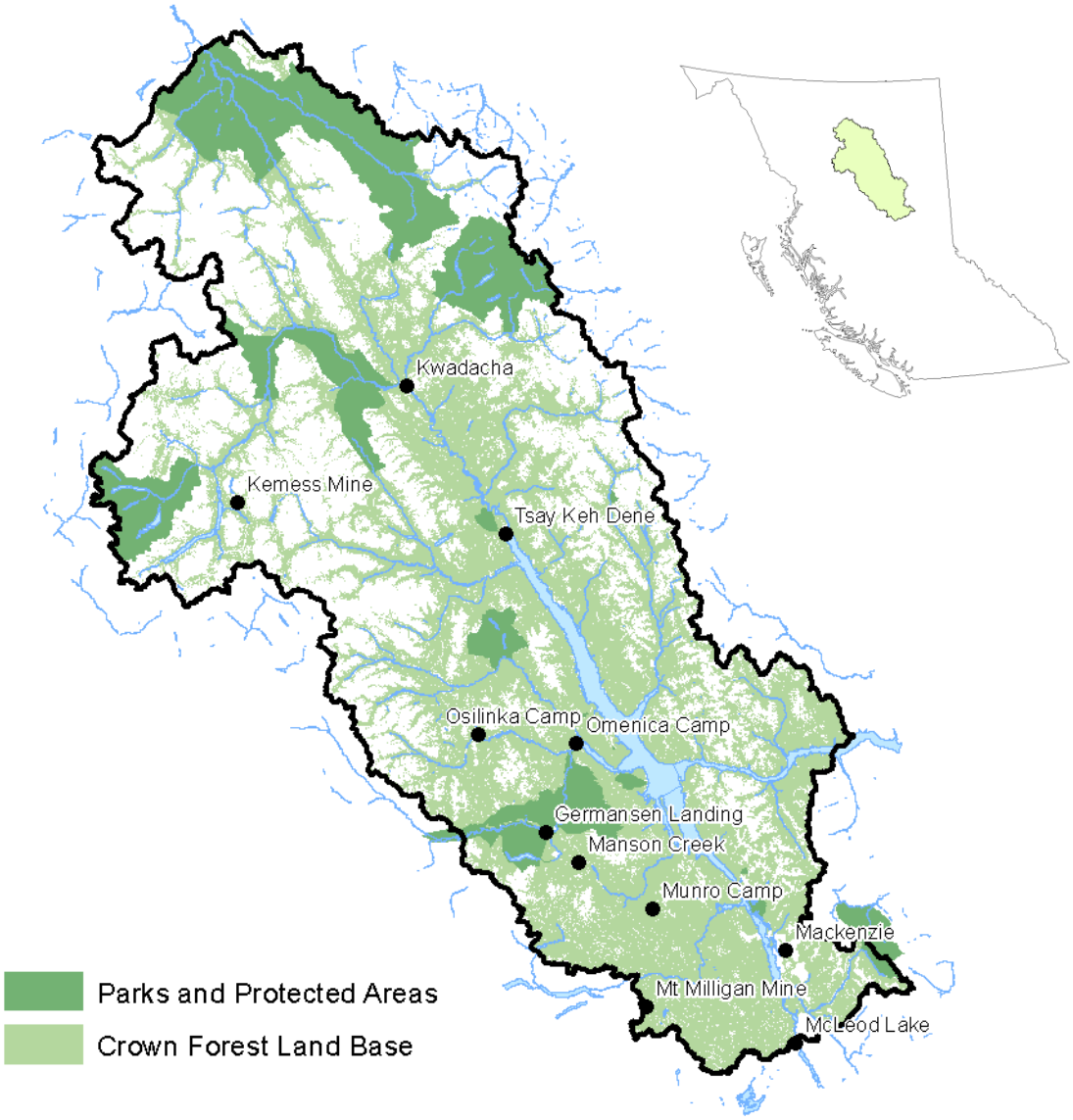


Figure 1 MNRD and Communities

According to the 1991 census, approximately 6,200 people live within the MNRD; the majority within the municipality of Mackenzie. Other communities located within the MNRD include Fort Ware, Tsay Keh, Germansen Landing, Kwadacha, and Manson Creek. The economy is dominated by forestry with more than 70 per cent of employment depending directly or indirectly on the forest sector.

2 Summary of Current Plans and Strategies

The subsections below provide a brief summary of the strategies and plans that may pertain to this project. Others are specifically identified in other sections of this document (e.g., climate change adaptation).

2.1 Provincial Timber Management Goals and Objectives

Provincial Timber Management Goals and Objectives (FLNR 2014) set high-level provincial timber management goals, objectives and targets to provide context and guidance for planning across management units - including specific direction to ISS projects.

The 5 main timber management goals are summarized below.

2.1.1 Timber volume flow over time

Timber volume flow over time describes what has traditionally been the focus of sustainable forest management. The provincial aim is not a strict even flow regime, but rather predictable and reliable flows to support economic and social objectives. Timber flow will be managed in an integrated manner with other key forest values.

Goal	Promote resilient and diverse forest ecosystems that will provide a sustainable flow of economically valuable timber that generates public revenues, supports robust communities, healthy economies that provide an opportunity for a vigorous efficient and world competitive timber processing industry
Objectives	1) Timber is managed in an adaptive manner to address the dynamic nature of natural processes and the inherent uncertainty of managing over long time frames. 2) Attainment in the long-term of realized harvest flows that benefit from timber management activities including harvest practices and silviculture investments. 3) Data used to determine timber flows will be continuously improved, to verify assumptions and to reduce uncertainty.
Targets	1) Targets for timber flow may be refined through MNRD level analysis and planning such as through Type 4 silviculture strategies (ISS in this case)

2.1.2 Timber quality

Timber quality is defined by species, log sizes and grades, end use, and economic value. In order to minimize risks and maintain future options for different products, a diverse portfolio of timber quality is desirable.

Goal	Maintain a diversity of timber-related economic opportunities through time.
Objectives	1) Proportions of high-value tree species within each management unit will be maintained at no less than pre-harvest levels. 2) Proportions of lower value species within each management unit will not be increased above pre-harvest levels. 3) To restock new forests with trees which will produce high quality fibre as the primary product objective. 4) To ensure a proportion of logs are of premium grade.
Targets	1) No reduction in the proportion of provincial forest land made up of high-value tree species. 2) To produce a minimum of 10 per cent premium grades from B.C.'s forests.

2.1.3 Tree Species Composition

Tree species influences timber values, quality, productivity, health, resilience, and non-timber values. Tree species diversity is a fundamental climate change adaptation strategy.

Goal	To maintain or enhance timber and non-timber values, forest health, and resilience, through the management of tree species composition.
Objectives	1) Where it is ecological feasible, reliable and productive, a resilient mix of species at both the stand and landscape scales will be used to reduce long-term forest risks and maintain future options. 2) Promote reforestation of species compositions that reduce vulnerability from climate change and forest health impacts on timber and other forest values. 3) Management will reduce the occurrence of species where future risks (ecological and economic) are disproportionately high compared with other species. 4) Seedlings planted are grown from source-identified and genetically-diverse tree seed that is climatically-suitable to the planting site.
Targets	1) The proportion of monoculture stands at free growing in B.C. is no greater than the proportion of monoculture stands prior to harvest. 2) Within the management unit, the total number of tree species at free growing is no less than what was present prior to harvest. 3) Within the management unit, the proportion of a specific tree species at free growing is no more than 10 per cent greater than what was present prior to harvest unless it increases the proportion of higher value species or specific species diversity targets are approved for the management unit. 4) By 2020, all tree seed used to establish a free growing stand is registered and selected in accordance with new climate-based seed transfer standards.

2.1.4 Stand productivity and growing stock

Management of stand productivity and growing stock encompasses the health, genetics, density, and stocking of various stands so that they can productively utilize site resources.

Goal	Maintain or improve stand productivity.
Objectives	1) Develop cost effective management options for the consideration of government with timely management unit analysis and planning after significant and sudden changes to growing stock from natural disturbances and salvage harvesting. 2) Management will target full site occupancy of growing space, after making effective allowances for other values and risks. 3) The proportion of high-risk species across a management unit will not be increased and, where future risks for such species are disproportionately high compared with other species, they will be gradually reduced. 4) Decisions at the stand level will not be made solely on the basis of return-on-investment data, but will consider stand level risks and management unit objectives and targets. 5) Use tree seed selected for improved growth or pest tolerance, where available.
Targets	1) Harvested areas will be reforested with tree species and stocking levels that meet or exceed growth and yield projections assumed in TSR. 2) By 2020, 75 per cent of all trees planted will be grown from selected seed with an average genetic gain of 20 per cent.

2.1.5 Inherent site capacity

Inherent site capacity is about the biophysical attributes of the land as they relate to timber productivity. Site capacity is mostly influenced by soil attributes, hydrological flows and balances, and associated processes such as decomposition and nutrient cycling.

Goal	To maintain the inherent site capacity of B.C.'s forested ecosystems.
Objectives	1) The permanent footprint of road, trails, and landings will not exceed what is necessary for logical and efficient natural resource management. 2) Access construction and maintenance will maintain natural drainage patterns and flows, and will not contribute to slope failures or chronic erosion over the long term. 3) Harvesting, silviculture and other management activities will not result in significant soil compaction and/or erosion on growing sites, temporary trails and work areas that will be reforested. 4) Harvesting, silviculture and other management activities will be conducted to provide for maintenance or recovery of proper nutrient cycling and soil nutrition.

Targets	1) The Forest Planning and Practices Regulation (FPPR), s. 35, restricts soil disturbance to a maximum percentage of site disturbance within the net area to be reforested 2) The province has incorporated explicit maximum percentage limits for site disturbance and construction of permanent access structures into the FPPR, s. 36. The ministry's target is to have the average site disturbance for the province at less than 5 per cent. 3) The province directs the maintenance of natural drainage patterns for road construction and maintenance in FPPR, s. 37-39.

2.2 Mackenzie Area Crown Land Plan

The Mackenzie Area Crown Land Plan guided the establishment of Agricultural Development Areas (1,244 hectares) and Settlement Reserve Areas (1,026 hectares) under section 93.4 of the Lands Act November 21, 2006. These areas are within close proximity to the town of Mackenzie (Figure 2) and after initial harvest these lands will be transferred out of the forest land base.

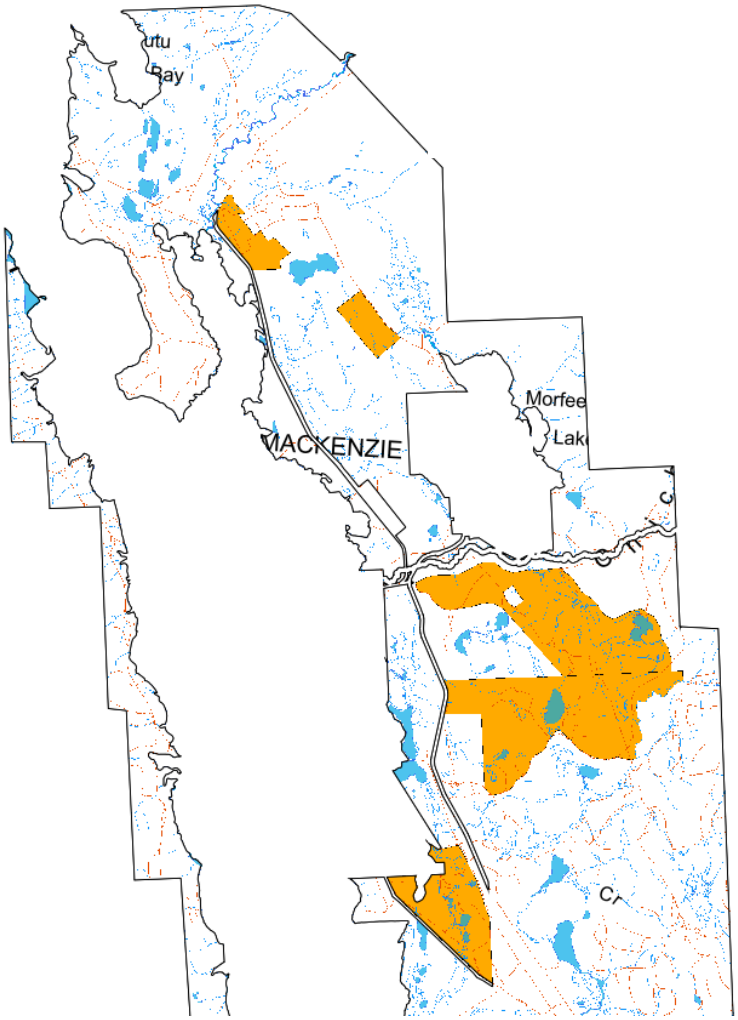


Figure 2 Designated Agricultural Development Areas and Settlement Reserve Areas

2.3 Mackenzie Land and Resource Management Plan

The Mackenzie Land and Resource Management Plan (LRMP), approved by the BC Provincial Government in November 2000, is useful long-term plan for land use and resource development on Crown land within the MNRD based on the principles of integrated resource management and

sustainability. While the LRMP itself is not a legally-established higher level plan, it contributed to the creation of two legal orders to establish the Muskwa-Kechika Management Area and the Mugaha Marsh. New Parks and Protected Areas were created as a result of the Mackenzie LRMP, which are part of the Crown Land base; they contribute to objectives for biodiversity and wildlife, but are not managed for timber supply. Direction in the LRMP has also supported the establishment of several wildlife habitat designations in the District.

The Mackenzie LRMP provides broad direction for the sustainable use of Crown land and resources. This planning process began in August 1996, involving 40 community and industry interests, First Nations, and local government. The table ratified its recommended plan in June 2000, with the exception of the independent local prospector. The government of British Columbia subsequently approved the LRMP later that year.

The LRMP includes guidelines for the management of natural resources, such as: biodiversity, soils, water, fish, wildlife, trapping, access, outdoor recreation and tourism, forest resources, energy, minerals, agriculture, grazing, visual quality, and heritage and culture. It also provides guidance for community stability, development, and air quality.

Source: Resources North website: http://www.resourcesnorth.org/rna/1/home

2.4 Muskwa-Kechika Management Area

The Muskwa-Kechika Management Area (M-KMA) is located in north-eastern BC within the Northern portions of the MNRD (Figure 3). It was conceived during the Mackenzie LRMP process and legislated by the BC Government in 1998 as a world class management model. The M-KMA is intended to establish a world standard for environmental sustainability and economic stability, serving as a model that balances human activities such as resource extraction and tourism with conserving its environmental values and wilderness state over time. It aims to:

> *"Maintain in perpetuity the wilderness quality, and the diversity and abundance of wildlife and the ecosystems on which it depends, while allowing resource development and use in parts of the M-KMA designated for those purposes, including recreation, hunting, trapping, timber harvesting, mineral exploration and mining, and oil and gas exploration and development."*

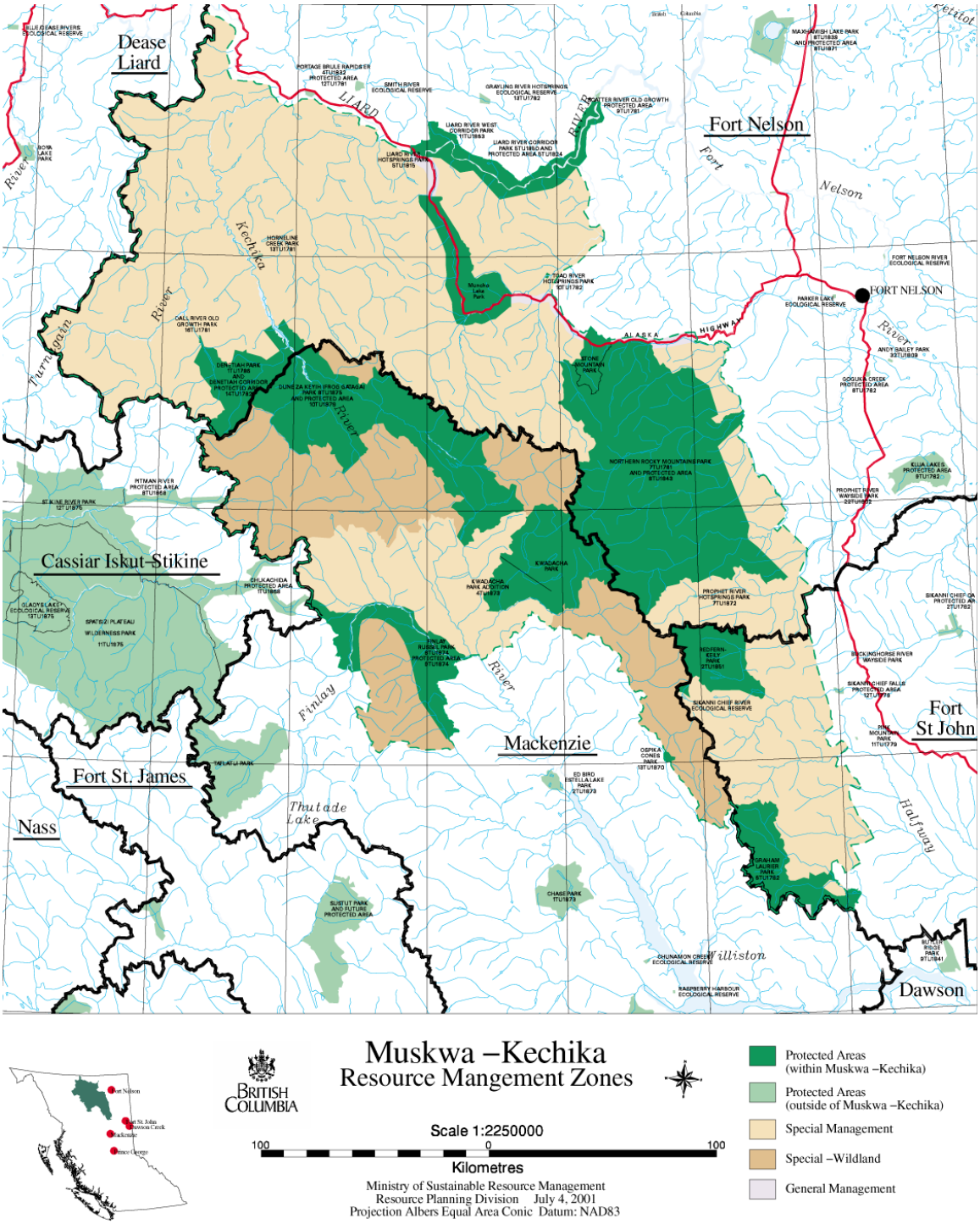


Figure 3 Muskwa-Kechika Management Area

The M-KMA includes significant portions of the MNRD along the North and Northwest end and extends far beyond the MNRD.

2.5 Northern Caribou in the MNRD

Northern Caribou Distribution

The MNRD overlaps the herd range of several northern caribou herds that generally utilize low elevation forests with abundant ground lichens, and/or higher elevation windswept alpine areas and subalpine forests. Northern caribou herds found within the Mackenzie TSA include: Frog, Gataga, Finlay/Akie, Chase, Wolverine, Scott West, Scott East, and Kennedy Siding. Also, the Moberly and Graham caribou herd range overlaps into the eastern edge of the MNRD. Some herds within Mackenzie are federally grouped as part of the Northern Mountain Population and some are grouped as part of the Southern Mountain Population based on genetic information, ecological behaviours, and distribution.

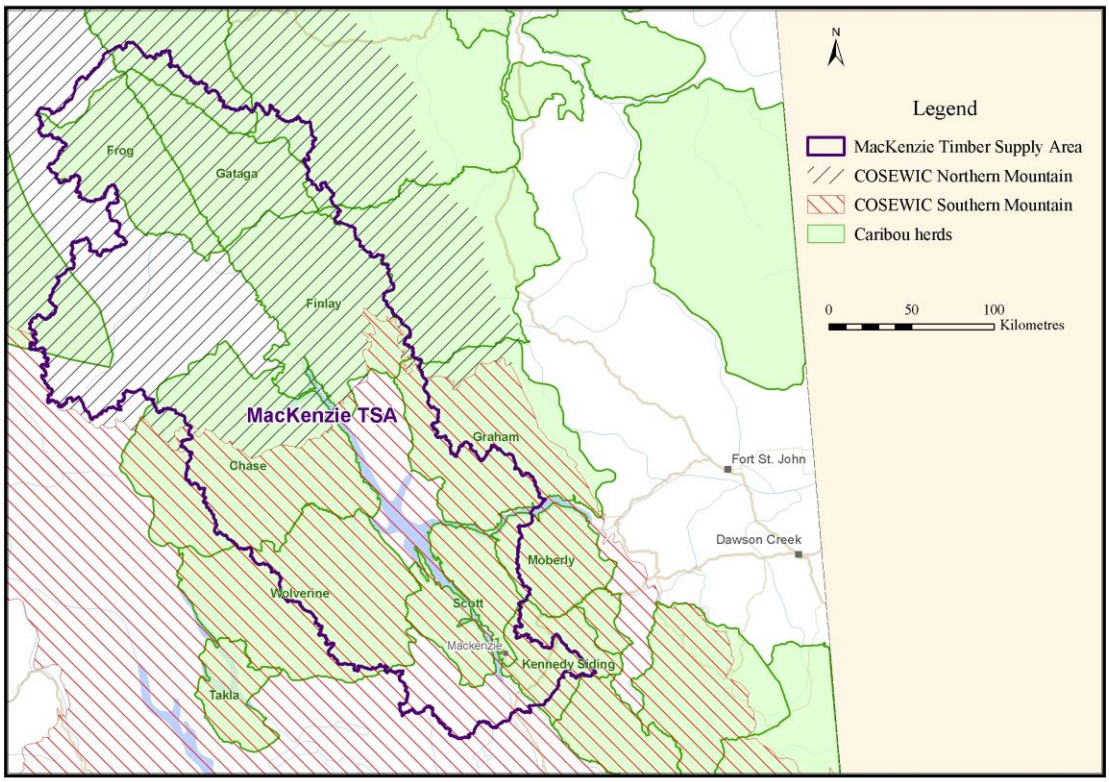


Figure 4 Northern Caribou Herds within and overlapping into the MNRD, showing COSEWIC Southern & Northern Mountain National Ecological Areas

Source: Byron Woods (MoE)

Federal Recovery Strategy

In 2002, Council on the Status of Endangered Wildlife in Canada (COSEWIC) designated northern caribou in the southern mountain national ecological area as threatened which means that those herds may become endangered facing imminent extirpation or extinction unless corrective management actions are undertaken. Threats to caribou include:

- habitat loss,
- predation (through altered predator-prey dynamics),
- human disturbance, and
- in some places, small population effects.

A "Recovery Action Plan for Northern Caribou herds in North-Central BC" was written in 2008 by caribou experts and MNRD Stakeholders (McNay et al., 2006). It provides recovery recommendations for the Wolverine, Chase, Scott and the Takla (Fort St. James) herds. This document was not a formal Recovery Strategy and was not endorsed by the Provincial Government, but summarizes the best available information.

In June 2014, Environment Canada finalized a *Recovery Strategy for the Woodland Caribou, Southern Mountain Population in Canada* (Environment Canada, 2014), which applies to Wolverine, Chase, Kennedy Siding, Scott West, Scott East, Graham and Moberly herds.

