Lakes Resiliency Project

DRAFT Current Condition Assessment

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forest ecosystem solutions ltd.

Prepared for:

BC Ministry of Forests
Forest Science, Planning and Practices Branch
PO Box 9513 Stn Prov Govt
Victoria, BC V8W 9C2

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Acknowledgements

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Name and Affiliation	Sections in the Report
Steffy Howard-Stratton, RPF, Land and Resource Specialist, MOF	Lakes District Land and Resource Management Plan (LRMP) (Section 3.2)
	Lakes South and Lakes North Sustainable Resource Management Plans (SRMP) (Section 3.3)
	Forest Health Strategy (Section 3.8)
	Forest and Range Evaluation Program (FREP) (Section 3.10)
	Young Stand Monitoring (YSM) (Section 3.10.1)
	Forest Restoration Plans (Section 3.11)
	Resource Values in the Project Area (Section 7)
Barry Snowdon, RPF, Silviculture planning and strategic planning officer, MOF	Young Stand Monitoring (YSM) (Section 3.10.1)
Bradley Martin, Senior Wildfire Officer prevention, BCWS	Wildfire (Section 4)
Vanessa Foord, P. Ag., Research climatologist, MOF	Climate change (Section 5)
Colin Mahoney, RPF, Research climatologist, MOF	Climate Change (Section 5)
Carolyn King, Land and Resource Specialist, LWRS	SSAF ESI indicators (Section 7.3)
Chris Schell, Skeena ecosystems section head, LWRS	Habitat, wildlife (Section 7.9)
Alex Woods, RPF, Regional pathologist, MOF	Stand development monitoring (Section 3.10.2)
Jesse Fraser, Land and resource coordinator, LWRS	Data, data links, deciphering data dictionaries

The principal authors would also like to acknowledge the contribution of the following individuals in providing comments and feedback throughout the writing of this document:

Name and Affiliation
Barry Snowdon, RPF, Silviculture planning and strategic planning officer
MOF, Steffy Howard-Stratton, RPF, Land and Resource Specialist, MOF
Bradley Martin, Senior Wildfire Officer prevention, BCWS
Lee-Ann Puhallo, RPF, Intensive silviculture specialist, MOF
Alex Woods, RPF, Regional pathologist, MOF
Agathe Bernard, RPF, Timber supply review forester, MOF
Craig Wickland, RPF, Stand management team lead and data custodian, MOF
Vanessa Foord, P. Ag., Research climatologist, MOF
Colin Mahoney, RPF, Research climatologist, MOF
Carolyn King, Land and Resource Specialist, LWRS
Dawn Stronstad, RPF (retired), Stewardship forester, MOF
Shannon Irvine, RPF, Operations specialist, BCWS
Pat Bryant, RPF, Forsite Consulting
Leslie Moore, Stewardship specialist, MOF (retired)
Leanne Elliott, Land and resource specialist, MOF
Lisa Nordin, Aquatics Resources Stewardship Evaluation Officer, Cumulative Effects
Chris Schell, Skeena ecosystems section head, LWRS
Jesse Fraser, Land and resource coordinator, LWRS
Laura Bolster, RPF, land and resource specialist, LWRS

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Executive Summary

Introduction

The Lakes Resiliency Project (LRP) consists of two project phases. The first phase investigates the objectives set out in the Lakes North and South Sustainable Resource Management Plans (SRMP) against the current condition of specified natural resource values and assesses whether the SRMPs should be amended and/or additional SRMP objectives incorporated into the plans. The geographic scope of this phase is the Lakes Timber Supply Area (TSA) and the Community Forest Agreements (CFA) and First Nation Woodland Licenses (FNWL) that reside within the gross boundary of the TSA.

The second phase of the project is a Forest Landscape Plan (FLP) pilot. The FLP will identify strategies that are expected to balance the natural resource values for improved ecosystem resilience within the TSA. The FLP will direct the development of forest licensees' Forest Operation Plans (FOPs) that will replace the current non-spatial Forest Stewardship Plans (FSPs). While this phase of the project is limited to volume - based tenures within the TSA it may inform the management of the large area-based tenures.

The Current Condition Report identifies the current management direction and expectations in the project area, based on legislation, policies, current management practises and natural disturbance. Furthermore, the report presents a set of resource values for the area, and reports on their current condition.

This document provides an abbreviated summary of the Current Condition Report. The reader is advised to consult the Current Condition Report for all scientific references.

Project Area

The project area is in north-western BC. It consists of the Lakes TSA and various area-based tenures, such as First Nations Woodland Licenses (FNWL) and Community Forest Agreements (CFA). The project area is part of the FLNRORD Skeena Region and is administered by the FLNRORD Nadina Natural Resource District in Burns Lake, the largest community in the area with a population of approximately 2,000. The balance of the population (approximately 6,000) can be found in many smaller communities, including Decker Lake, Danskin, and Grassy Plains.

The Lakes TSA is 1,577,450 ha in size, of which 1,039,665 ha is within the LRP study area. The rest of the land base is within Provincial parks, such as Tweedsmuir Provincial Park. Approximately 870,000 ha (84%) of the study area is forested.

The following First Nations have traditional territories within the project area: Wet'suwet'en First Nation, Lake Babine Nation, Ts'il Kaz Koh First Nation, Skin Tyee Nation, Nee Tahi Buhn Indian Band, Cheslatta Carrier Nation, Takla Lake First Nation, Stellat'en First Nation, Nadleh Whut'en Band, Yekooche First Nation, Tl'azt'en First Nation, the Ulkatcho First Nation, Binche Whut'en, and the Office of the Wet'suwet'en.

Climate Change

An examination of Environment and Climate Change Canada (ECCC) weather stations within the Lakes TSA show that climate change is occurring in the Lakes TSA. There are currently significant declines in winter precipitation as well as significant increases in summer and winter minimum temperatures.

Global climate models project that the average summer warming will continue. The models also project an increase in precipitation in most seasons. However, annual precipitation is predicted to vary significantly. This suggests that the primary driver for long-term trends in hydrology and drought is temperature rather than precipitation.

Forest disturbance

Within the last 20 to 30 years the predominantly mature and old forests in the Lakes TSA have transformed to forests dominated by young stands (Figure 1). Natural disturbance (mountain pine beetle and wildfire) and related timber salvage activities have been the main cause of this rapid transition.

Mountain Pine Beetle (MPB)

The mountain pine beetle (MPB) infestation which started at the turn of the century can be related to decreasing extreme cold temperatures. According to the observed data, the MPB peak occurred in 2005 in the Lakes TSA and 54 million m^3 of pine was killed by 2014. This represents approximately 76% of the pine volume in the TSA in 1999.

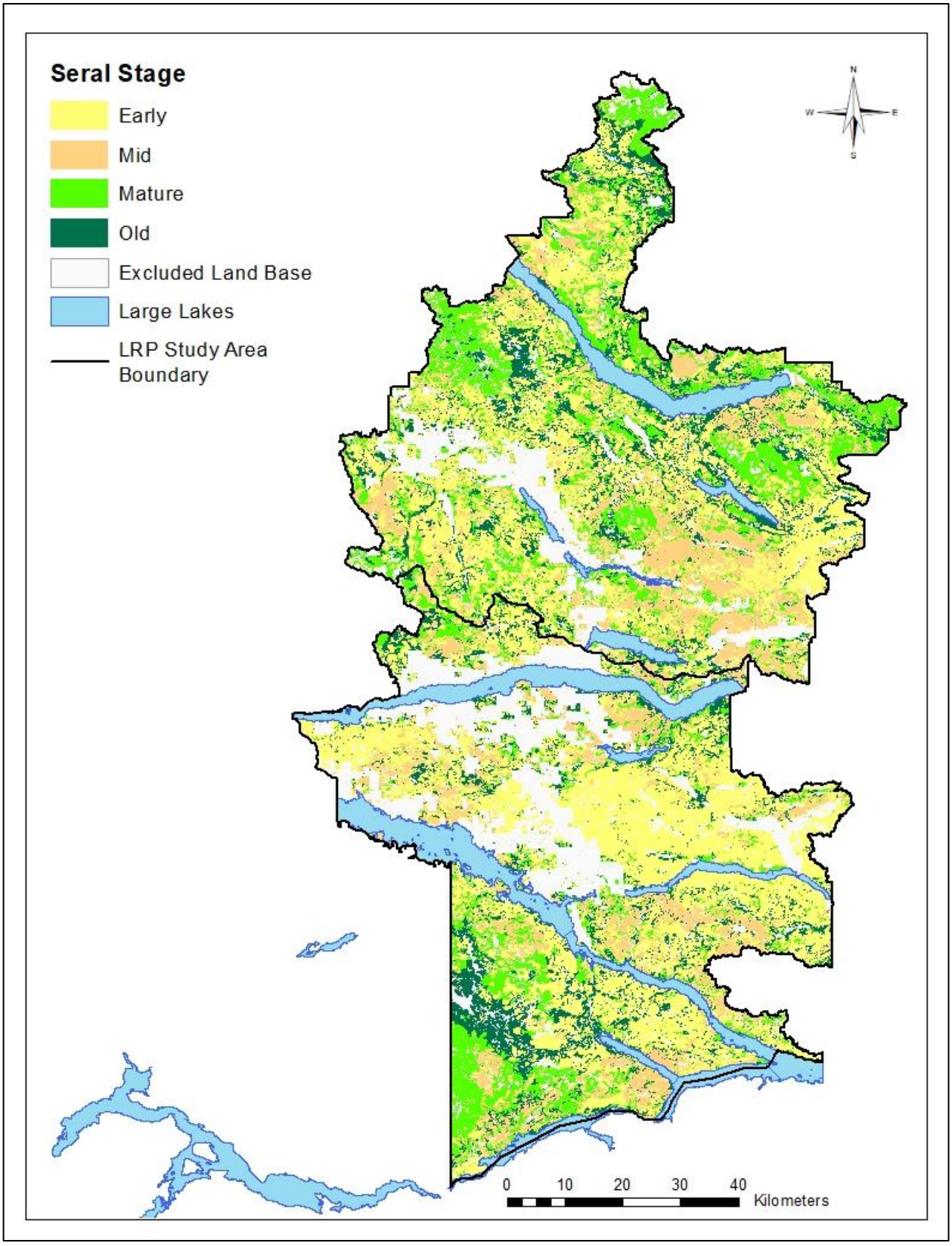

Figure 1: Seral stages in the Lakes project area

Wildfire

The ecosystems in the Lakes TSA are mostly natural disturbance type (NDT) 3 ecosystems. Stand initiating wildfires are common and historically they have occurred frequently and varied in size from small fires to large ones sometimes covering tens of thousands of hectares. Factors such as fire suppression, MPB, harvesting and climate change have exacerbated the fire situation in the Lakes planning area.

According to the BC Wildfire Service, the number of wildfires in the Lakes TSA has declined, while their size and the burned area has increased over time. The recent record-breaking wildfire years in BC have been attributed to extreme warm and dry conditions which were made more likely due to anthropogenic climate change. The largest area burned in the Lakes TSA occurred in 2018 which was the 3rd driest summer on record and followed the driest summer on record in 2017.

Timber Salvage

The MPB infestation has influenced forest management in the TSA significantly. The annual allowable cut (AAC) has been increased twice within the last 30 years to facilitate the salvage of MPB killed trees.

Forest Diseases

Dothistroma needle blight and various pine stem rusts, which are common in the Lakes TSA and can cause lodgepole pine mortality, are also more common with climate change. Recent warmer and wetter summers create favourable conditions for Dothistroma and increased growing season minimum temperatures favour pine stem rusts.

Resource Values and their Indicators

The current condition report identifies various resource values and their indicators for the project area, and reports on their current condition.

Biodiversity

Biodiversity in British Columbia is managed via a coordinated strategy that includes a system of protected areas at the regional scale, a variety of habitats and seral stages at the landscape scale and management practices that provide important ecosystem attributes at the stand scale.

Recent natural disturbances and salvage harvesting have altered the seral stage distributions in the Lakes TSA significantly. All ESSF BEC zones fail to meet landscape level late seral stage targets, while the Burns Lake East and Cheslatta landscape units within the SBS BEC zone also face an old growth deficit. The maximum early seral target is exceeded in both BEC zones in the Cheslatta landscape unit.

Water, Fish Habitat, Riparian Areas

Fish and Fish Habitat is one of the five values chosen by the Skeena Sustainability Assessment Forum Environmental Stewardship Initiative (SSAF ESI). A state of value report was released by SSAF ESI for fish and fish habitat in 2021 where the assessment results suggest that indicators in the moderate to high categories should be given further management attention.

Many of the SSAF ESI indicators for fish habitat are beyond the scope of this project. The project considered road density, equivalent clearcut area (ECA), young second growth and riparian disturbance. All are classified as high concern in the project area.

Salmonid habitat and salmon spawning were also considered. Approximately 99% of the area under assessment is classified as moderate or low salmonid habitat, while approximately 96% of the area under assessment is classified as having low salmon spawning habitat.

Water, Wetlands

Wetlands is another SSAF ESI value with a draft state of value report produced in 2021.

The current condition is presented for selected indicators:

- Road Density within a wetland buffer area (within 100 m of wetland). Approximately 63% of the wetland buffer area is classified as higher risk.
- Intactness of contributing area. This indicator presents the percent of natural and semi-natural land cover within 2 km buffer of wetlands. Approximately 88% of the area are classified as having low intactness.
- Wildlife habitat connectivity. Approximately 40% of the area have wildlife habitat connectivity, while 60% have not.

Wildlife

Wildlife in the Lakes TSA is impacted by the rapid changes in the TSA landscape caused by natural disturbance and harvesting. The current condition report considers several wildlife species and their habitat indicators.

Grizzly Bear

Grizzly Bear is managed through a FPPR Section 7 Notice around the indicators of the amount, distribution, and attributes of wildlife habitat required for the survival of species at risk in the Nadina Natural Resource District. Grizzly Bear is also one of the five SSAF ESI values. The SSAF ESI identified at risk LUs for various Grizzly bear population and habitat indicators. Within the project area, the following LUs have been flagged as higher risk to Grizzly bears:

- Burns Lake West
- Cheslatta
- Francois East
- Francois West
- Burns Lake East
- Babine West
- Ootsa
- Taltapin

While the SSAF have developed 10 indicators most of them are beyond the scope of this project. For the purpose of this report, only road density and mid-seral dense conifer were selected to be reported out on for Grizzly bear, in addition to the requirements of the FPPR Section 7 notice.

Age and Height Constraints (FPPR Section 7)

As per FPPR Section 7 Notice, within the grizzly bear habitat areas, it is required that no more than 50% of the forest cover is younger than 121 years old and no more than 33% of the forest cover is

younger than 28 years old, or less than 5 m tall. Seven out of the 13 landscape units do not currently meet the age defined habitat targets.

Road Density (SSAF ESI)

Road density is a population indicator for grizzly bear. Road density poses a high risk to grizzly bear populations and habitat. Roads cause habitat loss, fragmentation, and population isolation and decline. They also facilitate human-bear interactions.

Road density in all LUs exhibit a very high risk for Grizzly Bear populations except for Babine East (high risk). Both very high- and high-risk classes are problematic to grizzly bear.

Mid seral dense conifer (SSAF ESI)

Open canopy forests support greater berry production, which is an important food source for grizzly bears. This indicator flags potential LUs where forage supply could be an issue for grizzly bear due to excess mid seral forest in certain BEC zones.

LUs with less than 30% of area in mid-seral dense conifer are low risk to grizzly bears, while LUs with 30% or more of the area in mid-seral dense conifer are high risk to grizzly bears and are flagged for management attention. Burns Lake East and Ootsa LUs fail to meet the mid-seral dense conifer target. In both cases the target is exceeded in the ESSF BEC zone.

Caribou - Takla Herd

On January 4, 2021, a Government Actions Regulation Order established Ungulate Winter Range (UWR) U-6-013 for the Takla Caribou herd (red listed species in BC). Little logging or natural disturbance history is evident within the caribou habitat area. Age class 8 (stands older than 140) are most common in the no harvest and conditional harvest zones. Less than 2% of the area is younger than 80 years old.

The management of Caribou habitat is also facilitated through the Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8.

Mule Deer

The MoF Skeena Region has developed draft boundaries for a proposed UWR to meet the FPPR Section 7 Notice. All habitat areas are in deficit for mature forest. This likely due to historic natural disturbance; only 146 ha of the forest show harvest history in the proposed UWR area.

Moose

The MoF Skeena Region recently published preliminary explicit boundaries for the management of moose habitat. The preliminary moose habitat model is not finalized or published. It has been developed in collaboration with ESI/SSAF First Nations; however, it has not yet been approved or supported by them.

The preliminary moose habitat boundaries consist of core areas and moose winter range management zones (MWRMZ). The proposed management regime would not allow harvest in the core areas, while harvest in the MWRMZs would be constrained as follows:

- No harvest if >70% of the stand is mature deciduous.
- Otherwise >=33% of the stand must be mature, i.e., taller than 16 m with a crown closure >55%.

Northern Goshawk

The northern goshawk (NOGO, blue listed in BC) population in the project area is at risk. No official direction currently exists for managing NOGO in the area.

The Skeena Region has identified 60 potential NOGO breeding areas covering approximately 7,800 ha of the forested area. Breeding areas are surrounded by forage areas, which range in size; on average forage areas are approximately 2,600 ha. Approximately 49% of the forest in the forage areas are co-located in permanent reserves and visually sensitive areas, while 26 out of the 64 forage areas are at least 60% co-located in permanent reserves and visually sensitive areas.

Fisher

Fisher is a blue listed species in BC. There are 4 fisher habitat zones in British Columbia of which two exist in the project area. These are the sub-boreal dry and the sub-boreal moist habitat zones. The sub-boreal dry fisher habitat zone consists of SBSdw, SBSdh and SBSdk BEC subzones, while the sub-boreal moist is defined as SBSwk, SBSmk, SBSmc, SBSmm, and SBSmw.

Only a small percentage of the habitat zones currently meet the requirements for suitable fisher habitat (<6%).

Visual Quality

Visual quality objectives exist to guide forest management activities on a landscape.

Large areas with dead timber pose a problem, because maintaining visual quality may not be possible, or in some cases the visual quality objectives may conflict with other values, such as fire protection of communities.

The Forest and Range Evaluation Program (FREP) monitors the achievement of visual quality objectives. As per the FREP (FREP Dashboard (arcgis.com)) the VQOs in the Lakes TSA were achieved in 74.4% of the cases and not achieved in 25.6% of the cases. The data is based on 43 samples up to 2021.

Timber

Within the geographic boundary of the Lakes planning area, there are 35 woodlots, two First Nations woodland licences, three community forest agreements, eight replaceable forest licences and a timber sale licence program. The number and diversity of licences and tenure agreements in the TSA reflects the dependence of the local economy on the regional forest industry.

Annual Allowable Cut (AAC)

The current (2019) AAC in the Lakes TSA is 970,000 m^3 per year of which 400,000 m^3 is attributable to live conifer volume and 550,000 m^3 to dead volume. An additional 20,000 m^3 is attributable to live deciduous volume.

The historical and current Lakes TSA AAC are shown in Table 53. The increases in the AAC in 2001 and 2004 were in response to the MPB epidemic; the objective was to target moderately and severely impacted pine stands. The 2011 partition was put in place to maximize the mid-term harvest by controlling the harvest of non-pine species.

The expansion of the Burns Lake Community Forest, and the establishment of the Chinook Community Forest, the Lake Babine Nation Woodland Licence and the Nee Tahi Buhn Band First Nations Woodland Licence led to the decrease of the TSA's AAC in 2016.

The AACs for the area-based tenures in the project area are shown in Table 54. The current total AAC for the area-based tenures is 357,753 m^3 per year. The total AAC for the project area (sum of the TSA AAC and the area-based tenures AAC) is 1,327,753 m^3 per year.

Table 1: Historical and current AAC, Lakes TSA

AAC (m^3)		1982	2001	2004	2011	2016	2019
		1,500,000	2,962,000	3,162,000	2,000,000	1,648,660	**970,000**
Partition	Non-Pine				350,000	288,516	
	Live Conifer						400,000
	Live Deciduous						20,000
	Dead						550,000

Table 2: AAC for area-based tenures in the project area

Tenure	Licensee	Issued	Initial AAC	Current AAC
Community Forest Agreement	Burns Lake Community Forest	2005	86,000	194,226
	Cheslatta Carrier Nation	2007	16,613	73,397
	Chinook Comfor	2016	150,000	65,000
First Nations Woodland License	Lake Babine Nation Forestry	2016	18,930	18,930
	Nee Tahi Buhn	2016	6,200	6,200
Total			277,743	**357,753**

Harvest Performance and Trends

Figure 55 illustrates the scaled volume for the Lakes TSA and area-based tenures (CFAs and FNWLs) between years 2012 and 2020. Historically the scaled volume has been substantially less than the AAC except for 2020, when the harvest exceeded the project area AAC. Note that all licensees in the planning area are on a 5-year cut control system. Within the system the harvest vs. AAC is monitored over a 5-year period and annual surpluses and shortfalls are common.

Over time the share of area-based tenures of the total harvest has increased. In 2012 approximately 13% of the scaled harvest came from area-based tenures. In 2020 their share had increased to 30%.

Most of the harvest since 2012 has been pine. Pine together with spruce are the most common species in the area; the salvage of the MPB killed stands has further increased pine harvest. It is expected that the harvest of pine will be reduced significantly in the short and medium term as most of the merchantable dead stands have been salvaged.

Figure 2: Harvest 2012 – 2020, CFA, FNWL and Lakes TSA (m^3)

Volume of Merchantable Timber

The merchantable volume of timber in the forested area within the Lakes planning area is estimated at 88.8 million m^3. Approximately 26% of the volume is classified as dead. Most of the live volume consists of spruce (35%). Pine has a share of 17%, while 12% of the volume is made up of balsam. Approximately 84% of the dead timber is in the SBS BEC zones with the balance in ESSF.

Age class distribution

The MPB infestation in the project area required prompt salvage harvesting of the dead and damaged timber. Due to the salvage activities and recent wildfires, 37% of the forested area is less than 40 years old.

Volume per ha

There are 380,983 ha of natural stands (55 years old or older in 2021) in the potentially harvestable area in the Lakes planning area. Approximately 36% (138,855 ha) of them have less than 140 m^3 per ha (dead and live). The natural stands that have less than 140 m^3 of live timber per ha, but when combined with dead timber meet the 140 m^3 per ha threshold, constitute 22% (82,844 ha) of the area. The balance of the natural stands (159,283 ha, 42%) consists of stands where the live volume is 140 m^3 per ha or more.

Timber Supply Review (TSR) Forecast (TSA Only)

The Lakes TSA TSR base case projected a total harvest level of 800,000 m^3 per year, equally split between dead and live timber, over the first 10 years of the planning horizon (Figure 53). The harvest of dead timber is projected to fall to an average of 75,000 m^3 per year at year 11 and remain at this level until year 60. According to the base case harvest forecast, after year 60 dead volume no longer contributes to the harvest.

It is uncertain how long (shelf life) after death the mountain pine beetle killed trees are usable as sawlogs. The trees killed by the MPB are likely nearing the end of their shelf life.

The harvest of live timber is projected to be sustainable at 400,000 m^3 per year until year 60, after which the harvest forecast for live timber (and total) increases to 900,000 m^3 per year until the end of the planning horizon.