Under the Federal Species at Risk Act (SARA) a Recovery Strategy must be prepared for a threatened species, which includes identification of Critical Habitat (Section 37 of SARA). Critical habitat is defined as habitat necessary for a species survival or recovery and includes "*core*" and "*matrix*" habitat. Core habitat is occupied by caribou, and matrix habitat is the surrounding areas that influences predator – prey dynamics. The ultimate objective of caribou management is to create or maintain habitat conditions - including low wolf and moose densities - that allow caribou to be naturally self-sustaining.

Peace Northern Caribou Plan

In March, 2013, BC released an implementation plan for seven Northern Caribou herds (Graham, Moberly, Quintette, Narraway, Burn Pine, Kennedy Siding, Scott) found in the South Peace (with overlap into Mackenzie TSA - see Figure 4) that identifies management actions and management objectives under the umbrella of the Peace Northern Caribou Plan (PNCP) (MoE 2013). Several herds under the PNCP are found within the MNRD: Kennedy Siding, Scott, and portions of the Graham and Moberly herds. Their main habitat types including high elevation (winter and summer) habitat, low elevation habitat and matrix have been mapped. One of the objectives in the PNCP is to protect 90% of identified high elevation winter habitat across the range.

Designated Caribou Habitat

Ungulate Winter Ranges (UWR) are established under FRPA as areas that contain habitat necessary to meet the winter requirements for an ungulate species and have corresponding General Wildlife Measures/or Objectives that provide legal management direction. UWRs do not address all species management aspects. There are currently several established UWRs for northern caribou in the MNRD with a number of additional ones proposed.

Timber supply impact assessments are based on the spatial overlap of the UWR units with the THLB and associated management direction in the General Wildlife Measures – it is policy that the THLB budget and resultant impacts of UWRs are calculated using TSR 2.

Wildlife Habitat Areas (WHA) are currently established under FRPA for species on the Identified Wildlife Management Strategy list (MWLAP 2004) and have corresponding General Wildlife Measures that provide legal management direction. Additional WHAs are in draft stage for northern caribou for migration corridors, post rutt aggregation areas, and calving for the Wolverine, Chase and Finlay/Akie herds.

The approved, proposed and draft caribou UWRs and WHAs will cover much of the Core Critical Habitat being identified by Environment Canada, but because these initiatives are not yet approved there are gaps in habitat protection for caribou conservation.

Northern caribou are particularly affected by the loss of forest cover resulting from the MPB infestation and salvage operations, as this can open up areas that in turn may increases predation.

2.6 Sustainable Forest Management Plans

To promote responsible forestry practices, some forest companies have achieved forest management certification through independent third-party auditors (Table 1). Requirements under the SFI standard include measures to protect water quality, biodiversity, wildlife habitat, species at risk and forests with exceptional conservation value while CSA SFM standards take environmental, social, and economic factors into account - in part, by facilitating public advisory groups. Both standards require the development of a Sustainable Forest Management Plan that describes commitments made, through a set of management and operational principles, to conduct business in a manner that protects the environment while ensuring sustainable development of forests. These plans are typically available for public review.

Table 1 Forest Management Certification

	Certification Standard	Licensees
CSA	Canadian Standards Association Z809-08 Sustainable Forest Management Standard	Canfor
SFI	Sustainable Forestry Initiative 2015-2019 Forest Management Standard	BCTS and Conifex

2.7 Silviculture Strategies

2.7.1 Type 1 Silviculture Strategy

This silviculture strategy was developed through a workshop of local experts in silviculture activities who considered existing TSR summary information to identify issues and opportunities for silvicultural investments. This exercise was intended to provide interim strategies until a more comprehensive project could be completed.

2.7.2 Type 2 Silviculture Strategy

The Type 2 Silviculture Strategy (Tesera 2003) included forest level modelling but did not incorporate impacts of the Mountain Pine Beetle epidemic. Five strategies were developed to increase overall fibre supply:

1. partial harvest within visually sensitive areas,
2. late rotation fertilization on pine leading stands,
3. repeat fertilization on pine leading stands,
4. repeat fertilization on pine and spruce leading stands, and
5. planting of genetically improved spruce and pine stock.
6. The onset of the MPB infestation in 2004 completely changed the direction of these silvicultural strategies so they were not implemented.

2.7.3 Type 1 Silviculture Investment Strategy

To address the MPB epidemic, a silviculture investment strategy (Forest Ecosystem Solutions Ltd. 2006) was undertaken. This was primarily intended to deal with government-funded intensive and backlog silviculture opportunities and reforestation of dead pine stands that will not be salvaged. This investment strategy relied on expert opinions to develop plausible targets and strategies that can be used as inputs for a more in-depth analysis like this ISS (Table 2).

Table 2 Treatment options from the Type 1 Silviculture Investment Strategy

Category	Treatment Option

Timber Supply (Quality and Quantity)	Fertilize targeted stands Reforest areas otherwise deemed unsalvaged loss Evaluate and treat unsatisfactorily restocked areas Evaluate and treat repressed pine sites Re-examine stocking standards Attain full site occupancy by utilizing mixed-species planting to address future losses from pest and disease Utilize improved seed
Habitat Supply	Under-plant unsalvaged areas and riparian areas Thin mid seral and mature forest to advance old growth attributes Adapt incremental silviculture treatments developed to advance recovery of habitat elements Utilize deciduous species
Climate Change	Develop clear objectives and strategies
Broadcast Burning	Implement to manage fuel levels and establish understory as browse and berry production

2.8 BC Mountain Pine Beetle model

FLNR developed a BC Mountain Pine Beetle model (BCMPB) to project the annual volume of mature pine killed by MPB. Data from a series of annual aerial overview surveys are used to calibrate the BCMPB. For the MNRD, weather conditions in 2007 and 2008 prevented aerial overview surveys from being conducted, while in 2009, weather conditions precluded surveys of the northern half of the MNRD. Consequently, there is a substantial amount of uncertainty associated with the MPB mortality projections for this MNRD.

The FLNR (Forest Analysis and Inventory Branch) recommends using MPB mortality data generated through BCMPBv12 modeling and updated in the latest vegetation resources inventory. These data indicate that between 2003 and 2011, approximately 81.8M m^3 of pine was killed by MPB within the THLB of the MNRD (Figure 5). This mortality represents and 29% of the total volume on the THLB and 65% of the pine volume on the THLB (Figure 6). BCMPBv12 modeling indicates that the MPB infestation cycle is nearly over and that very little new mortality is expected over the next 4 years. Figure 7 shows the spatial distribution of MPB infestation by severity and year of death.

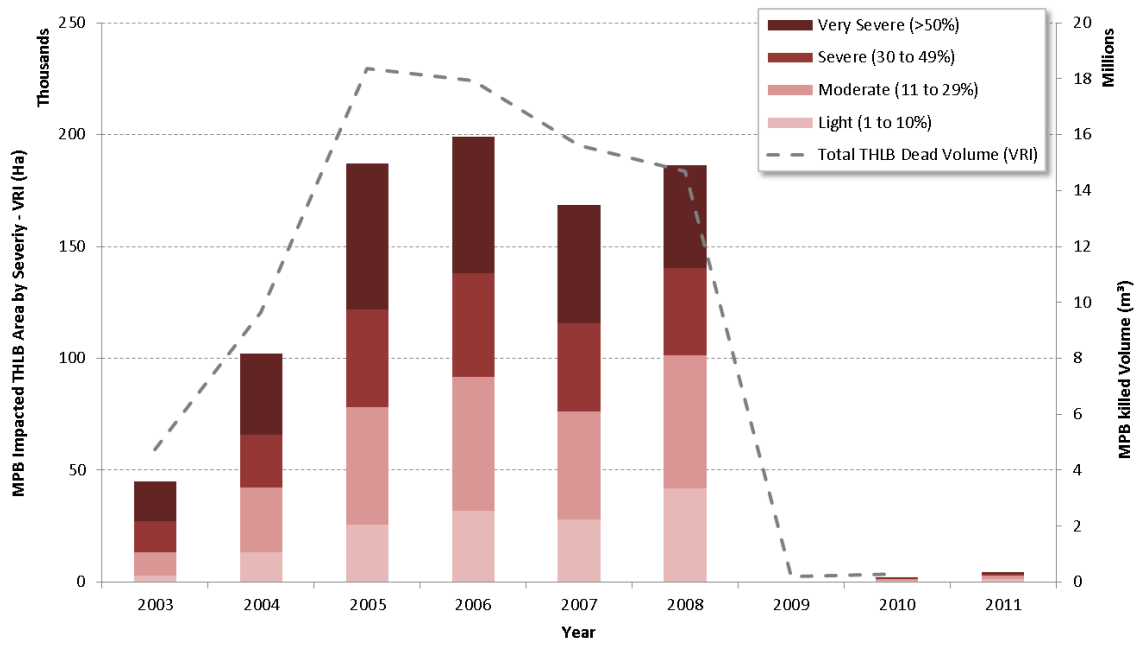


Figure 5 ***Area of MPB impacted area by Severity and Year of Death (Left axis) and Volume (m³) killed (right axis)***

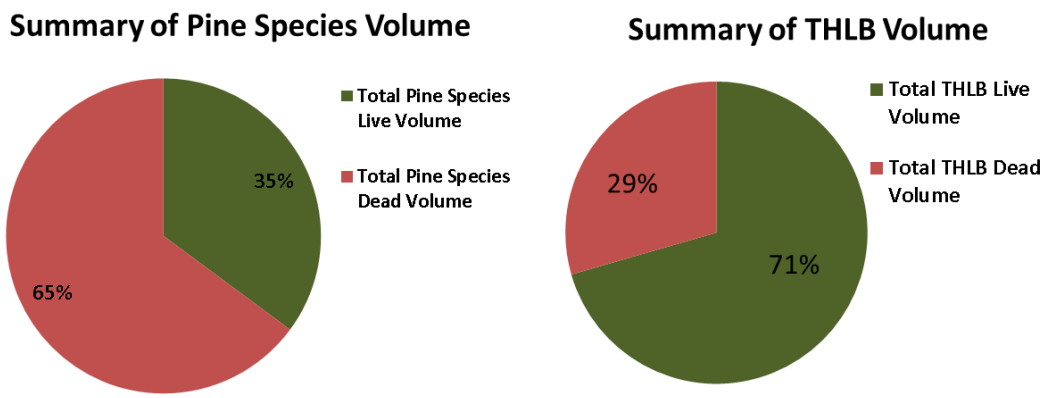


Figure 6 ***Proportion of Pine volume killed and proportion of total volume killed on the THLB***

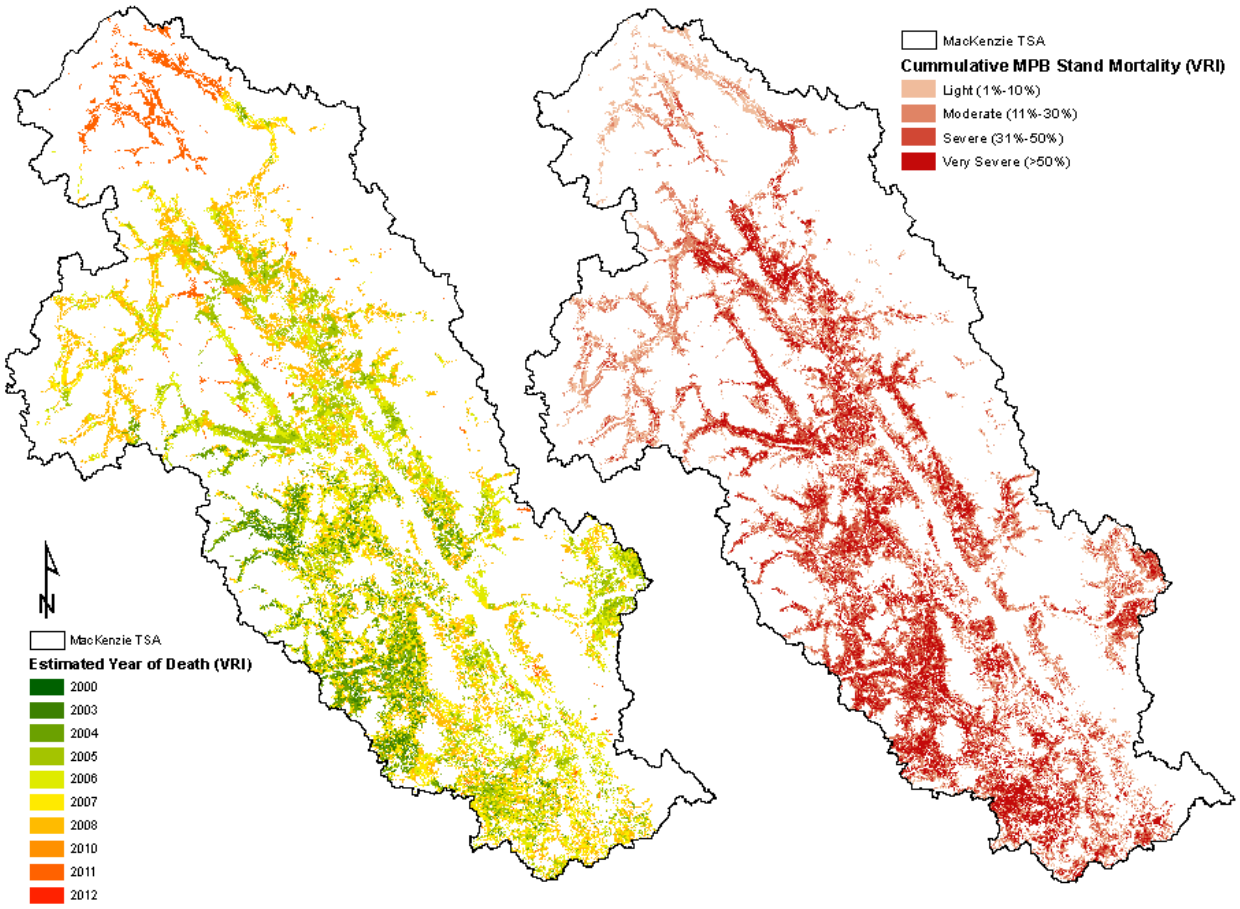


Figure 7 Area Impacted by MPB by severity and estimated year of death in the Vegetation Resource Inventory

Source: Forsite 2015 - MPB Summary for MNRD

2.9 Future Forest Products and Fibre Use Strategy

The Omineca Beetle Action Coalition (OBAC) was formed in 2005 with the purpose, "to work to ensure sustainable development and resiliency for the OBAC region". OBAC has worked with its member communities, First Nations, all levels of government, industry and sector representatives, academic institutions and allied partner organizations to develop a regional diversification plan to build resilient communities during and after the mountain pine beetle epidemic. Through its Future Forest Products and Fibre Use Strategy (Timberline 2008), the OBAC recommended long-term strategies designed to mitigate the social and economic impacts of the MPB epidemic. They stated six overall objectives:

1. Increase community benefits from forest resources.
2. Diversify and strengthen the forest sector.
3. Form stronger working partnerships and communication among First Nations, local communities, government, and the forest sector.
4. Increase the ability to train and retain the required work force.

5. Create a climate of ownership and pride in the region's forest resources.
6. Ensure the forest is managed to meet future needs and opportunities.

OBAC developed four recommendations to promote change in the management of the region's forests, the beneficial use of forest resources and community resiliency:

1. Increase the benefits that communities can rely upon from forest resources and forestry.
2. Ensure that the forest sector remains a strong economic contributor to the region.
3. Recognize the pine beetle killed stands as a valuable asset which should be used to full potential before their commercial value is depleted.
4. Increase awareness and understanding of the long-term viability of the forest sector.

Specific actions required to enact the OBAC report vision included:

1. Provide all communities in the region with a more direct role in forest management and in the benefits derived from the region's forests.
2. Incorporate community resilience considerations into major forest management decision making.
3. Improve and enhance transportation infrastructure and services.
4. Provide more equitable and diverse access for existing and new users of fibre.
5. Increase the range of products generated from the region's forest resources. Start by determining which high value and locally wealth-generating products are best suited for production from this region's assets.
6. Ensure that dead pine stands are managed in a manner which addresses both their economic and environmental utility.
7. Create a positive and competitive business climate for bio-energy development through an integrated policy, regulatory, tenure, and pricing environment.
8. Provide information to the public on the strength and importance of the forest sector and the collective efforts to grow future opportunities.
9. Grow the forests that we will need in the future with focused, large scale investments in a targeted reforestation program.

Ten years later, it is evident that much of the OBAC report vision has been realized, including:

1. Solid relationships now exist between licensees, manufacturing companies, First Nations, the Town of Mackenzie, and the Provincial Government.
2. There is an increased level of local management.
3. The forest sector has diversified.
4. A bioenergy plant has been built and is now operating in Mackenzie.
5. There has been a full realization of the MPB-killed pine value and the opportunity it represents.

2.10 Multiple Resource Value Assessment

The goal of sustainable forest management is to achieve a balance between environmental, social and economic objectives. The purpose of Multiple Resource Value Assessment (MRVA) reports is to provide resource professionals and decision makers with information about the environmental component of this 'balance' so that they can assess actual outcomes compared to expectations.

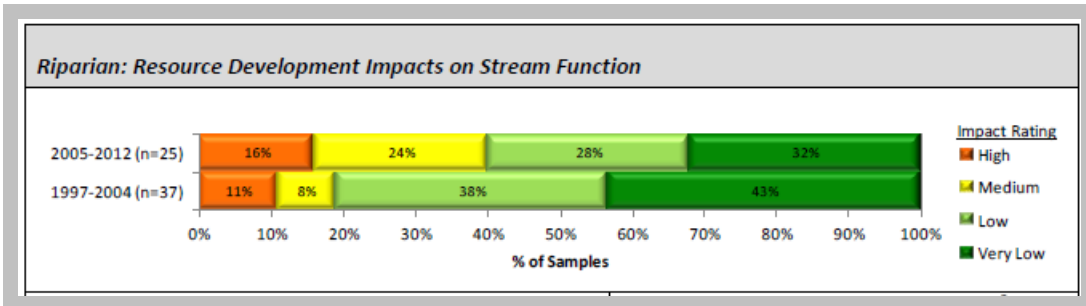
The Forest and Range Practices Act (FRPA) lists eleven resource values essential to sustainable forest management in the province: biodiversity, cultural heritage, fish/riparian and watershed, forage and associated plant communities, recreation, resource features, soils, timber, visual quality, water, and wildlife. MRVA reports summarize the conditions of these values through available field assessments. These assessments are generally conducted on or near recently harvested cut blocks and therefore are only evaluating the impact of industrial activity and not the condition of the value overall (i.e., they do not take into account protected areas and reserves). Most of the information gathered is focused on the ecological state of the values which provides useful information to resource managers and professionals on the outcomes of their plans and practices. This information is also valuable for communicating resource management outcomes to First Nations, stakeholders, and the public, and providing a foundation for refining government's expectations for sustainable resource management in specific areas of the Province.

Source: FLNR, MNRD, MRVA 2014

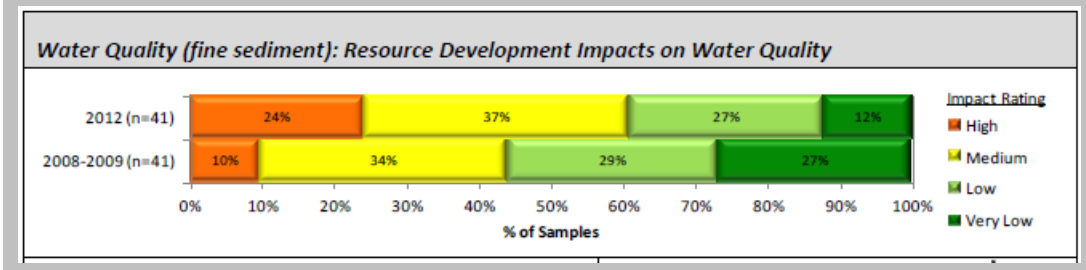
The extraction and development of natural resources, along with natural factors (e.g., insects, wind, floods), influence and impact the ecological conditions of a management unit. The goal of effectiveness evaluations is to assess these impacts on public natural resource values (i.e., status, trends, and causal factors). These evaluations do not assess compliance with legal requirements but do help resource managers:

- assess whether the impacts of resource development result in sustainable resource management,
- provide transparency and accountability for the management of public resources,
- support the decision-making balance between environmental, social, and economic factors, and
- inform the ongoing improvement of resource management practices, policies, and legislation.

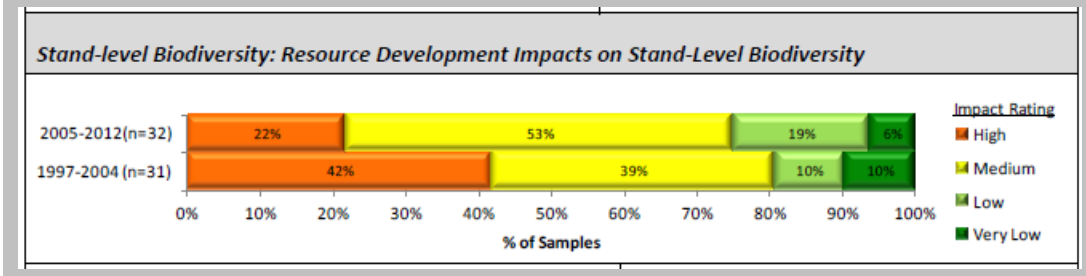
The MRVA for the MNRD produced a summary of key findings and, in some cases, identified performance trends (Figure 8) to provide excellent baseline data for comparing performance against strategies developed from this and other future projects.



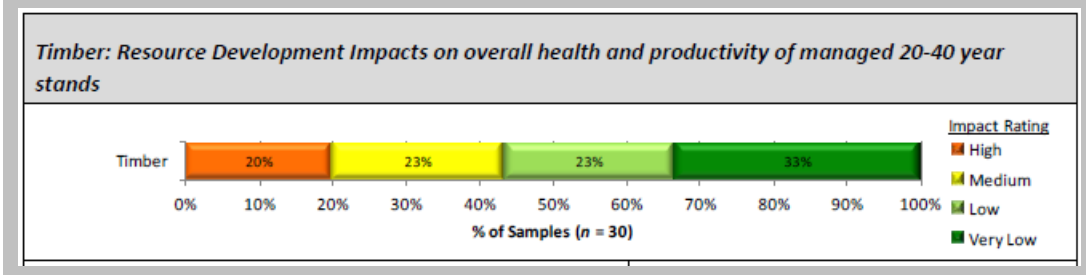
Overall Trend: Declining in riparian stewardship



Overall Trend: Declining in water quality stewardship



Overall trend: Improving in Stand-level Biodiversity



Overall trend: No trend established for Timber

Source: Mackenzie MRVA Report, January 2014

Figure 8 MRVA Performance and Trends - MNRD

2.11 Provincial Stewardship/Timber Harvesting Land Base Stabilization

The FLNR's Forest Competitiveness Initiative has produced a set of guidelines for implementing Provincial Stewardship/THLB Stabilization Projects. The intent of these projects is to optimize the

stewardship of Provincial forest and natural resources while realizing the full operational potential of the timber harvesting land base. While these projects, often referred to as co-location, do not change existing land use plans or legislation, they explore the best possible combination of overlapping the many constraints on timber harvesting. The key objective of the process is optimizing the placement of spatial constraints that results in an overall increase in THLB.