The base case harvest forecast contains important assumptions regarding the ongoing harvest operations, the quality of natural stands, the growth and yield and the associated quality of managed stands. These assumptions are as follows:

1. Up to 400,000 m^3 of MPB killed dead timber is available for harvest annually for 10 years.
2. Up to 75,000 m^3 per year of dead timber may be available until year 60.
3. The available dead timber will be harvested by the area licensees.
4. The minimum harvest volume (live and dead) is 140 m^3 per ha. This assumption is combined with a minimum harvestable age requirement of 80 years. Both conditions must be met.
5. The timber in low productivity stands will be harvested as modelled; 292,000 m^3 per year of live volume and 268,000 m^3 per year of dead volume are expected to be harvested in stands where the harvest volume per hectare is low.
6. At year 60, approximately 90% of the harvest is assumed to come from managed stands meeting the minimum harvest criteria of 140 cubic metres per hectare and 80 years of age

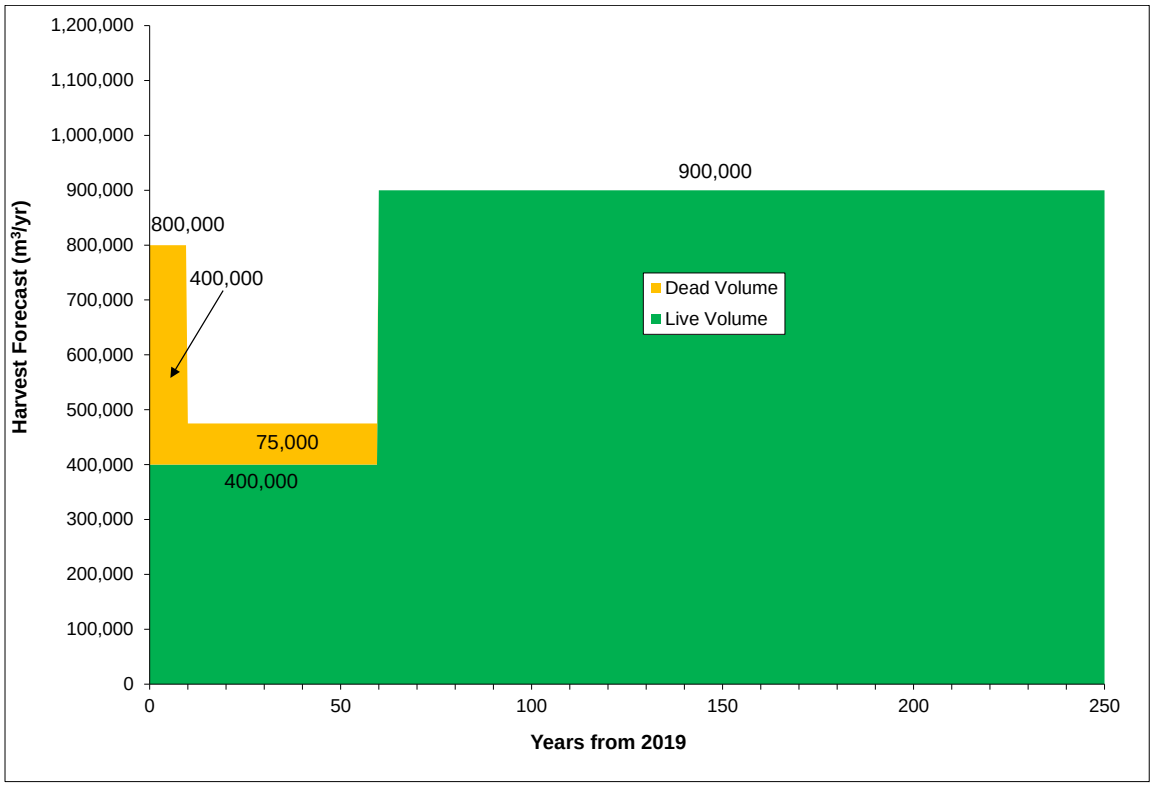

Figure 3: Timber supply forecast (TSR 2019)

Range

Range is a significant economic driver in the Lakes area. In 2021, there were 99 grazing licenses and permits granted in the Lakes area, authorizing 24,652 animal unit months of grazing.

Range health data that assesses proper functioning condition for range uplands, wetlands, and streams exists for the Lakes TSA. Of the 28 sites assessed between 2010 and 2020, 71% were deemed in proper functioning condition, 7% were found to be slightly at risk, 18% moderately at risk, and ~4% at high risk.

Rangeland faces increased pressure from many different sectors. Proper management of these unique landscapes and sometimes rare ecosystems ensures that rangelands continue to support recreationists, ranchers, and First Nations' interests.

1 Introduction

The Lakes Resiliency Project (LRP) consists of two project phases. The first phase investigates the objectives set out in the Lakes North and South Sustainable Resource Management Plans (SRMP) against the current condition of specified natural resource values and assesses whether the SRMPs should be amended and/or additional SRMP objectives incorporated into the plans. The geographic scope of this phase is the Lakes Timber Supply Area (TSA) and the Community Forest Agreements (CFA) and First Nation Woodland Licenses (FNWL) that reside within the gross boundary of the TSA.

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This report identifies the current management direction and expectations in the project area, based on the legislation, policies, and the most recent data on current management practises and natural disturbance. Furthermore, this report presents a set of resource values for the area, and reports on their condition. Many of the resource values are presented from the western science point of view and as such they do not represent Indigenous perspectives adequately. For this reason, the First Nations Steering Committee of this project prepared a section for this report presenting First Nations values and issues (Section 3).

The draft current condition report continues to be refined by the Lakes Resiliency Project Planning Table members, the First Nation Steering Committee, and the local Stakeholder Review and Input Group, with further feedback from the public. The feedback will be reviewed and incorporated, where appropriate, to contribute to the development of a final report.

2. Project Area

The project area is in north-western BC. It consists of the Lakes TSA and various area-based tenures, such as First Nations Woodland Licenses (FNWL) and Community Forest Agreements (CFA). The project area is part of the FLNRORD Skeena Region and is administered by the FLNRORD Nadina Natural Resource District in Burns Lake, the largest community in the area with a population of approximately 2,000. The balance of the population (approximately 6,000) can be found in many smaller communities, including Decker Lake, Danskin, and Grassy Plains.

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Figure 4 shows the location of the project area.

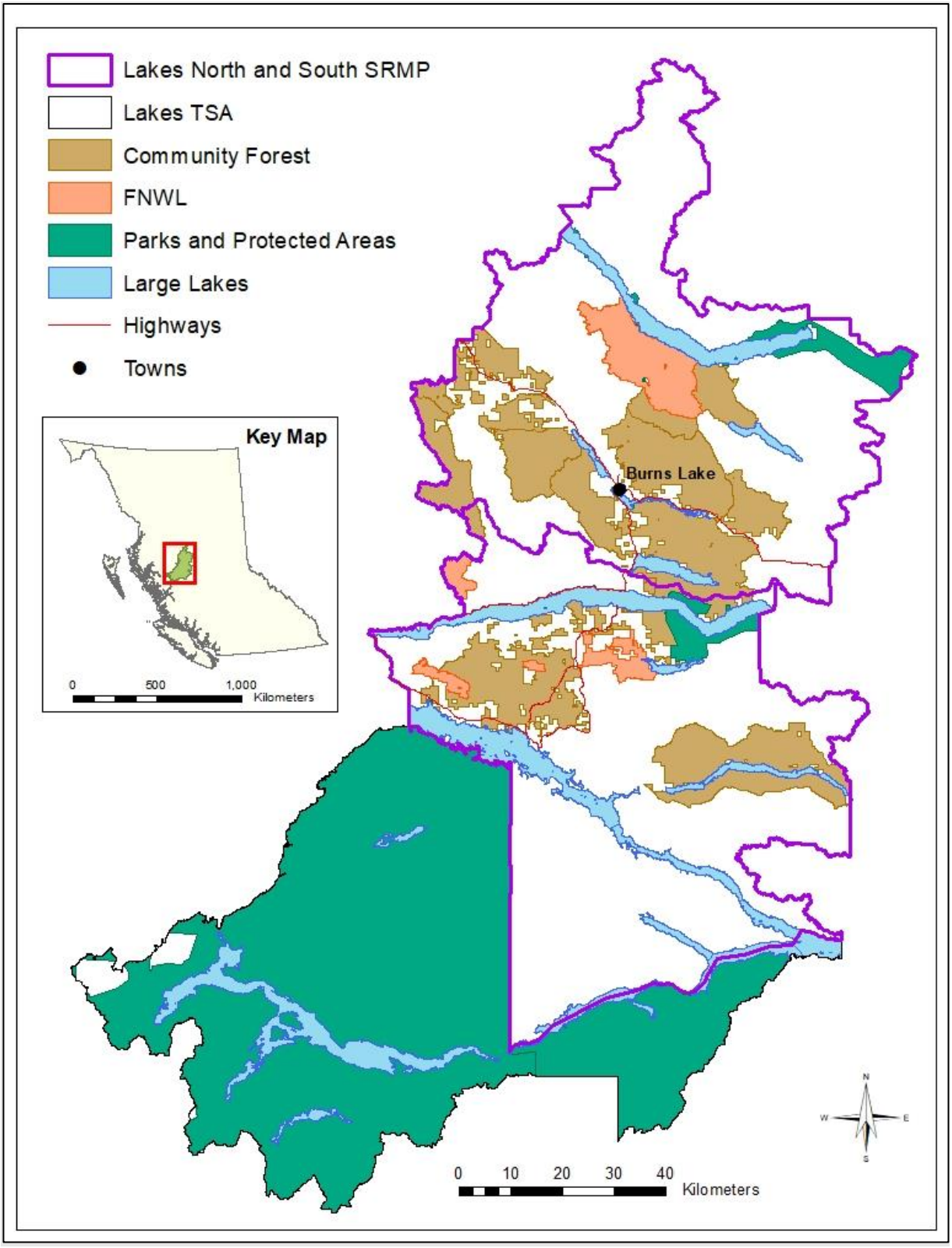


Figure 4: Project Area

3 Indigenous Values and Issues[1]

The following section provides the necessary elements from multiple Indigenous perspectives to complete a successful landscape-level plan with Indigenous values meaningfully incorporated.

3.1 Goals and Outcomes

3.1.1 Food Security

Indigenous communities have the right to sufficient, preferred and convenient access to healthy and abundant traditional food and medicine sources in their territories. This access is an intrinsic component of traditional governance systems and laws. Indigenous rights are recognized and affirmed by section 35 of the *Constitution Act*, 1982.

3.1.2 Co-Developed Plans[2]/Exercise of Stewardship Rights and Responsibilities

For some Nations, the landscape-level plan and timber harvest areas need to be approved through **house/keyoh** communities within their respective traditional territory within the Lakes Timber Supply Area (TSA). The plan must be **understandable** (unlike previous Forest Stewardship Plans), and information must be presented in a way that is clear and uses normative language. **Indigenous terms/language** should try to be incorporated within plan documents. The **current state of values and rights** needs to be explained in relation to Indigenous rights and values. **Risks** posed to Indigenous rights and values both presently and into the near future need to be understood and supported by planning scenarios that show social, economic, and cultural/ecological implications and trade-offs. Indigenous governing bodies must be meaningfully involved in the review and amendments of SRMPs and other land use plans, and exercise **co-decision making** on approving, amending, and monitoring plans into the future.

3.1.3 Investment Plans and Funding

For areas, values, and/or rights that have been degraded, an investment plan (for funding the necessary ecosystem restoration) needs to be created with approval of the strategy. Consistent and reliable multi-year funding needs to be established to facilitate meaningful Indigenous involvement in landscape-level planning processes.

3.1.3.1 Inventory

Many Indigenous rights and values depend on the understory which the vegetation resources inventory (VRI) does not capture. The plan should support the development of trusted data regarding the understory and should leverage existing forums such as Omineca ESI and SSAF to do so. The project must develop an improved data collection program in collaboration with First Nations, licensees and government.

3.1.3.2 Scale

Plan information needs to be presented and reported out at the appropriate scale (territory, watershed, house/keyoh/yintah) as there are rights and title interests at different scale levels.

[1] Not all First Nations in the Lakes TSA have participated in this guidance and direction.

[2] Any changes within plans that increase or reduce carbon offsets, shared benefits should be distributed to overlapping First Nations.

3.2 Preliminary list of Indigenous Values

Below is a list of Indigenous values with associated aspects and indicators (where known) for meaningful implementation into landscape-level plans. Maintaining a full range of ecosystem representation at a landscape level to meaningfully support Section 35 Rights (food, social, ceremonial needs, medicinal plants etc.), if possible, is the starting point to try to see if most of the Indigenous values can be co-located or captured within the coarse filter approach before going to the fine filter of Indigenous values identified.

3.2.1 Cultural Sensitivities

Aspects of cultural sensitivities include[3]: cultural use areas, cultural features, and economic opportunities.

Cultural use areas include indicators such as:

- trails (including grease trails)
- fish camps
- camping sites
- harvesting areas (including fishing, hunting, trapping and gathering sites)
- cabins
- spiritual or sacred places
- cultural corridors
- cultural survival areas

Cultural features include indicators such as:

- pictographs
- graves/ burial sites
- home sites
- cremation sites
- cache pits
- culturally modified trees
- resting areas
- sacred sites
- cultural use sites

Cultural features and objects are not limited to those dated before 1846, and post 1846 sites may still have significant cultural and legal value to Indigenous peoples and communities.

Economic opportunities include indicators such as:

[3] In this document "include(s)" means "include(s), but not limited to" and "including" means "including, but not limited to".

- tourism
- trade
- commerce
- artisans

3.2.2 Cultural Plants and Trees

Aspects of cultural plants and trees include: medicinal, food, fuel, material, technological uses, and abundance, diversity, convenient, and preferred access and health/condition (including the possibility of contamination).

3.2.3 Fish

Aspects of fish include: habitat, abundance, and health/condition. Habitat includes indicators such as:

- riparian health and function
- water quality (including temperatures, sedimentation and contamination)/quantity (flows)/connectivity
- road density
- number and conditions of water crossings (bridges, culverts)

Abundance includes indicators such as:

- Satisfaction of harvesting rights

3.2.4 Water

One aspect of water is health/condition which includes indicators such as:

- sedimentation
- contamination
- temperature
- flows
- hydrological connectivity (e.g roads/road networks/densities)

3.2.5 Wetlands

Aspects of wetlands include: moose browse, water storage, medicinal plants, harvesting areas, migratory bird habitat, fur bearing animal habitat, and riparian buffers/flood control.

3.2.6 Wildlife

Wildlife provides food security and other cultural and traditional uses. The health/condition and abundance of the following wildlife species is important for Indigenous food security and other traditional uses:

- moose

- Elk
- caribou
- mountain goat
- deer
- grouse
- ptarmigan
- beaver
- bear
- marmot
- swans
- geese
- rabbit
- Lynx
- marten
- mink
- fisher
- porcupine
- wolverine
- fox
- rabbit
- wolves
- beaver
- bear
- owl
- falcon
- woodpecker
- moose
- hummingbirds

3.2.7 Landscape Condition

Aspects of landscape condition include: health/condition and ecosystem representation. Grizzly bear is an important indicator for the health/condition of the landbase.

The following images are from the Omineca and Skeena Environmental Stewardship Initiatives as values identified as important to the participating First Nations in these forums. Many of the same First Nations are involved in the Lakes Resiliency Project.

4 Summary of Current Plans and Strategies

4.1 Provincial Timber Management Goals and Objectives

The provincial timber management goals and objectives (FLNRORD 2017) set high-level provincial timber management goals, objectives and targets and provide direction for planning across all management units. The goals are set for timber volume flow over time, timber quality, tree species composition, stand productivity and growing stock, and inherent site capacity.

The provincial timber management goals and objectives can be found here:

Provincial Timber Management Goals, Objectives & Targets Objectives & Targets (gov.bc.ca).

The achievement of targets in individual management units (TSA) are monitored and reported annually. The reports compare harvested volumes against the Allowable Annual Cut (AAC) volumes and the inventory profile. Furthermore, the monitoring evaluates harvest and regeneration performance in contrast to assumed performance in the timber supply review (TSR) for each TSA and performance is monitored for several indicators such as minimum harvestable volume, species planted or percentage of permanent access structures. The monitoring results can be requested from:

Forests.ForestPractisesBranchOffice@gov.bc.ca

4.2 Lakes District Land and Resource Management Plan (LRMP) 2000

The *Lakes District Land and Resource Management Plan* (LRMP) and associated higher level plan orders direct resource management on Crown land within the project area that is managed by FLNRORD. The plan was completed in January 2000. Some of the resource management zones and objectives were established through a higher level plan order later that year (July 2000) under the *Forest Practices Code of British Columbia Act (FPC*).

The higher level plan order of 2000 set seral stage distribution targets. It also provided direction for OGMA development and for maintaining caribou habitat in the southwest corner of the project area.

Except for the caribou habitat zone, the 2000 order was canceled and replaced in 2003 by land use objectives legally established under the Land Use Objectives Regulation by the Lakes South Sustainable Resource Management Plan and in 2009 by the Lakes North Sustainable Resource Management Plan.

The *Lakes District Land and Resource Management Plan* (LRMP) and associated orders are located here.

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/skeena/lakes-lrmp

4.3 Lakes South and Lakes North Sustainable Resource Management Plans (SRMP)

Two independent land use plans were completed in 2003 and 2009: one for the southern portion of the timber supply area (Lakes South SRMP) and one for the northern portion of the timber supply

area (Lakes North SRMP). These plans provide more specific implementation direction for the provisions of the Lakes District LRMP and the Lakes Higher Level Plan Order.

4.3.1 Lakes South SRMP

A higher level plan order in 2003 under the Forest Practices Code of British Columbia Act (FPC) legally established the Lakes South landscape units and legalized the following eight objectives:

1. Seral Stage Distribution
2. Old Growth Forest Retention
3. Old Growth Management Area Establishment
4. Habitat Connectivity through Landscape Corridors
5. Patch Size Distribution: Temporal and Spatial Distribution of Cutblocks
6. Stand Structure through Wildlife Tree Retention (Wildlife Tree Patch targets by cutblock)
7. Wildlife Tree Patch characteristics
8. Wildlife Tree Patch Management (allowance for natural processes to occur)

The old growth forest retention objective was amended in 2003 to spatialize the objective and 2016 to better operationalize OGMA boundaries. The Lakes South SRMP and associated legal orders are located here:

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/skeena/lakes-lrmp/lakessouth-srmp

4.3.2 Lakes North SRMP

The Lakes North landscape units and the objectives for the SRMP area were established by the Land Use Objections Regulation order in 2009 under the *Land Act.* The Lakes North SRMP includes the following biodiversity objectives; however, only objectives 1-4 were legally established:

1. Seral Stage Distribution
2. Old Growth Forest Retention through OGMA Establishment
3. Stand Structure through Wildlife Tree Retention
4. Connectivity; Landscape Connectivity Matrix (LCM)
5. Patch Size Distribution: Temporal and Spatial Distribution of Cutblocks
6. Retention of Wild Young Forest
7. Coniferous and Deciduous Tree Species Diversity

The plan presents targets and management strategies for resource management zones established in the higher level plan order for the Lakes TSA (formerly Lakes District) in 2000 and replaces the LRMP objectives canceled in 2009.

In 2016, the location of old growth management area boundaries was amended to better reflect operational boundaries and in 2017, the objective for the landscape connectivity matrix (LCM) was amended. The boundary of the LCM was not changed; the amendment specified the circumstances in which harvesting is allowed.

The Lakes North SRMP and associated legal orders are located here:

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/skeena/lakes-lrmp/lakesnorth-srmp

4.4 Government Actions Regulation (GAR) Orders

4.4.1 Scenic Areas and Visual Quality

The Lakes Scenic Areas Order (March 2010) established scenic areas in the LRMP area, while the Lakes Visual Quality Order (March 2010) established visual quality objectives for the scenic areas. Both Orders were established through Government Actions Regulation orders (GAR).

4.4.2 Ungulate Winter Range (UWR)

Ungulate winter ranges (UWR) have been established in the project area through the Government Actions Regulation (GAR), Sections 7 and 9 of the Forest Planning and Practices Regulation (FPPR).

GAR order U-6-017 establishes UWR for mountain goats and GAR order U-6-013 establishes UWR for the Takla Caribou.

Approved UWRs can be found here:

https://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html

4.4.2.1 Mountain Goat

No harvesting or road building is allowed within the mountain goat winter range (U-6-017). In addition, primary forest activities are limited adjacent to the UWR.

4.4.2.2 Takla Caribou

Within high value caribou winter range as defined in the GAR (U-6-013), no primary forest activities are permitted with some exceptions. Within medium value caribou winter range, limited harvesting is allowed subject to forest cover and scheduling constraints.

4.5 FPPR section 7 Notices

4.5.1 Ungulate Winter Range

Notices regarding the amount of area, distribution of areas and attributes of those areas necessary to conserve sufficient habitat for the winter survival of moose and mule deer have been issued under FPPR section 7. They can be found here:

https://www.env.gov.bc.ca/wld/frpa/notices/uwr.html

Forest stewardship plans specify the results or strategies with respect of the winter survival objectives for moose and mule deer.

4.5.2 Species at Risk Notices

A notice regarding the amount of area, distribution of areas and attributes of those areas necessary to conserve sufficient habitat for the survival of species at risk has been issued under FPPR section 7 and WLPPR section 9 for grizzly bear. It can be found here:

https://www.env.gov.bc.ca/wld/frpa/notices/sar.html

4.5.2.1 Grizzly Bear

Within the Lakes TSA 4,310 ha are designated as grizzly bear habitat. The area is not spatially defined. Rather, the notice gives direction regarding the attributes and distribution of habitat. The size, spatial distribution, connectivity and appropriate biogeoclimatic units are identified in the species account for grizzly bear in the Accounts and Measures for Managing Identified Wildlife (Identified Wildlife Management Strategy Version 2004).

https://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_grizzlybear.pdf

4.6 Silviculture Strategies

Several strategies that focus on basic and incremental silviculture have been developed over time in the Lakes TSA. A sustainable forest management plan (SFMP) was developed for the Lakes TSA in 2002 by the Morice and Lakes Timber Supply Areas Innovative Forest Practices Agreement (IFPA). The second and third versions of these plans were completed in 2004 and 2008, respectively.

The above plans used scenario analyses to test various management strategies and developed one management strategy for the IFPA. The strategy relied on specific species mixes and incremental silviculture as tools to increase the mid- and long-term timber supply.

The IFPA completed a Type 2 Silviculture Investment Analysis in 2009, which recommended a silviculture strategy for the Lakes TSA. Another silviculture strategy – a Type 4 Silviculture Strategy – was completed for the Lakes TSA by Forsite Consultants in 2014. Its objective was to mitigate the impacts of the mountain pine beetle (MPB) epidemic and wildfires on the mid-term timber supply. The strategy focussed on the rehabilitation of MPB and fire impacted stands that were not likely to be salvaged due to their young age and/or low merchantable volume. Fertilization was also recommended to mitigate the MPB and fire impacts and to increase the mid-term timber supply. The strategy encouraged enhanced basic silviculture – mostly higher establishment densities – for increased resilience and timber quality for the long term.

The Type 4 strategy included a habitat supply component. Silviculture treatments were recommended to promote old growth attributes within designated habitat areas and the retention of coarse woody debris and wildlife trees was encouraged.

The details of the various silviculture strategies can be found here:

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/silviculture-strategy-areas

4.7 Fire Management

Aside from plans that are designed to protect the urban interface, a fire management plan exists for the Burns Lake Community Forest (Blackwell, 2019). This plan is a wildfire risk reduction plan, and it is currently being implemented.

The Burns Lake Community Forest fire management plan can be found here:

https://blcomfor.com/wp-content/uploads/2019/05/Burns-Lake-LFMP_14May2019_FINAL.pdf

The Nadina District has a draft 2020 fire management plan. FLNRORD corporate Policy 9.4 - Fire Management Planning - requires that Resource District Managers and Fire Centre managers sign off on fire management plans (FMPs) in advance of each fire season. The purpose of FMPs is to identify

values on the landscape that require protection from wildfire. The FMPs are updated annually using the best available information.

Values are organized and prioritized based on human life and safety, property, and critical infrastructure, high environmental (species at risk) and cultural values, and other resource values (timber, range). The FMPs provide the information required to make appropriate fire response decisions in complex emergency situations.

The wildfires in 2017 and 2018 demonstrated that wildfire has the potential to significantly impact the TSA and its forest values. B.A. Blackwell and Associates is currently working on the Nadina Natural Resource District Wildfire Resiliency Analysis. The project explores fire history and causes, identifies values at risk and forms a risk rating system. Furthermore, the project will develop a risk management strategy which will include fuel treatment areas, fuel breaks and opportunities for prescribed fire. The plan is expected to be completed in November 2021.

4.8 Forest Health Strategy

Forest Health Strategy Nadina District 2016-2017, presents forest health conditions, issues, management strategies and bark beetle management procedures.

https://www.for.gov.bc.ca/ftp/DND/external/!publish/Forest_Health/2016-2017_DND_Forest%20Health%20Strategy_Final.pdf

Since 2017, a forest health portal has been established with the latest forest health information. The portal can be found here:

https://skeena-region-forest-health-governmentofbc.hub.arcgis.com/

Username: PX_Skeena

Password: PX_Skeena2

Below are the most up to date identified and prioritized forest health agents and factors in the project area (Table 3). Table 3 was provided by Leslie Moore, Stewardship Specialist in the Nadina Natural Resource District. Ranking considers the known or suspected impacts to forest resource values. The brief discussion below focuses on the forest health agents with very high or high management priority with the exception of the MPB.