The MNRD ISS has been identified as a potential pilot project under this program, for the Northern Interior Forest Region.

2.12 Forest Health Strategy

The Omineca Region Forest Health Strategy (FLNR 2013) was prepared consistent with the Provincial Forest Health Strategy and Forest Health Implementation Strategy goals and objectives. This strategy is a key source of information for identifying and prioritizing the existing forest health issues and factors that exist within the MNRD (Table 3).

Table 3 List of ranked damage agents in the MNRD

Rank	Damage Agents
High	Mountain pine beetle (*Dendroctonus ponderosae* Hopkins) Western balsam bark beetle (*Dryocoetes confuses* Swain) Comandra blister rust (*Cronartium comandra*e Peck) Stalactiform blister rust (*Cronartium coleosporoides* Arthur) Western gall rust (*Endocronartium harknessii* Hiratsuka) Spruce beetle (Dendroctonus rufipennis Kirby)
Medium	Warren's root collar weevil (*Hylobius warreni* Wood) Two-year cycle budworm (*Choristoneura biennis* Freeman) Engraver (Ips bark) beetle (*Ips pini* Say)
Low	Tomentosus Root Disease (*Onnia tomentosa*) Lodgepole pine dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm) White pine weevil (*Pissodes strobi* Peck) Aspen, Poplar Leaf and Twig Blight (*Venturia* spp.) Dothistroma Needle Blight (*Dothistroma septosporum*) (Red Band)
Very Low	Forest tent caterpillar (*Malacosoma disstria*) Serpentine Leaf Miner (*Liriomyza brassicae*) (Aspen) Birch leaf miner (*Fenusa pumila*) Lodgepole pine terminal weevil (*Pissodes terminalis*) Large aspen tortrix (*Choristoneura conflictana* Walker) Lodgepole pine beetle (*Dendroctonus murryanae*)

Note: revised slightly to match current ranking (Pers. Comm., Miodrag Tkalec).

2.13 Ecosystem Restoration

Ecosystem Restoration is defined as the process of assisting with the recovery of an ecosystem that has been degraded, damaged, or destroyed by re-establishing its structural characteristics, species composition, and ecological processes. The vision of the Provincial ecosystem restoration program is to restore identified ecosystems to an ecologically appropriate condition, creating a resilient landscape that supports the economic, social, and cultural interests of British Columbia. The province has produced a draft strategic plan (Ministry of Forests and Range 2009) with goals, strategic priorities, and methods to help guide the program.

The Society for Ecosystem Restoration in North-Central BC (SERNbc) is a group of individuals and agencies interested in collaborating to help restore vulnerable and degraded ecosystems in the Omineca Region of Northern BC. Members include representatives from government agencies such as FLNR, Ministry of Environment, and organizations like the Fish and Wildlife Federation, B.C. Trappers

Association, the Guide Outfitters Association, and Cattlemen; as well as private citizens. The purpose of the society is to:

1. Identify, treat, and monitor vulnerable and degraded ecosystems in the Omineca Region to achieve a desired future condition that will sustain ecological services and human socio-economic needs.
2. Coordinate ecosystem restoration activities in the Omineca Region and foster collaboration amongst stakeholders.
3. Acquire technical information on ecosystem restoration and disseminate it to members and stakeholders.
4. Inform public and land managers on current ecological vulnerabilities as understood through the implementation of ecosystem restoration.

SERNbc receives its funding through the Provincial Habitat Conservation Trust Foundation, the anglers, hunters, trappers, and guides who contribute to the Trust, and other sources. They recently completed a strategic plan to provide guidance to the society overall and to support funding applications (e.g., identifying and assigning priorities to proposed projects). In addition they identified three sites for treatment within the MNRD:

1. Ospika - Habitat Enhancement in the Ospika area will compensate for past losses of moose habitat from wildfire suppression and flooding of the Williston Reservoir. This project consists of several polygons totalling approximately 9,000 hectares.
2. Bevel Creek - Some planning completed through the Peace Williston Fish and Wildlife Compensation Program. Budget identified to conduct baseline monitoring and to conduct prescribed burn treatment activities promoting wildlife and biodiversity.
3. Kwanika Creek - Range burn planned to promote forage for range permit holder.

2.14 Whitebark Pine

Due to various forest health factors, (white pine blister rust, pine beetle, others) whitebark pine has declined across its range and is now listed as a species at risk (section 7.1). The Omineca region of BC contains the most northern stands of whitebark pine so to provide some guidance a tactical plan for its recovery was prepared (BVRC 2013) that includes three parts:

1. current baseline maps showing known locations of whitebark pine stands,
2. management options, and
3. a summary of potential restoration priorities by forest district.

The existing vegetation inventory does not identify where whitebark pine is located within the MNRD. The only indication of occurrence is in several polygons just north of the Peace arm of the Williston Reservoir. Predictive models indicate high probability that potentially suitable areas are well-distributed throughout the MNRD. While it may be worthwhile to survey the mountainous areas south of Mackenzie by air, this may be a lower priority than undertaking these surveys elsewhere.

2.15 Fire Management

It is likely that a large portion of the MPB-impacted land base will remain unsalvaged and contain increased fuel loads. This can result in very aggressive fire behaviour and high fire intensity due to the increased amount of dry standing and surface fuels.

The British Columbia Wildland Fire Management Strategy (MFR 2010) provides direction for a proactive provincial wildland fire management program aimed to:

1. Reduce fire hazards and risks (particularly in and around communities and other high-value areas).
2. Carefully use controlled burning where the benefits are clearly defined and the risks can be cost-effectively managed.
3. Monitor and manage, rather than suppress, fires that are of minimal risk to communities, infrastructure or resource values.
4. Implement land, natural resource and community planning that incorporates management of wildland fire at all appropriate scales.
5. Develop a high level of public awareness and support for wildland fire management.

Fire Management Plans are tools used by land managers and response staff to identify values at risk in developing a fire analysis that describes general control objectives and strategies. Priority is given to protecting values ranked as follows: human life and safety, property, high environmental values, and resource values.

The MNRD completed a Community Wildfire Protection Plan in 2005 which identifies areas at risk from wildfire in and around the District of Mackenzie. This plan supported the development of operational fuel treatment projects

Source: Timberline Natural Resource Group, District of Mackenzie Operational Fuel Treatment Project Summary November 2007

3 First Nations and Cultural Heritage

Source: Mackenzie Stewardship Initiative First Nations Background, MNRD

This section provides a very brief description of the 10 First Nations that reside within the MNRD, claim traditional territories, and have social and economic interests in the area. Many of these traditional territories overlap within the MNRD (i.e., 159% non-disputed and 239% asserted).

Tsay Keh Dene

The main community for the Tsay Keh Dene (formerly known as the Ingenika Band) is located at the northern end of the Williston Reservoir. They speak Tsek'ene and, as a nomadic people, Tsay Keh Dene members inhabit the valleys of mountainous areas of the rivers (Omineca, Meslinka, Ingenika, Finlay, and Parsnip). The Thutade Lake area also holds high cultural value to the people of Tsay Keh Dene.

The Tsay Keh Dene territory is situated in the middle of the MNRD and encompasses the largest territory with resource activity within the district. Construction of the W.A.C Bennet Dam and the subsequent flooding during the late 1960s resulted in the displacement of the Tsay Keh Dene families from their homes at Fort Grahame; forcing them to move elsewhere in and around their traditional territory.

Tsay Keh Dene interests include cultural rediscovery, economic prosperity, cumulative effects of resource activities on traditional culture, water quality, caribou populations, and increased access for hunters. Concerns raised through TSR consultation include: Ungulate Winter Range (UWR) and landscape connectivity, decline in caribou populations, high and low elevation caribou and wildlife corridors, and road maintenance to northern communities.

Kwadacha Band

The Kwadacha Band (formerly Fort Ware Band) of the Kaska Dena Council, live in the Finlay River watershed, at the confluence of the Fox, Kwadacha, and Finlay Rivers. The Kwadacha people are an Athapaskan-speaking people and belong to the Kaska culture group. The band is affiliated with the Kaska Dena Council, the Kwadacha Natural Resources, the Kaska Forest Resource and Stewardship Council, and the Tsay Keh Nay (a partnership between Tsay Keh Dene, Kwadacha and Takla Lake).

The Kwadacha traditional territory is primarily located in the northern third of the MNRD and the least amount of overlap with other First Nations there. A large component of their territory area has limited road access and minimal natural resource development.

Kwadacha interests include: cultural rediscovery, economic prosperity, shared decision making within territory, and community development.

Takla Lake First Nation

The Takla Lake First Nation is one of several local groups that make up the Carrier people; members of the Athapaskan language family (Nedut'en dialect). Traditionally, the Takla Lake First Nation were semi-nomadic moving seasonally throughout their traditional territory in response to the availability of their primary food sources. Takla Lake is part of Tsay Key Nay, a partnership between Tsay Keh Dene, Kwadacha and Takla Lake.

Takla Lake First Nation traditional territory is primarily located within the mid-western portion of the MNRD and includes significant overlaps with other First Nations. Traditional territory for hunting and fishing is passed along through family groupings referred to as Keyohs. The Noostel Keyoh community is the most active within the MNRD, with a number of Takla members residing year round in the Germansen Landing area.

Takla Lake First Nation interests include: cultural rediscovery, economic prosperity, cumulative effects of resource activity on traditional culture, water quality, caribou populations, and the Wolverine Lake and Jack Fish areas.

Their concerns raised through TSR consultation included: UWR, management and protection of water, soil erosion, surface runoff flow control and stream temperature increases, future state of forest health, damage to fish and wildlife populations, impacts to aboriginal rights and title, consultation, financial assistance for their land use plan, access to digital maps from FLNR, independent environmental assessment, and employment.

McLeod Lake Indian Band

McLeod Lake Indian Band members are an Athapaskan-speaking people within the Tse'khene group of Aboriginal peoples that include bands at Fort Ware (Kwadacha) and Ingenika (Tseh Keh Dene). The English translation of Tse'khene is "people of the rock". They were a nomadic hunting people who inhabited the basins of the Parsnip and Finlay Rivers and the valley of the Peace River.

The McLeod Lake Indian Band traditional territory lies within the southern portion of the MNRD extending into the Prince George, Fort St. James, and Dawson Creek Districts. McLeod Lake Indian Band interests include: rebuilding of traditional culture, economic prosperity/a successful local economy, cumulative effects of resource activity on traditional culture, and impacts of resource activity on water and water quality. Maintenance of fisher populations was a key concern raised through TSR consultation.

Nak' azdli First Nation

The Nak'azdli form one of several local groups that make up the Carrier or Dakelh (on water travel people) who are members of the Athapaskan language group. The English translation of Nak'azdli is "when arrows were flying".

The main traditional activity of the Nak'azdli was/is fishing (primarily salmon from the Stuart watershed). The Nak'azdli people were semi-nomadic; seasonal movements throughout the traditional territory were dictated by the availability of their primary food sources.

Traditional territory for hunting and fishing is passed through clan based family groupings referred to as Keyohs. Nak'azdli peoples participate in the balhats (potlatch) system which is organized by matrilineal clans.

Tahltan First Nation

The Tahltan are Athapaskan speaking people located around the upper Stikine River. Their origins are believed to trace back to a meeting between people from the north (Tagish) and those from the head of the Nass River to the south, who settled at Tahltan. Those people were later joined by others from the east and together the three groups became the Tahltan tribe. Tahltan First Nation's traditional territory is within the north western portion of the MNRD and is primarily within parks and high elevation areas with mountainous terrain with very limited access.

Halfway River First Nation

The Halfway River First Nation is an Athapaskan-speaking people belonging to the Beaver/Cree culture group and member of the Treaty 8 Tribal Association. Their community is located about 75 km northwest of Fort St. John. The Halfway River First Nation's non-disputed traditional territory encompasses the Peace and Mackenzie Natural Resource Districts. This non-disputed traditional territory is located in the eastern portion of MNRD, while their asserted traditional territory extends into the Fort St James, Prince George, and Mackenzie Natural Resource Districts.

West Moberly First Nations

West Moberly First Nations (plural) is an Athapaskan speaking group, belonging to the Beaver and Cree culture group. West Moberly linguistic groups include Beaver and Cree. Formerly part of the Hudson Hope Band, West Moberly First Nations signed onto Treaty No. 8 in 1914, and in 1977 split into West Moberly Lake and Halfway River.

West Moberly's non-disputed traditional territory is located in the mid-eastern portion of the MNRD. Through TSR consultation their concerns included: UWRs and landscape connectivity, the Peace caribou herds, and in the establishment of Fisheries Sensitive Watersheds.

Saulteau First Nations

The Saulteau First Nations are one of the treaty 8 bands. Saulteau First Nations is an Athapaskan-speaking group, belonging to the Cree culture group. The Saulteau First Nation's linguistic groups include Saulteau, Beaver and Cree. Their community of about 850 is located approximately 100 km southwest of Fort St. John on Highway 29. Formerly named East Moberly Lake (or Moberly), the Saulteau First Nations signed onto Treaty 8 in 1914. Saulteau First Nations originally travelled to the Moberly Lake area from Manitoba.

Saulteau First Nations' traditional territory is within the south eastern portion of the MNRD.

Gitxsan

Gitxsan (or Gitxsanimaax, Gitksan, Giatikshan, Gityskyan, Giklsan) is a First Nation's language of north-western British Columbia. It is a Tsimshianic language, closely related to the neighbouring Nisga'a language. The English translation of the Gitxsan is "people of the river of mist".

Gitxsan traditional territory falls within the North western portion of the MNRD primarily within park boundaries, lakes, and high elevation.

4 Forest Licensees

At present, there are five forest licensees within the MNRD. With the latest increase in AAC, a new apportionment decision was approved on June 30, 2015 which will create opportunity for new forest licenses. While existing licence commitments are described in section 5.2.5, this section briefly describes the current licensees within the MNRD.

4.1 Replaceable Forest Licensees

Canadian Forest Products Ltd.

Canfor holds the largest forest licence in the district with an AAC of 1,082,904 m³/year. Their operating areas are to the west of Mackenzie in the SW corner of the MNRD, along the northeast shore of Williston Reservoir and just north of Tsay Keh. Canfor's sawmill in Mackenzie produces spruce-pine-fir dimension lumber.

Canfor is currently certified to the ISO 14001: 2004 Environmental Management System Standard and operates under Sustainable Forest Management Plan in support of their multi-site certification under the Canadian Standards Association Z809-08 Sustainable Forest Management Standard.

Conifex Timber Incorporation

Conifex holds a forest licence with an AAC of 932,500 m³/year. Their operating areas are located on the west and north sides of Williston Reservoir. Conifex's sawmill in Mackenzie produces spruce-pine-fir dimension lumber. Conifex has just opened a 36MW biomass power plant that is expected to utilize 172,000 oven dried tonnes (~380,000 m³) of forest biomass per year.

Conifex Fort St. James and Mackenzie woodlands operations have achieved and maintained certification under the Sustainable Forestry Initiative.

4.2 Non-Replaceable Forest Licensees

Chu Cho Industries, which is owned by the Tsay Keh Dene First Nation, holds two non-replaceable forest licenses totalling 81,924 m³/year.

Three Feathers Limited Partnership, a consortium comprised of Tsay Keh Dene First Nation, Kwadacha First Nation, and McLeod Lake Indian Band, has one non-replaceable forest licence of 88,000 m³/year.

Mackenzie Fibre Management Corporation (MacFibre)

MacFibre is a company owner by Paper Excellence Canada Holdings Corp., the McLeod Indian Band and several other shareholders. MacFibre's mandate is to manage the McLeod Lake Indian Band's 5 year licence to cut. This tenure allows for a total of 4 million m³ to be cut - with no annual cut control limits - to supply pulp logs to the Paper Excellence Mackenzie Pulp Mill either directly or through exchanging sawlogs for pulp logs, chips and sawdust.

4.3 BC Timber Sales

BC Timber Sales (BCTS) has a mandate to provide the cost and price benchmarks for timber harvested from public land by auctioning blocks through timber sale licenses. This semi-autonomous program within FLNR has an AAC allocation of 900,000 m³/year. BCTS is currently certified to the ISO 14001: 2004 Environmental Management System (EMS) Standard and, as part of the Provincial Sustainable Forestry Initiative single certificate initiative, BC Timber Sale's Prince George Business Area is certified under the 2015 - 2019 Sustainable Forestry Initiative Standard.

4.4 Area-Based Forest Tenures

Within the MNRD, two types of area-based tenures - Community forests and woodlots - are awarded separate AACs based on a defined area and management regimes. While these tenures are managed separately from the Mackenzie TSA (i.e., not within the scope of this project), they are affected by similar issues and regulatory regimes.

Community Forests

The McLeod Lake Mackenzie Community Forest is an area-based tenure of 24,220 hectares held in partnership between the McLeod Lake Indian Band and the town of Mackenzie. It has an AAC of 30,000 m^3/year, and an operating area near the two communities.

Woodlots

Ten woodlot licenses with a total AAC of 8,000 m^3/year have been established within the MNRD. Each is managed by individual woodlot licensees.

5 Timber Supply

5.1 Vegetation Inventory

The Vegetation Resource Inventory Management System (VRIMS) is used to update the Provincial Forest Inventory. In this process, new harvest and free-growing data are extracted from the Reporting Silviculture Updates and Land status Tracking System (RESULTS), verified and integrated into the Vegetation Resource Inventory.

While the vegetation inventory available for the MNRD has been acquired over several decades (Figure 9), most projects throughout the area defined as the THLB have been conducted fairly recently - albeit prior to impacts from MPB, spruce and balsam beetle infestations.

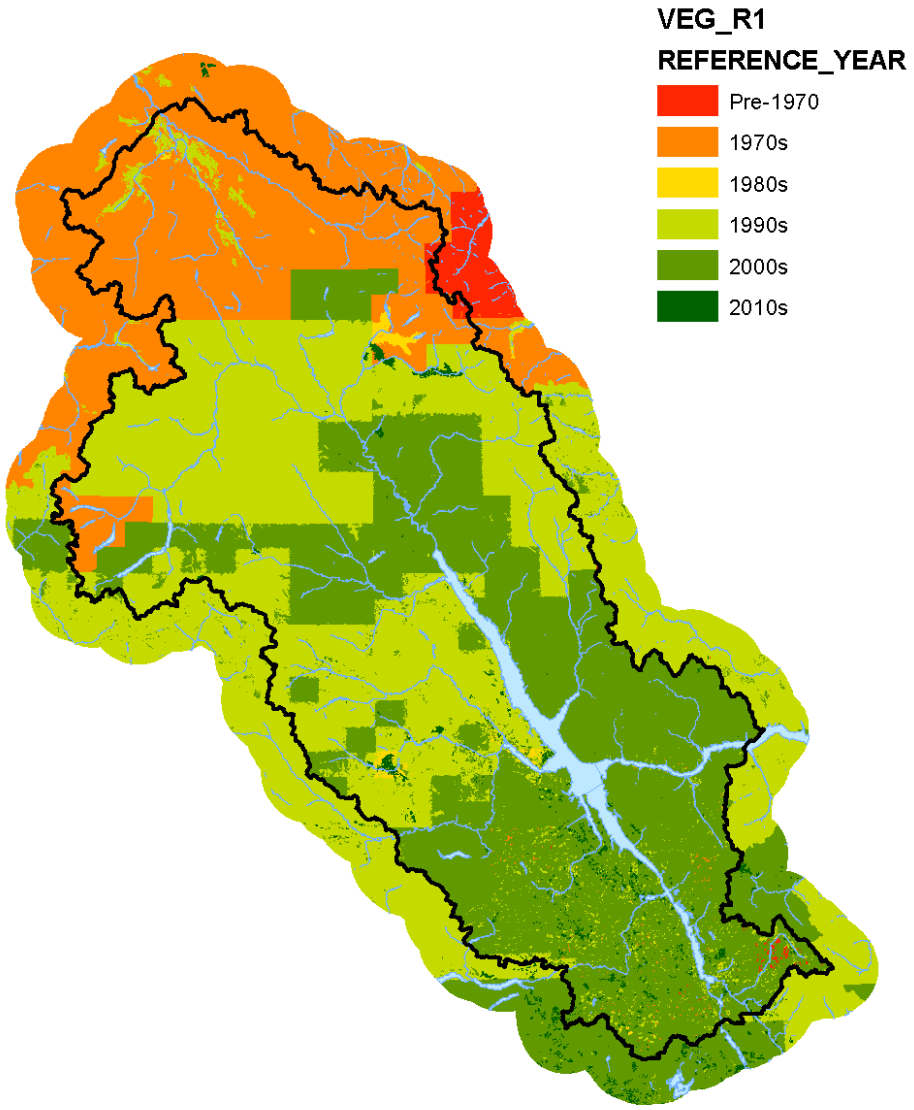


Figure 9 Forest inventory projects of the MNRD

5.2 Allowable Annual Cut

5.2.1 Historic AAC

The MNRD was established in 1981 with an AAC of 2,900,000 cubic metres. The AAC has since increased due to minor adjustments and establishment of a deciduous stand partition. The deciduous partition was established at 50,000 m^3/year from 1996 to 2001; thereafter, it was increased to 100,000 m^3/year. The 2001 AAC determination increased the harvest rate to 3,050,000 cubic metres. In 2004, the determination of the next AAC was postponed by order of the chief forester.

5.2.2 Current AAC

The AAC was last set in November 2014, and included a significant uplift in volume to facilitate the time-limited salvage of MPB killed pine (Table 4). The Chief Forester also issued a clear direction to target pine-leading stands from specific areas; over the next few years of dead pine salvage, harvesting must concentrate on developing the northern portion of the MNRD.

Table 4 Current AAC Partition

Partition	Total AAC (m^3/year)	%	Chief Forester's Expectations
Conventional	3,550,000	78.89	Pine-leading (pine ≥ 70% total stand volume) and deciduous stands
Non-Pine Species	950,000	21.11	Maximum 300,000 m^3/year from the southwest portion of the MNRD
Total	4,500,000	100.00	

TSR documents consider a range of viewpoints regarding the shelf life of the MPB-killed pine, and the ability of licensees to develop some of the remote areas. Harvest performance is monitored closely as these factors have potential to directly influence mid-term timber supply.

Despite the MPB infestation, if strategies provided in the determination are followed, the base case harvest flow (Figure 10) shows that harvesting pine-leading stands at 3.05 million m^3/year can be maintained for 15 years before declining to 2.51 million m^3/year (mid-term harvest level). At this point, it is expected that the MPB killed pine will have exceeded its shelf life, and the accelerated harvest due to salvage operations will end. The mid-term harvest level is expected to drop to just over 2.5 million m^3/year for approximately 80 years before stepping back up to the former AAC of 3.05 million m^3/year.