Table 3: Damage agents in the project area

Forest Health Factor	Impacts to Timber Supply Known	Management Strategies Available	Lakes	
			Management Priority	Potential Impacts on Forest Values
INSECTS				
Spruce Bark Beetle	Yes	Yes	High	High
Mountain Pine Beetle	Yes	Yes	Low	Low
Western Balsam Bark Beetle	Yes	No	Moderate	Moderate
Douglas Fir Beetle	Yes	Yes	Low	Low
Black Army Cutworm	Yes	Yes	Moderate	Low
2 Year Cycle Budworm	Yes	Yes	Moderate	Moderate
Engraver Beetle (IPS)	No	Yes	Low	Low
Warren's Root Collar Weevil	Yes	Yes	Low	Low
Spruce Leader / White Pine Weevil	Yes	Yes	Low	Low
Lodgepole Terminal Weevil	No	Yes	Low	Low
Poplar and Willow Borer	No	Yes	Moderate	Moderate
Aspen Leaf Miner	No	No	Low	Low
Aspen Pest Complex	No	No	Low	Low

Forest Health Factor	Impacts to Timber Supply Known	Management Strategies Available	Lakes	
			Management Priority	Potential Impacts on Forest Values
DISEASE				
Western Gall Rust	Yes	Yes	High	Moderate
Comandra Blister Rust	Yes	Yes	High	Moderate
Stalactiform Blister Rust	Yes	Yes	High	Low
Other Pine Foliar Diseases	Yes	No	Moderate	Low
Dothistroma Needle Blight	Yes	Yes	Low	Low
Rhizosphaera Needle Cast	No	No	Low	Low
Lodgepole Pine Dwarf Mistletoe	Yes	Yes	Low	Low
Rhizina Root Disease	Yes	Yes	Low	Low
Tomentosus Root Rot	Yes	Yes	Low	Low
Woody Decay Fungi	Yes	Yes	Low	Low

Forest Health Factor	Impacts to Timber Supply Known	Management Strategies Available	Lakes	
			Management Priority	Potential Impacts on Forest Values
ABIOTIC				
Windthrow	Yes	No	Low	Moderate
Drought	No	Yes	Low	Moderate
Mammal Damage	No	No	Low	Low
Snow Press	No	No	Low	Moderate
Wildfire	Yes	Yes	High	High

4.8.1 Spruce Bark Beetle

Spruce bark beetle causes significant damage in mature spruce forests in BC. Spruce bark beetle is comparable to other bark beetles such as the mountain pine beetle (MPB) that directly impact the tree through physical damage to the phloem and indirectly by introducing a fungus to the wood.

As the mid-term timber supply in the TSA will depend on the harvest of spruce due to the recent MPB epidemic and the subsequent loss of pine, the spruce bark beetle management priority has been updated to high. The status of the infestation is considered to be returning to endemic levels after several years of elevated infestation. Aerial monitoring and ground surveys will continue.

4.8.2 Mountain Pine Beetle

Mountain pine beetle is a low priority forest health factor in the project area as a large percentage of the mature pine was killed by the earlier epidemic. Pine is the dominant tree species in the TSA.

In British Columbia (BC), the BC Mountain Pine Beetle Model (BCMPB) has been used to forecast the annual volume of pine killed by the MPB. According to the 2015 BCMPB observed data, the MPB peak occurred in 2005 in the Lakes TSA and 54 million m^3 of pine was killed by 2014. The elevated harvest to salvage dead pine stands has increased the area of young plantations in the project area; approximately 24% of the project area GHLB consists of young plantations.

The MPB infestation has influenced forest management significantly. The annual allowable cut (AAC) was increased in 2001 to allow for the salvage of MPB killed trees. In 2011 the AAC was partitioned limiting the harvest of non-pine species. The 2019 partition decision was also influenced by fire killed timber; a 400,000 m^3 annual limit was placed on the harvest of live trees in the 2019 AAC determination.

The length of time that the trees killed by the MBP are usable (shelf life) is uncertain and varies depending on the ecosystem. In the project area, significant areas of MPB killed trees remain unharvested. Given the time that has elapsed since the infestation reached its cumulative kill, it is likely that some of the remaining dead trees are nearing the end of their shelf life.

4.8.3 Pine Stem Rusts

According to the Forest Health Strategy Nadina District 2016-2017, pine stem rusts are the most serious disease of managed stands in the project area. The prevalence of rusts is likely linked to climate change. The pine stem rusts of concern are:

- Comandra Blister Rust - Cronartium comandrae
- Stalactiform Blister Rust - Cronartium coleosporioides
- Western Gall Rust - Endocronartium harknessii

Their impact of pine stem rusts on stand productivity is estimated at approximately 7.2% (Woods et al, 2000). Further monitoring has been carried out in 2021; it is expected that the latest monitoring results will be published in 2022.

Management strategies include planting of non-pine species where ecologically suitable and mixed species reforestation with higher planting densities (2,200-2,500 sph) in pine leading plantations. In plantations where the share of pine is high, the condition of the plantation should be assessed prior to further silviculture treatments, such as spacing and/or fertilization.

4.9 Cumulative Effects and the Environmental Stewardship Initiative (ESI)

The provincial Cumulative Effects Framework (CEF) is an interim guiding policy which outlines how cumulative effects are to be managed in the province. The core deliverables of the CEF are the value-based assessments and associated reports - called State of the Value reports or Current Condition reports. The CEF allows for regional flexibility in how the policy is applied and allows for regions to report out on provincial values and/or on regionally specific values. In Skeena Region, the CEF is primarily delivered through the monitoring, assessment, and reporting work of the Skeena Sustainability Assessment Forum Environmental Stewardship Initiative (SSAF ESI), one of four Environmental Stewardship Initiative (ESI) forums occurring across the North Area.

4.9.1 Skeena Sustainability Assessment Forum Environmental Stewardship Initiative

The SSAF ESI is a collaborative partnership between ten Skeena Nations (including the following First Nations who have traditional territories within the project area: Wet'suwet'en First Nation, Lake Babine Nation, Skin Tyee Nation, Nee Tahi Buhn Indian Band, and the Office of the Wet'suwet'en) and the Province of BC. The SSAF ESI has completed state of value reports for grizzly bear, fish and fish habitat and wetlands, and is working on assessments for moose and medicinal plants. The three completed assessments are currently the only publicly available cumulative effects reports available for the Skeena Region, and are available through the CEF webpage

(https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/cumulative-effects-framework/regional-assessments/skeena),

as well as through a third-party site. These assessments have been endorsed by the SSAF ESI partner Nations and the North Area assistant deputy ministers as mutually trusted data.

Outside of the SSAF ESI work, the Skeena CE team has completed a Forest Biodiversity assessment using the provincial CEF protocol found here:

https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/protocols/cef_forest_biodiversity_protocol_sept2020_final.pdf.

The associated report for this value is expected to be completed by spring of 2022.

This project will incorporate the SSAF ESI values and biodiversity data where feasible and forecast some of the indicators attached to those values.

4.9.2 Omineca Environmental Stewardship Initiative

The Omineca ESI boundary overlaps with the project area. The Omineca ESI is a collaborative project between the Province of BC and the Carrier Sekani First Nations (CSFN), including the following First Nations who have traditional territories within the project area: Tl'azt'en First Nation, Ts'il Kaz Koh, Nadlen Whut'en band, and Stellat'en First Nation.

Key areas of importance have been identified for Omineca ESI values (moose, forest biodiversity, watersheds (including freshwater and anadromous fish)). The analysis indicates that these values in the Omineca region are at risk in many parts of the study area. This collaboratively developed information is used in the Immediate Forest Management Measures (IM). The IM support the selected values by avoiding harvest in the key areas; the management is changed in the short term to preserve options for the future.

The IMs are voluntary practices and require co-operation by forest licensees. Recognizing this, a Memorandum of Understanding (MOU) between seven First Nations, British Columbia and seven major licensees was developed and signed in November 2018.

This project will incorporate some Omineca ESI data concerning moose habitat and biodiversity management areas (BMA) to help inform value discussions at the planning table.

Further information on the ESI can be found here:

Environmental Stewardship Initiative - Province of British Columbia (gov.bc.ca)

4.10 Forest and Range Evaluation Program and other Stand Monitoring

The forest and range evaluation program (FREP) dashboard has the most up to date monitoring information. The dashboard conveys the results of monitoring that has been carried out by FREP

and currently includes the results of monitoring for riparian, water quality, stand-level biodiversity, and visual quality. FREP was established in 2003 for the purpose of evaluating the effectiveness of the results-based *Forest and Range Practices Act* (FRPA). FREP's mission is to:

- Assess the impacts of forest and range activities on the 11 FPRA resource values to determine if on-the-ground results are achieving government's desired outcomes for these values;
- Monitor and report on the condition of resource values, including trends and causal factors, and;
- Identify opportunities for continued improvement of practices, policies, and legislation.

The FREP dashboard monitoring information can be found here:

https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=603880eba0034040810572ca99f7c385

A FREP report was completed in April 2008 for the Lakes TSA. The report found that on average, free-growing stands were meeting expectations; however, the analyses suggested that free growing declarations may occur too early in the life of stands to provide an accurate projection of future stand productivity where the influence of forest health factors is not yet fully realized. The report provided seven management recommendations and can be found here:

https://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/reports/FREP_Report_13.pdf

A multiple resource value assessment (MRVA) report was completed for the Lakes TSA in November 2013. The MRVA reports show the results of stand and landscape-level monitoring carried out under the FREP. The report summarized results for riparian, biodiversity, water quality (sediment), visual quality, and cultural heritage monitoring.

The MRVA report can be found here:

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/mrva-lakes-tsa.pdf

Monitoring data was also used for the Wet'suwet'en Hereditary Territory as defined by the asserted traditional boundaries of the Office of the Wet'suwet'en (Hereditary Chiefs) and the Wet'suwet'en First Nation. Most of the monitoring data applied to the FREP stand/site-level monitoring. Landscape-level monitoring of biodiversity, visual quality, and wildlife resource values were also included in this assessment.

The data was also collected through BC Forest Practices Board audits (13 audits). The audits were conducted under the FPC and FRPA.

The report from 2017 can be found here:

nrsmonitoringandassessmentreport-wetsuweten.pdf (gov.bc.ca)

4.10.1 Young Stand Monitoring (YSM)

A Young Stand Monitoring (YSM) report was completed for the Lakes TSA in 2018. The report summarizes the YSM data. The primary goals of YSM are to:

- Characterize the young stand population, including composition, structure, mortality, growth, yield, and health;

- Assess the accuracy of some Phase I VRI photo-interpreted polygon attributes for young stands;
- Assess accuracy of site index estimates in the Provincial Site Productivity Layer (PSPL);
- Compare observed stand yields to predictions generated from TIPSY;
- Compare observed change to forecasts from growth and yield models for the young stand population once remeasurements are available.

The report summarizes YSM data as follows:

- 29 plots were established in 2017.
- Sampling population consisted of 15 – 50 year old stands.
- 67% of the basal area is pine, 14% spruce, 14% aspen with the remainder being cottonwood and balsam.
- Tree form which would impact product and possibly whether the volume is harvested was a major issue for both pine and spruce stands.

  Approximately 50% of the basal area (highly correlated to volume) in the case of pine stands and approximately 60% in the spruce stands showed problems with form.

  Furthermore, approximately 20% of the pine basal area was impacted by diseases—presumably rusts. No details are given in the report.
- While predicted yields tend to underestimate the ground volumes, this comparison ignores the form and disease issues.
- The YSM report can be found here:
- https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/inventory-analysis/provincial-monitoring/lakesmorice_ysm_dec_18.pdf

4.10.2 Stand Development Monitoring (SDM1)[4]

The FREP Stand Development Monitoring (SDM) protocol was designed to check on stand health and growth of managed stands aged 15-40. Nadina District staff were some of the earliest adopters of the provincial protocol. A total of 19 SDM version 1 stands were assessed in the Lakes TSA between 2011 and 2013.

Across all stands and species combined 69% of trees were damage free. Lodgepole pine trees had the greatest proportion (40%) of trees affected by a damage agent severe enough to fail the SDM damage criteria. Interior spruce had 23.5% damaged while subalpine fir had the least (10%).

Hard pine rusts were the most damaging forest health agent of lodgepole pine with 15.3% of basal area (BA) affected by western gall rust; only trees with > ¼ of stem circumference girdled were included in this value. A further 4.7% of lodgepole pine BA was affected by comandra blister rust. In addition, 5.7% of lodgepole pine BA was affected by significant stem deformities including forks and broken tops. The largest diameter class lodgepole pine trees, those with greater than 17.5 cm

[4] Authored by Alex Woods, Regional Pathologist, Smithers, with editorial changes by Antti Makitalo

diameter at breast height (dbh), suffered the greatest proportional losses as only 62.3% of pine trees of this size were damage free.

4.11 Ecosystem Restoration Plans

Several wildfire ecosystem restoration plans were completed in the Nadina District by consultants in conjunction with Omineca ESI, Carrier-Sekani First Nations, FLNRORD, and the Society for Ecosystem Restoration (SERNbc). Two ecosystem restoration plans were written, one for restoration of the Island Lake wildfire and one for the Shovel Lake wildfire. The plans identify management zones and suggest zone-specific treatment options for forest biodiversity, watershed and riparian, moose, goshawk, grizzly bear, fur bearers, cultural areas, berries, medicinal plants, mushrooms, and timber with respect to harvesting, planting, and access.

The Ecosystem Restoration Plans can be found here:

https://sernbc.ca/projects/Shovel-and-Island-Lake-Ecosystem-Restoration-Plan

5 Wildfire

The ecosystems in the Lakes TSA are mostly natural disturbance type (NDT) 3 ecosystems. Stand initiating wildfires are common in these ecosystems and historically (prior to European influence) they have occurred frequently and varied in size from small fires to large ones sometimes covering tens of thousands of hectares.

Wildfire starts are the result of human or natural causes and can vary greatly from year-to-year depending on many factors. Fire behaviour is determined by the fuels, weather, and topography of the area. Cumulative issues such as fire suppression, mountain pine beetle (MPB), harvesting practices and climate change have worked together to exacerbate the fire situation in the Lakes planning area.

The Lakes TSA has seen a significant change in its forest fuels since the Mountain Pine Beetle epidemic. In general, Lodgepole pine forests now have a far greater component of dead and down woody debris available to fuel wildfire. Additionally, pine forests that have been harvested have resulted in significant slash loadings due to an increase in overall woody debris. The combination of these two fuel type changes has resulted in a significant increase in fuels on the land base that are more easily ignited and require lower fire weather indices to initiate high intensity wildfires. Horizontal fuel continuity has also increased across the landscape allowing wildfires to become larger in size than what has been experienced historically.

The fuel types for the Lakes planning area are broadly grouped into four categories to better understand the current state of the landscape and where the fire/fuel hazard currently exists (Figure 5). The groupings are relative. For a given a set of fire weather indices, the fuel types that are red will typically have a higher intensity and present more suppression challenges when compared to any of the other groupings.

The red and orange groupings depict those areas that may require some form of landscape activity/fuel management to lessen the chances of a large fire.

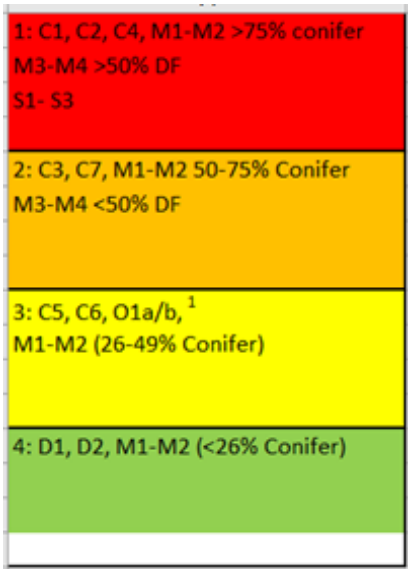


Figure 5: Lakes planning area fuel types

Figure 6 shows an example of how the four fuel type groupings are spatially distributed across a portion of the Lakes planning area.

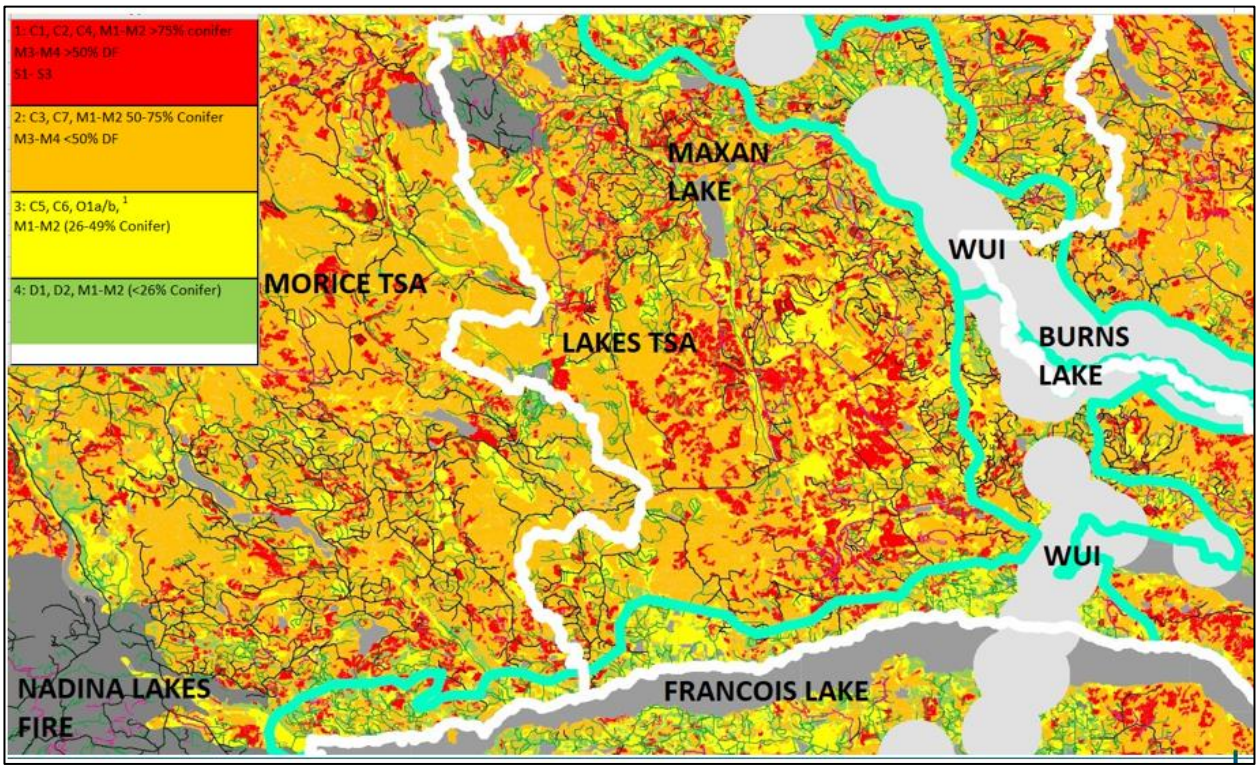


Figure 6: Example of the fuel types across a portion of the Lakes planning area

Another way to consider fuel changes in the landscape is to compare how some fuel types in the Lakes planning area have changed from pre-MPB attack to post-MPB attack, resulting in fuel types that burn more intensely. It is generally recognized that fires burning at Intensity[5] class 4 and higher will challenge suppression efforts. Figure 7 shows the different fire intensity classes in the project area, while Figure 8 and Figure 9 compare pre and post MPB fire intensity classes.

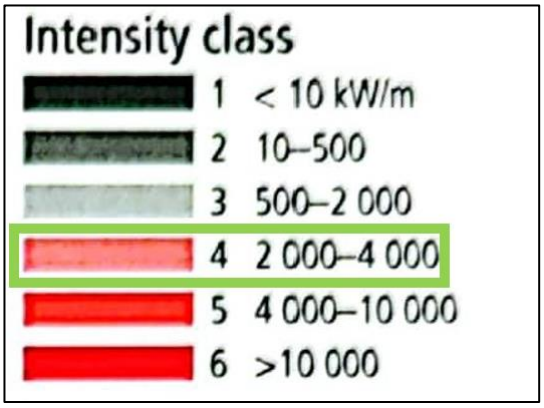


Figure 7: Fire intensity classes

[5] **Fire intensity:** The amount of heat or energy released per unit length of fire front. Frontal fire intensity is a major determinant of certain fire effects and difficulty of control. Numerically, it is equal to the product of the net heat of combustion, the quantity of fuel consumed in the flaming front, and the linear rate of spread.

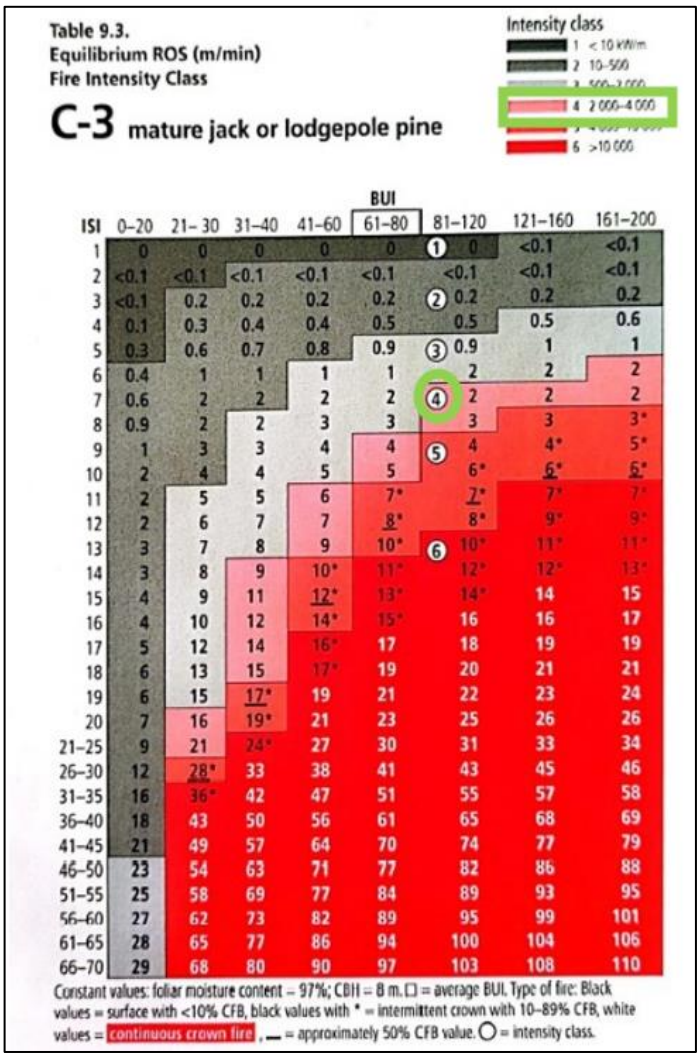


Table 9.3.
Equilibrium ROS (m/min)
Fire Intensity Class

C-3 mature jack or lodgepole pine

Intensity class
1 < 10 kW/m
2 10–500
4 2 000–4 000
6 >10 000

ISI \ BUI	0–20	21–30	31–40	41–60	61–80	81–120	121–160	161–200
1	0	0	0	0	0	① 0	<0.1	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3	<0.1	0.2	0.2	0.2	0.2	② 0.2	0.2	0.2
4	0.1	0.3	0.4	0.4	0.5	0.5	0.5	0.6
5	0.3	0.6	0.7	0.8	0.9	③ 0.9	1	1
6	0.4	1	1	1	1	2	2	2
7	0.6	2	2	2	2	④ 2	2	2
8	0.9	2	2	3	3	3	3	3*
9	1	3	3	4	4	⑤ 4	4*	5*
10	2	4	4	5	5	6*	6*	6*
11	2	5	5	6	7*	7*	7*	7*
12	2	6	7	7	8*	8*	9*	9*
13	3	7	8	9	10*	⑥ 10*	11*	11*
14	3	8	9	10*	11*	12*	12*	13*
15	4	9	11	12*	13*	14*	14	15
16	4	10	12	14*	15*	16	16	17
17	5	12	14	16*	17	18	19	19
18	6	13	15	17*	19	20	21	21
19	6	15	17*	19	21	22	23	24
20	7	16	19*	21	23	25	26	26
21–25	9	21	24*	27	30	31	33	34
26–30	12	28*	33	38	41	43	45	46
31–35	16	36*	42	47	51	55	57	58
36–40	18	43	50	56	61	65	68	69
41–45	21	49	57	64	70	74	77	79
46–50	23	54	63	71	77	82	86	88
51–55	25	58	69	77	84	89	93	95
56–60	27	62	73	82	89	95	99	101
61–65	28	65	77	86	94	100	104	106
66–70	29	68	80	90	97	103	108	110

Constant values: foliar moisture content = 97%; CBH = 8 m. □ = average BUI. Type of fire: Black values = surface with <10% CFB, black values with * = intermittent crown with 10–89% CFB, white values = continuous crown fire, ▁ = approximately 50% CFB value. ◯ = intensity class.

Figure 8: Pre MPB-attack fuel type and fire intensity class in the Lakes planning area

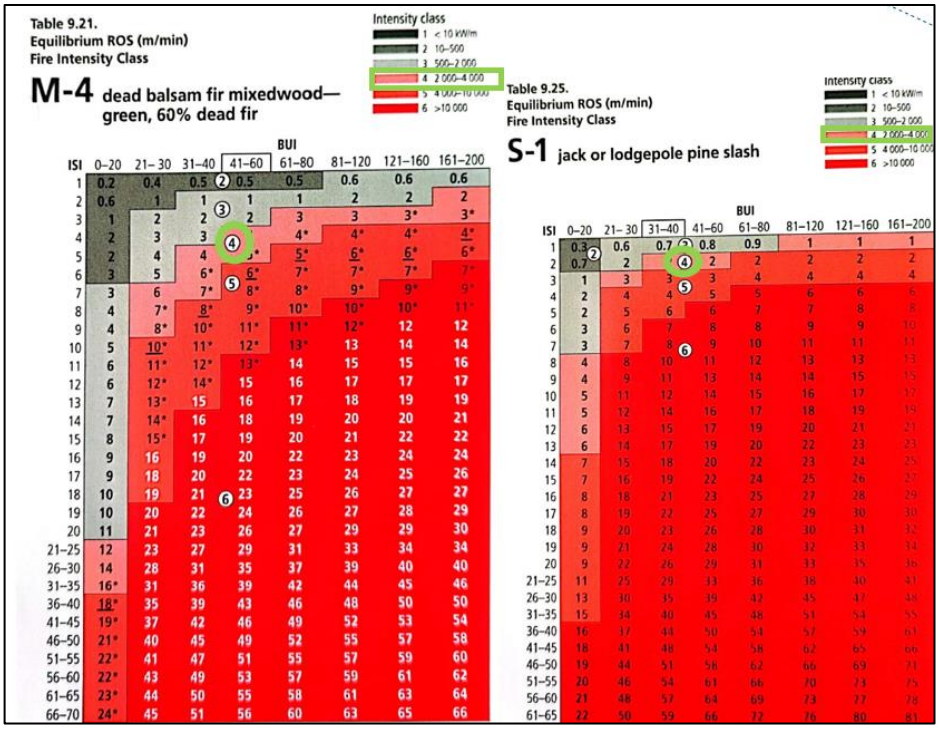


Figure 9: Post MPB-attack fuel type and fire intensity class in Lakes planning area

According to the BC Wildfire Service, the number of wildfires in the Lakes TSA has declined, while their size and the burned area has increased over time. This is illustrated in Figure 10.

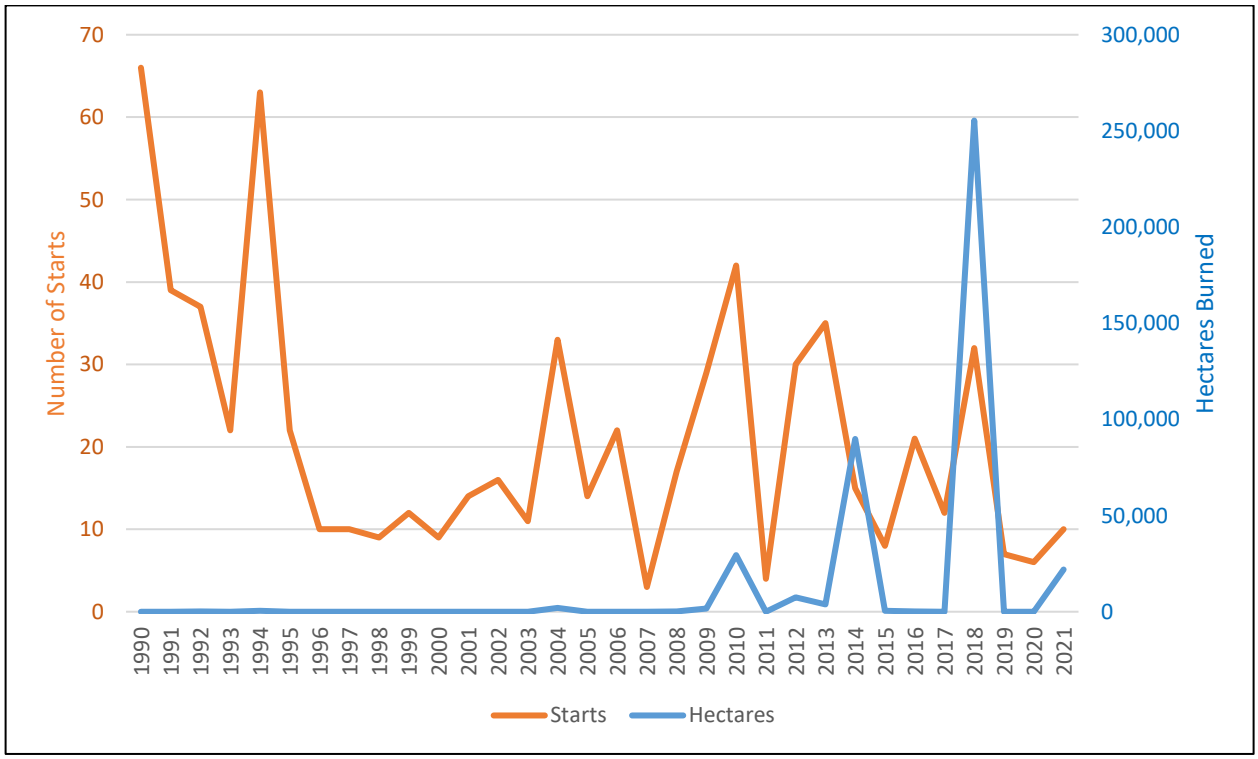


Figure 10: Lakes TSA; historical fire starts and hectares burned

Wildfires cause substantial volume losses and alter the developmental stages of the forest significantly. The total volume loss in 2018 is estimated at 2.8 million m^3 as per the Lakes TSA TSR Public Discussion Paper.

For the 2017 and 2018 fires, the VRI has been updated by the Forest Analysis and Inventory Branch (FAIB) to account for the burned areas. This was done by reducing the VRI input variables (basal area, stems per hectare, and crown closure) based on the severity class, before the volume projections were carried out. Table 2 shows the forested area impacted by these reductions within the project planning area.

Table 4: Inventory reductions due to wildfire in the project area

Age Class (2022)	Burn Severity Class (ha)					Total
	High - 2017 (80% reduction)	High - 2018 (95% reduction)	Medium (50% reduction)	Low (20% reduction)	Unburned within fire perimeter (10% reduction)	
0-20	68	4,531	16,434	2,423	2,985	**26,440**
21-40	20	1,374	2,266	1,841	9,274	**14,775**
41-60	15	591	966	376	1,040	**2,988**
61-80	58	781	1,801	497	252	**3,389**
81-100	64	2,522	7,804	1,967	1,353	**13,710**
101-120	21	1,495	3,288	683	577	**6,064**
121-140	173	2,175	4,041	751	749	**7,889**
141-250	10	6,513	12,288	2,891	1,781	**23,482**
>250	0	61	304	213	85	**663**
Total	**429**	**20,041**	**49,192**	**11,641**	**18,097**	**99,400**

6 Climate Change

6.1 Observed and projected climate trends

This section[6] provides an overview of observed and projected climate changes in the Lakes TSA. It is intended as a starting point for the Lakes TSA Resiliency Project current condition analysis and is not a comprehensive assessment of climate change. This is a fairly simple description of changes in monthly climate variables. Many aspects of climate change are not captured by this approach, such as trends in extreme temperature and precipitation, and in more sophisticated indices such as drought and fire weather. The results in this document can be explored interactively in the supplementary web applications cited in the figure captions.

6.1.1 Highlights

- **Temperature**—Observed temperature trends in the region are generally consistent with global climate model projections. The most significant observed temperature trends have been a dramatic loss of cold winters and a significant departure of nighttime temperatures from natural variability. Global climate models project that mean summer warming by 2050 will be double the observed current warming under all scenarios, and triple the current warming by 2100 under the medium emissions scenario.

- **Precipitation**—On average, climate models project an increase in precipitation in most seasons. However, this increase is dwarfed by year-to-year variability and is less than decadal variability of precipitation. The implication is that significant long-term trends in hydrology and drought will be driven primarily by changes in temperature rather than precipitation, e.g., decline of snowpack and glaciers, longer snow-free period, and increase in growing-season evaporative demand. Global climate model projections suggest that the lower-than-usual precipitation of the past 20 years is more likely due to natural variability than due to climate change.

- **Biogeoclimatic analogs**—The trends towards warmer and wetter conditions can be characterized as a shift from SBPS and ESSF climates to ICH-like climates (primarily ICHmk2 in ~2030 and ICHxm1/mc2 in ~2050). These climate analogs are useful for ecosystem management interpretations, but likely are imperfect descriptions of the future climates of the Lakes TSA.

An examination of Environment and Climate Change Canada (ECCC) weather stations within the Lakes TSA, following the methods of Foord (2016), show that some climate change is already occurring in the Lakes (Table 5). There are currently significant declines in winter precipitation (-27%) as well as significant increases in summer minimum temperature (1.1^{o}C) and annual extreme minimum temperatures (3.0^{o}C). ECCC weather station records are limited in the area, with few long-term stations and few stations still active. Therefore, it is difficult to find many statistically significant trends using weather station records. Although there is limited recent data, there are some indications that the last decade was generally warm and dry.

[6] Authors: Colin Mahony and Vanessa Foord, MOF Research Climatologists

Global climate models suggest that warming in Central Interior BC will be greater in summer than in winter (Figure 11 and Figure 12). The actual winter climate has warmed faster than the summer climate. The winter warming trend is driven by a dramatic decline in extremely cold winters. This trend culminated in the extremely warm winters of the 1998-2007 period before falling back to a level more consistent with climate model projections. Summer temperatures are less variable than winter and are expected to depart from natural variability sooner: summers colder than the historical average are projected to be rare after 2050 in the most optimistic scenario (SSP1-2.6) and essentially absent after 2040 in the business-as-usual scenario (SSP2-4.5)[7]

Table 5: Historical climate trends using Environment and Climate Change Canada weather stations, 1926-1921

Lakes TSA-Change in:	Annual	Winter	Spring	Summer	Fall
Precipitation (%)	-2.0	**-27**	0.9	-4.6	1.5
Mean Temperature (C)	0.6	1.5	0.2	0.4	0.2
Extreme Max Temperature (C)	-0.4	-0.3	-1.1	-0.4	-1.6
Extreme Min Temperature (C)	[8]**3.0**	2.5	0.9	**1.1**	1.5

Figure 11 illustrates summer (Jun-Aug; top) and Figure 12 winter (Dec-Feb; bottom) temperature changes in the Central Interior ecoprovince.

The blue line is the observed climate calculated from climate stations. The shaded polygons are the minimum and maximum of multiple historical (pre-2015) and future simulations from each of 8 global climate models[9]. Bold colored lines are the ensemble mean for each emissions scenario. The time series of observed historical anomalies is provided by Faron Anslow of the Pacific Climate Impacts Consortium.

[7] CMIP6 climate projections follow scenarios of future greenhouse gas emissions called Shared Socioeconomic Pathways (SSPs). ClimateBC includes projections for the four major SSP scenarios: SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5. SSP1-2.6 assumes strong emissions reductions (mitigation) roughly consistent with the goals of the Paris Climate Accords to limit global warming to 2°C above pre-industrial temperatures. SSP2-4.5 assumes moderate mitigation roughly consistent with current emissions policies and economic trends (Hausfather and Peters 2020). SSP3-7.0 is representative of a broader range of "baseline" scenarios that assume the absence of mitigation policies and is associated with linear increase in the rate of greenhouse gas emissions. SSP5-8.5 is at the high end of the baseline scenarios, and rapid expansion of greenhouse gas emissions over the next several decades and end-of-century emissions more than three times higher than current emissions. Collectively, SSP1-2.6, SSP2-4.5, and SSP3-7.0 provide a reasonable representation of optimistic, neutral, and pessimistic outlooks on global emissions policies and socioeconomic development. We do not include SSP5-8.5 in this report because the emissions pathway described by SSP5-8.5 is extremely unlikely based on current trends in energy economics and policy (Hausfather and Peters 2020). For simplicity and feasibility of analysis, results for the Lakes TSA use only the SSP2-4.5 scenario. Given the uncertainties in long-term greenhouse gas concentrations, the interpretation of results beyond the year 2050 should focus on the trend rather than the timing of changes.

[8] Bold are statistically significant p<0.05

[9] This report features 8 of the 13 climate models that are available in ClimateBC. The rationale for the selection of this subset is explained in Mahony et al. (2022). More information on the models and their selection criteria can be found at the cmip-BC app.

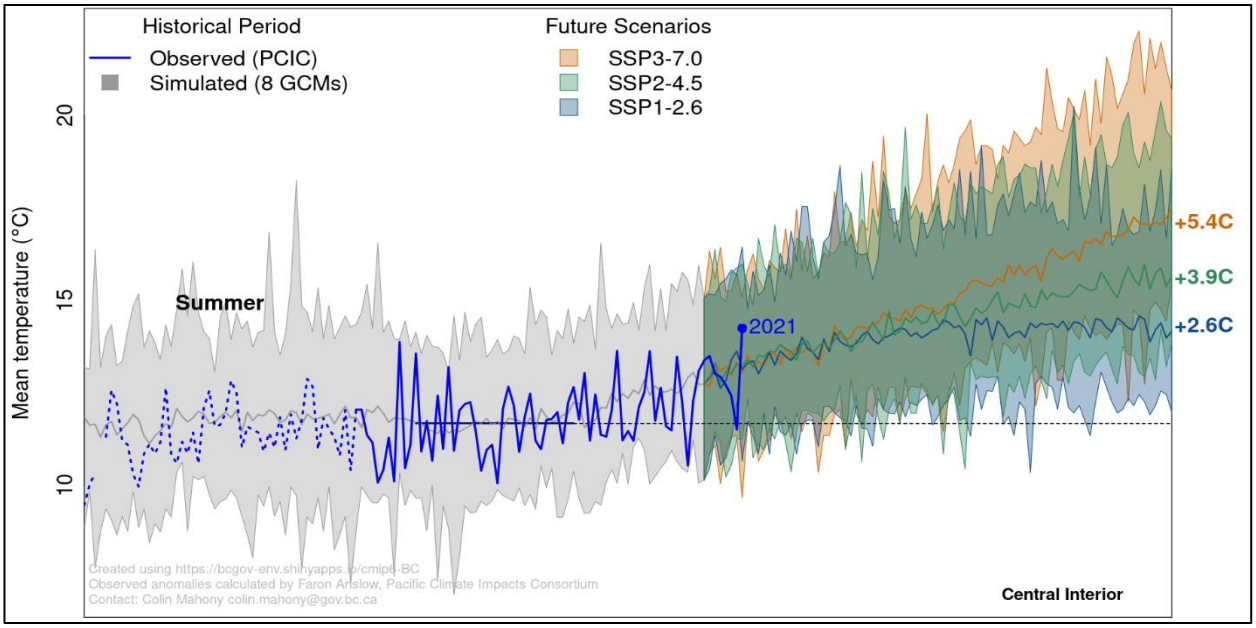


Figure 11: Summer (Jun-Aug) temperature change in the Central Interior ecoprovince.

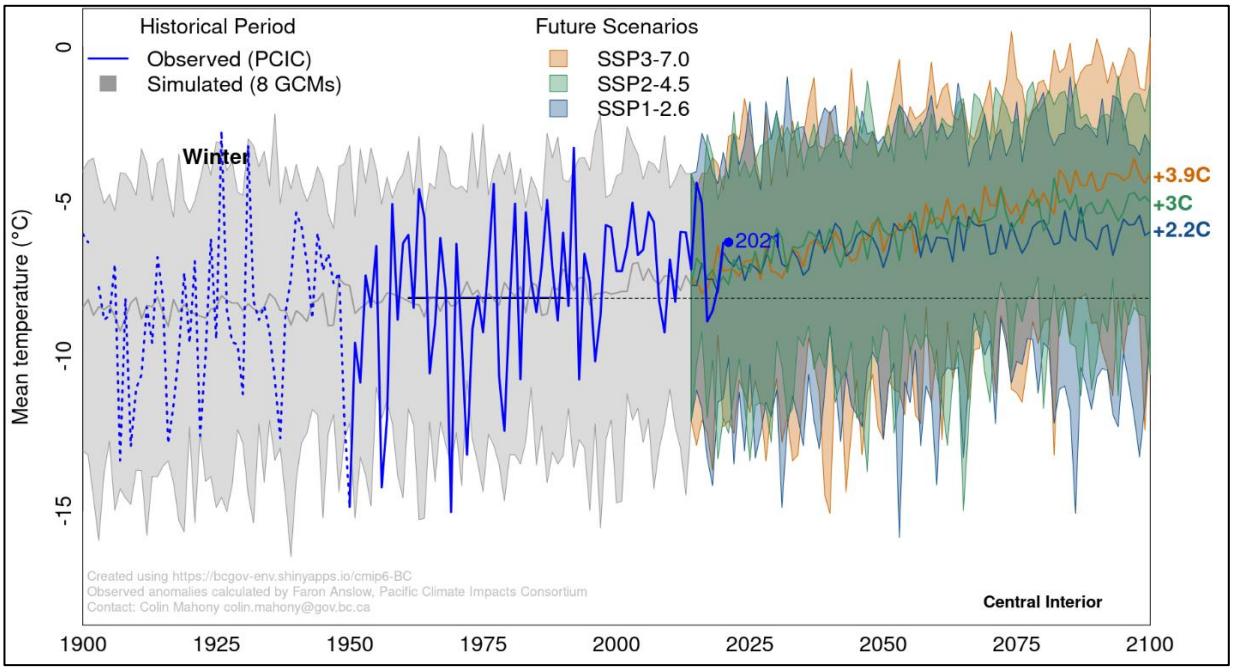


Figure 12: Winter (Dec-Feb; bottom) temperature change in the Central Interior ecoprovince.

There are important differences in the observed trends of nighttime minimum vs. daytime maximum summer temperatures (Figure 13). Nighttime summer temperatures are less variable than daytime temperatures (Figure 14) and their observed warming trend is a much more significant departure from natural variability. The trend in nighttime temperature is consistent with global climate model projections, while the trend in daytime temperature lags the models somewhat. However, this lag is not significant given the natural variability in summer daytime temperatures.

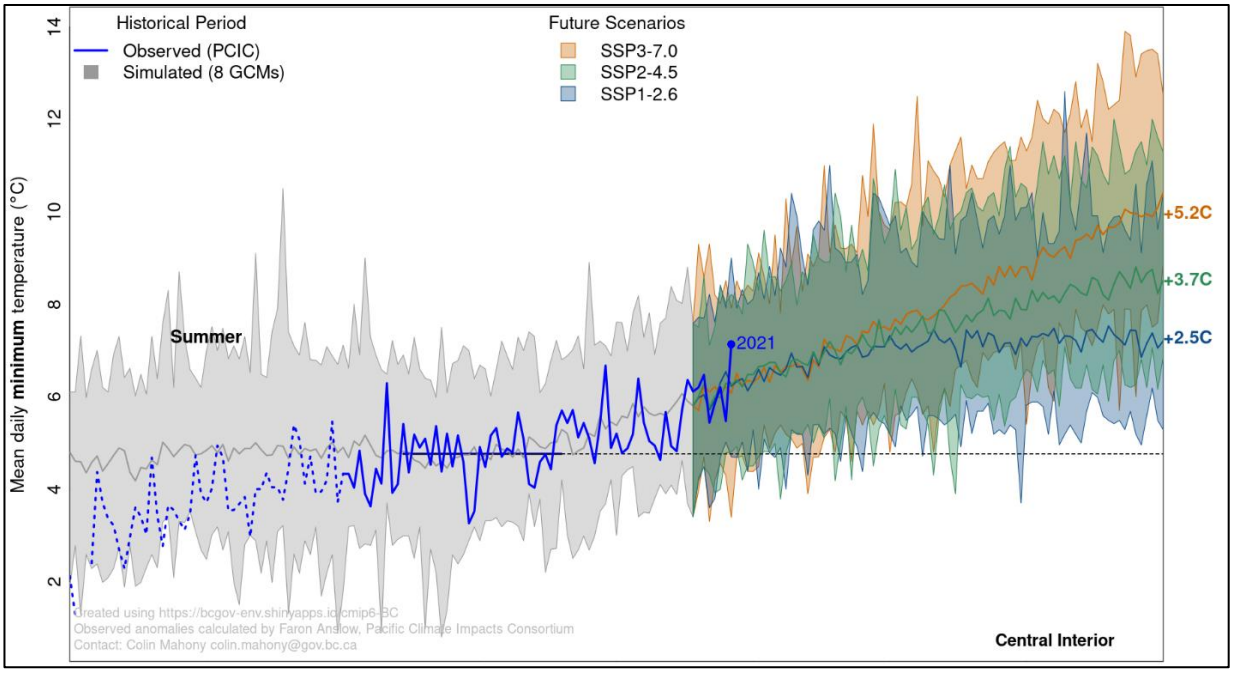


Figure 13: Nighttime minimum summer temperature.

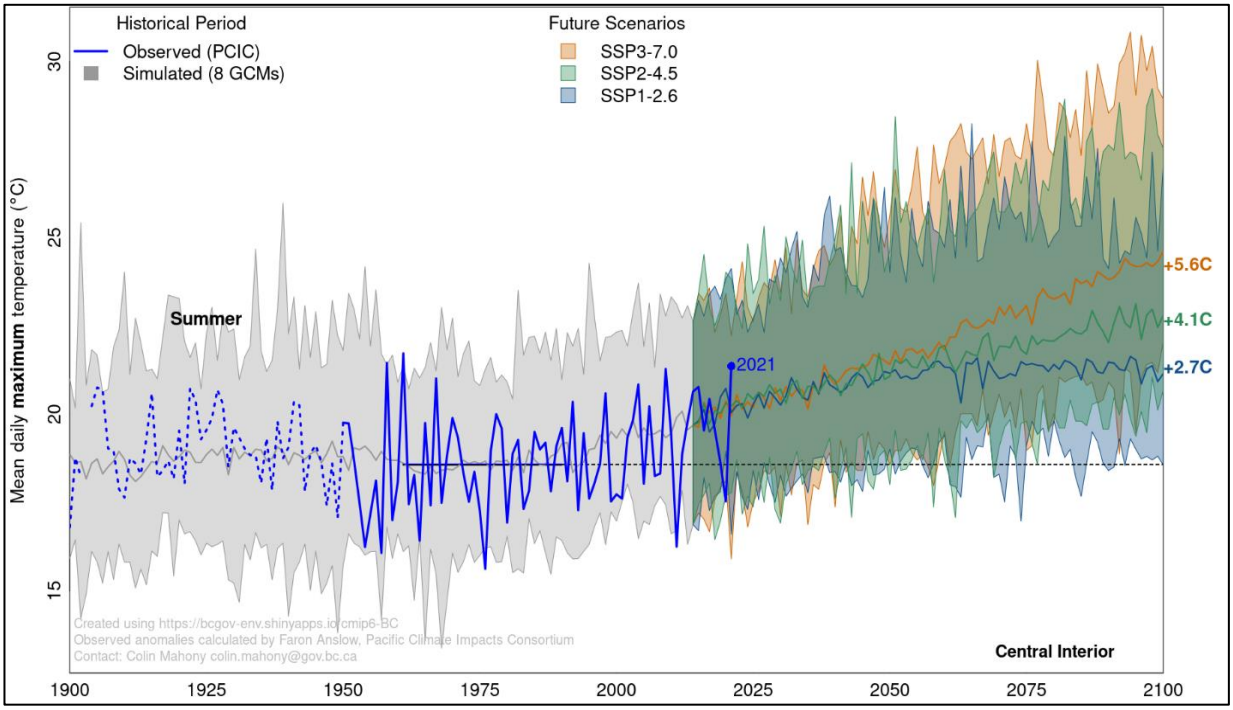


Figure 14: Daytime maximum summer temperature.

On average across models, precipitation is projected to have no trend in summer (Figure 15) and increase slightly (~8%) in winter (Figure 16). These trends emphasize that natural variability of precipitation is much greater than climate change trends. Interannual variability in precipitation, overlaid on the temperature trend, is a key driver of impacts: the extreme fire year of 2018 is clearly visible as a record dry summer. Multi-decadal oscillations of +/-10% in precipitation are also evident. It is important not to confuse these oscillations with climate change trends when

comparing observations to global climate model projections. The lower-than-usual winter precipitation of the past 20 years is more likely due to natural variability than due to climate change.