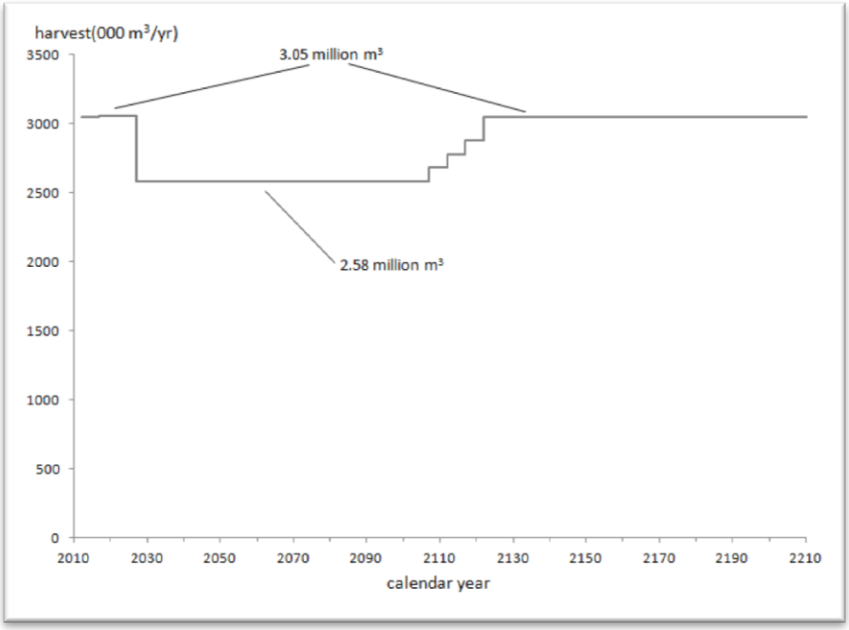


Figure 10 Base case forecast for the MNRD 2014 determination

5.2.3 AAC Partition to Salvage MPB-Killed Timber

The partition of the AAC specifically directs licensees to salvage MPB-killed pine now, maximizing volume recovery before these trees become unviable, while protecting the timber supply earmarked for the mid-term harvest. It also directs licensees to concentrate on areas further away from processing facilities in Mackenzie. The AAC determination reads:

> *"Effective November 14, 2014 the new AAC for the Mackenzie TSA will be 4,500,000 cubic metres, of which a maximum of 950,000 cubic metres is attributable to non-pine leading coniferous stands. Of this partition, no more than 300,000 cubic metres is attributable to non-pine leading coniferous stands from the southwest portion of the TSA, west of Williston [Reservoir] and south of Omineca Provincial Park and Omineca Arm.*
>
> *With regard to the 3.55 million cubic metres of unpartitioned AAC, it is my expectation that this volume be harvested from pine-leading stands in which pine represents at least 70% of the total stand volume and from deciduous-leading stands."*

Significant implications are expected with this AAC uplift and partition:

1. The new AAC is a 50% increase in volume, which will require considerable effort from licensees to ramp up their operations to harvest this additional volume. Additional equipment will be acquired for timber development, harvesting and handling, and road development must accelerate to keep ahead of the harvesting.
2. The harvesting pattern will be different than in the past. Often, roads will have to extend beyond operable green timber to reach the dead pine stands. This will likely result in higher average development and road maintenance costs.
3. The direction for the majority of non-pine leading harvest to be in area other than the southwest corner of the MNRD will result in a higher average hauling and barging distance, and overall higher development costs.

4. There is potentially a higher risk to non-timber values in this period of accelerated development. This is a major factor in requiring the development of this ISS.
5. The AAC for the mid-term timber supply depends on the success of the implementation of this partition; saving the green wood for the future.
6. The mid-term timber supply may come with the economic advantage of being already substantially roaded. Roads must be maintained or properly put to bed to maintain the initial development investment.
7. There will be a distinct shift in species composition for both lumber and pulp products both during the pine salvage partition period and immediately afterwards.
8. The MPB salvage uplift in the AAC provides an immediate opportunity for First Nations to develop their own economic opportunities. Their geographical locations may provide economic advantages for long-haul scenarios.

5.2.4 Harvest Performance

Since the MPB infestation entered the district in 2004, harvesting has targeted dead pine so that pine-leading stands account for approximately 70% of the total volume harvested. The proportion of pine harvested has averaged 65% over the last seven years (Figure 11) while the infestation has sharply declined since its peak in 2009.

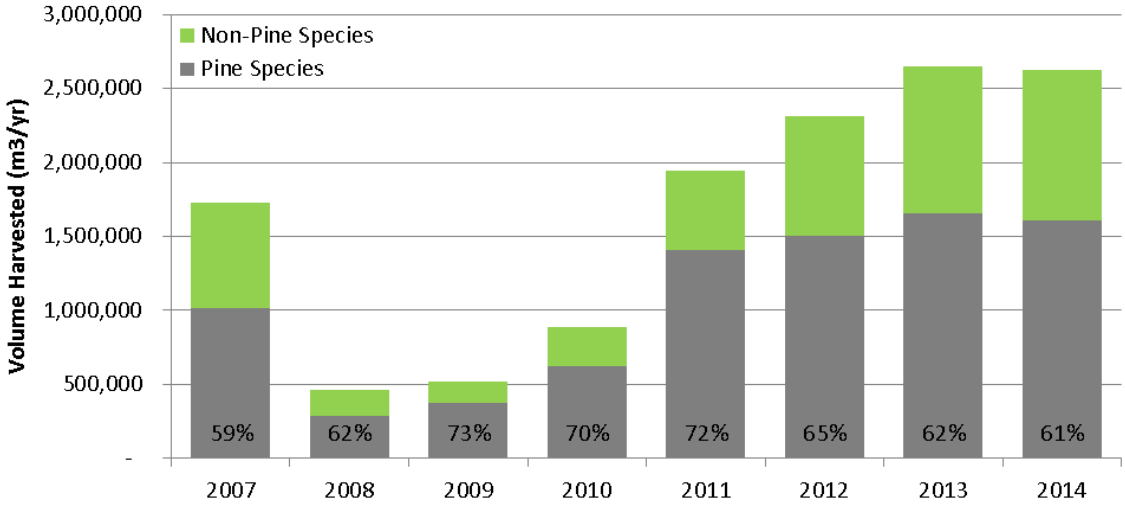


Figure 11 Pine and non-pine harvest over the last seven years (2007 to 2014)

Figure 12 summarizes the harvest performance across the MNRD between 2006 and 2013. These results indicate that current licensee harvest performance has not been meeting apportionments. This substantial undercut was primarily due to a significant downturn in market conditions, as well as the onset of the MPB salvage strategy which required a shift in operational direction. Over time shortfalls like these could accumulate to a significant undercut volume in the MNRD.

Source: Considerations Regarding the Disposition of Crown Timber in the MNRD March 31, 2014

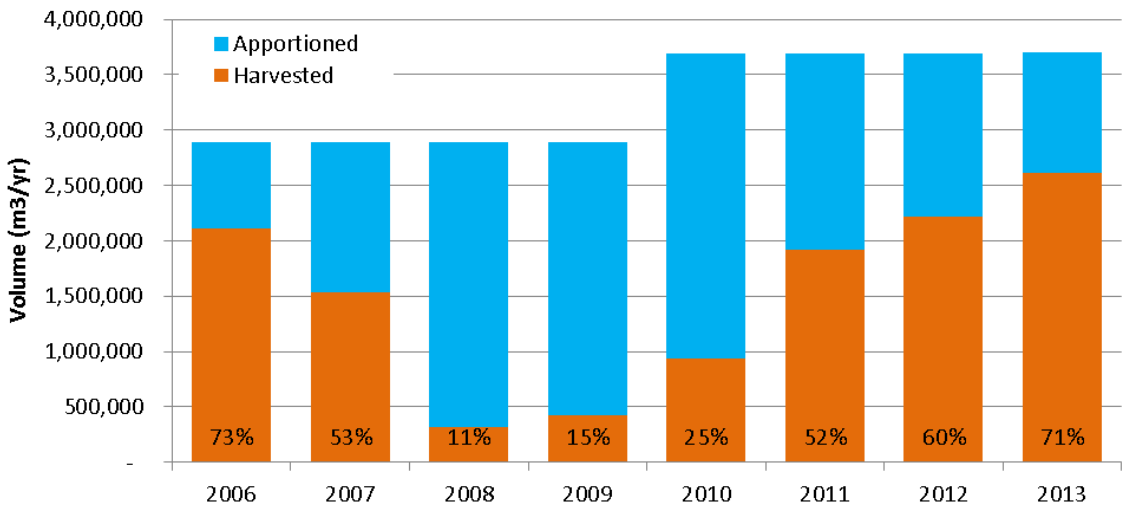


Figure 12 Apportioned and harvested volume over seven years (2006 to 2013)

5.2.5 Existing Licence Commitments

The current AAC has been apportioned according to various forest licence types (Table 5). Additional details are provided in section 5.4.

Table 5 Current AAC Apportionment

Forest Licence Type	Total AAC (m^3/year)	%
Forest Licensees – Replaceable	2,015,404	45
Forest Licensees – Non-Replaceable	1,244,596	28
Non Replaceable Forest License	100,000	2
First nations Woodlands Tenure	200,000	4
BCTS	900,000	20
FS Reserve	35,000	1
Total	**4,500,000**	**100**

Source: MNRD apportionment and commitments report of 2015/07/24

Only 69% of the current AAC has been committed to licensees operating within the MNRD (Table 6).

Table 6 Licence AAC commitments in the MNRD

Type	Licence	Licensee	Conventional AAC (m^3/year)	Deciduous AAC (m^3/year)	Non-AAC (m^3)
Forest Licenses (Replaceable)	A15384	Canfor	1,082,904		
	A15385	Conifex	932,500		
Forest Licenses (Non-Replaceable)	A86661	Three Feathers	88,000		
	A90829	Tsay Keh Dene	72,000		
	A90832	Tsay Keh Dene	9,924		
Forestry Licence to Cut	A87345	MacFibre			800,000
BCTS			900,000		
		Total	**3,085,328**	**0**	**800,000**

The three largest licensees operating within the MNRD are Canfor, Conifex, and BCTS. While operating areas are not legally defined, a well-respected agreement exists to define geographical operating areas (Figure 13).

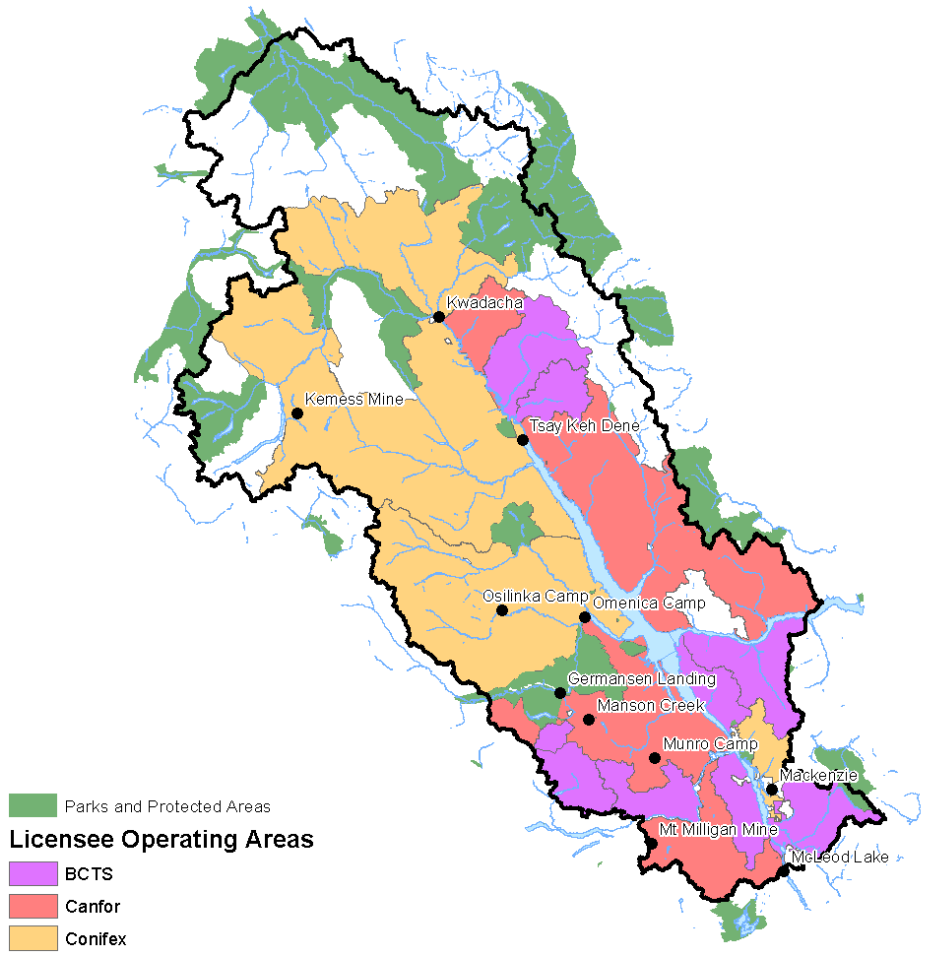


Figure 13 Existing licensee operating areas in the MNRD

5.3 Forest Health Impacts

5.3.1 Mountain Pine Beetle

The widespread MPB epidemic (section 2.8) poses the following three timber supply challenges that must be carefully addressed through the course of this project.

How much volume is dead and how/where is it distributed?

<u>MPB Kill in Old Stands</u>

As mentioned in section 2.8, current data from the vegetation resources inventory indicate that about 81.8M m³ or 66% of the pine volume on the THLB was killed between 2003 and 2011.

In contrast, for the last TSR district staff estimated that about three-quarters of the pine in the MNRD had already been killed; based on observations made during repeated aerial reconnaissance of the MNRD. They noted that the MPB epidemic developed in two distinct phases. The first phase, which began in 2004 but occurred primarily in 2005, was limited to the area west of Williston Reservoir and south of the Omineca Arm. The outbreak appeared to be contained in this area of the MNRD until 2009, when it rapidly spread throughout the rest of the MNRD.

One negative aspect of applying an average fixed kill percentage to all stands is that it results in the spatial distribution of the dead and remaining live trees that is based entirely on species composition. Ideally, estimates of dead percentages should be spatially explicit.

MPB Kill in Young Stands

Observations by district staff suggest that death in stands younger than 60 years old was considerably lower than that observed in mature stands. The MPB has attacked and killed trees as young as 25 years old (only light to moderate severity), and stands aged less than 25 years appear not to have been affected. Forest Health Overview flights indicate that infestations in young pine stands peaked in 2011 with approximately 45,000 hectares being mapped as trace or light infestation severities (Figure 14). Much of this impact has occurred along Williston Reservoir and more recently northwest of the Omineca arm.

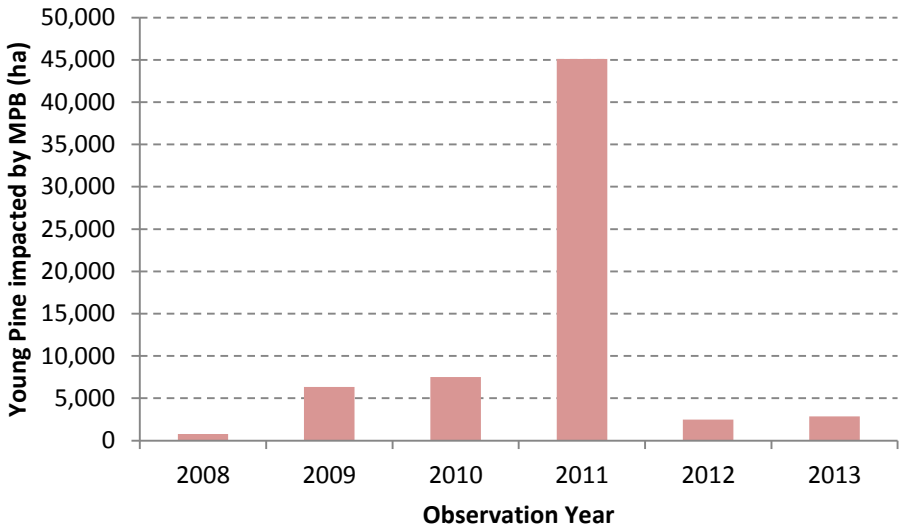


Figure 14 Forest Health Overview reporting on Young Pine impacted by MPB

How can we maximize the volume harvested throughout the salvage period?

Shelf Life

Following attack, wood fibre of the dead forest becomes increasingly dry and more brittle and rot begins to set in at the base of trees. This negatively impact both costs and revenues where:

- Stands already associated with higher costs due to harvesting constraints (e.g., cable harvesting on steep slopes) and/or long haul distances become infeasible as pine volume/value declines.
- Logging costs rise, since more “non-sawlog” timber must be left in the woods and harvestable stands get farther away from the mills.
- Sawmill lumber recoveries drop as wastage due to rot/checks increases.
- Difficulties in sawmilling expand (e.g., more saw changes, clog-ups, breakage and wood dust).
- Lumber grade yields decline.

The length of time that a tree retains its commercial value after it has died, or shelf life, is a key determinant of a mill’s ability to utilize MPB-killed logs. Shelf life is affected by a combination of factors such as time since death, moisture, temperature, and aspect.

The 2014 TSR applied an assumption that the dead trees may have some commercial use (e.g., sawlog, chip, bioenergy) as long as the tree is standing but rot rapidly once they fall to the ground. It was assumed that these dead pine trees would remain standing for 15 years after attack. If one applies the shelf life assumption used in the current TSR for Prince George (i.e., exponential loss curve), the amount of dead volume in 2015 is reduced by 64% or 45.8M m^3.

Source: Forsite 2015 - MPB Summary for MNRD

AAC Partition

To achieve a balance between optimizing salvage and exacerbating the projected decline in mid-term timber supply, the Chief Forester instituted an AAC partition to limit the harvest of non-pine leading coniferous stands. She provided further direction of this partition to avoid a concentration of timber harvesting in the southern portion of the MNRD.

How will unsalvaged stands respond?

Secondary Structure

Section 43.1 of the Forest and Range Practices Act Forest Planning and Practices Regulation, *Secondary structure retention in mountain pine beetle affected stands,* requires forest licensees to protect secondary structure (understory advanced regeneration and non-pine canopy trees) in MPB affected areas.

Considerable variation in secondary stand structure exists among different lodgepole pine stands. In their recent study to determine the proportion of Biogeoclimatic Ecosystem Classification (BEC) units considered to be in poor condition and hence likely to recover slowly from a timber supply perspective, Coates and Sachs (2012) reached the following conclusions for pine leading stands:

- Generalizations about secondary structure abundance based solely on pre-beetle pine dominance are too crude since understory, sub-canopy and canopy secondary structure post-beetle can vary widely at any level of pine dominance.
- ESSF and ICH zones pose few problems for recovery while MPB-impacted stands in the SBS zone pose the greatest risk.

Based on 3,823 plots examined, Coates and Sachs (2012) further predicted the natural recovery of pine leading stands, as shown in Table 7.

Table 7 Predicted Natural Recovery of Pine-Leading Stands by BEC

BEC Unit	Suggested % range of predicted natural recovery [1]
SBS	58-68
MS	76-86
SBPS	78-88
IDF	75-85
ESSF	92-100
ICH	90-100
BWBS	80-100
Total	70-80

+/- 5% tolerance used around calculated means except for ICH and BWBS where +/-10% used given low # of plots

Since a large area of MPB attacked pine-leading stands will not be reached during the salvage period, it important to understand the existing regeneration structure within these stands to predict their eventual contribution to timber supply. Stands with good advanced regeneration may be available to

contribute to timber supply near the end of the mid-term. Establishing new inventory information for these stands is a considerable challenge.

Regeneration of Unsalvaged Stands

Unsalvaged stands, unless rehabilitated, will regenerate naturally through advanced regeneration (dominated by shade-tolerant species; spruce and balsam) or seed currently on site (dominated by pine within the seed bed or aspen from adjacent stands). Stands that are not salvaged may require an assessment to determine how they are performing and whether additional treatments are required to ensure they are regenerating satisfactorily (or perhaps better).

Pine Seed Availability

In response to the initial years of widespread outbreak in the Province, particularly in the hard-hit Williams Lake and Quesnel Districts, the issue arose of adequate seed supply to reforest pine-leading stands harvested at accelerated rates. Seed collection and supply has increased in response to the MPB epidemic, and the Provincial Seed Planning and Use website now has specific strategies and programs in place to address MPB reforestation seed requirements. Due to the interest in this issue the Tree Improvement Branch of the FLNR has issued the *Mountain Pine Beetle Seed Planning BULLETIN 05, March 2008.* This bulletin begins:

> *"In response to the mountain pine beetle (MPB) outbreak in the interior of BC, there is a large and ongoing lodgepole pine (Pli) cone collection effort. This is to ensure that those with reforestation obligations have a supply of seed into the future."*

5.3.2 Spruce Beetle Outbreak

Outbreaks of spruce beetle occur periodically (e.g., 1990-1996) in the MNRD. Spruce beetle infestations have been relatively low since 2003 when approximately 133,000 ha were identified (Figure 15). However, in 2014 forest health overview flights identified approximately 106,000 ha infested with spruce beetle (Figure 16). This figure may be conservative because the northern quarter of the TSA could not be flow in 2014. The current outbreak is easily observed through yellow, red and gray attack trees, but the two-year life cycle of the beetle makes the progress of the outbreak in green attacked trees difficult to track. Indications from the visibly-attacked trees show that this could be an epidemic outbreak.