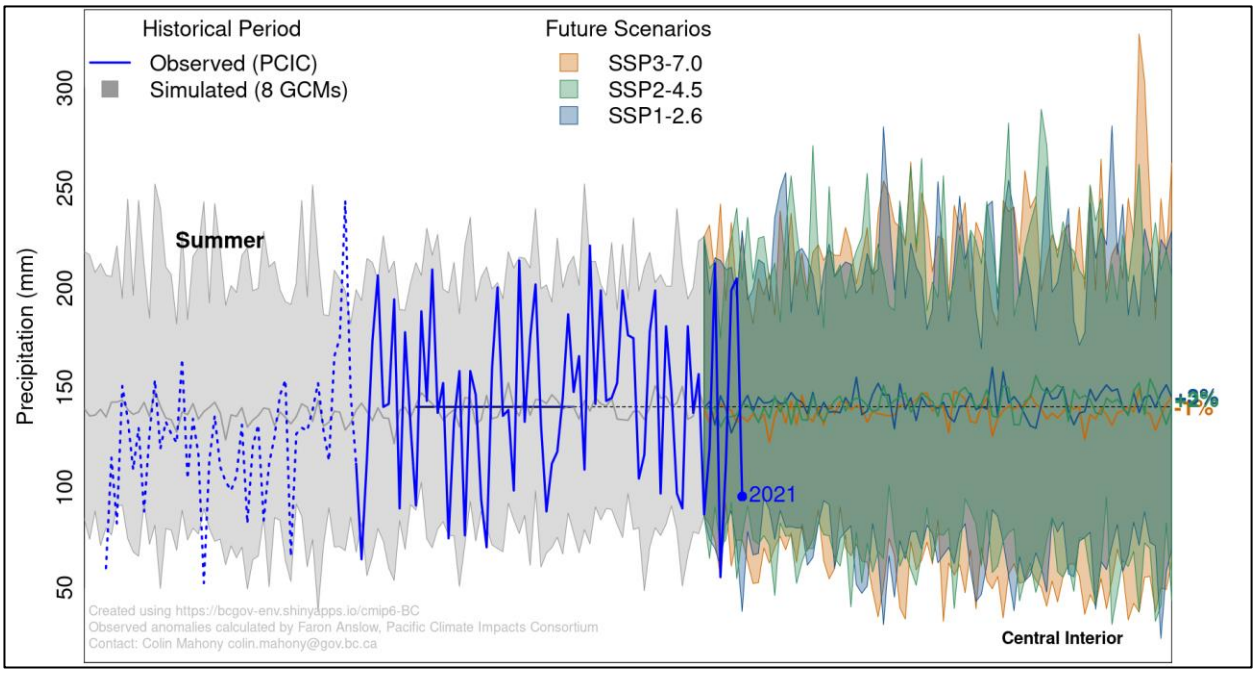


Figure 15: Projected summer precipitation

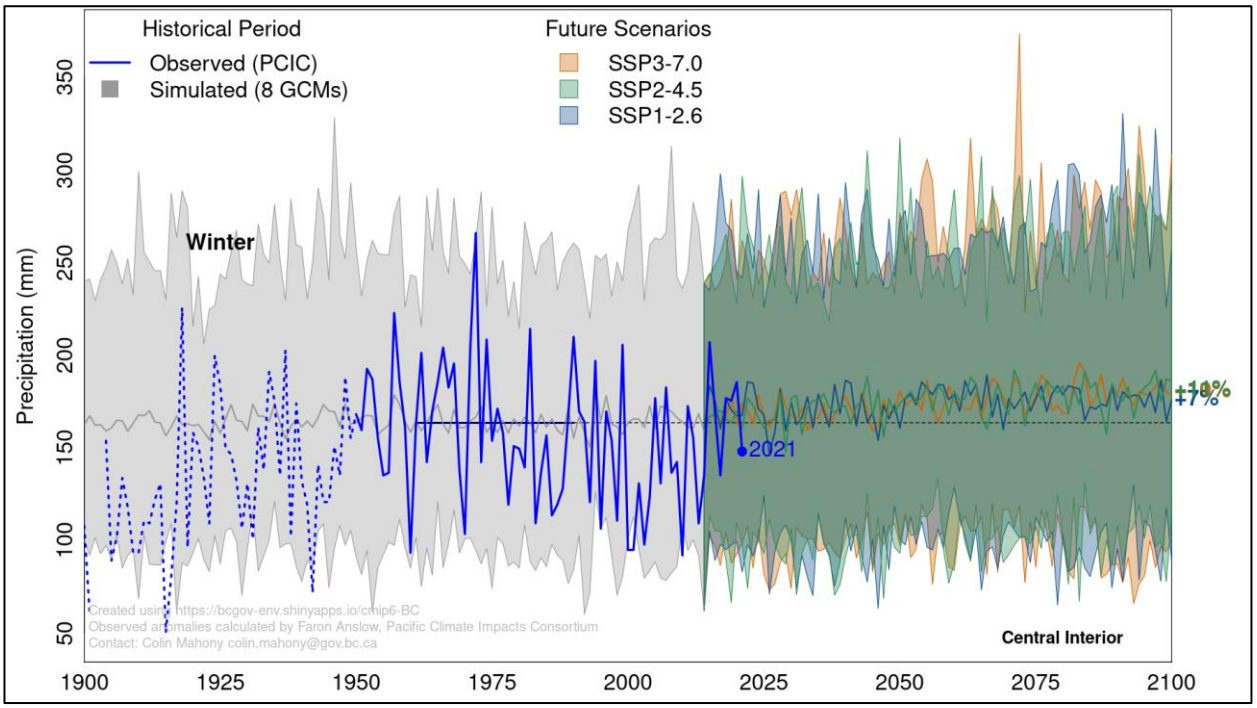


Figure 16: Projected winter precipitation

There is some variation among models in seasonal precipitation trends for the Lakes TSA, though generally the models do agree on the direction of the trend. All models but one project an increase in annual precipitation (ensemble mean 8% increase by 2050). In the growing season, there is

general ensemble agreement on a mean 12% increase in May-June precipitation by 2050 but disagreement among models (by +/-20%) on the direction of the trend in July-September. Observed precipitation over the 2001-2020 period was generally lower than the 1961-1990 period. This contradiction of the model trends doesn't indicate that the models are wrong: the observed anomaly is subject to decadal oscillations that are reduced in the model projections by averaging across multiple simulations of each model.

Figure 17 illustrates the projected changes in precipitation relative to projected changes in mean annual temperature in the Lakes TSA. Colored points are the mean change, relative to a 1961-1990 baseline, over each of the five 20-year periods of the 21st century for the 8-model ensemble (SSP2-4.5 scenario); the labeled points are the 2041-2060 period. The interpolation lines connecting the points for each model are visual aids and are not generated by the models. The observed climate of the Lakes TSA for the 2001-2020 period is shown as a grey point. Each panel represents precipitation for different times of year: annual (top left), December-February (top right), May-June (bottom left), and July-September (bottom right). Source: https://bcgov-env.shinyapps.io/ccsummary-LakesTSA-cmip6/.

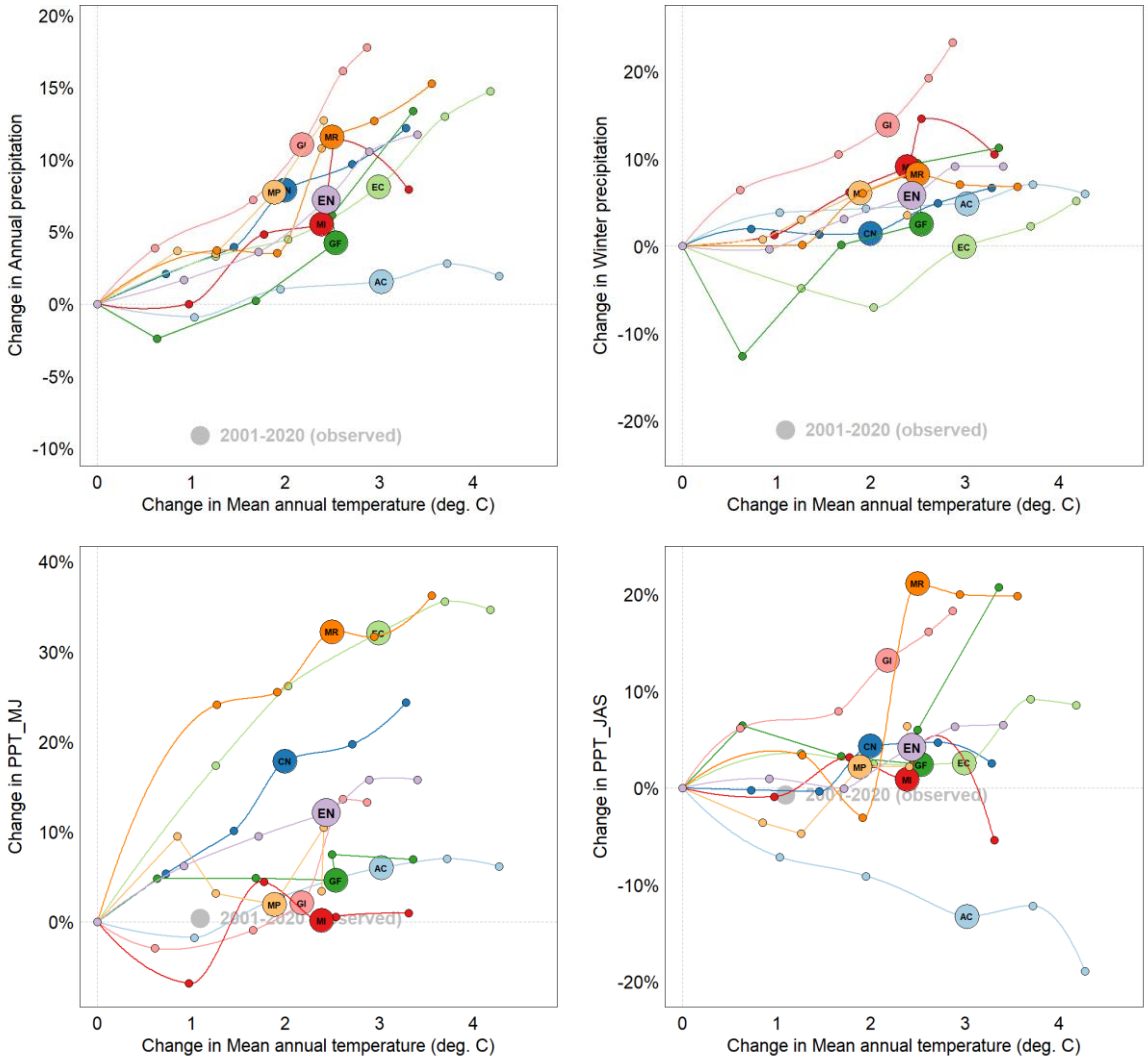


Figure 17: Projected changes in precipitation relative to projected changes in mean annual temperature in the Lakes TSA.

Despite the model uncertainty around the direction and strength of precipitation trends, the impact of these trends on ecosystems is strongly mediated by the strong warming trend. This effect is exemplified by the high model agreement on a 10-20% decline in precipitation as snow by 2050 (Figure 18). This decline is despite the projected increase in winter precipitation. The ClimateBC estimate of a 13% decline in precipitation as snow over the 2001-2020 period far exceeds the modeled decline, but this is primarily due to the temporarily reduced winter precipitation over this period.

The warming is expected to drive substantial changes in environmental conditions that more directly impact ecosystems, such as the number of frost-free days (Figure 18, right panel). ClimateBC estimates a 10% increase in frost-free days for every degree of warming, on average across the Lakes TSA, or about 10-20% by 2050. Changes in snowfall and frost will be highly spatially variable across the landscape. In addition, the calculation of these derived variables is based on monthly temperature and precipitation and should be understood as a rough approximation.

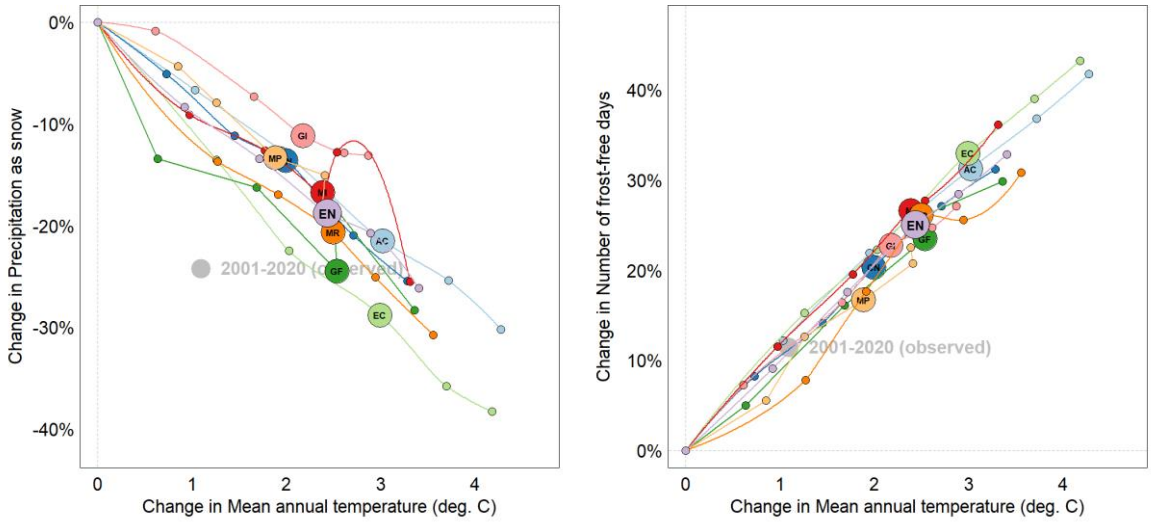


Figure 18: Projected changes in annual precipitation as snow (left) and number of frost-free days (right).

6.2 Biogeoclimatic Analogs for Changing Climate Conditions

A climate analog is a location with a historical climate that is similar to the current or projected climate of a different location. Climate analogs are a useful technique for interpreting how changes in climate variables could impact ecosystems. Biogeoclimatic subzone/variants are a rich set of climate analogs because they are associated with an abundance of information for ecosystem management. Biogeoclimatic analogs are identified by training a statistical or machine learning model to recognize biogeoclimatic subzone-variants in terms of their 1961-1990 climatic conditions, and then applying that classification model to new (current or projected) climate conditions (MacKenzie and Mahony 2021).[10] Although the visual effect is of biogeoclimatic units shifting across the map, some caution is required in interpreting the analogs. The actual future

[10] Biogeoclimatic analogs are identified using a Random Forest model developed by Will MacKenzie, updated for the BECv12 classification and refinements to the variable selection and training sample.

climates will likely be a hybrid of the characteristics of the analog climate combined with enduring features (such as frost pockets) of the local historical climate.

Figure 19 presents biogeoclimatic analogs for the recent and future climates of the Lakes TSA. The baseline projection is the predicted biogeoclimatic unit of the 1961-1990 climate (a). Map (b) shows biogeoclimatic analogs for the observed (actual) 2001-2020 climate, while maps (c to f) present the biogeoclimatic analog with the most votes among the 8-model ensemble. All projections are based on the SSP2-4.5 emissions scenario. Analogs are identified at the biogeoclimatic subzone/variant level and color-themed by zone. Source: https://bcgov-env.shinyapps.io/ccsummary-LakesTSA-cmip6/

While biogeoclimatic analogs have traditionally been applied to future climates (e.g., Wang et al. 2012), they can be applied to observed climate conditions as well, such as to the actual climate of the 2001-2020 period as shown in Figure 19 (b). During this period of warmer and drier conditions, the lower elevations of the Lakes TSA, such as the areas around Babine, Francois, and Eutsuk Lakes, experienced climates similar to the 20th-century climate of the IDFdk1 (the historical climate of middle elevations of the Thompson-Okanagan Plateau) and IDFdc (the historical climate of Carpenter Lake, near Lillooet).

The Quanchus Range experienced the incursion of ICHmc-like climates (the historical climate of the Nass and Skeena Valleys) into the SBSmc2 and ESSFmc. Even though large portions of the SBS, SBPS, and MS zones experienced their native zone-level climate, large areas of these zones experienced a different subzone-variant analog than their historical climate. These subzone/variant analogs are not depicted in the plots but can be explored in this app.

Figure 20 shows the observed and projected trends in biogeoclimatic analogs for the future climates of the Lakes TSA. The top panels show the change in the area of (a) biogeoclimatic zone analogs and (b) biogeoclimatic subzone/variant analogs relative to the projected change in mean annual temperature; coloured points are the area of analogs for the observed 2001-2020 climate. The bottom panels show ensemble variation in the area of (c) ICH and (d) IDF analogs; coloured circles are the area of analogs for each model's projected 2041-2060 climate. Source: ***https://bcgov-env.shinyapps.io/ccsummary-LakesTSA-cmip6/***.

The projected climates are characterized by a rapid displacement of historical SBS climates with ICH-like climates: ICHmk2 in ~2030 and ICHxm1/mc2 in ~2050 (Figure 19, c-f, Figure 20b). These trends are consistent with the warmer/wetter climate projected by the climate model ensemble.

If annual precipitation remains constant, as projected by the ACCESS-ESM1 model, some of the TSA will shift to IDF-like climates (Figure 20 d). There is a high degree of model agreement on the expansion of ICH-like climates as the climate warms (Figure *20*c). There is moderate model agreement on the limited incursion of IDF-like climates, except for the ACCESS-ESM1-5 model (Figure 20d). An important caveat on the projections is that they rely solely on monthly climate data that may not fully represent shorter-duration extremes distinctive of the Nechako Plateau. The ICH climates may therefore be imperfect analogs for the future climates of the Lakes TSA. Incorporating daily extremes is a priority for future development of biogeoclimatic analog models.

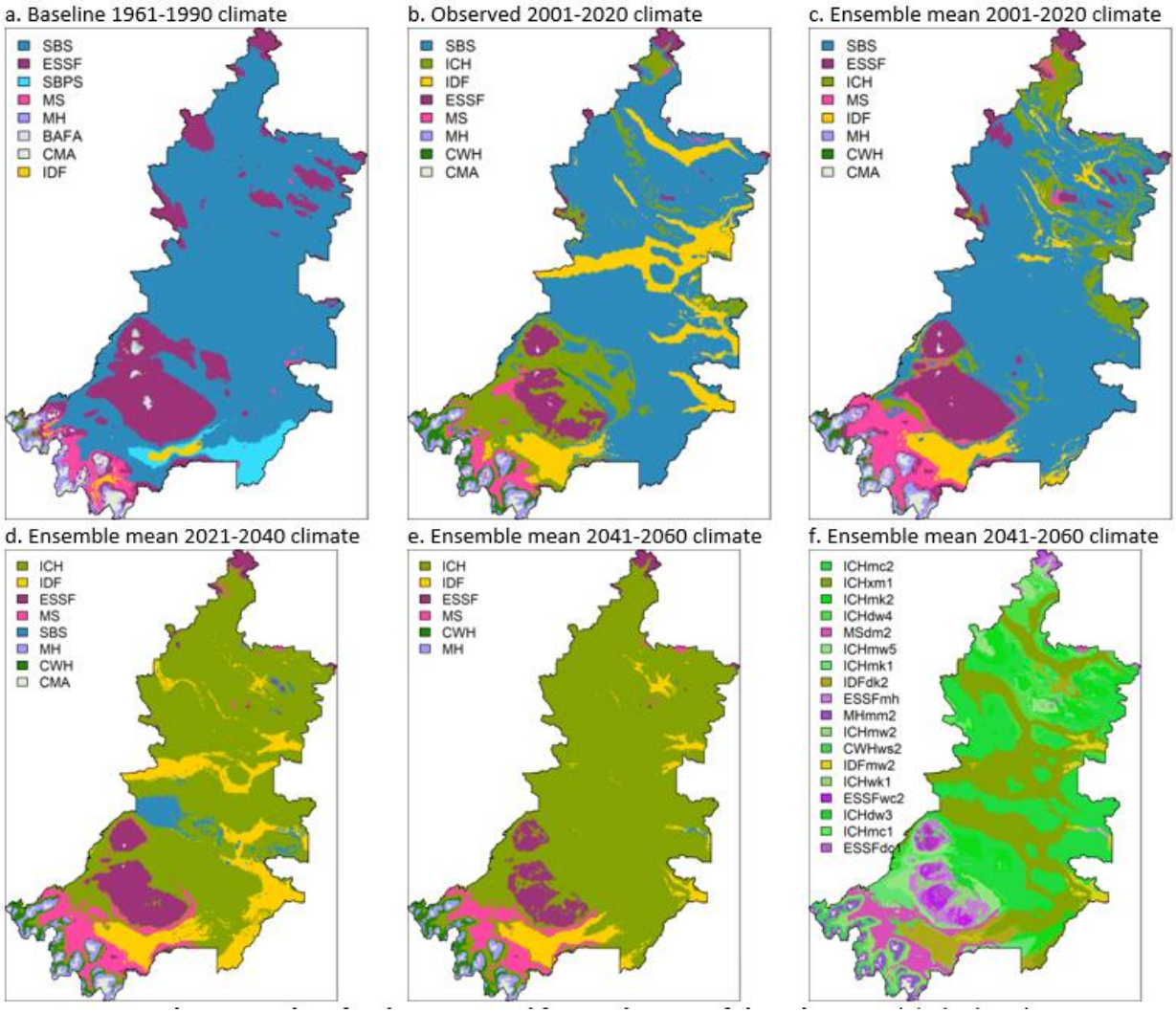


Figure 19: Biogeoclimatic analogs for the recent and future climates of the Lakes TSA

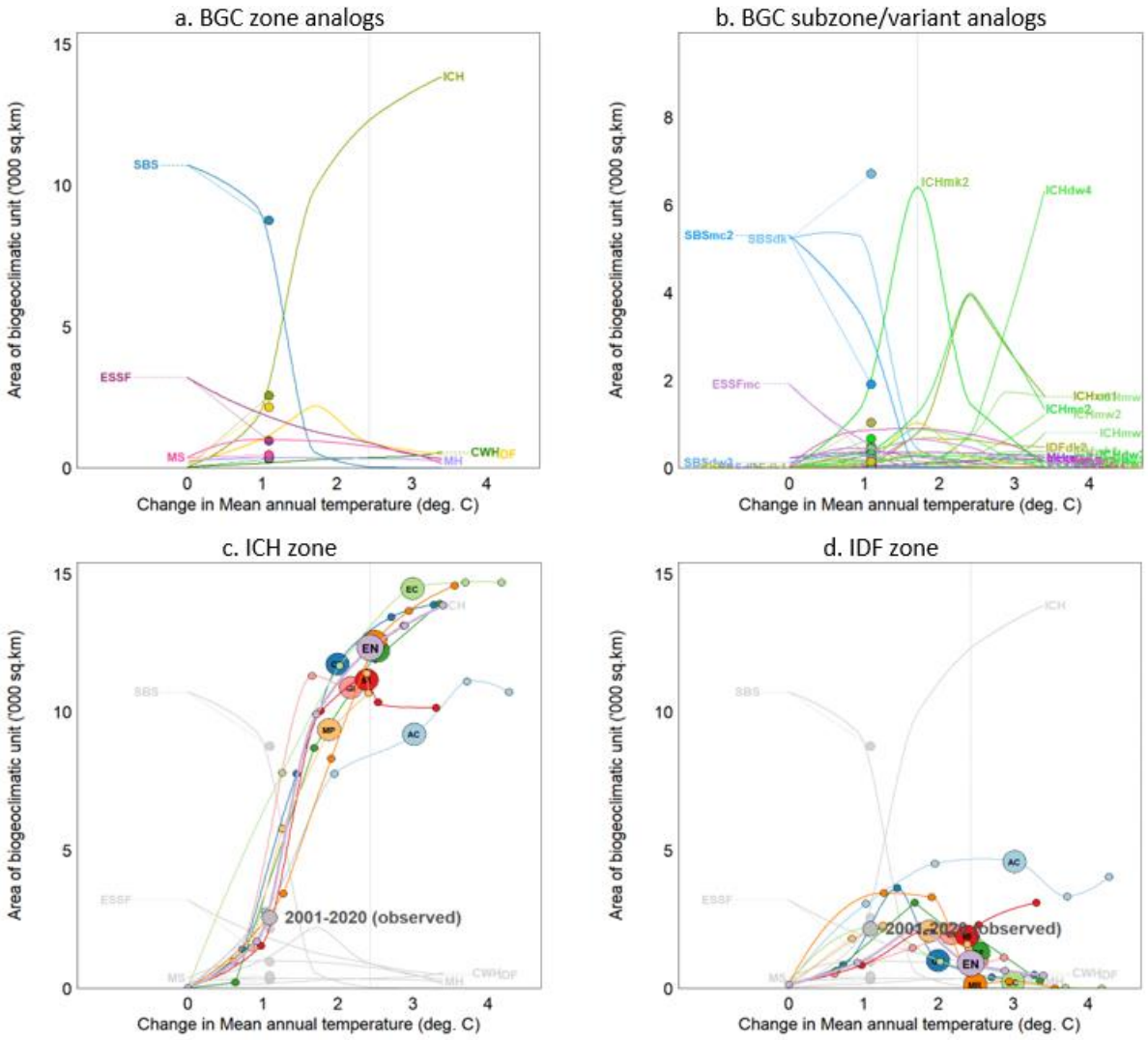


Figure 20: Observed and projected trends in biogeoclimatic analogs for the future climates of the Lakes TSA

6.3 Climate Change Impacts[11]

6.3.1 Forest disturbance

Climate change induced alterations to the frequency and magnitude of forest disturbances such as wildfires, pest and pathogen outbreaks, and high winds may be more important than the benefits of warmer temperatures and elevated carbon dioxide levels enhancing growth conditions (Kirilenko and Sedjo, 2007). Monitoring and analysis of multiple disturbance agents in northern BC, including the Lakes TSA, has shown increasing damage and mortality in managed stands, especially to lodgepole pine, that may be related to more favourable climate conditions for such disturbances

[11] Vanessa Foord, MOF Research Climatologist

(Woods et al. 2017). The impact of the mountain pine beetle is well known and can be directly related to decreasing extreme cold temperatures (Carroll et al. 2004).

Dothistroma needle blight and various pine stem rusts, which are common in the Lakes TSA and can cause lodgepole pine mortality, are also more favourable with current climate change such as recent warmer and wetter summers being favourable for Dothistroma and increasing growing season minimum temperatures being favourable for hard pine rusts (Hennon et al., 2021). Preliminary results from a research project in the Lakes TSA examining 16 years of rust and on-site weather data show high levels of mortality related to rusts in combination with more favourable climate conditions for rust development and infection. A review of aerial overview survey data 2008-2018 in the Lakes TSA has also shown increasing trends in area impacted by western balsam bark beetle and aspen leaf minor likely related to recent climate warming; however, research is still in progress.

Climate change projections of large increases in temperature and minor increases in precipitation may result in moisture stress and potential tree mortality in parts of the Lakes TSA. Using the stand-level drought risk assessment tool (Table 6) (DeLong et al. 2019) for available biogeoclimatic units in the Lakes TSA on sites with average soil moisture conditions results in a high risk of mortality by 2071-2100 in sub-alpine fir and paper birch in the ESSFmv1, SBSdk, and SBSdw3 as well as western larch in the same units if planted. The following may be at moderate risk in the associated biogeoclimatic units with average soil moisture conditions.

Table 6: Projections of moderate drought stress in tree species for particular sites in the Lakes TSA. 2020s = 2011-2040, 2050s = 2041-2070, and 2080s = 2071-2100.

BEC Variant	Western Hemlock	Subalpine Fir	Paper Birch	Western Red-cedar	Spruce Hybrid	Lodgepole Pine	Trembling Aspen	Western Larch	Douglas-fir
ESSFmc	2050s	2050s	2050s	low	low	low	low	low	low
ESSFmv1	2050s	2050s	2050s	low	2050s	low	low	low	low
ESSFmv3	2050s	2050s	2050s	low	2080s	low	low	low	low
SBPSmc	2080s	2080s	2080s	low	low	low	low	low	low
SBSdk	2050s	2050s	2050s	low	2050s	low	low	low	low
SBSdw3	2020s	2020s	2020s	2080s	2020s	2080s	2080s	low	low
SBSmc2	low	low	low	low	low	low	low	low	low

Tree species that are at moderate or high levels of drought stress in the future are also more susceptible to impacts from various forest pests (Hennon et al. 2021) and may pose an increased wildfire risk.

The record-breaking wildfire year of 2017 in BC, which included area burned in the Lakes TSA, has been attributed to extreme warm and dry conditions which were made 2-4 times more likely due to anthropogenic climate change (Kirchmeier-Young et al. 2018).

Using the Canadian National Fire Database (1980-2020), the most area burned in the Lakes TSA, occurred in 2018 which was the 3rd driest summer on record at the longest running weather station in the TSA (Ootsa Lake, 1957-2021) and followed the driest summer on record in 2017. Under 2 mm of precipitation was recorded at multiple weather stations in the central interior in August, including at Ootsa Lake, which made fire suppression extremely challenging. Under a climate change scenario of rapid emission reduction, the Lakes TSA could see a lengthening of the fire season of 10-20 days by 2041-2070 (Natural Resources Canada, 2022). Future area burned in the Lakes TSA is likely to increase with climate change, as many fire weather variables are projected to

increase under different models and scenarios for the area, such as days of intermittent crowning and days of active fire growth potential (Wotton et al. 2017).

6.3.2 Hydrology

Area residents have noted that the recently warm and dry decade has decreased stream flows and increased stream temperatures, potentially threatening aquatic species and habitat. Jackson (2014) examined Water Survey of Canada hydrometric stations in the Skeena region and found some tendency towards increasing winter minimum flows and declining summer flows. Earlier freshets and reduction of median August flows may be related to increasing spring and summer temperatures (Jackson, 2014).

For streams within just the Lakes area, there were many declining trends in discharge variables regardless of the season as well as the start of freshet between 1961-2010 (Jackson, 2014). Canada's Changing Climate report also found an area within the Lakes TSA of significant decreasing trend in maximum flow and a significant increasing trend in minimum flow between 1961-2010 (Bonsal et al. 2019). Loss of forests from harvesting, wildfires, and pest outbreaks may have influenced these trends, especially by increasing winter snow accumulation and earlier, faster spring melting (Vore et al. 2020).

Hydrologic-climate change projections indicate a continued trend of earlier spring freshets and declining summer flows related to increasing temperatures and earlier snowmelt (Stadnyk and Déry, 2021). Continued glacial retreat will reduce the buffering capacity on summer low flows, especially in warm, dry years (Stadnyk and Déry, 2021). In interior systems in the Skeena region, projections of increased winter temperatures, increased precipitation, and reduced snowfall in the spring will likely shift the hydrological regime from a snowmelt driven system to a hybrid rain/snow driven system which may also lead to more frequent rain-on-snow events, smaller spring snowpacks, changes to timing of peak flows, sediment loads, channel stability, and increase the duration of low flows with increased risk to fish and fish habitat (FLNRO, 2016).

Projections for 2071-2100 in the Skeena Environmental Stewardship Initiative area show peak flows 1-2 months earlier and summer discharge decreasing to less than half of current discharge (Price and Daust, 2020). Increased water evaporation in summer and decreased input from snowpack may also lead to drying of wetland areas (Price and Daust, 2020). An analysis of wetlands under a drying index developed from climate projections showed wetlands are particularly vulnerable to climate change in the south and east-central portions of the Skeena region (Price and Daust, 2020).

Stream temperature-climate change projections for the Babine watershed showed stream temperatures during the timing of salmon migration likely to rise with rising air temperatures (Stiff et al. 2018). If the duration of hot days increase, which some models indicate is possible, this could negatively impact sockeye migrating to the Babine (Stiff et al. 2018). Projected rises in water temperature will negatively affect cold-tolerant species such as bull trout and provide more favourable habitats for invasive species (Price and Daust, 2020). Changes to dissolved oxygen from changes in flow and/or temperature will also affect various salmonids (Price and Daust, 2020).

Loss of vegetation from potential climate change related disturbances as well as human-induced changes may decrease the capacity of landscapes to buffer and store rainfall, increase streamflow flashiness, and increase sediment delivery and channel instability (Price and Daust, 2020) as well as increase stream temperatures and threaten aquatic habitat, water quality, and quantity in the Lakes TSA. Conservation or enhancement of riparian habitat can help mitigate some of these impacts; however, future harvesting must be done in conjunction with watershed health

assessments to reduce the combined impacts of climate change and human induced changes to Lakes TSA area water systems.

6.3.3 Wildlife

Wildlife in the Lakes TSA will be impacted by associated habitat change as described in the above sections. Where they find their food, the quality of their food, availability of their food as well as ability to find shelter will be altered by changes to habitat assemblages. For example, analysis in the Lakes TSA shows that communities of plant and lichen species in current versus projected climate envelopes may differ by up to 80% (Price and Daust, 2013). Interactions between species (e.g., predation, pollination, mutualism) may decouple with changes in climate effecting the timing of available food sources (FLNRO, 2016).

Invasive species, terrestrial and aquatic, are expected to increase with warmer temperatures and current species may be too stressed to compete (FLNRO, 2016). Invasives may also bring foreign diseases current species are not immune to or affect foraging habitat, such as the willow borer which is currently leading to willow dieback in parts of the central interior (Price and Daust, 2020). For some ecosystems, potentially irreversible regime shifts may occur following intense disturbances (Price and Daust, 2020).

Changes to snowpack and freeze-thaw regimes may also influence predator-prey interactions of certain wildlife species, such as hunting success of wolves on a crustier snowpack (FLNRO, 2016). Biting insects and disease may increase with more favourable climates, such as moose ticks (FLNRO, 2016) and shifting temperatures altering the timing of peak blackfly abundance simultaneous with nesting period of northern goshawks has led to high mortality in parts of the Skeena region (Doyle, 2015).

Many cold adapted species, such as moose, can be affected by heat stress in all seasons and will need to migrate to areas of relatively cooler climates (Price and Daust, 2020). Moose will also be affected by potential drying of wetland habitat (Price and Daust, 2020). Top predators such as grizzly bears may also be affected by climate change in the Skeena region, primarily in changes to their food sources (Price and Daust, 2020).

Climate change vulnerability has been assessed for several of BC's fish and wildlife species, in terms of their sensitivity and adaptive capacity (Price and Daust, 2016). Some examples of species that may be at medium to high sensitivity to climate change (based on sensitivity to habitat changes) as well as having moderate to poor adaptive capacity (based on ability to recover or adjust following change) and currently within the Lakes TSA are: coastal tailed frog, western toad, wood frog, Columbia spotted frog, grizzly bear, mountain goat, northern bog lemming, wolverine, hoary marmot, American pika, southern red-backed vole, caribou, American beaver, fisher, moose, little brown myotis, northern myotis, northern goshawk, bull trout, and coastal cutthroat trout (Price and Daust, 2016). Climate change impacts to wildlife will be exacerbated by forest management activities that alter, degrade, or fragment habitat- which may include climate change adaptation strategies such as planting of different tree species or extensive salvage following wildfire or pest outbreaks.

6.3.4 Old growth management areas

Conservation of remaining old or primary forests in the Lakes TSA promotes carbon storage and climate change mitigation. While net carbon uptake decreases with age, total storage increases (Pojar, 2019). Primary forests also provide relatively cooler and moister environments that can provide refuge for current terrestrial and aquatic species during periods of abnormal climate

conditions. Spatial connection between areas of primary forest will facilitate the movement of terrestrial species and habitats with a changing climate.

7 Inventory Update and Definition of the Crown Forest Management Land Base

This report presents the current condition for several resource values in the project area (Section 8). The reporting is presented for the Crown Forest Management Land Base (CFMLB) and in some cases for the Gross Harvesting Land Base (GHLB). The definitions for these two land bases are provided below.

7.1 Data Sources

The following data sources were used for ***the inventory update and the land base definitions***:

- Vegetation Resource Inventory (VRI) rank 1 – projected to 2020
- Burns Lake Community Forest inventory – projected to 2019
- Consolidated Cutblocks (includes harvest to December 2020)
- RESULTS Openings
- FTA cutblocks
- Licensee past and planned harvest
- Fire severity data from Forest Analysis and Inventory Branch (FAIB)
- Provincial ownership (fOwn)
- Freshwater Atlas (FWA), Lakes, Rivers, and Wetlands
- Parks
- Roads
- OGMA
- UWR
- Lakes North SRMP biodiversity overlaps and Landscape Connectivity Matrix
- Cheslatta fee simple lands
- CEF (2019) roads

7.2 Harvest Data (Depletions) Processing

It is important that the recent harvest that may not be yet recorded in the VRI is accounted for in this project. The harvest data from the past 10 years was received from the area licensees. The harvest data was checked for overlaps and conflicts. Some conflicts were found where the same block was reported as harvested by two licensees. These conflicts were resolved by contacting the licensee.

RESULTS data was used only for disturbance types logging or salvage, and disturbance end dates between 2019 and 2021.

Data for the FTA permitted and harvested blocks were compared with Consolidated Cutblocks, RESULTS, and Licensee depletions. Only those blocks (5) that did not exist in other sources were kept. The result was verified against satellite imagery.

7.3 Inventory Update

For all depletions, the expected age as of 2022 was calculated as 2022 minus harvest year. The expected age was compared to the VRI age.

The age was updated as follows:

1. Within the BLCF, if harvest year > 2018, age = expected age
2. Within the BLCF, if harvest year 2016 to 2018, and inventory age > (expected age + 5), update age = expected age, otherwise inventory age was accepted
3. VRI, if harvest year >= 2015, age = expected age
4. VRI, if harvest year 2000-2014, and inventory age > (expected age + 5), update age = expected age
5. If inventory age is null, and there is a harvest year, set age = expected age
6. If inventory age is null and there is no harvest record, assume NSR and set age = 0
7. All other stands, update age to 2022: +2 for VRI, +3 for BLCF

The impact of fire and MPB on stand ages and seral stages will be considered in this analysis. However, in the inventory update, the ages of these stands were not adjusted for fire and MPB impacts.

7.4 Fire and MPB Disturbance

Percent dead from the MPB infestation for all forested stands was calculated using the VRI live and dead stand volume at 12.5 cm utilization. Stands where the percent dead was > 70% were considered early seral when reporting selected metrics.

Stands where the fire severity class = high or medium, were also considered early seral when reporting selected metrics.

7.5 Crown Forest Management Land Base (CFMLB) and Gross Harvesting Land Base (GHLB) Definition

7.5.1 CFMLB

In the CFMLB, netdown areas that are not considered for resource management are removed from the TSA land base as per the following steps:

1. Areas outside of the Lakes North and Lakes South SRMPs were removed.
2. Cheslatta fee simple lands were removed.
3. Areas that are not under the management of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development for this project were removed. These are Ownership codes 40-N, 52-N, 54-N, 80-N, 81-U, 91-U, 99-N, or 99-U. Note that Community Forest Licenses and First Nation Woodland Licenses are included in the CFMLB.
4. Woodlot Licenses were removed from the CFMLB.
5. Areas classified as non-forest were removed from the land base.

a. The VRI Forest Management Land Base Indicator (FMLB) was used as the starting point. If FMLB = N, the polygon was initially classified as non-forest (CFMLB=N).

b. If the stand has been harvested or is planned for harvest based on the depletion data above, the polygon was classified as CFMLB, regardless of the VRI FMLB classification (logging exception).

   Note there is no logging exemption for water features. A visual check of imagery shows that water features within cutblocks are not actually logged, they are WTP (wetlands) or NP areas (small ponds, lakes).

c. FWA lakes and rivers were classified as non-forest (CFMLB = N), regardless of the FMLB classification

d. VRI wetlands and FWA wetlands were classified as non-forest (CFMLB = N) regardless of the FMLB classification.

e. Alpine areas (BEC zone = BAFA, CMA, or IMA) were classified as non-forest (CFMLB=N).

6. Roads were removed from the CFMLB.

The CFMLB netdown is shown below in Table 7.

Table 7: CFMLB netdown

Description	Net Area (ha)	Gross Area (ha)
Total TSA		**1,577,483**
Outside SRMP		537,818
Project Planning Area		**1,039,665**
Cheslatta Fee Simple Lands	8,256	8,256
Non-Crown Lands	77,599	77,613
Woodlots	24,893	24,996
Non-forest	147,475	170,733
Roads	15,728	19,720
CFMLB Area	**765,713**	

Note that Community Forest Agreements (CFA) and First Nation Woodland Licenses (FNWL) are included in the study area, while woodlots are not.

7.5.2 GHLB

The GHLB is the area within the CFMLB where timber harvesting is permitted; however, it is subject to forest management objectives and constraints. The GHLB netdown removes all permanent reserves from the CFMLB. The GHLB netdown is presented in Table 8.

Table 8: GHLB netdown

Description	Net Area (ha)	Gross Area (ha)
CFMLB Area		**765,713**
Parks and Protected Areas	21,707	23,485
OGMA	74,923	85,581
UWR No Harvest	5,658	9,528
Red/blue and Hydroriparian in LCM	14,460	34,424
Ownership - Misc reserves	1,127	2,028
GHLB Area	**647,839**	

The GHLB is further netted down by removing Inoperable areas, low productivity areas, problem forest types, riparian areas, and wildlife tree retention areas. The result of this net down is called the Timber Harvesting Land Base (THLB). The THLB will be determined later in this project in consultation with the planning table.

8 Resource Values in the Project Area

The planning table will identify the full range of timber and non-timber values in the TSA. The planning table will also develop management objectives for some or all the identified resource values. The achievement of these objectives is measured via indicators. Furthermore, each objective will have a strategy or "how-to" component that describes broadly how an objective could be met. Finally, a target may be included to facilitate quantitative or qualitative measurement for the objective. The target can also facilitate planning, optimization with other objectives, implementation, and funding, and provide a monitoring point. The following hypothetical example illustrates this approach:

Value: Seral Stage Distribution

Objective: Maintain the range of forest stand ages that were historically found within the various biogeoclimatic zones within the Lakes North SRMP area

Indicator: Seral stage distribution within each Landscape Unit / BEC Zone / Biodiversity Emphasis Option

Strategy: Targeted harvesting and retention; to be explored within the planning process

Target: As specified in the Lakes North and Lakes South SRMP or as proposed by the planning table.

Modelling over a long period of time, such as 250 years, will be used as a tool to explore various strategies and their predicted impact on selected indicators. It is not likely that all the values, objectives, indicators, and their targets can be explicitly modeled. In those cases where it is not possible to direct models to try to meet indicator values, it may still be possible to report on these values and gain insight into the relationship between the indicator in question and different management strategies.

There are also indicators that cannot be reported on reliably. Fuel treatments in urban interface areas reduce the fire hazard, however there is no practical way to quantify this positive impact. Regardless, the related objectives can and should be included in the project.

This report will suggest various resource values and their indicators for the project area, and report on their current condition. The following resource values will be discussed and analyzed.

1. Biodiversity
2. First Nations Cultural Heritage
3. Water, Fish Habitat, Riparian Areas, Wetlands
4. Forage and Associated Plant Communities
5. Recreation and Resource Features
6. Soils
7. Timber
8. Visual Quality
9. Wildlife

Each resource value listed above is accompanied by an 'Issues Raised' section, whereby the issues listed are from direct, personal communications between government members of the LRP and forest licensees or First Nations. The issues that were raised are not exhaustive and only reflect what was heard in those conversations.

8.1 Biodiversity

Biodiversity means the biological diversity of plants, animals, and other living organisms in all their forms and levels of organization, including the biological diversity of genes, species, and ecosystems (FPPR). Biodiversity in British Columbia is managed via a coordinated strategy that includes a system of protected areas at the regional scale, a variety of habitats and seral stages at the landscape scale and management practices that provide important ecosystem attributes at the stand scale (FPC 1995, Biodiversity Guidebook).

8.1.1 Landscape level biodiversity

Forest habitats can be grouped into four categories at the landscape level to create landscape level biodiversity: early seral stage, mid-seral stage, mature seral stage, and late seral stage (old growth). Species diversity is generally greatest in early and late seral stages. In the project area, landscape level diversity is achieved through several land use objectives established within the Lakes North and South SRMPs.

The SRMPs provide clear direction regarding the landscape level biodiversity indicators. Quantitatively their condition can be assessed quite easily. However, the qualitative assessment is challenging; the age or seral stage of burned stands or MPB killed stands introduces uncertainty to the assessment. Information from research indicates that in many cases the mature and late seral stages, as defined by age, may not be functional anymore; however, little explicit direction exists that could be used to determine a seral stage of a stand impacted by the MPB and fires. In this report MPB impacted stands where at least 70% of the volume has been killed are considered early seral unless otherwise stated. The same applies to stands with a burn severity rating of high or medium.

In the Lakes North SRMP, low Biodiversity Emphasis Option (BEO) targets apply to the Babine West, Burns Lake East, Burns Lake West, and Taltapin Landscape Units (LUs). The intermediate BEO targets apply to the Babine East, Bulkley, and Fleming LUs.

In the Lakes South SRMP, low BEO targets apply to the Francois East Landscape Unit. Intermediate BEO targets apply to the Francois West, Cheslatta, Intata, and Ootsa LUs. The Intata and Ootsa LUs are both divided by the Nechako Reservoir with the southern portions of both units falling within the "Low Use" Caribou migration corridor and follow the low BEO old seral establishment targets. Intermediate BEO targets apply to the northern portions of both units. The Chelaslie LU has a high BEO target, however the entire LU falls within the Caribou migration corridor with its own seral stage targets.

Table 9 and Table 10 show the seral stage definitions for the Lakes North and South outside of Caribou migration corridors and within the corridors respectively.

Table 9: Seral stage definitions outside of Caribou migration corridors

Seral Stage	BEC	Age
Early	All	<40
Mature	SBS	101-140
Mature	ESSF	121-250
Old	SBS	>140
Old	ESSF	>250

Table 10: Seral stage definitions in Caribou migration corridors

Seral Stage	Age
Early	<40
Mature	>80
Old	>140

8.1.1.1 Seral Stage Distribution

The legal references and management direction along with current practice are described in Table 11.

Table 11: Seral stage distribution legal reference and management direction

Legal Value Reference	Direction
Land Use Objective -Lakes North SRMP Ministerial Order Pursuant to Sec 93.4(1) of the Land Act for the purposes of FRPA.	Maintain a range of forest seral stages by biogeoclimatic zone within each of the landscape units and in accordance with targets set for the percent of forest in early, mature plus old, and old seral stages.
Land Use Objective. Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8	The Lakes South SRMP has additional seral stage targets for the Caribou Migration Corridor which include targets for the percent of forest in early, mature, and old seral stage by seral management zone.
Current Practice	
Harvesting and road construction will maintain the percentage of early seral stage below the target levels set in the legal orders and will maintain the percentage of forest in mature plus old and old seral stages above the target levels. Harvesting will not occur where the targets in the legal orders cannot be met, unless the licensees maintain an area of mature seral forest in the BEC/LU combination equal to the area of old seral forest deficit until there is adequate old forest in the landscape unit. Licensee strategies vary with some focusing more on recruitment.	
Issues Raised	
Licensees: ➢ Most LUs fall short of meeting the old target in the ESSF in the Lakes TSA. Consider redefining ESSF old age class. ➢ Recruitment strategies are affected by age definitions. No credit in mature and old seral targets for recruitment of stands. ➢ How is VRI age class reset in burnt stands? What are the criteria?	

8.1.1.1.1 Current Condition

Figure 21 illustrates the location of different seral stages in the project area; the seral stages account for the MPB infestation and the recent fires. MPB impacted stands where the percent dead is > 70% were considered early seral when reporting seral stages. Similarly, stands where the fire severity class = high or medium, were also considered early seral.

Figure 22, Figure 23 and Figure 24 show the achievement and location of old seral stage, mature and old seral stage, and early seral stage in the project area.

All ESSF BEC zones fail to meet the late seral stage targets in both the Lakes North and the Lakes South, while the Burns Lake East and Cheslatta landscape units within the SBS BEC zone also face an old growth deficit. (Figure 22, Table 12).

Mature and Old seral stage targets are met in all landscape units except for Cheslatta and Intata/Ootsa North, where both SBS and ESSF are in deficit; however, the deficits in SBS are small (Figure 23, Table 12).

The maximum early seral target is exceeded in both BEC zones in the Cheslatta landscape unit (Lakes South) (Figure 24, Table 12). Note that not all landscape units have maximum early seral stage targets.

The old and mature seral stage targets are met in the caribou migration corridor high and moderate use zones, while the low use zone is in small deficit. In the moderate and low use zones the maximum early seral stage targets are exceeded (Table 13).