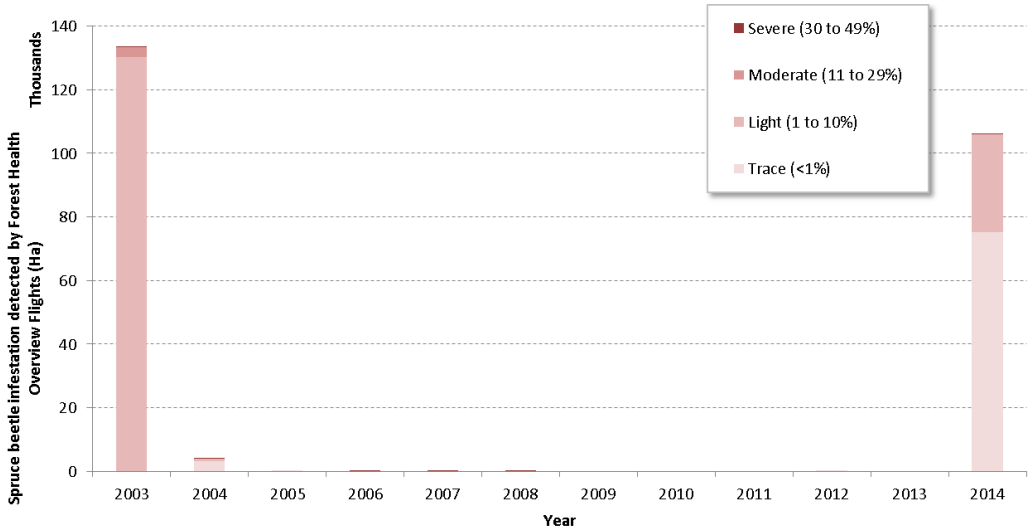


Figure 15 Spruce Beetle Infestation by severity detected by Forest Health Overview Flights 200-2014

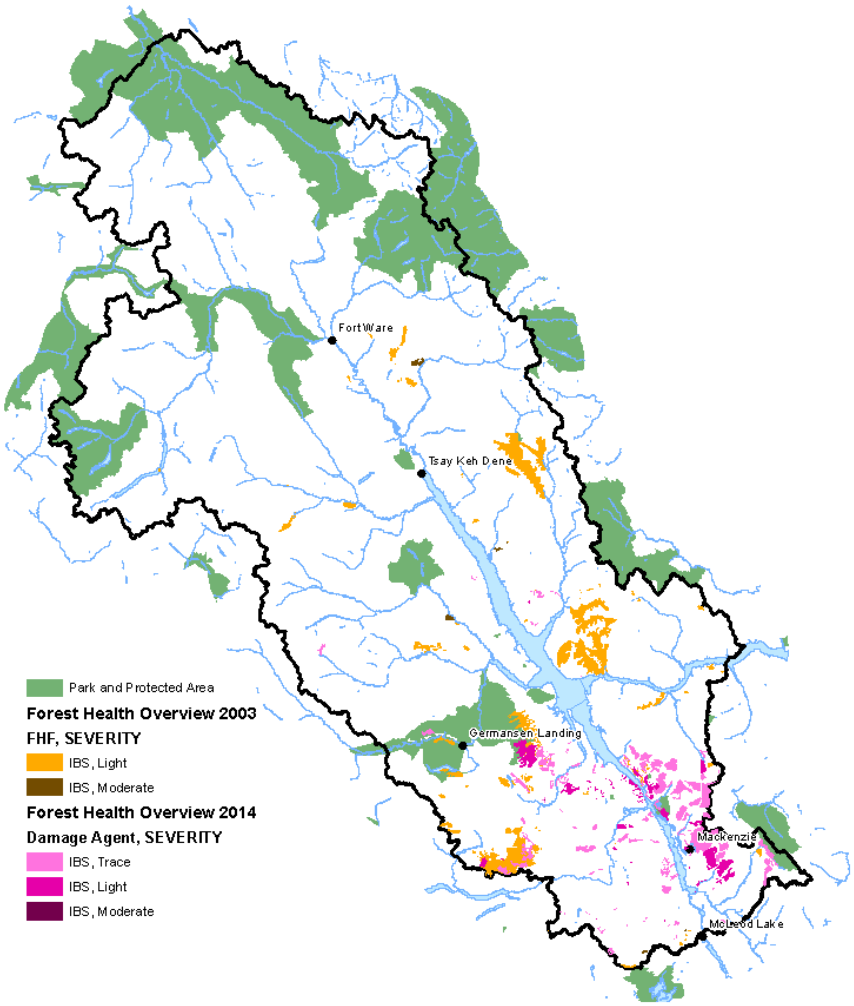


Figure 16 Extent and Severity of Spruce Beetle Infestation identified from the 2014 Provincial Health Overview Survey

To help determine the extent of the current infestation, the FLNR recently implemented extensive on-the-ground detection surveys for spruce beetle within green-attack stands. This current outbreak is particularly alarming because of its rapid spread and the increased importance of spruce as a main timber species through the mid-term. Preliminary results from the 2015 forest health overview flights should be available towards the end of the year.

5.3.3 Balsam Decline

According to district staff, older balsam stands are experiencing considerable mortality similar to many within the Stuart Nechako Resource District. However, no formal survey has been completed.

Source: TSR data package

Western balsam bark beetle attacks high-elevation mature sub-alpine fir, along with recorded incidents on white and Engelmann spruce, contributing to historic losses. Aerial survey data shows that 183,086 hectares were impacted in 2007. Balsam bark beetle outbreaks often coincide with other stress agents, such as Two-year Cycle Budworm, which makes it difficult to accurately record the outbreak pattern and extent of the damage caused.

The life cycle of the western bark beetle typically requires two years to complete. Eggs are deposited in chambers within the inner bark where adult beetles over-winter. A phytopathogenic lesion-causing fungus (*Ceratocystis dryocoetidis*), carried on western balsam bark beetles could be responsible for 65% of the mortality associated with an attack. This fungus can invade the phloem causing lesions which can girdle and cause mortality without the additional effect of beetle movement within the tree (Garbutt 1992).

Balsam decline and the western balsam bark beetle is a topic that will need further investigation since the mid-term timber supply will rely, in part, on these stands.

Source: FOREST HEALTH STRATEGY FOR THE MACKENZIE TIMBER SUPPLY AREA v4.3 March 2008, Industrial Forestry Service Ltd.

5.3.4 Gall Rust

The majority of damage resulting from rusts are growth losses and mortality from blisters girdling the stem. Trees of all ages can be attacked however young trees are most susceptible. Damage from rusts can impact lumber quantity and quality. Increased stocking is sometimes recommended to compensate for young trees losses due to gall rusts.

All pine trees - including those at high elevations - are potential primary hosts to three species of gall rust: Western gall rust, Stalactiform blister rust and Comandra blister rust. Western gall rust requires no secondary host while Stalactiform blister rust requires a member of the figwort family (e.g., common red paintbrush) and Comandra blister rust requires Comandra spp. or Geocaulon spp. (e.g., bastard toadflax).

Western gall rust creates irregularly rounded, woody distortions in the tree that grow larger each year until they are attacked by secondary fungi and insects. Signs of infection occur approximately three years after infection distinguished by discoloration of the needles and swelling of the bark. Blisters form from the swelling and spores are releases to infect secondary hosts. Infected stems and branches die from attack by secondary organisms.

Stalactiform blister rust is locally abundant, although not wide spread, and can cause high levels of mortality if young trees are infected.

Comandra blister rust can result in high mortality as it kills rapidly and can occur in high levels.

The Mackenzie Rust Working Group developed a rust management strategy and standard operating procedures for ground detection. The strategy focuses on promoting a greater awareness of rusts and associated alternate hosts, reforesting to higher densities and planting non-susceptible species where ecologically appropriate. To control rusts, infected trees and branches can be removed during the spacing of young stands while infested mature stands can be harvested to minimize the spread of spores from old blisters.

Source: FOREST HEALTH STRATEGY FOR THE MACKENZIE TIMBER SUPPLY AREA v 4.3, March 2008 Industrial Forestry Service Ltd.

5.3.5 Unsalvaged Losses

The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects, and disease) that is not harvested is referred to as unsalvaged losses.

Last year was exceptionally bad for fires (Figure 17) comprising 94% of the 70,000 hectares of THLB located within fire perimeters mapped between 2005 and 2014. This will have a considerable influence on how fire should be included in the unsalvaged loses that could range between 60,000 and 875,000 m^3/year.

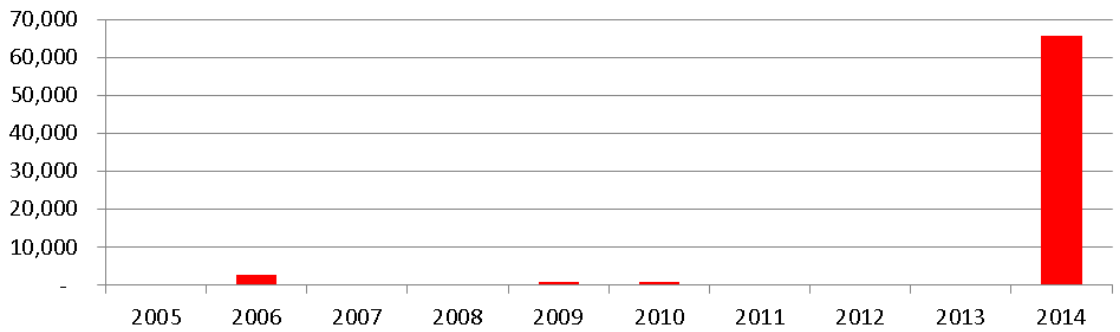


Figure 17 THLB impacted by fire over the last decade

The TSR estimated that approximately 600,000 m³ blew down within the THLB over 10 years with salvaging occurring on approximately half of this volume.

In the TSR, losses due to balsam decline and insects were addressed through adjustments to stand yield tables.

5.4 Capacity to Harvest the AAC in the Short Term

Source: Considerations Regarding the Disposition of Crown Timber in the Mackenzie Timber Supply Area, March 31, 2014. Jim Snetsinger RPF, Chris Bailey RPF, INDUSTRIAL FORESTRY SERVICE LTD. [Note: including some updates]

Past harvest levels may provide some insight into the future demand for fibre, however new and possibly better insight into future demand can be obtained by understanding:

- the implications of the MPB epidemic that are starting to result in decreased regional fibre supplies,
- vastly improved solid wood and pulp markets,
- the emergence of the bioenergy sector,
- increasing timber processing capabilities through mill start-ups,
- upgrading of existing lumber mills,
- the potential for additional timber processing capacity to be brought on line in the near future, and
- forest tenure opportunities being sought by First Nations.

The following are some of the key factors likely to drive an increased demand for fibre from the MNRD:

1. Conifex is currently only running their Site 2 sawmill which consumes approximately 900,000 m³/year of sawlogs operating on a 2-shift basis, while their current apportioned AAC is 932,500 m³/year. However, Conifex is contemplating the restart of their Site 1 sawmill which would require additional volume above their current apportionment to operate both mills. The amount of additional volume would be dependent upon the type of upgrades done to the mill.
2. Conifex started up their thirty-five megawatt wood fired electrical generating plant adjacent to their Site 2 facility in September 2015. This power plant will require approximately 370,000 m³/year of biomass material.

3. Canfor has recently completed a $42 million upgrade to their Mackenzie sawmill. Canfor intends to utilize their existing 1,082,000 m^3/year AAC in the MNRD to supply this sawmill. Canfor deals with their fibre supply on a more strategic regional basis as a result they predict that they will be requiring an additional 1.0 to 1.5 million m^3/year to be sourced from BCTS and First Nations in the MNRD.
4. Paper Excellence restarted the Mackenzie pulp mill (i.e. Mackenzie Pulp) in 2010. The pulp mill currently requires 1.2 million m^3/year of roundwood equivalent to produce approximately 250,000 tonnes of northern bleached softwood kraft pulp. Based on recent investments in the pulp mill they are targeting to increase production to 1,000 tonnes per day over the next three years. This would result in an increase in fibre required to approximately 1.6 million m^3/year of roundwood equivalent in the form of chips (60%), sawdust (25%) and hog fuel (15%). Currently this material is coming from a variety of sources including short-term fibre supply arrangements with Conifex, Canfor, and whole log chipping by Duz Cho Logging Industries.
5. In 2010, an 800,000 m^3/year Forestry Licence to Cut (FLTC) was awarded to the Mackenzie Fibre Management Corporation (MacFibre) as part of an economic development agreement with the MLIB to support the restart and ongoing operations of the Mackenzie pulp mill. This licence is utilized to develop saw logs that can be traded for non- sawlog material needed by the pulp mill. In addition revenues generated from the sale of sawlogs from the licence can be used to purchase non-saw log material. Non-sawlog material generated from harvesting activities on the FLTC is also provided to the pulp mill. This level of fibre requirement for the pulp mill will continue as long as the pulp mill is operational. Hence, the FLTC is envisioned by MacFibre and MacPulp as a necessary long-term tenure in order to support the fibre supply requirements of the pulp mill.
6. In 2013, Paper Excellence purchased the pulp mill in Chetwynd. This mill was upgraded and began operations again in September 2015.
7. Duz Cho Industries recently opened a small log cant mill operation in the Mackenzie industrial complex. This operation utilizes lower value fibre (i.e. small diameter pine saw logs or the tops of larger saw logs destined for sawmills) currently not be utilized by other timber manufacturers in Mackenzie. The cant mill will consume approximately 411,000 m^3/year of timber based on a one line operation. Sawmill residuals (i.e. chips) of approximately 80,000 oven dry tonnes per year are currently committed to the Mackenzie Pulp mill which services approximately 20% of their chip requirements. The construction of this new timber processing facility in Mackenzie would on the surface appear to exacerbate the demand on the fibre resource in the MNRD. However, given the lower-value log profile this timber processing facility will utilize along with their fibre supply arrangement with the pulp mill, the development of this facility is complimentary to the area's current milling infrastructure.
8. Three First Nations groups (i.e. Tsay Keh Dene, Kwadacha, and McLeod Lake Indian Band - the Three Feathers Limited Partnership) groups collectively have 176,000 m^3/year in non-replaceable forest licences with various expiry dates ranging from 2015 to 2022. There is 29,391 m^3/year of Bill 28 available to four Nations groups (i.e. Tsay Keh Dene, Kwadacha, Takla Lake, and Nak'azdli) in the current apportionment that has yet to be tenured. In addition, there is 355,000 m^3/year of volume arising from past undercuts that has been committed to five different FN groups in the MNRD. BCTS currently has an apportionment of 768,886 m^3/year (i.e. 718,886 m^3/year coniferous and 50,000 m^3/year deciduous). Over the

past five years BCTS has sold 1,594,231 m³ which is well below their total five year sales projection (i.e. 718,886 m³/year x 5 = 3,594,430 m3). This is likely due to mill closures, the economic downturn and a regional harvest focus on the MNRD. BCTS would like to have their apportionment increased in order to sell somewhere between 1.2M and 2.0 million m³/year on the open market.

9. In 2010, Paper Excellence restarted the Mackenzie pulp mill via the Mackenzie Pulp Mill Company (i.e., MacPulp). This restart has resulted in the pulp mill becoming the region's largest employer, largest taxpayer, and is a major consumer of support services of all kinds from the community. Paper Excellence also has a majority interest in the Mackenzie Fibre Management Company (MacFibre) which manages a FLTC which was facilitated through an Economic Development Agreement with the MLIB in order to support the operation of the pulp mill. As mentioned above, this support was envisioned to arise from the trading of fibre derived from harvesting on the FLTC, direct provision of pulp logs arising from FLTC harvesting, and through the generation of income that could be used to purchase fibre on the open market for the pulp mill. The FLTC came into effect on May 13, 2010. The licence provides for the harvest of 4,000,000 m³ of MPB damaged pine stands over a five-year fixed term. This licence was awarded to provide the pulp mill with some level of access to a fibre supply without which the pulp mill would not have reopened. Harvesting on the FLTC has been ramping up over the past four years and in 2013 the harvest was approximately 550,000 m³. MacFibre and MacPulp are both very concerned about a possible AAC uplift and the potential impact that additional fibre on the regional market may have on the marketability of the fibre from the FLTC and hence the economic stability of the pulp mill.

5.5 Minimum Harvest Criteria

Many site factors play a role in determining the economic feasibility or operability of any stand. These criteria can include: timber value, species, volume, piece size, slopes requiring cable logging, and long haul/barge distances.

The minimum harvest criteria is a key assumption used to assess the timber supply, as well as quality, for a management unit and is often a source of debate when comparing past harvesting performance and future opportunities. The last TSR set the minimum harvest volume threshold at 151 m³/ha as this represented 99% of the stands harvested between 1988 and 2011. This criterion was only applied to the coniferous component of the stand yields.

5.6 Haul Distances

Timber harvesting in the majority of the MNRD typically involves high operating costs associated with long haul distances (i.e., trucking and barging). This criterion is a dominant factor in determining a stand's economic operability. For a large proportion of the THLB, operations require both hauling to a log dump and towing to Mackenzie for processing. Changing costs, most notably fuel, continually affect the operability of stands located along the outer extent of the THLB. The hauling distance issue has been well described in the TSA Public Discussion Paper and the AAC Determination, as follows:

> *"Due to the large size of the Mackenzie TSA, much of the timber harvest must be hauled long distances, either by water or road, to reach processing facilities in Mackenzie or elsewhere. Historically, timber was transported on Williston [Reservoir] by means of tug and tow or large log transporter. The log transporter has ice-breaking capabilities and can operate year round; whereas, tow boats can only operate about six months of the year. Consequently, since the log transporter was*

taken out of service, the capacity for log transportation on Williston [Reservoir] has been significantly reduced.

As the distance from the Community of Mackenzie increases, the cost of hauling logs also increases until the cost is so high that timber harvesting becomes uneconomical. Areas south of the Peace Arm and Omineca Provincial Park are sufficiently close to Mackenzie that haul distance is not a barrier to harvesting. In order to establish a maximum haul distance criterion for use in the base case, the haul distances associated with about 115,000 hectares of cutblocks north of the Peace Arm and Omineca Provincial Park were calculated. The results indicate that 99% of the areas harvested had haul distances less than 293 kilometres from Mackenzie."

Source: AAC Rationale for MNRD, November 2014:

A map of the modelled haul distances associated with the TSR base case (Figure 18) shows that approximately half of the projected harvest in the base case is assumed to come from that portion of the MNRD south of Omineca Park and south of the Peace Arm of Williston Reservoir. Approximately 90% of the harvest is assumed to come from within the modelled distance of 250 km of Mackenzie.

From the MNRD Public Discussion Paper:

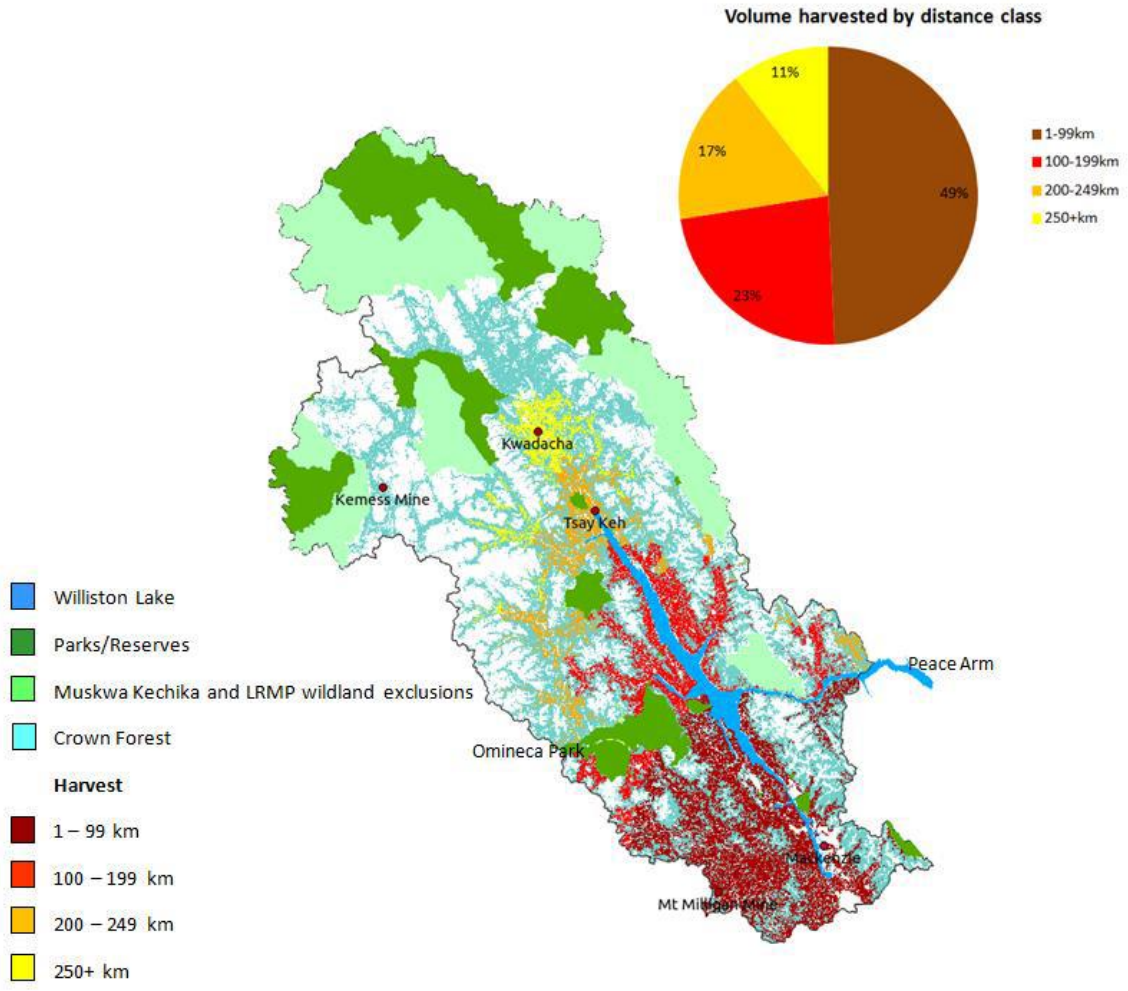


Figure 18 Modelled Haul Distances for the MNRD

5.7 Steep Slopes

The MPB-killed pine salvage partition is expected to direct operations to more steep slopes in the near future. The TSR base case scenario limited the harvest to ground-based systems on slopes up to 46%. Steeper slopes could only be accessed with cable logging systems at a higher cost, so the stand value must be proportionately higher to be economically viable. Accordingly, it was assumed that dead pine salvage would not occur on slopes in excess of 35%.

5.8 Tree Species Diversity and Age Class Distribution

Source: Considerations Regarding the Disposition of Crown Timber in the Mackenzie Timber Supply Area Jim Snetsinger, R.P.F. Chris Bailey, R.P.F. March 31, 2014

The crown forest land base in the MNRD is composed of 35% lodgepole pine, 31% spruce, 27% balsam, and 7% deciduous and is estimated at 3.3 million hectares or 51.5% of the total area. The THLB in the MNRD is estimated to be about 1.5 million hectares. The species composition of the THLB is 46% pine, 35% spruce, 10% balsam, and 9% deciduous. The age class distribution of the stands in the crown forest land base and THLB are predominantly in a mature state (> 81 years) as depicted in Figure 19.

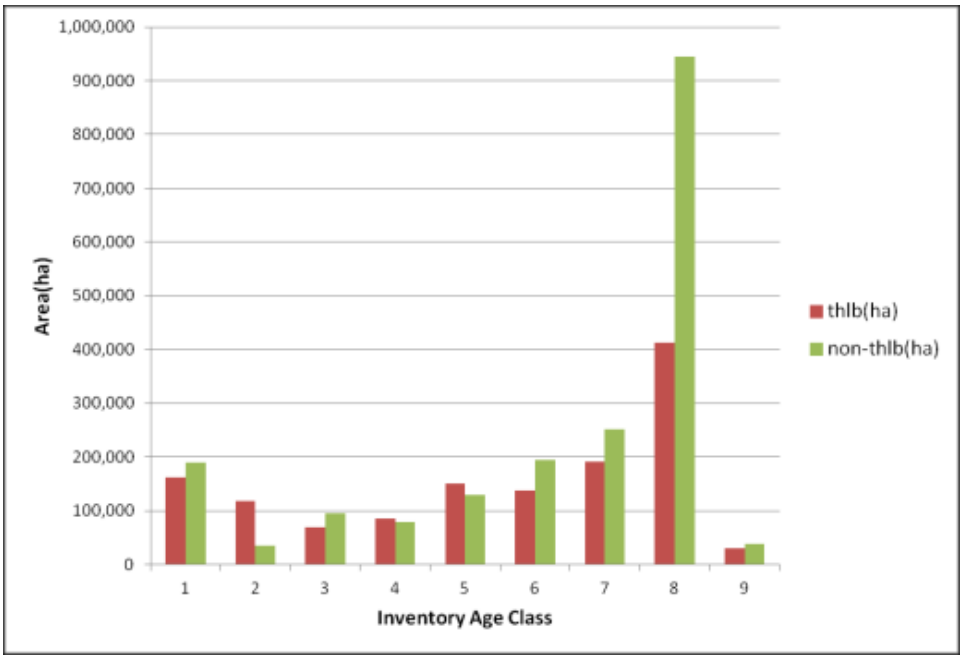


Figure 19 Age Class Distribution of the Crown Forested Landbase and THLB in the MNRD

Likely due to a combination of natural disturbance and harvest patterns, the current age class distribution within THLB of the MNRD is fairly even (Figure 20).