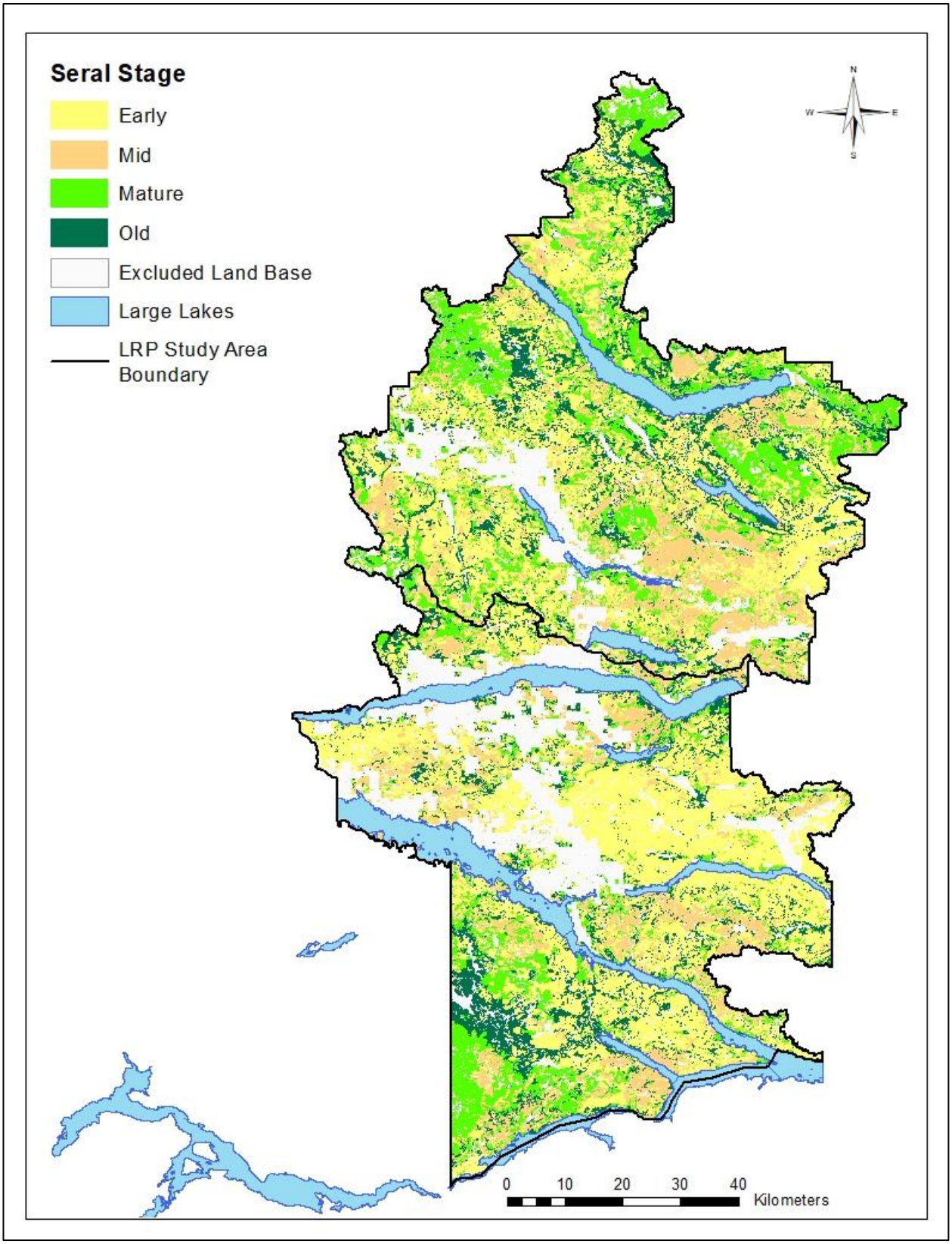


Figure 21: Seral stages in the project area

Table 12: Seral stage distribution by landscape unit and BEC in the Lakes North and South

SRMP	LU	BEC Zone	Early (ha)	Mid (ha)	Mature (ha)	Old (ha)	CFMLB (ha)	Target Early	Percent Early	Target M+O	Percent M+O	Target old	Percent old
Lakes North	Babine East	ESSF	1,292	3,926	6,566	66	**11,850**	36%	11%	28%	56%	9%	1%
		SBS	6,941	8,301	9,189	7,684	**32,115**	54%	22%	23%	53%	11%	24%
	Babine West	ESSF	2,280	967	10,223	679	**14,149**		16%	14%	77%	9%	5%
		SBS	18,901	6,308	9,193	10,218	**44,621**		42%	11%	44%	11%	23%
	Bulkley	ESSF	3,474	3,350	7,301	679	**14,804**	36%	23%	28%	54%	9%	5%
		SBS	22,857	8,272	7,987	6,211	**45,326**	54%	50%	23%	31%	11%	14%
	Burns Lake East	ESSF	2,260	6,412	2,670	165	**11,506**		20%	14%	25%	9%	1%
		SBS	24,592	27,830	8,622	5,451	**66,495**		37%	11%	21%	11%	8%
	Burns Lake West	ESSF	665	165	861		**1,692**		39%	14%	51%	9%	0%
		SBS	22,662	6,864	8,618	6,888	**45,031**		50%	11%	34%	11%	15%
	Fleming	ESSF	834	1,354	7,267	264	**9,719**	36%	9%	28%	77%	9%	3%
		SBS	17,135	4,564	8,655	8,798	**39,152**	54%	44%	23%	45%	11%	22%
	Taltapin	ESSF	5,636	3,265	10,545	103	**19,549**		29%	14%	54%	9%	1%
		SBS	21,859	7,342	5,128	13,817	**48,146**		45%	11%	39%	11%	29%
SRMP	**LU**	**BEC Zone**	**Early (ha)**	**Mid (ha)**	**Mature (ha)**	**Old (ha)**	**CFMLB (ha)**	**Target Early**	**Percent Early**	**Target M+O**	**Percent M+O**	**Target old**	**Percent old**
Lakes South	Cheslatta	ESSF	1,520	1,545	453		**3,518**	36%	43%	28%	13%	9%	0%
		SBS	58,030	13,377	6,058	7,198	**84,663**	54%	69%	23%	16%	11%	9%
	Francois East	ESSF	765	650	551		**1,966**		39%	14%	28%	9%	0%
		SBS	33,547	12,663	5,528	8,784	**60,522**		55%	11%	24%	11%	15%
	Francois West	ESSF	638	1,011	1,637	284	**3,570**	36%	18%	28%	54%	9%	8%
		SBS	22,617	11,207	4,990	6,977	**45,791**	54%	49%	23%	26%	11%	15%
	Intata / Ootsa North	ESSF	22	56	25	0	**104**	36%	21%	28%	24%	9%	0%
		SBS	14,777	11,979	3,756	3,848	**34,361**	54%	43%	23%	22%	11%	11%

Table 13: Seral stage distribution in the Caribou migration corridors

SRMP	Caribou Migration Corridor Seral Stage Management Zone	Early (ha)	Mid (ha)	Mature (ha)	Old (ha)	CFMLB (ha)		Target Early	Percent Early		Target Mature	Percent Mature		Target old	Percent old
Lakes South	High Use Zone	12,200	982	20,934	26,225	**60,341**		25%	20%		60%	78%		40%	43%
	Moderate Use Zone	8,475	499	2,935	8,836	**20,745**		32%	41%		45%	57%		30%	43%
	Low Use Zone	26,925	1,262	8,577	7,629	**44,393**		54%	61%		30%	37%		20%	17%

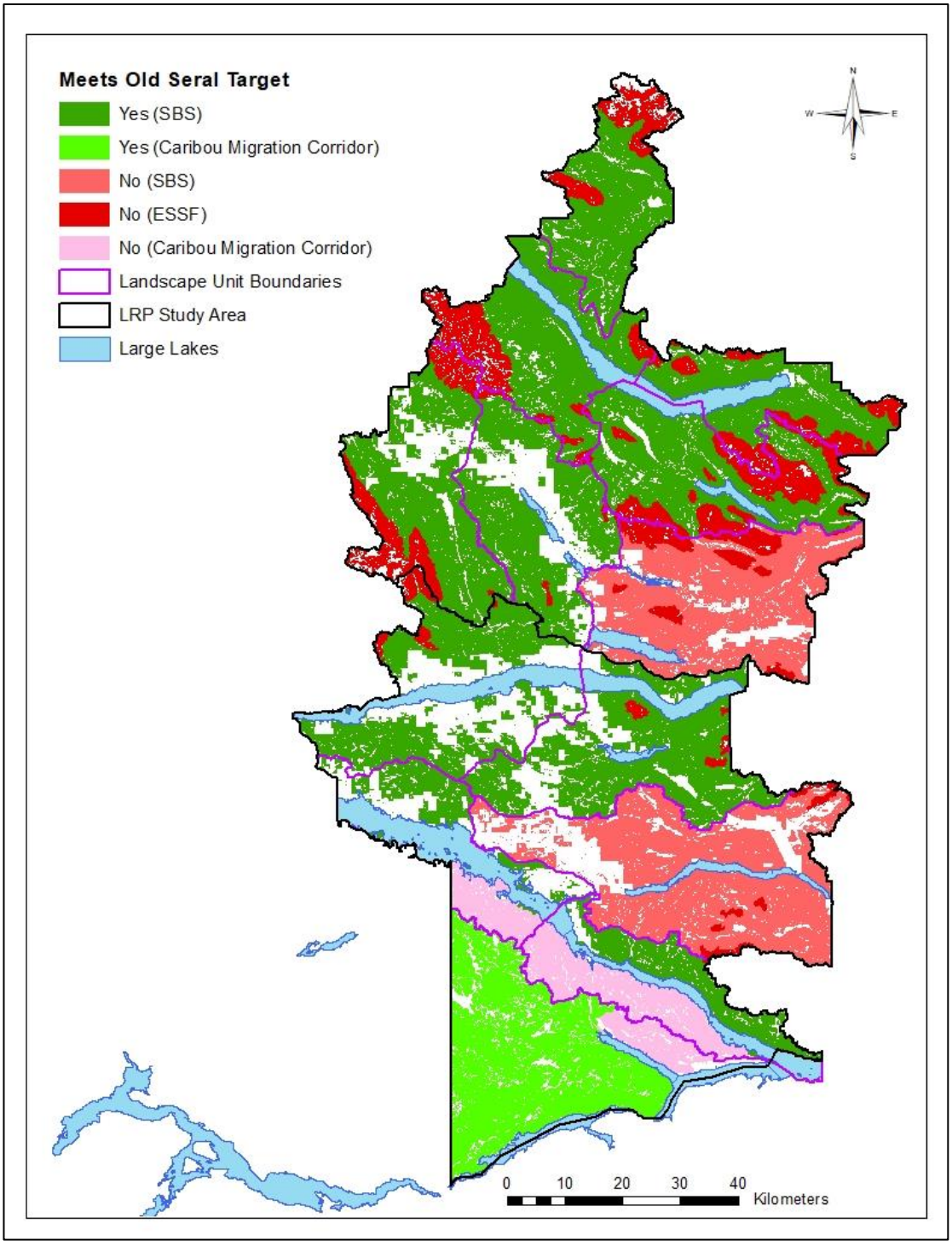


Figure 22: Old seral stage distribution in the project area

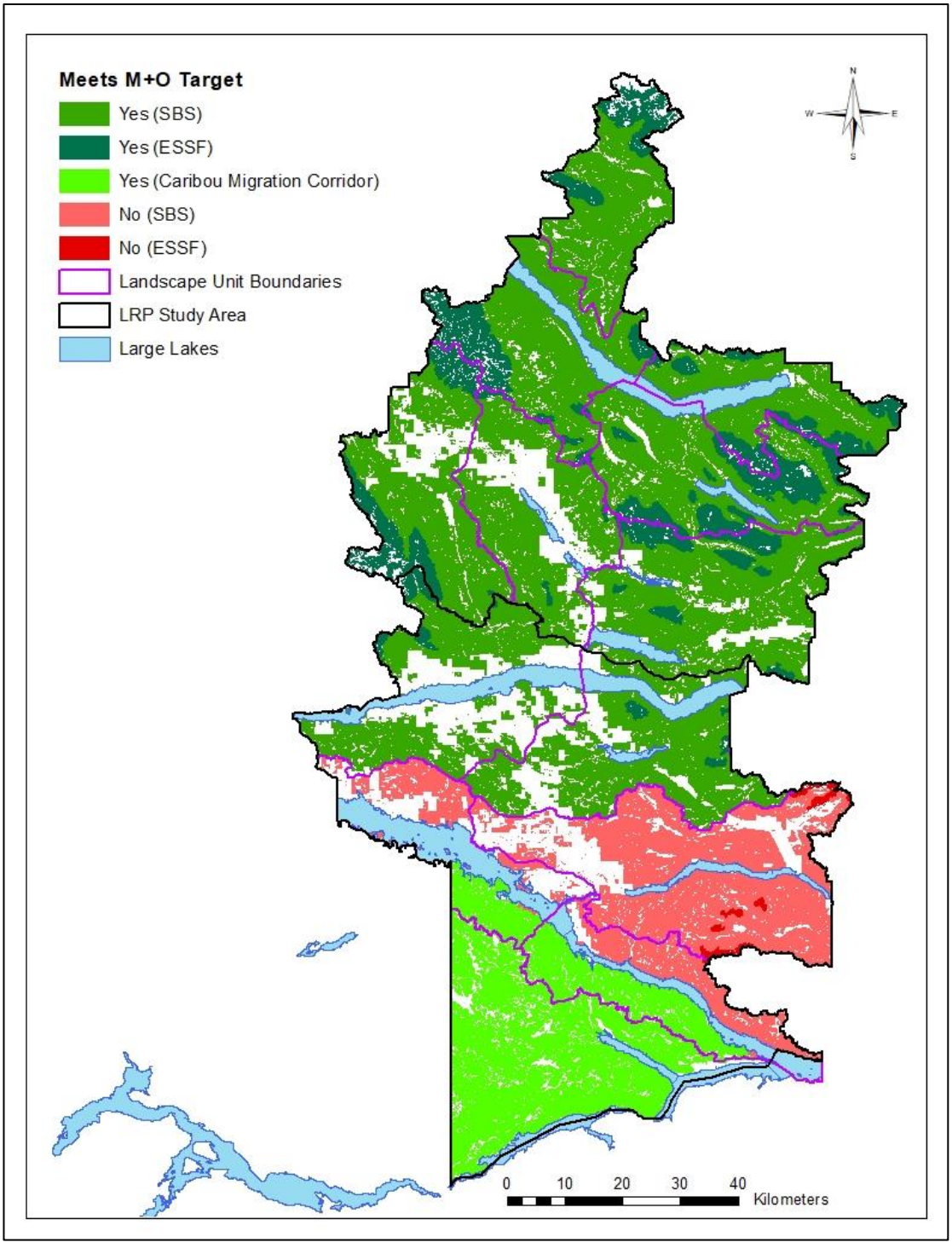


Figure 23: Mature and old seral stage distribution in the project area

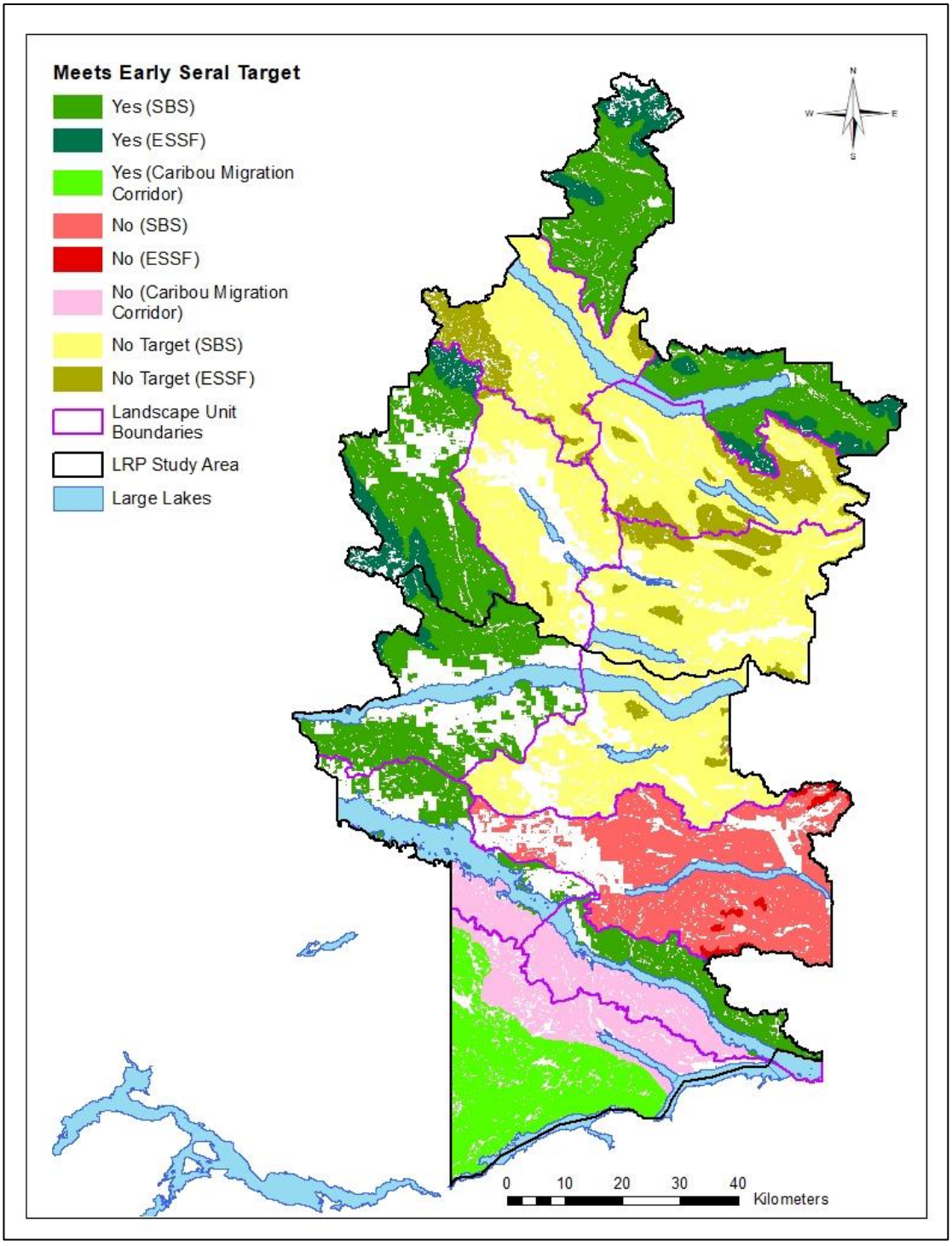


Figure 24: Early seral stage distribution in the project area

As discussed above, MPB impacted stands where at least 70% of the volume has been killed are considered early seral. The same applies to stands with a burn severity rating of high or medium. Table 14 and Table 15 show the effect of classifying late seral MPB and wildfire impacted stands as early seral in the Lakes North and South, and in the Caribou Migration Corridors.

Table 14: Impact of classifying old MPB and fire impacted stands as early

SRMP	LU	BEC Zone	Old Target (ha)	Old in the Analysis (ha)	Old Classified as Early (ha)
Lakes North	Babine East	ESSF	1,066	66	0
		SBS	3,533	7,684	814
	Babine West	ESSF	1,273	679	0
		SBS	4,908	10,218	262
	Bulkley	ESSF	1,332	679	1
		SBS	4,744	6,001	860
	Burns Lake East	ESSF	1,000	141	5
		SBS	6,281	4,113	1,874
	Burns Lake West	ESSF	123	0	0
		SBS	3,398	5,104	411
	Fleming	ESSF	875	264	0
		SBS	4,307	8,798	258
	Taltapin	ESSF	1,724	103	0
		SBS	4,920	13,307	1,720
SRMP	**LU**	**BEC Zone**	**Old Target (ha)**	**Old in the Analysis (ha)**	**Old Classified as Early (ha)**
Lakes South	Cheslatta	ESSF	317	0	0
		SBS	9,313	7,198	8,895
	Francois East	ESSF	177	0	0
		SBS	6,535	8,539	4,501
	Francois West	ESSF	321	284	0
		SBS	5,037	6,977	2,913
	Intata/Ootsa North	ESSF	9	0	0
		SBS	3,780	3,848	954

Table 15: Old seral in Caribou migration corridors accounting for age only compared to adjusted seral stage

SRMP	Caribou Migration Corridor Seral Stage Management Zone	Old Target (ha)	Old in the Analysis (ha)	Old Classified as Early (ha)
Lakes South	High Use Zone	24,136	26,225	1,942
	Moderate Use Zone	6,223	8,836	1,119
	Low Use Zone	8,879	7,629	4,338

8.1.2 Old Growth Management Areas (OGMA)

The legal reference and direction along with current practice for OGMAs are described in Table 16.

Table 16: Spatial OGMA legal reference and management direction

<table>
<tr><th>Legal Value Reference</th><th>Direction</th></tr>
<tr><td>Land Use Objective. Lakes North SRMP Ministerial Order Pursuant to Section 93.4(1) of the Land Act for the purposes of FRPA. Amended in 2016 to provide spatialization of OGMAs.</td><td rowspan="2">OGMAs are intended to make up approximately 75% of the old seral target in intermediate BEOs and 50% of the old seral target in low BEOs. A High BEO area exists in the Chelaslie LU for Caribou management and has separate old establishment targets and seral stage requirements.
The old establishment targets in BEOs are meant to be aspirational; therefore, in some LUs OGMAs may overachieve the old seral establishment targets and in other LUs they may underachieve them. The remaining old seral target requirements are to be met through aspatial old growth management.</td></tr>
<tr><td>Land Use Objective. Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8. Amended in 2016 to provide spatialization of OGMAs.</td></tr>
<tr><th colspan="2">Current Practice</th></tr>
<tr><td colspan="2">No harvesting or road construction is permitted within established OGMAs as identified on the OGMA maps in the Lakes North and South SRMP Orders.

Harvesting in OGMAs may be permitted, if the OGMA is amended and the following conditions are met:
➢ Allowance for road building where no other practicable road building options exist.
➢ Substantial forest health factor that poses a significant and substantiated forest health risk outside of the OGMAs and where harvesting is an appropriate and effective action.
➢ A need to address public or industrial safety concerns or an environmental hazard where no other practicable alternative exists.
➢ OGMA amendment is consistent with the Skeena Region old growth amendment policy.
➢ If boundary adjustments are made, an alternate area must be identified and reserved from harvesting in the same LU/BEC combination as the original OGMA. The old growth attributes of the replacement OGMA must meet or exceed the attributes of the original OGMA.</td></tr>
<tr><th colspan="2">Issues Raised</th></tr>
<tr><td colspan="2">Licensees:

➢ Spatial OGMAs create certainty. Easy to avoid; however, they can burn.
➢ OGMAs are co-located with First Nation values; however, it is not known what the values are. How do we know they are meeting the management intent?
➢ Aspatial old growth management could be used where there is an increase in fire risk close to communities.
➢ Not all OGMAs are created equal. Are they still meeting their intent?
➢ Rotating OGMAs could deal with landscape natural disturbance pressures while still being spatial.
➢ Aspatial old growth targets would help recognize disturbance on the landscape. However, aspatial old growth retention is difficult to track, especially, if a natural disturbance occurs and affects the seral targets.
➢ An old interior target could be helpful.</td></tr>
</table>

- Current practice is to avoid OGMAs. Lack of monitoring of OGMAs.
- OGMAs are important; however, a clear process is needed where OGMAs are not always looked at in a permanent way.
- What would be a good recruitment strategy?
- Manage for interior old.
- Lots of age class 2 on the landscape; only large contiguous areas.
- Grizzly bear areas would be good spots for old-growth attributes.
- Lots of OGMAs are dead and have no timber or wildlife value.
- Some OGMAs are in the wildland urban interface.

First Nations:

- Some First Nations would like to see more old growth on the landscape.
- OGMAs are important habitat for wildlife.

8.1.2.1 Current Condition

Old growth management areas (OGMA) have been legally established both in Lakes North and Lakes South. The MPB attack and the recent fires have impacted OGMAs (Figure 25, Figure 26, Table 17 and Table 18). Approximately 12% of the OGMA area have more than 70% of the standing volume killed by the MPB. Only 47% of the total OGMA area has not been impacted by the MPB (Figure 25). While the MPB impacted the SBS biogeoclimatic zone OGMAs more than those in the ESSF zone, the relative impacts are comparable (Table 17).