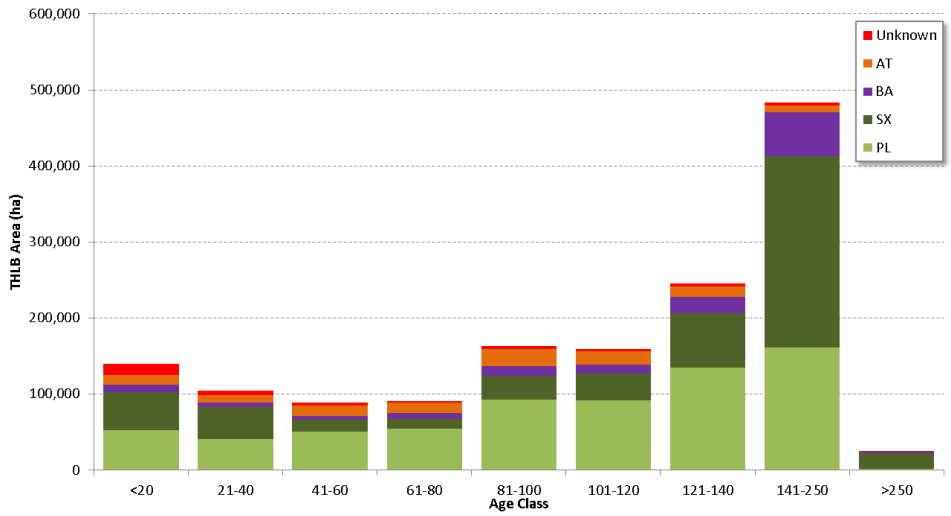


Figure 20 THLB area by age class and leading species

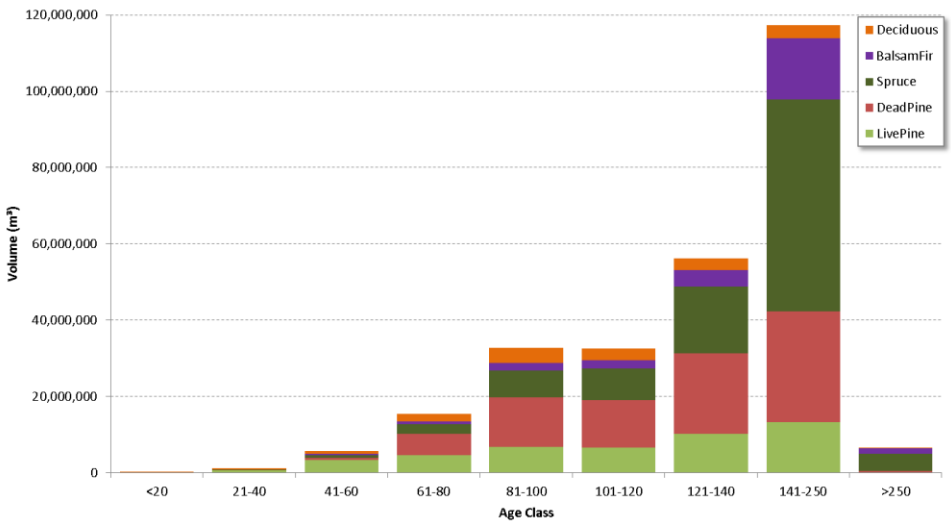


Figure 21 Volume on the THLB by age class and individual species

Despite the lack of data for some years (reason unknown), Figure 22 illustrates how the actual species composition of the stands harvested varies from year to year. Meanwhile, volumes billed (Figure 23) show a definite trend towards harvesting more pine.

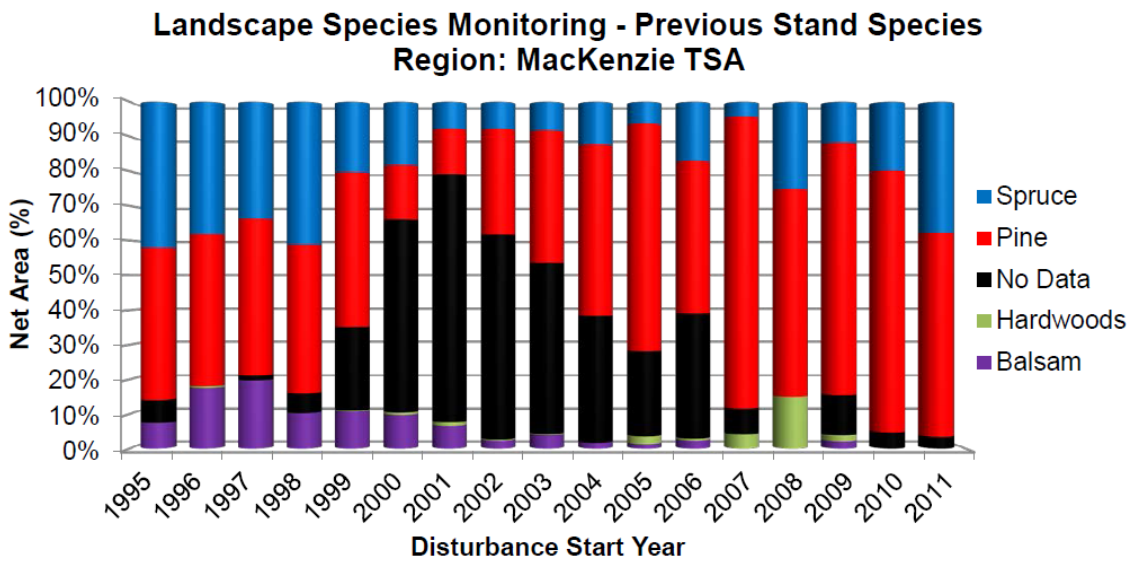
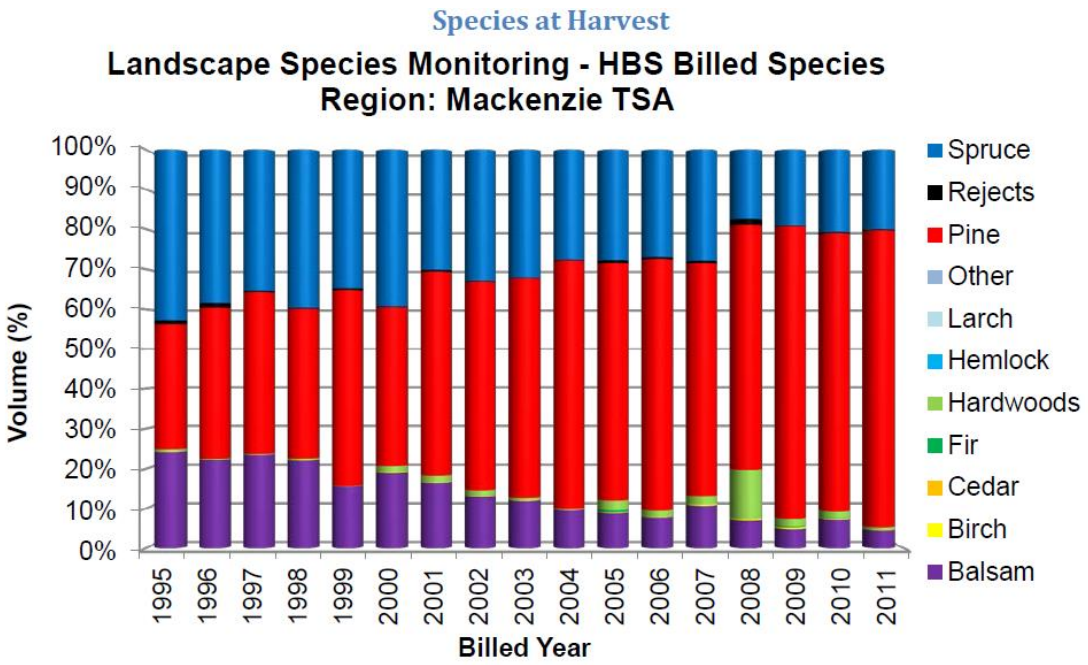


Figure 22 Species harvested - previous stand species



Species Monitoring Report MNRD Summary Charts and Graphs May 2012

Figure 23 Species harvested - harvest billing system

6 Timber Quality

To date, silviculture strategies have focused on achieving timber quantity objectives and did not substantially address the issue of timber quality. With the anticipated fall down in the mid-term timber supply due to the MPB impact, timber quantity remains the key management issue facing silviculture.

The current Land Based Investment Strategy – Strategy at a Glance (FLNR) states that, *"No specific timber quality objectives have been identified in the Type 1 Strategy. Timber supply quality is the focus as opposed to the quality of the individual stems."*

Source: http://lbis.forestpracticesbranch.com/LBIS/taxonomy/term/3

The quality of live timber from the MNRD is generally considered to be good. For example, Conifex Timber Inc. reports in their Annual Information Form, of March 18, 2015:

> *"We believe that we have an excellent timber base with a significant amount of high-quality fibre within economic reach of each of our mills." and "We believe our competitive strengths include a secure and high quality timber base…"*

The imminent issue concerning timber quality is the inevitable decline in log quality of beetle-killed wood (both pine and spruce) throughout the salvage period (i.e., shelf life - section 5.3.1). It will be a challenge for mills to maintain high grade and value output required to remain competitive and economically viable towards the end of the salvage period given an ever-declining average quality of log. The beetle-killed pine shelf life of 15 years is based upon them having some economic value, but this is certainly well beyond the shelf life for most economically viable sawlogs.

High quality logs are a product of long growing periods in naturally grown stands forming consistently sized and straight logs yielding lumber with tight annual growth rings and small branches. Silviculture strategies are typically focused on exploring ways to maintain a desirable profile of products throughout the mid- and long-terms. Various treatment options are considered to manipulate species composition, stand densities, and minimum harvest criteria to influence wood properties such as specific gravity, knot sizes, fiber length, and stiffness. Since strategies to improve timber quality usually involve some compromise to timber quantity, an appropriate balance of these two opposed drivers is required.

7 Fish and Wildlife Habitat

7.1 Species at Risk

Species at risk, as defined by the Federal *Species at Risk Act* means an extirpated, endangered or threatened species or a species of special concern.

In British Columbia, the Ministry of Environment utilizes their red and blue list system:

- Red listed ecological communities, species and subspecies are those that are extirpated, endangered or threatened in British Columbia.
- Blue listed ecological communities, and indigenous species and subspecies are those of special concern in British Columbia.

In considering habitat supply, it is important to identify the environmental values potentially at risk from harvesting, roads and forest health impacts.

Table 8 to Table 10 list the red and blue listed species for the MNRD.

Source: Exported from the Ministry of Environment BC Species and Ecosystems Explorer, September 15, 2015

Table 8 Species at risk for the MNRD: Vertebrate Animals.

Scientific Name	English Name	BC List
Anaxyrus boreas	Western Toad	Blue
Contopus cooperi	Olive-sided Flycatcher	Blue
Euphagus carolinus	Rusty Blackbird	Blue
Gulo gulo luscus	Wolverine, luscus subspecies	Blue
Hirundo rustica	Barn Swallow	Blue
Myotis septentrionalis	Northern Myotis	Blue
Oreamnos americanus	Mountain Goat	Blue
Pekania pennant	Fisher	Blue
Rangifer tarandus pop. 15	Caribou (northern mountain population)	Blue
Salvelinus confluentus	Bull Trout	Blue
Setophaga tigrina	Cape May Warbler	Blue
Ursus arctos	Grizzly Bear	Blue

Table 9 Species at risk for the MNRD: Invertebrate Animals.

Scientific Name	English Name	BC List
Acroloxus coloradensis	Rocky Mountain Capshell	Blue
Somatochlora brevicincta	Quebec Emerald	Blue
Somatochlora forcipata	Forcipate Emerald	Blue

Table 10 Species at risk for the MNRD: Vascular and Non-Vascular Plants and Lichens

Scientific Name	English Name	BC List
Amblyodon dealbatus		Blue
Astragalus umbellatus	tundra milk-vetch	Blue
Atrichum tenellum		Red
Botrychium crenulatum	dainty moonwort	Blue
Botrychium simplex var. compositum	least moonwort	Blue
Brachythecium trachypodium		Blue
Bryobrittonia longipes		Blue
Carex lenticularis	lakeshore sedge	Blue
Castilleja miniata var. fulva	tawny paintbrush	Red
Cynodontium glaucescens		Blue
Dicranum majus var. orthophyllum		Red
Didymodon subandreaeoides		Red
Draba cinerea	gray-leaved draba	Blue
Draba lacteal	milky draba	Blue
Drosera linearis	slender-leaf sundew	Red
Encalypta brevicollis		Blue
Encalypta intermedia		Blue
Encalypta longicolla		Blue
Encalypta mutica		Blue
Erigeron uniflorus var. eriocephalus	northern daisy	Blue
Hygrohypnum alpestre		Blue
Hygrohypnum alpinum		Blue
Juncus stygius ssp. americanus	bog rush	Blue
Lescuraea saxicola		Blue
Micranthes nelsoniana var. carlottae	dotted saxifrage	Blue
Nymphaea leibergii	small white waterlily	Red
Orthothecium strictum		Blue
Orthotrichum pallens		Blue
Oxytropis maydelliana	Maydell's locoweed	Blue
Oxytropis nigrescens var. uniflora	one-flower oxytrope	Blue
Papaver alboroseum	pale poppy	Blue
Philonotis yezoana		Blue
Pinus albicaulis	Whitebark pine	Blue
Plagiobryum demissum		Red
Pohlia bulbifera		Blue
Polypodium sibiricum	Siberian polypody	Red
Potentilla nivea var. pentaphylla	five-leaved cinquefoil	Blue
Pseudocalliergon turgescens		Blue
Ranunculus pedatifidus ssp. affinis	birdfoot buttercup	Blue
Rumex arcticus	arctic dock	Blue
Sagina nivalis	snow pearlwort	Blue
Salix raupii	Raup's willow	Red
Schistidium boreale		Blue
Schistidium trichodon		Blue
Seligeria subimmersa		Red
Seligeria tristichoides		Blue
Sphagnum contortum		Blue
Thermopsis rhombifolia	prairie golden bean	Red
Timmia norvegica		Blue
Trichostomum crispulum		Blue
Warnstorfia pseudostraminea		Blue

Specific strategies, including silviculture practices, can be employed to reduce the risks to biodiversity, water, fish, wildlife, and habitat (Manning et. al., 2006). These strategies focus on enhancing special habitat like riparian areas and maintaining landscape level biodiversity elements and ecological values. Managing forest health and salvaging MPB will increase road densities across the landscape, which can cause disproportionate impacts to species at risk. Given the vulnerability of forest-dependent species and large areas of MPB impacted timber, increased emphasis on managing these impacts is warranted.

Grizzly Bear

Grizzly Bears are found throughout the MNRD but their densities vary based on habitat quality, habitat fragmentation/connectivity, and human activity. The Province manages grizzly bears through Grizzly Bear Population Units (GBPU) with boundaries that define nearly discrete populations and as such, focus on maintaining conservation locally. Maximum allowable human-caused grizzly bear mortality (i.e., licensed harvest, conflict kills, and poaching) is managed at the GBPU level and based on population estimates that are derived through field-based studies or models. Regional biologists have prioritized areas for which field-based population estimates should be created or updated; some of these are located within the MNRD (pers. comm., Marshall, 2015[1]). The MNRD contains parts of 7 GBPUs with viable Grizzly bear populations.

Conservation objectives and effective strategies around industrial development are necessary to ensure activities on the land base do not threaten the viability or continuity of grizzly bear populations through either direct effects on bears (i.e., mortality) or indirect effects on bears (i.e., habitat loss/fragmentation).

A habitat capability model was applied to the MNRD, focused on security areas and foraging areas in light of predicted grizzly bear densities (McCann 2012). Areas that would benefit from road density management (e.g., deactivating existing roads, limiting new roads) and silviculture protocols to maintain grizzly bear forage beyond an early seral stage were identified. Areas where road density threshold alone would be sufficient to benefit grizzly bears were also identified (threshold density of <0.6km/km squared of road) Figure 24 and Figure 25 below reflect this habitat capability:

[1] Personal Communication with Shelly Marshall, Wildlife Biologist, Omineca Region, FLNR, in 2015

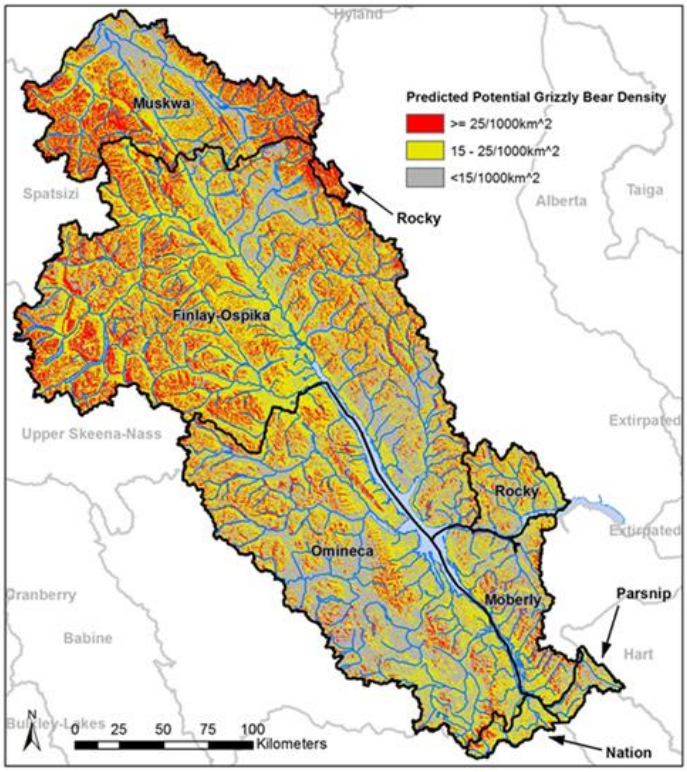


Figure 24 Distribution of grizzly bear habitat capability within GBPUs

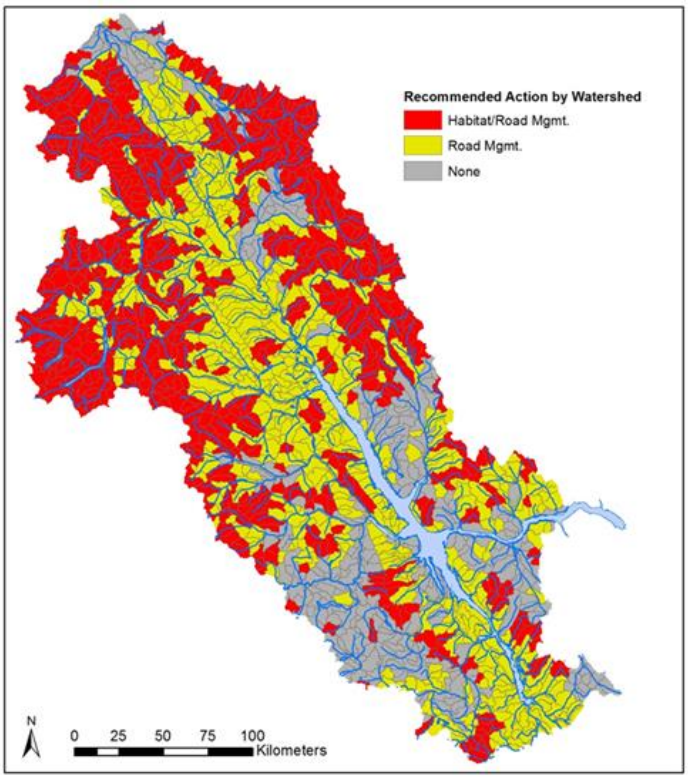


Figure 25 Recommended grizzly habitat and road density management areas

Source: McCann 2012

Bull Trout

Bull Trout are recognized as being the most sensitive BC fish species to landscape level impacts. New road access can have significant impact on previously unexploited populations. FLNR biologists are beginning draft WHA work on several important spawning habitats (specified reaches within the Davis, Graham, Chowika, Point, Scott and Misninchinka) that are key index sites for long term monitoring of bull trout abundance and trends. The proposed WHAs for Bull Trout are based on bull trout redd locations with a 200 metre buffer on either side of the stream segment with the identified important spawning habitat.

Northern Caribou

A previous discussion on Northern Caribou was provided in section 2.5.

Northern caribou are an eco-type of woodland caribou that generally utilize low elevation forests with abundant ground lichens, and/or higher elevation windswept alpine areas and subalpine forests to survive the winter.

These caribou require large areas of relatively undisturbed habitat to enable them to reduce predation by "spacing away" from moose and wolves (Bergerud and Elliot 1986). Predation risk from wolves is a major factor influencing recovery management of northern caribou in BC (McNay et al. 2008). Implementation of legal management tools is a critical component to recovery management of northern mountain caribou. Regional Biologists are currently working on draft UWRs (section0) and draft WHAs (section 7.4) for migration corridors, post-rutt aggregation areas, and calving for the Wolverine, Chase and Finlay/Akie herds. The resulting proposal will be based on the habitat mapping and recommendations provided by Wildlife Infometrics Inc. who used existing habitat modeling, new modelling, and caribou GPS and VHF location data to recommend draft WHA polygons (Brumovsky and McNay 2015). The final proposed WHA polygons will consider prioritization, intersects with existing and proposed FRPA habitat designations to minimize impacts to THLB (i.e., calving polygons have significant overlaps with proposed caribou high elevation ungulate winter ranges).

Mountain Goat

BC supports about half of the world's population of mountain goats; as such, they are a high priority for conservation management. Mountain goats are provincially blue listed. In the MNRD, mountain goats occur primarily in high elevation alpine and subalpine habitats; seldom far from cliffs or steep "escape terrain". Winter range habitat is identified by access to nearby good escape terrain, forage availability and winter sun exposure (McNay et. al., 2006). They will move seasonally to access high value mineral licks.

Regional Biologists have proposed two UWRs for mountain goat. The first identifies winter habitat for mountain goats in the Ospika, Osilinka and Akie-Pesika Landscape Units, where very detailed modelling and habitat information exists (Wright et. al., 2012). A number of known high-value mineral licks and trails were incorporated within this UWR proposal to capture important winter habitat and improve the functionality of the UWR. Mountain goats are particularly sensitive to industrial disturbance so General Wildlife Measures are proposed that will prescribe measures related to timing of operations, access management and forestry-related helicopter disturbance.

Fisher

Fisher are a forest-dependent carnivore of the Mustelidae (weasel) family that are a Species at Risk under the Identified Wildlife Management Strategy, and a Species of Special Concern (blue-listed) by the BC Conservation Data Centre. Although much of BC's landscape historically supported viable fisher populations, the distribution and abundance of the species has declined over the last several decades.

They are vulnerable to changes in vegetation from forestry and over-harvest by trapping (Weir and Corbould, 2008). Several aspects of their ecology make them vulnerable to changes from forestry operation, including their use of structural elements found primarily in late-successional forests (Weir, and Almuedo, 2010).

Fisher are associated primarily with coniferous and mixed forest habitats and regularly forage along forest edges and in riparian areas, small wetlands and meadows, and the thick conifer and shrub patches that regenerate in areas opened up by forest fire, windthrow, and some logging practices. In general, the structural make-up of a forest is more important to fisher than is its age or tree species composition. Important structural features include coarse woody debris, snags, and often multiple layers of overhead vegetation (shrubs, saplings, trees) all of which provide cover for both fisher and their various prey. The species is poorly adapted for travel in deep, soft snow. During winter in BC, fisher may avoid deeper snow areas occupying forests with thick canopies which intercept snow and reduce the amount that reaches the ground, or, in mountainous areas, by using lower-elevation habitats and slopes exposed to sun and wind. Although they commonly hunt for prey in younger or more open habitats, fisher usually rest and den in areas with high structural diversity.

Regional biologists are working on a draft WHAs (section 7.4) for fisher that are based on detailed inventory available from past projects (Weir, 2000) for only a small portion of fisher habitat in the MNRD (Weir, and Corbould, 2008). The draft fisher WHAs are comprised of very small core habitat polygons surrounding maternal dens (i.e., no harvest) and a larger surrounding management zone where harvesting with minor modifications will be permitted as best management practices for fisher. The surrounding management zone polygon is projected to have very little impact on THLB.

7.2 General Fish and Wildlife

There are other species across the MNRD that are not categorized as “species at risk”. Some species may be abundant with a widespread distribution, others less common and tied to discrete rare habitat features, and some we may not have very much inventory information on making their distribution and abundance somewhat unknown. Some may be considered to be “regionally important wildlife” such as moose and Arctic Grayling.

Moose

In addition to their ecological importance, Moose are a regionally important wildlife species to First Nations, recreational hunters, and guide outfitters. Within the Omineca region, moose are widely distributed and generally considered abundant, but some populations are experiencing decline. We assume moose numbers in the northern Omineca (including MNRD) are somewhat stable, but trend data is required to better understand current population status (pers. comm., Klaczek 2015[2]).

The focus on recovery of threatened caribou herds will impact moose management in the Omineca region and MNRD. The objective of caribou recovery is to create or maintain habitat conditions for caribou to be naturally self-sustaining - including low moose and wolf densities. Strategies to maintain low moose densities within and adjacent to northern caribou habitat (core and matrix), include limiting the production of preferred moose browse and, where moose densities are considered to be unnaturally high, population management to reduce moose numbers by increasing opportunities for hunters.

Since 2005, moose densities in the central portion of the region around Prince George have declined by 50 per cent (Cadsand et. al., 2012). Current moose densities in the Omineca remain consistent with

[2] Personal communication with Michael Klaczek, Wildlife Biologist, Omineca Region, FLNRO, in 2015

healthy populations in other parts of North America (pers. comm., Klaczek 2015[2]). Accordingly, there are currently no moose UWRs established within the MNRD. Efforts to update estimates of moose populations and densities within caribou herd ranges are required to better inform management options and decisions. A key management goal is to achieve a landbase where both moose and caribou are present but are spatially segregated at densities where populations are sustainable.

Currently, there are no moose UWRs established within MNRD. Generally, they are a lower priority for establishing habitat designations because of their secure conservation status.

Some prescribed burning plans for ecosystem restoration (section 2.13) are aimed to improve moose habitat; with the caveat that these are in areas outside of threatened caribou range.

Arctic Grayling

Arctic Grayling is found in northern portions of the Omineca Region. The Williston watershed population occurs in the reservoir, along with major rivers that drain into the reservoir. The Arctic Grayling utilizes a wide variety of habitats from large main-stem rivers to small alpine streams, but makes limited use of lakes. The Williston watershed population is at risk due to habitat alterations that stem from dam construction, loss & degradation of key spawning and rearing areas, changes in food supply, alterations of overhead cover, disruption of migration patterns and competition with other species. The fragmentation of previously connected populations has increased the risk of local population extirpation. Increased access via new road systems have led to more angling pressure. Road building and poor culvert installations have created movement barriers and siltation and removal of streamside veg. Recommended management procedures would be to maintain spawning, rearing, and foraging habitat and connectivity throughout its range of occurrence.

Stone's Sheep

Stone's sheep is a subspecies of thinhorn sheep, with half the world's population found in northern BC. The Russel Range supports a significant Stone's sheep population of up to 550 animals. The Finlay-Russel Protected Area was established in 2000, but a large area of Stone's sheep and mountain goat habitat was not included. Stone's sheep winter ranges are treeless, with little or no snow cover and close to escape terrain. Key winter ranges are rare on the landscape, as these animals do not cope well with snow.

Additional proposed UWRs encompass critical Stone's sheep winter range outside of the Finlay-Russel Protected Area as well as prohibiting domestic sheep, goats, llamas, or alpacas within existing or new Range Use permits, due to potential disease risks.

The proposed UWR cover 3,574,352 ha; encompassing 87,186 ha of core high elevation habitat and 3,487,166 hectares of specified area. General Wildlife Measures for the core winter range units include no forest harvesting or road-building. The specified Area is a 30km buffer around core polygons where there can be no use of domestic sheep or goats for vegetation management to prevent spread of disease.

Stone's sheep, like mountain goats, are sensitive to disturbance (Festa-Bianchet and Côté 2008, Walker et al. 2007). Since key winter ranges are rare on the landscape, specified area General Wildlife Measures are proposed adjacent to Stone's sheep winter range units that will prescribe measures related to timing of operations, access management, and forestry-related helicopter disturbance.

7.3 Ungulate Winter Range

UWRs are designated areas that contain habitat necessary to meet the winter requirements of an ungulate species; in this case northern caribou, moose, elk, mountain goat, and Stone's sheep.

Sections 9 and 12 of the Government Actions Regulation of the Forest and Range Practices Act outline the regulatory authority for establishing UWRs. FLNR may legislate "General Wildlife Measures" (management rules) to allow the UWR areas to be managed to maintain the winter habitat conditions needed by these species.

General Wildlife Measures specify what activities are permitted within the UWRs (e.g., "No Primary Forest Activities" to prohibit activities such as timber harvesting or road building). Some General Wildlife Measures may apply to mineral exploration activities if timber cutting or road-building is required. Oil and gas activities that may occur within UWRs are managed separately under the Oil and Gas Activities Act. While General Wildlife Measures can restrict logging, they should not affect First Nation traditional activities such as hunting, trapping, or berry or plant collecting.

There are currently 136,292 hectares of ungulate winter range (UWR) established within the MNRD for Moose, Elk, Mountain Goat, Stone's Sheep, Northern Caribou, and one unit managed for three ungulates: Moose, Elk, and Mountain Goat (Figure 26). These established UWRs can also be viewed on the MNRD ISS web map service at http://services.forsite.ca/mackenzie_TSA/.

A substantial number of proposed UWRs are being developed to protect winter habitat for Northern Caribou, Stone's Sheep, and Mountain Goat.

Source: Proposed UWR Multispecies package for the Mackenzie and Fort St. James Resource Districts (July 2013)

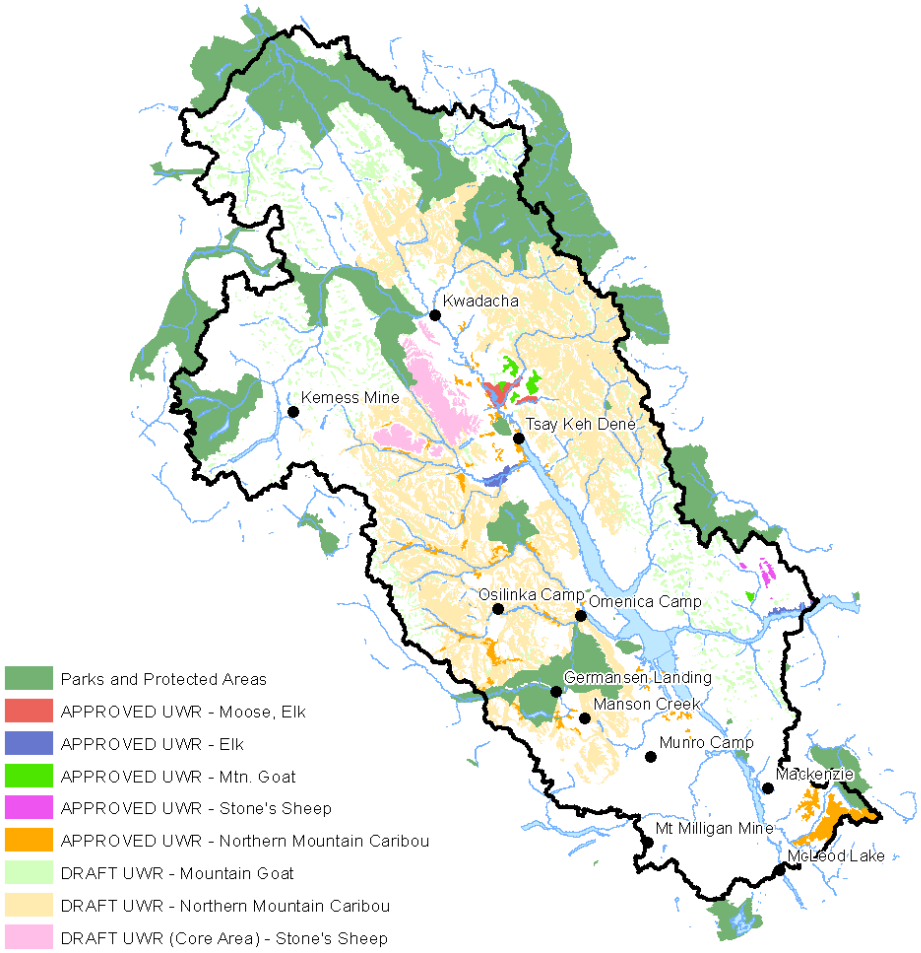


Figure 26 Approved and draft ungulate winter ranges

7.4 Wildlife Habitat Areas

While there currently are a few WHAs established for northern caribou, more WHAs are proposed for caribou, fisher, and bull trout (Figure 27), as discussed in section 7.1.

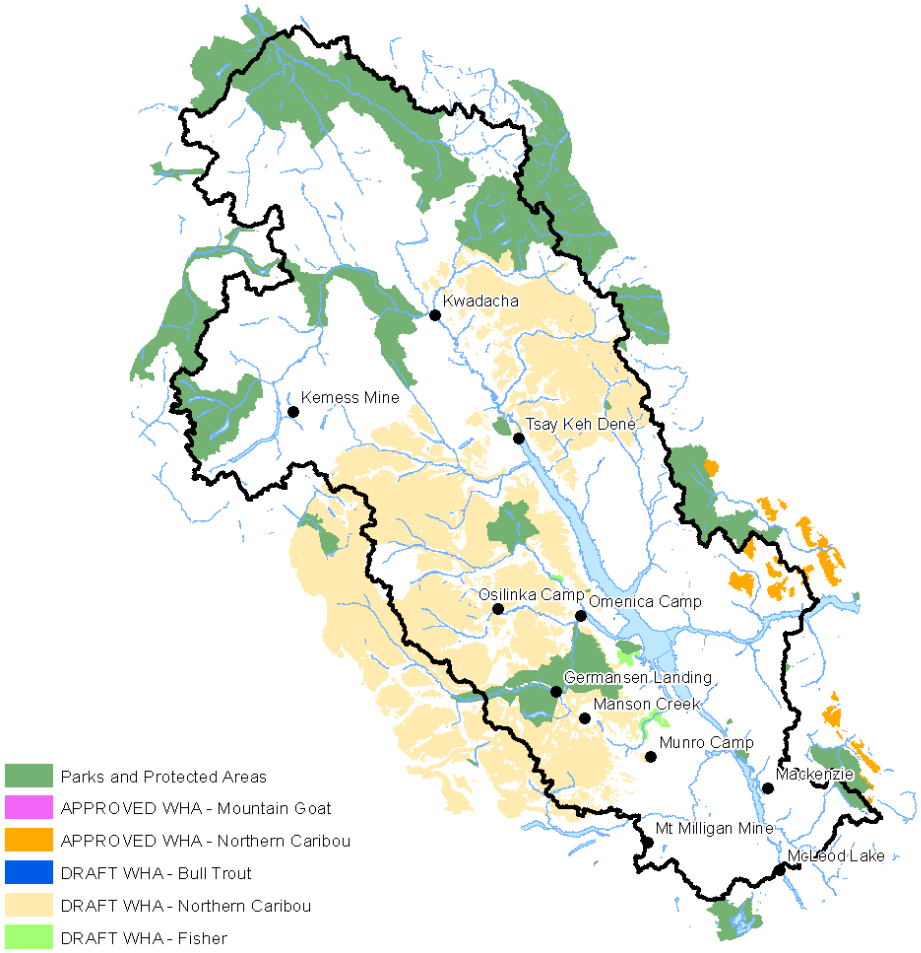


Figure 27 Approved and draft wildlife habitat areas

8 Biodiversity

Increasing AACs to facilitate salvaging value from the dead pine trees across the province has led to concerns about the stewardship of non-timber values such as wildlife and biodiversity. To accommodate these concerns, the "timber uplift" (AAC increase) was to be accompanied by a "conservation uplift" (an increase in retention of mature forest structure in harvested areas).

To help achieve the conservation uplift, the chief forester provided forest professionals with non-legally binding "Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations." This explains the chief forester's view of how the conservation uplift could be applied. At the landscape-level, the guidance was "that collaborative, multi-stakeholder, long-term landscape-level planning is the best option for managing increased retention." At the stand-level, the guidance was that retention of mature forest structure should increase as the size of harvested patches increased.

The Forest Practices Board found that, while some efforts were made to provide the necessary information, no landscape-level planning was done within the study area. Despite this, the board concluded that on average, retention levels increased after the guidance was issued and retention levels were higher in larger cutblocks.

Source: Forest Practices Board. 2009. Biodiversity Conservation during Salvage Logging in the Central Interior of BC

8.1 Stand-Level Retention

Obviously, MPB impacts are not limited to areas available for timber harvest. Lands reserved to protect sensitive species, riparian areas, wildlife tree patches, and old growth management areas are also affected directly (e.g., increased mortality of pine, roads) or indirectly (e.g., water quality/quantity and equivalent clear cut area). A higher risk of loss to species diversity occurs within landscape units with low biodiversity emphasis (with reduced reserve areas) and species sensitive to changes in pine forest. Stand-level reserves designed to protect species or features will also be at higher risk where salvaging of MPB-attack stands is occurs.

As shown in the MRVA (section 2.10), stand level biodiversity improved over the last studied period of 2005-2012. Harvesting the AAC uplift for MPB-killed pine salvage will challenge this improving trend. Within the MRVA report the MNRD Manager, David Schwarz, addressed this challenge:

> *"Sustainable forest management relies on a dynamic process based on continued learning and improvement. It aims to ensure forests maintain their biodiversity, productivity and regenerating capacity; while providing beneficial ecological, social and economic conditions now and for future generations.*
>
> *In the past 10 years a large percentage of the lodgepole pine in the district has been killed by the Mountain Pine Beetle. Economic conditions have recently improved creating an increased demand for wood fibre. With this increased demand attention needs to be placed on forest and range practices and the values that are key to maintaining good forest stewardship at both the stand level and landscape level. Forest Stewardship Plans do state they will meet or exceed the key objectives of government in the Forest and Ranges Practices Act. The district expectations are that licensees will review the findings in this report and adjust practices to improve future results."*

Specifically regarding stand-level retention for maintaining biodiversity, he went on to state:

> *"Stand-level retention on the landscape is in an increasing trend compared to the Forest Practices Code era. The amount of retention and the retention quality has increased quite significantly. I want*

to see this trend maintained and continue to leave at least low levels of retention on every cutblock. Leaving higher densities of large snags, large coarse woody debris, and big diameter trees with the full spectrum of species will help contribute to the maintenance of this value."

Forest licensees typically target minimum levels for stand-level retention as required under the Forest and Range Practices Act's (FRPA), Forest Planning and Practices Regulation (FPPR), as demonstrated in the following excerpt from BC Timber Sale's current Forest Stewardship Plan (FSP):

5.1.2.5 Objectives Set by Government for Wildlife and Biodiversity – Stand Level

5.1.2.5.1 all FDUs – Stand Level Biodiversity	
Applicable FDUs	All FDUs
Legal Reference	FPPR Section 9.1 and Section 12.5(1).
Definitions	None.
Result and Strategy	The following results or strategies apply to the holder of this FSP and to each agreement holder. 1. Ensure that the total area covered by wildlife tree retention areas relating to one or more cutblocks where harvesting is concluded between April 1st and March 31st of any fiscal year, is a minimum of 7% of the total area of the cutblocks; 2. Ensure that at the conclusion of harvesting in a cutblock that is greater than 15 hectares in size, the total amount of wildlife tree retention areas that relate to the cutblock is a minimum of 3.5% of the area of the cutblock; 3. Ensure that for the purposes of (1) and (2) above, a wildlife tree retention area may relate to more than one cutblock if all of the cutblocks that relate to the wildlife tree retention area collectively meet the applicable requirements of this section; and

Source: BC Timber Sales, Forest Stewardship Plan, December 5, 2010 – December 4, 2015

In addition to wildlife tree retention, riparian areas contribute to maintaining stand-level biodiversity. In the last TSR, these areas were combined for a total of 4.7% of area harvested.

8.2 Landscape-level Retention

This section refers to general biodiversity and habitat management provisions not dealt with through other processes such as parks, ecological reserves, UWRs, and WHAs. Within the MNRD, landscape-level retention has been addressed through three separate orders:

8.2.1 Order to Establish the Obo River and Fox Landscape Units and Objectives

This legal order (2002) established the first patch size distribution targets for two landscape units within the MNRD: the Obo and Fox landscape units north of Kwadacha. They specify patch size distribution per natural disturbance type, old seral retention levels including requirements for old and mature combined, and wildlife tree retention targets, as well as, a specific lakeshore retention area related to lake trout around Weissener Lake.

Source: Ministry of Sustainable Resource Management, October 24, 2002.

8.2.2 Non-spatial Landscape Biodiversity Objectives

This legal order (2009) established aspatial old growth retention levels for all of the landscape units, as well as specifying minimum levels of old interior forest within the total retained old forest retention. This order defines old forest as:

- forests within the SBMmk1 and 2 biogeoclimatic variants greater than 120 yrs old;
- birch or aspen leading stands within the BWBC BEC zone greater than 100 yrs old;
- conifer leading stands within the BWBS BEC zone greater than 140 yrs old; and
- forest stands in all other BEC variants greater than 140 yrs old.

The order further specifies that old forest can be either "live old forest" or "natural forest area", which can be MPB impacted units that have not been harvested (could be live, dying or dead, or young natural forest) etc. The order also has an old interior forest retention requirement, which requires 25% of the retained old forest to be interior – 100m from an edge.

This order establishes an 'old seral' accounting system that forest licensees use to ensure that the required level of old forest, as well as interior forest conditions within those areas, is maintained.

An amendment to the order in 2010 updated the landscape unit map and changed old forest retention requirements by landscape unit.

Source: Ministry of Agriculture and Land, Ministerial Order, April 8, 2009; Amendment Order September 23, 2010.

8.2.3 Spatial Landscape Biodiversity Objectives

Spatial Old Growth Management Areas (OGMAs) have been delineated in the southern portion of the MNRD, south of the Omineca and Peace arms of the Williston Reservoir. They legally established OGMAs in 13 of the 73 landscape units: Connaghan Creek, Eklund, Gaffney, Gillis, Jackfish, Kennedy, Klawli, Manson River, Misinchinka, Parsnip, South Germansen - Upper Manson, Tudyah B, and Twenty Mile.

Old seral requirements for all other landscape units are addressed through non-spatial objectives (section 8.2.2).

Source: Ministry of Agriculture and Lands Ministerial Order, September 23, 2010

8.3 Landscape Connectivity

In some areas, stand structures that serve to connect habitats across a landscape have been adversely affected by: salvaging dead pine from mixed stands, extensive clearcuts in pine-dominated watersheds, limited retention, and large scale fires. The loss of landscape connectivity can cause disproportionate impacts to species at risk confined to isolated pockets of suitable habitat. Existing connectivity has been provided as an outcome of various mechanisms, including strategies that prescribe retention for specific resource management zones, OGMAs, old-plus-mature forest representation levels, and provisions for riparian management.

Monitoring the impact to stand structure in these areas may be needed to ensure they provide required stand structure over time. Prescribing foresters can help enhance connectivity by increasing retention levels in large cutblocks and focusing retention strategies in riparian areas, gullies, and other connectivity corridors.

8.4 Management for Coarse Woody Debris

At a stand level, coarse woody debris is managed through provisions in forest stewardship plans that consider the Chief Forester's guidance and other stewardship principles. While MPB-impacted stands will certainly enhance the supply of coarse woody debris in the short- and medium-terms, activities such as salvage, road building, safety-hazard abatement for roads, replanting and stand tending, can significantly reduce the supply of coarse woody debris over time. Coarse woody debris is also vulnerable to intensive fires promoted by large supplies of MPB-killed pine. Strategies to retain coarse woody debris through time should be considered in developing silviculture strategies.

9 Climate Change Adaptation

The rate of change in climate over the last 100 years is equivalent to the rate of change of the preceding 1000 years. Rapid change in climate is an overarching pressure on the forests affecting both timber and environmental values (see table below for predicted change by 2050).

Table 11 Summary of Climate Change for Omineca in the 2050s

Summary of Climate Change for Omineca in the 2050s

Climate Variable	Season	Projected Change from 1961-1990 Baseline	
		Ensemble Median	Range (10th to 90th percentile)
Mean Temperature (°C)	Annual	+1.8 °C	+1.3 °C to +2.7 °C
Precipitation (%)	Annual	+8%	+2% to +15%
	Summer	+1%	-8% to +9%
	Winter	+9%	-2% to +18%
Snowfall* (%)	Winter	+2%	-7% to +10%
	Spring	-54%	-71% to -10%
Growing Degree Days* (degree days)	Annual	+223 degree days	+136 to +379 degree days
Heating Degree Days* (degree days)	Annual	-642 degree days	-975 to -459 degree days
Frost-Free Days* (days)	Annual	+19 days	+11 to +30 days

Projected changes in average (mean) temperature, precipitation and several derived climate variables from the baseline historical period (1961-1990) to the 2050s for the Omineca region. The ensemble median is a mid-point value, chosen from a PCIC standard set of Global Climate Model (GCM) projections. The range values represent the lowest and highest results within the set.

Source: Pacific Climate Impacts Consortium, 2012. Plan2Adapt, http://www.plan2adapt.ca/tools/planners?pr=47&ts=8&toy=16

Through the Omineca Climate Action Plan, work is well underway in considering climate change in concert with the development of management plans and strategies. Examples of changes to specific practices include:

- Range expansion and planting of western larch and Douglas-fir.
- Expanding wildlife habitat areas for Bull Trout.
- Trials of white pine and ponderosa pine on drier sites.
- Increasing planting density, sites with higher disease risk.
- Implementing forest health stocking standards, rust stocking standards, increasing minimum free to grow heights.
- Increased streamside retention on temperature sensitive streams.
- First Nations tenures awarded as carbon trusts/credits.
- Building road structures to be more resilient.

This ISS project aims to consider the effects of climate change in develop clear objectives and strategies for appropriate tree species to be planted at the landscape and forest level.

10 Other Development

10.1 Mines

Three mines are currently active within the MNRD: the Mt. Milligan mine (copper/gold) in the extreme southwest corner, the Aley Creek mine (niobium) just east of the Ospika River and the Kemess East underground mine (copper/gold) in the northwest. The Kemess South open pit mine closed several years ago. All of these mines are located in remote, mountainous areas and pose very little potential to conflict with forest resource management.

10.2 Oil and gas development

The Rocky Mountain Trench, which runs through the middle of the district and includes the mountains to either side of the trench, positions the MNRD between - but not within - the main sedimentary deposits where hydrocarbon deposits are found (Figure 28). There is potential for oil and gas development but no extraction activities are currently underway.

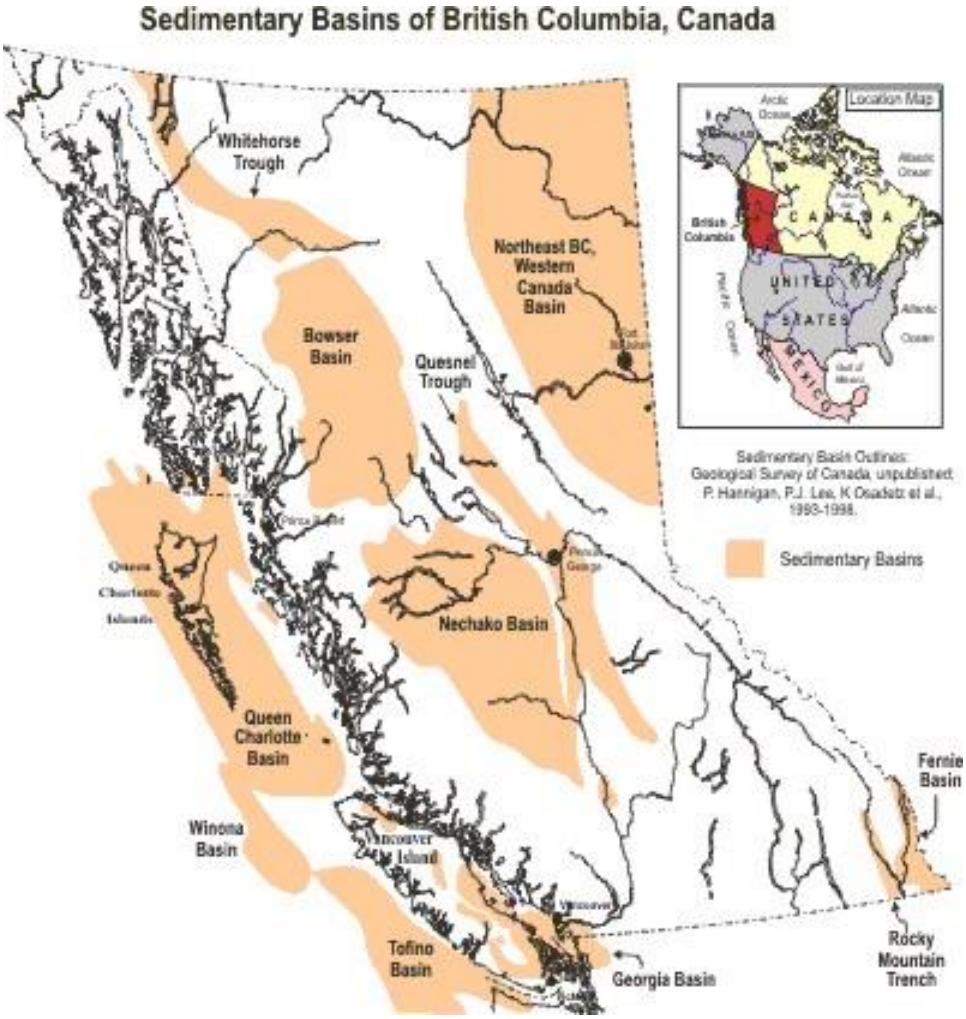


Figure 28 Sedimentary Basins of British Columbia

10.3 Pipelines

One liquid natural gas pipeline currently passes through the MNRD; just south of the town of Mackenzie. Planning is underway for two proposed pipeline corridors crossing the MNRD from east to west just north of the town of Mackenzie, across the Williston Reservoir on to Prince Rupert.

10.4 Hydro-Electric Power

Williston Reservoir lies within the Rocky Mountain Trench along the central portion of the TSA. This hydro power reservoir was created by the W.A.C Bennett Dam on the Peace River. It is approximately 360 kilometres long and is the largest fresh water body in the province.

Hydro transmission corridors currently extend north from Kennedy to the town of Mackenzie and another running northwest along the west side of the Williston Reservoir to the Kemess mine.

Over 185,000 hectares is currently under application as a licence of occupation for investigating and monitoring of waterpower projects along the northwest shore of the Williston Reservoir at Finlay River.

10.5 Wind Power

There are 8 wind power licence and permit areas within the MNRD , totalling about 31,000 hectares, that are in the investigative and monitoring phase. Another 4 areas totalling 4,750 hectares are currently under application. As expected, most of these areas are on mountaintops and along ridges. While their development poses little potential conflict with timber interests, studies are ongoing to ascertain their potential impact on various wildlife and their habitats. Several of the larger investigative wind power sites are within proposed UWR for caribou.

11 Other Key Values and Issues

11.1 Watershed Health

Large scale MPB infestations will affect watershed hydrological processes such as canopy interception, transpiration, soil moisture storage, groundwater levels and recharge, snowfall, snow melt, rain-on-snow effects, runoff and peak flow timing and duration, flood events, stream and stream bank stability, erosion, and sedimentation. Changes in these hydrologic factors can increase the risk on a number of watershed values including aquatic ecosystems, species, and supply of domestic water use. In some cases the potential for hydrologic changes may be, to some degree, estimated by equivalent clear cut areas within specific drainages.

The accelerated rate of harvesting and associated road development poses an increased risk to water quality, as does the increased amount of road that will be active throughout the salvage period. As described in section 11.4, the requirement to by-pass live stands of trees to salvage dead pine will result in more roads developed and actively maintained per m^3 of harvest during this period. Significant increases in road density and numbers of stream crossings can increase peak flows, sedimentation, and changes in channel morphology. This can be reduced by accelerating hydrological green-up with an emphasis on maintaining vegetation within riparian ecosystems. This is especially important along fish-bearing streams and wetlands, as well as, within fishery-sensitive watersheds and community watersheds. Landscape level effects of MPB salvage harvest within watersheds that contain bull trout is a management concern.

The MRVA completed in 2014 (section 2.10) assessed: a) water quality as affected by road construction and ongoing maintenance, and b) well riparian management as affected by forest harvesting activities, including blowdown. Together these assessments provide an indication of how well watersheds are faring today compared to past practices and also provide an excellent baseline for comparing ongoing and future operations and the impacts of the accelerated salvage harvesting.

Approximately 1,300 assessment watersheds are identified within the MNRD.

11.1.1 Community Watersheds

While there are no designated Community Watersheds within the MNRD, three community watersheds are identified as reserve notations. The community watershed for the town of Mackenzie is listed as a Section 16 map reserve. This watershed is directly to the east of the town of Mackenzie and includes Morfee Lakes and the watershed above it. The town has an intake, or registered point of diversion, on the lake to supply the town.

The Communities of Germansen Landing and Fort Ware have small map notations for the purposes of watershed reserves adjacent to their towns.

11.1.2 Fisheries Sensitive Watersheds

There are no fisheries sensitive watersheds (FSW) established within the MNRD but ten draft FSWs totally over 830,595 hectares are currently being developed (Figure 29). Default draft objectives that might accompany each FSW include:

1. maintain an equivalent clearcut area (ECA) less than 20%,
2. maintain long term large woody debris (LWD) recruitment to the stream channel by only impacting the riparian area for the purpose of a stream crossing,

3. manage fine sediment production at all active road crossings on fish streams, and direct tributaries to fish streams, such that sediment production is kept below a moderate rating,
4. maintain fish habitat and fish movement throughout the fisheries sensitive watershed by ensuring that active roads crossing fish streams will be constructed, replaced, and deactivated so that they preserve or replicate, throughout the stream channel at the crossing:
    a. the pre-crossing stream channel width, and
    b. the natural roughness of the stream channel bed,
5. Permitted access structures must:
    a. minimize road densities on unstable terrain directly connected to fish-bearing streams and their non-fish-bearing tributaries such that they achieve ≤ low risk rating, and
    b. maintain natural water drainage patterns, and
6. ensure industrial management or primary forest activities in gentle-over-steep terrain that have connectivity or coupling to fish streams do not cause landslides or other mass wasting events.

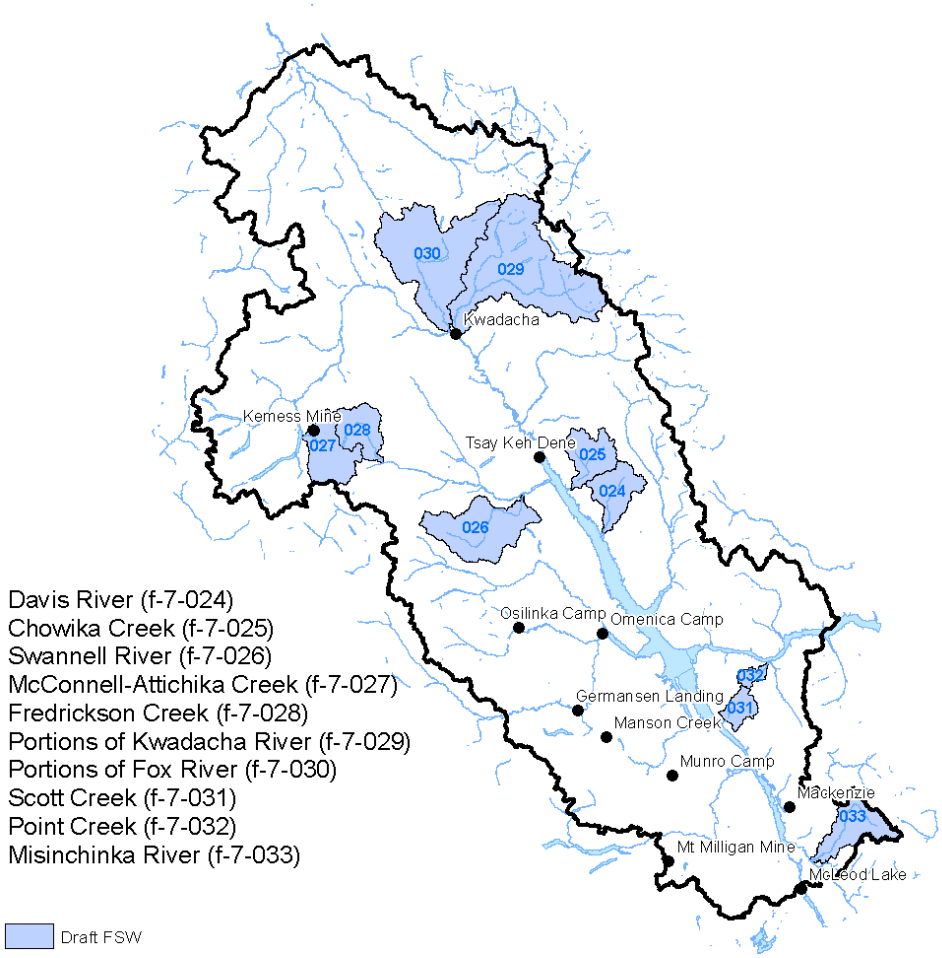


Figure 29 Draft Fisheries Sensitive Watersheds

11.1.3 Fish Passage

Past road construction and associated stream crossings (culverts) have caused barriers to fish passage. The need to replace these structures to restore fish passage is often complicated by issues of current responsibility or tenure of the associated road.

Through funding provided by BC Hydro and FLNR, SERNbc recently implemented a fish passage planning project focused on restoration planning within the Williston Reservoir watershed (i.e., areas draining into Williston Reservoir). This planning process identified a number of key priority watersheds or basins within the overall Williston study area:

- Watersheds - Ingenika River, Nation River, Finlay River, Parsnip River, Omineca River, Mesilinka River, and Osilinka River.
- Basins – Tenakihi, Munro, and Swannell.

The priorities were based on the number of crossings, potential habitat gain, presence of Bull Trout, and priority for local First Nations.

11.2 Visual Quality Objectives

Scenic areas and visual quality objectives have been legally established or grand-parented under the FRPA, and in accordance with the FPPR 9.2 to set default VQOs for known scenic areas. Of the 562 visual polygons identified, 345 were classed as modification and 217 as partial retention. Figure 30 shows the location of these designations.

Only 4.6% of the revised THLB is located within visual polygons and 61% of that area is “modification” the remaining being “partial retention”. While it is possible that a small fraction of the visual polygons may have been artificially constrained, the estimated impact of this is less than 1%.

Source: Mackenzie Timber Supply Review Technical Record June 11, 2014.

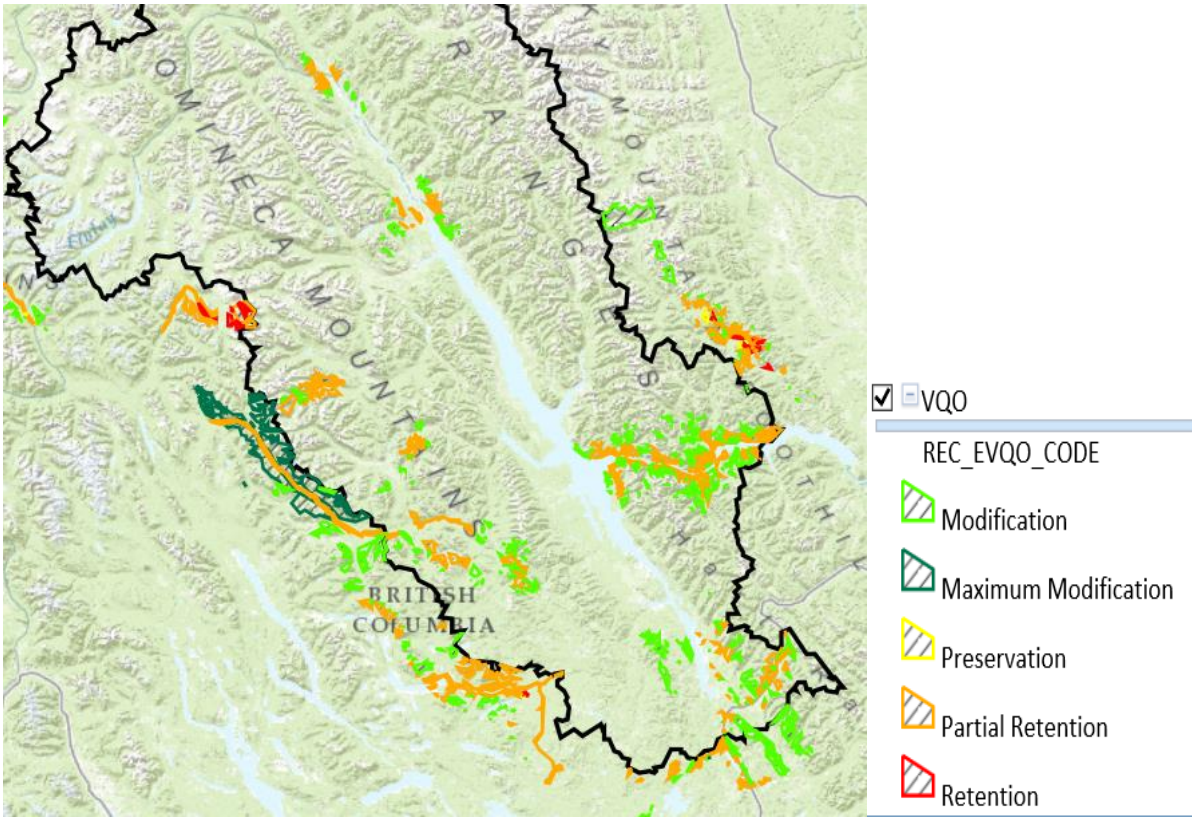


Figure 30 Visual quality objectives

11.3 Recreation Areas

There are many recreation areas of various sizes designated within the MNRD. They are best viewed on the project website: http://services.forsite.ca/mackenzie_TSA/. Recreation sites and trails are managed within the context of integrated resource management and are typically included within the THLB but some sites and trails may be more sensitive to harvesting and development.

11.4 Guide Outfitters and Trappers

In BC, all non-residents are required to be accompanied by a licenced guide while hunting big game (i.e., deer, mountain sheep, mountain goat, moose, caribou, elk, cougar, wolf, grizzly bear, black bear, lynx, bobcat, and wolverine). There are 30 guide-outfitter certificates designated within the MNRD (Figure 31) held by 28 individuals.

In 1926, to protect species from over harvesting, the Province was divided into registered trapline areas sold to a trapper so that he/she is the only person with the right to trap furbearing animals inside this area. There are 98 trapline licenses distributed throughout the MNRD (Figure 31).

Both trappers and guide outfitters rely on the maintenance of wilderness, wildlife and fisheries values and concerns has been expressed that salvage operations within areas that were previously untouched may adversely impact wildlife populations and, in the case of guide outfitters, their clients' experience.

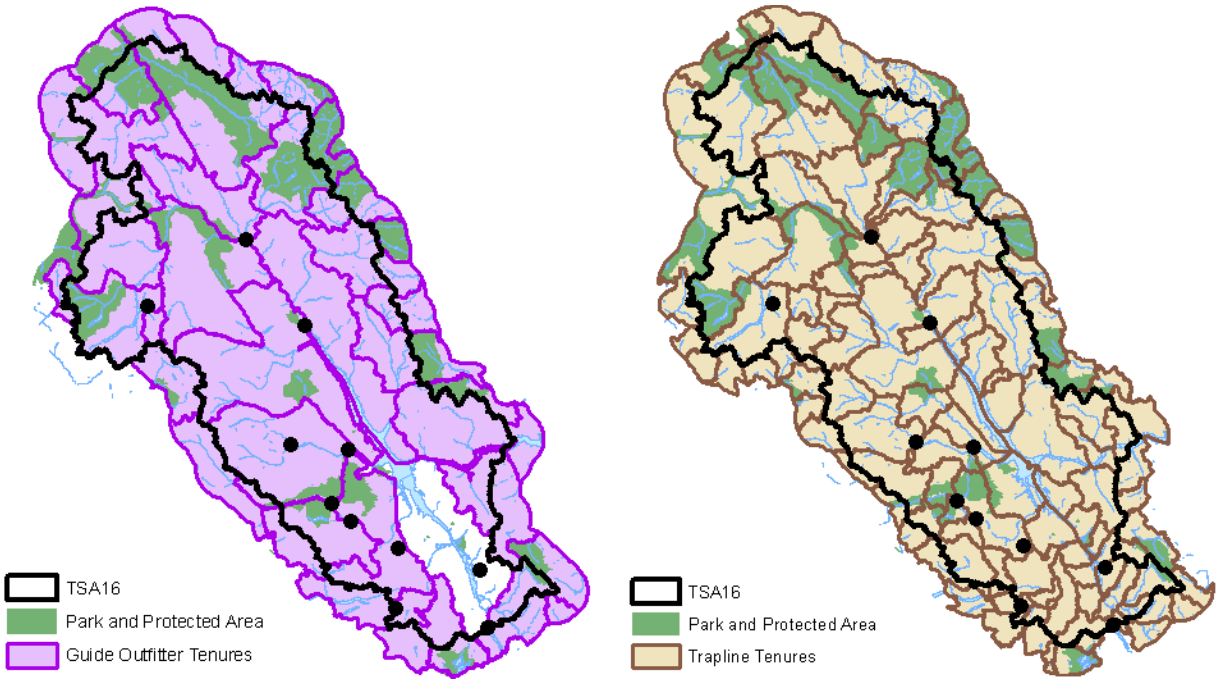


Figure 31 Guide outfitter and trapline licenses

11.5 Road Density and Access Issues

Road density throughout the forest landbase will increase at a faster rate with the AAC uplift to salvage dead pine. This can have negative effects on fish and wildlife populations, biodiversity, watershed health, and guide outfitters.

As an example, roads have a negative effect on Grizzly bear habitat use when they reach a density of about 0.6 km/km². This effect is amplified when road density increases over 1.0 km/km². New or improved roads typically bring people into contact with Grizzly bears more frequently which is sometimes lethal for bears.

Source: MoE. Environmental Reporting BC Grizzly Bear Populations Status in BC (2012)

Increased access to the far reaches of the MNRD allows more recreational and hunting in those areas, and of particular concern is the increase in area accessible to snowmobiles and quads. These vehicles are potentially disturbing to wildlife in their critical winter habitat. Increases in hunting access may bring higher pressures on specific game populations and impact the unique opportunities offered by licenses guide outfitters.

11.6 Herbicide Use

The increased harvest of the MPB-killed stands will likely lead to an increased reliance on herbicide applications to ensure regenerating stands with excessive brush competition reach a free-growing status in timely fashion. The most common pesticides - glyphosate and triclopyr - are applied to reduce the competition of aspen, birch and cottonwood. Licensees utilize herbicides in accordance with a registered Integrated Pest Management Plan (IPMP) which is required by the Integrated Pest Management Act.

Despite their proper and appropriate use, there is public concern that this silviculture treatment could impact habitat/food species and biodiversity values where non-target species are affected by overspray. Riparian areas and grassland/forest interface are also areas of particular concern.

Concern has also been expressed regarding the reduction of aspen and birch stands, fast growing species that might contribute towards mitigating the mid-term timber supply fall down.

11.7 Deciduous Utilization

While the MNRD includes a considerable deciduous component, it has yet to be utilized to any extent. Market values are slowly beginning to increase with more products available:

- Oriented Strand Board (OSB) sheets are now a widely used building material in North America.
- Birch lumber and veneers are known internationally, clear birch is particularly valued in Japan.
- Aspen is now used by a number of pulp mills for making kraft paper.
- Poplar is used in many Asian plywoods as core stock.

In Alberta, several pulp mills are utilizing aspen fibre, including the Peace River Division of Diashowa Marubeni International Ltd. (http://www.dmi.ca/products/prpd/prpd.html) describes:

> *"In today's challenging markets and ever increasing energy costs DMI Aspen hardwood pulp is a practical choice for most paper grades because it is readily refined with minimal energy to produce the desired sheet properties, namely excellent formation, smoothness, strength and a low porosity that is excellent for coating holdout."*

From a timber supply and silvicultural perspective there are some advantages to utilizing the deciduous resource:

1. it regenerates easily from roots,
2. it grows quickly,
3. brushing to eliminate it would not be required,
4. mixed stands with spruce underneath the deciduous may lessen the incidence of spruce terminal weevil (*Pissodes strobi*), and
5. a large amount exists within current and ongoing development areas and just needs to be added to the existing harvest.

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