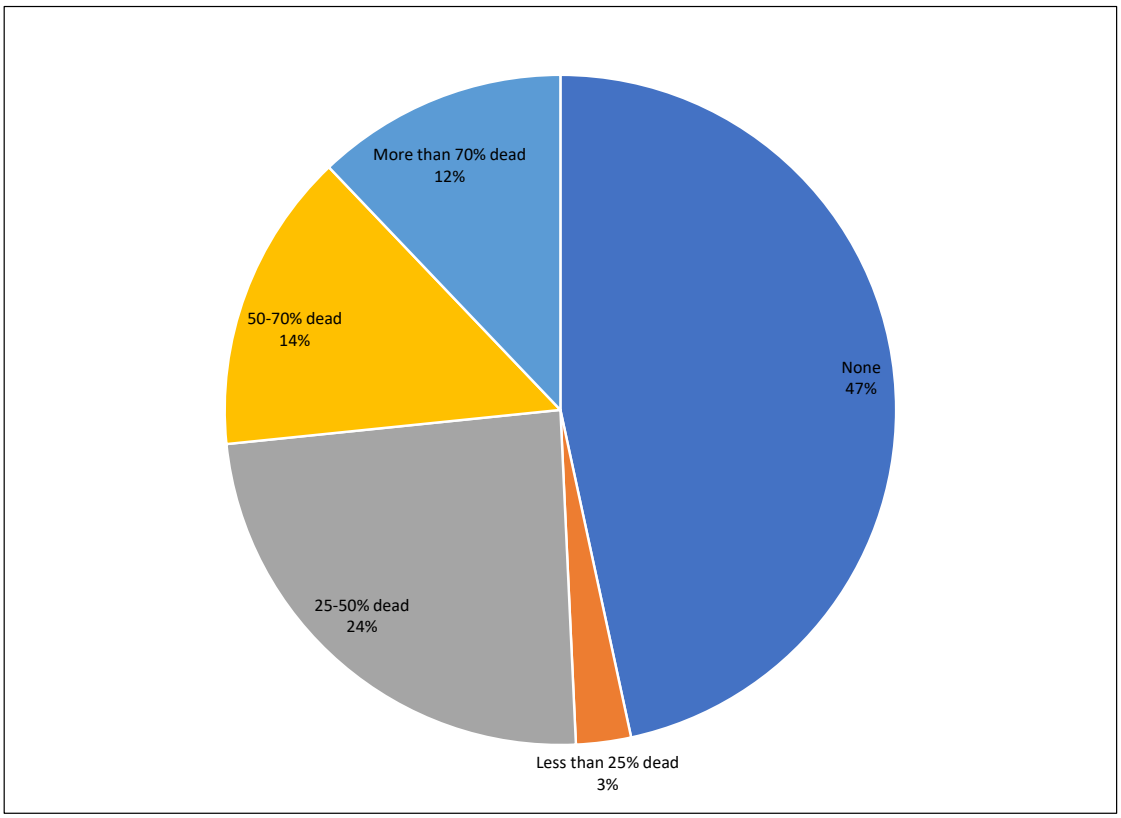


Figure 25: MPB infestation impact on OGMAs

Table 17: MPB impact on OGMAs

MPB attack	ESSF		SBS		Total	
	CFMLB (ha)	% Of OGMA	CFMLB (ha)	% Of OGMA	CFMLB (ha)	% Of OGMA
None	6,691	51%	28,238	46%	34,929	47%
Less than 25% dead	388	3%	1,593	3%	1,981	3%
25-50% dead	3,046	23%	15,019	24%	18,065	24%
50-70% dead	2,176	17%	8,700	14%	10,876	15%
More than 70% dead	856	7%	8,216	13%	9,073	12%
Total	**13,156**	**100%**	**61,766**	**100%**	**74,923**	**100%**

According to the available data, the impact of wildfires on the OGMAs has been modest. Only 16% of the OGMA area has been impacted by fires (Figure 26). Most of the fires occurred in the SBS biogeoclimatic zone (Table 18).

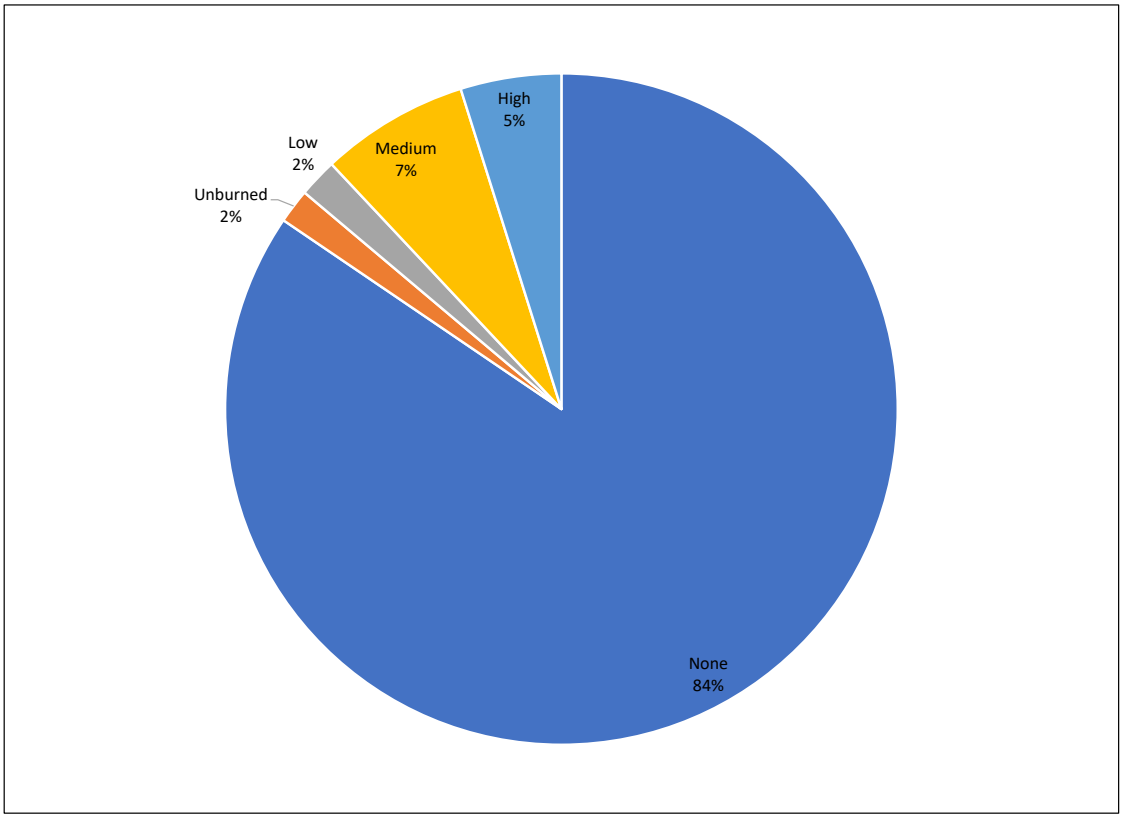


Figure 26: Wildfire impact on OGMAs

Table 18: Wildfire impact on OGMAs

Burn Severity	ESSF		SBS		Total	
	CFMLB (ha)	% of OGMA	CFMLB (ha)	% of OGMA	CFMLB (ha)	% of OGMA
None	13,156	100%	50,161	81%	63,317	85%
Unburned[12]	0	0%	1,237	2%	1,237	2%
Low	0	0%	1,393	2%	1,393	2%
Medium	0	0%	5,348	9%	5,348	7%
High	0	0%	3,628	6%	3,628	5%
Total	**13,156**	**100%**	**61,766**	**100%**	**74,923**	**100%**

Figure 27 and Table 19 depict the current age class distribution in all OGMAs across the TSA. The young forests where the seral stage has been adjusted due to MPB and wildfires are called Wild Young Forest. Stands older than 140 years occupy approximately 43% of OGMAs. The balance (57%) consists of younger stands.

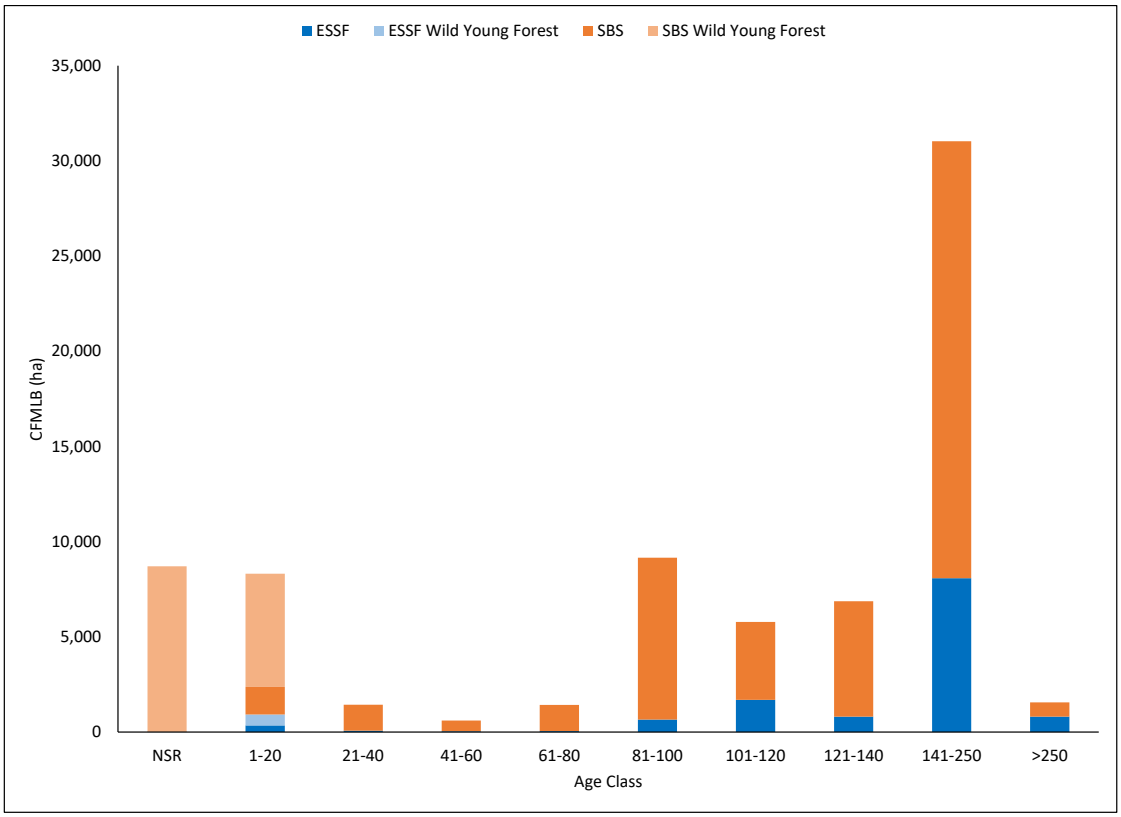


Figure 27: Age class distribution of OGMAs

[12] Unburned depicts areas that were within the fire perimeter but not burned.

Table 19: Age class[13] distribution of OGMAs

Age Class 2021	ESSF (ha)	ESSF, Wild Young Forest (ha)	SBS (ha)	SBS, Wild Young Forest (ha)	Total (ha)	%
0	9	0	1	8,700	8,710	12%
1	349	572	1,454	5,947	8,322	11%
2	76		1,358		1,434	2%
3	45		566		611	1%
4	55		1,375		1,430	2%
5	659		8,502		9,161	12%
6	1,694		4,092		5,786	8%
7	811		6,064		6,876	9%
8	8,081		22,954		31,035	41%
9	806		753		1,559	2%
Total	**12,584**	**573**	**47,119**	**14,647**	**74,923**	**100%**

As illustrated above, OGMAs consist of various age classes, many of them not representing the old seral stage as shown in Table 20. Table 20 illustrates the seral stage distribution in all OGMAs in the TSA by BEC zone. In ESSF only 6% of the OGMA area is considered old, while mature stands cover approximately 68% of the total ESSF area. In SBS the old seral stage is better represented; 38% of the area is considered old seral. The data in Table 20 is also illustrated in Figure 28 and Figure 29.

The prevalence of the early seral stage areas in OGMAs is due to natural disturbance (MPB, wildfires), while the mid and mature seral stages contribute to OGMAs by design. OGMAs are a component of an old growth management strategy in both Lakes South and Lakes North. When initially established, OGMAs were set contain old growth characteristics, including interior forest conditions. However, because other forest values were also considered in OGMA establishment, mid and mature seral stage forests were included within their boundaries as old forest recruitment areas.

Table 20: Seral stage distribution of OGMAs by BEC zone

Seral Stage	ESSF		SBS		Total	
	CFMLB (ha)	%	CFMLB (ha)	%	CFMLB (ha)	%
Early	434	3%	2,741	4%	3,174	4%
Early, Wild Young Forest	573	4%	14,647	24%	15,220	20%
Mid	2,452	19%	10,515	17%	12,968	17%
Mature	8,892	68%	10,157	16%	19,049	25%
Old	806	6%	23,707	38%	24,512	33%
Total	**13,156**	**100%**	**61,766**	**100%**	**74,923**	**100%**

[13] Age Classes: 0=NSR, 1=1-20, 2=21-40, 3=41-60, 4=61-80, 5=81-100, 6=101-120, 7=121-140, 8=141-250, 9>250

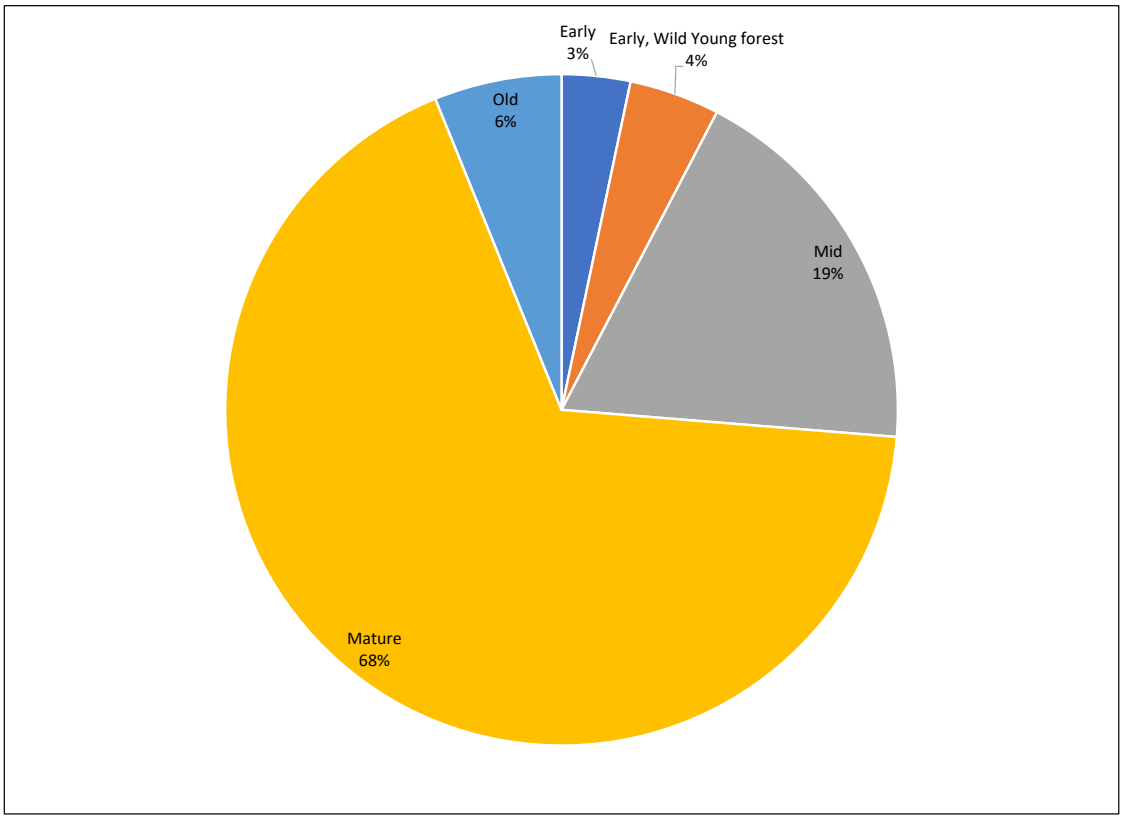


Figure 28: Seral stage distribution of OGMAs, ESSF

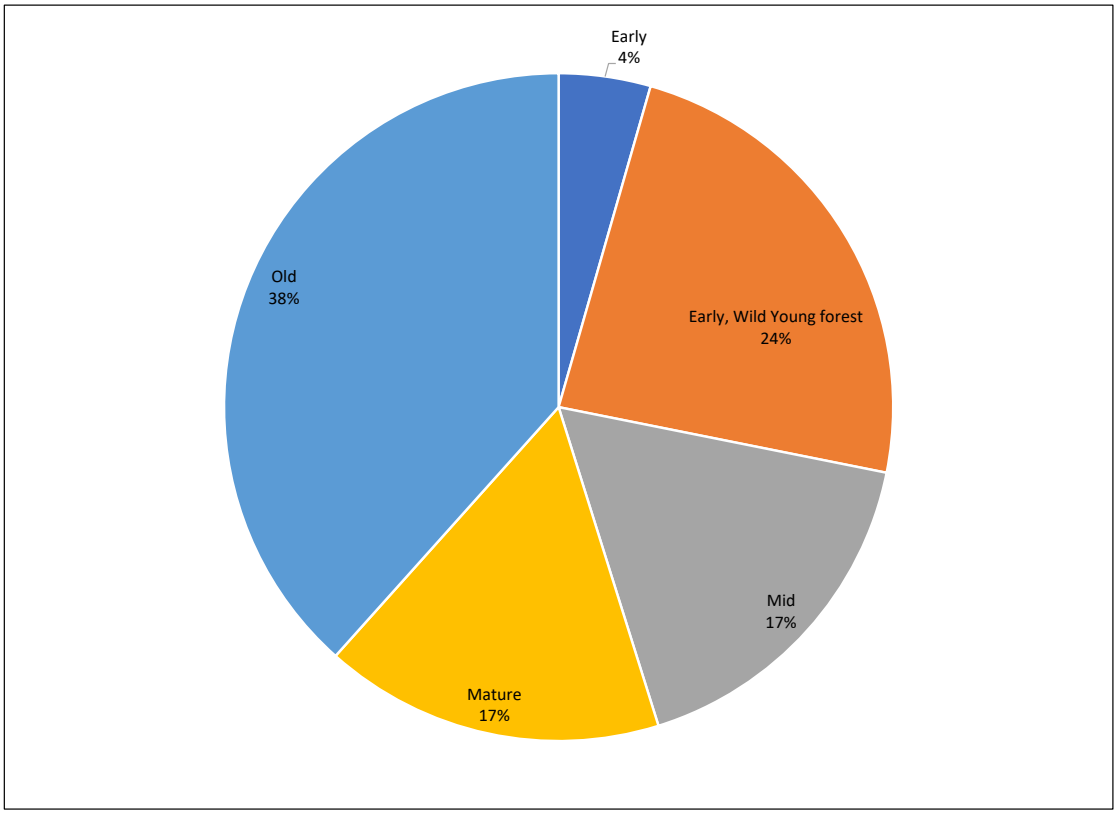


Figure 29: Seral stage distribution of OGMAs, SBS

The Lakes South SRMP originally set a target for the percentage of the old growth objective that is expected to be met through OGMAs. In 2016 the objective was amended and replaced with an updated map of OGMAs.

The Lakes North SRMP also originally specified (in Appendix 2) the proportion of the old seral target that must be met in OGMAs. OGMAs were spatially located because of those specifications and have since been amended and replaced with updated spatial areas in 2016; the percentage of the old growth objective that was initially expected to be met through OGMAs is no longer required.

The current condition of OGMAs by landscape unit in Lakes North and Lakes South is shown in Table 21 and Table 22 respectively. In all landscape units the old seral targets must be met through a combination of non-spatial old growth retention and OGMAs because the area under OGMAs is not large enough to meet old seral targets even when the forest reaches the age of old. This is particularly true in Lakes North.

Table 21: Current condition of OGMAs by landscape unit in Lakes North

LU	BEC Zone	CFMLB (ha)	Target old (%)	Target old (ha)	Total Old (ha)	Total OGMA (ha)	Old OGMA (ha)	% Of target in OGMA (ha)	% Of target old in OGMA
Babine East	ESSF	11,850	9%	1,066	66	196	41	18%	4%
	SBS	32,115	11%	3,533	7,684	133	123	4%	3%
Babine West	ESSF	14,149	9%	1,273	679	613	153	48%	12%
	SBS	44,621	11%	4,908	10,218	2,648	1,056	54%	22%
Bulkley	ESSF	14,804	9%	1,332	679	911	221	68%	17%
	SBS	45,326	11%	4,986	6,211	3,817	1,841	77%	37%
Burns Lake East	ESSF	11,506	9%	1,036	165	543	59	52%	6%
	SBS	66,495	11%	7,314	5,451	3,316	922	45%	13%
Burns Lake West	ESSF	1,692	9%	152		86	0	56%	0%
	SBS	45,031	11%	4,953	6,888	2,788	1,544	56%	31%
Fleming	ESSF	9,719	9%	875	264	489	43	56%	5%
	SBS	39,152	11%	4,307	8,798	3,210	1,796	75%	42%
Taltapin	ESSF	19,549	9%	1,759	103	946	53	54%	3%
	SBS	48,146	11%	5,296	13,817	2,596	1,240	49%	23%
Total		404,153	11%	42,792	61,023	22,292	9,093	52%	21%

Table 22: Current condition of OGMAs by landscape unit in Lakes South

LU	BEC Zone	CFMLB (ha)	Target old (%)	Target old (ha)	Total Old (ha)	Total OGMA (ha)	Old OGMA (ha)	% Of target in OGMA (ha)	% Of target old in OGMA
Cheslatta	ESSF	3,518	9%	317		774	0	244%	0%
	SBS	84,663	11%	9,313	7,198	9,560	1,196	103%	13%
Francois East	ESSF	1,966	9%	177			0	0%	0%
	SBS	60,522	11%	6,657	8,784	3,862	1,543	58%	23%
Francois West	ESSF	3,570	9%	321	284	316	97	98%	30%
	SBS	45,791	11%	5,037	6,977	6,166	1,794	122%	36%
Intata/Ootsa North	ESSF	104	9%	9	0		0	0%	0%
	SBS	34,361	11%	3,780	3,848	3,644	1,512	96%	40%
Total		233,382	234,495	11%	25,611	27,091	24,322	6,142	95%

Table 23: Current condition of OGMAs in Caribou migration corridor use zones

Caribou Migration Corridor Use Zone	CFMLB (ha)	Target old (%)	Target old (ha)	Total old (ha)	Total OGMA (ha)	Old OGMA (ha)	% Of target in OGMA (ha)	% Of target old in OGMA
High Use Zone	60,341	40%	24,136	26,225	20,763	11,687	86%	45%
Moderate Use Zone	20,745	30%	6,223	8,836	350	218	6%	2%
Low Use Zone	44,393	20%	8,879	7,629	7,061	2,834	80%	37%
Total	60,341	40%	24,136	26,225	20,763	11,687	86%	45%

8.1.3 Landscape Connectivity Matrix

The Lakes LRMP includes an objective to maintain or enhance habitat connectivity at the landscape level. A landscape connectivity matrix (LCM) was developed for the Lakes North and the Lakes South SRMPs. The LCM consists of a network of landscape corridors.

The legal reference and direction for LCM along with current practices are described in Table 24.

Table 24: Landscape connectivity matrix legal reference and management direction

Legal Value Reference	Direction
Land Use Objective. Lakes North SRMP Ministerial Order Pursuant to Section 93.4(1) of the Land Act for the purposes of FRPA. Amended 2017.	Within the Lakes North SRMP, connectivity is maintained through a percentage of the forested area required to be in mature and old forest condition.
Land Use Objective. Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8.	In the Lakes South SRMP, connectivity is maintained by minimum age requirements and maximum cutblock sizes.
Current Practice	
In the Lakes North SRMP, no harvesting is permitted within an LCM and adjacent to another cutblock within the LCM unless a specified percentage of the existing cutblock has developed attributes consistent with a mature seral condition. Additional limitations on harvesting in LCMs exist regarding the width of the LCM and associated seral stage requirements. No harvesting is permitted within red and blue listed ecological communities or in hydro-riparian ecosystems identified in the Order by BEC variant and site series. One licensee has a recruitment strategy for areas within the LCMs that fall below the mature forest target percentage levels. Roads may be constructed within an LCM where no practicable alternative exists and must be deactivated upon completion of harvesting. There are exceptions in the Order for meeting some of the LCM targets for salvage purposes and several licensees outline strategies in their Forest Stewardship Plans (FSPs) on how connectivity will be maintained in the case of salvage operations. In the Lakes South SRMP and within a landscape connectivity segment (LCS), harvesting	

must retain a minimum percentage of forest stands within minimum age criteria. Cutblocks must not exceed a certain size within the LCS. Roads may be constructed within an LCS if no other practicable alternative exists.

Issues Raised

Licensees:

- The LCMs are too large and make it difficult to manage them in certain units. If one area is locked out it causes the rest of the LCM to be locked out as well.
- In other cases, the smaller LCMs are more difficult to salvage because the percentage of allowable salvage is exceeded more quickly than in a larger polygon.
- The percentage cut-off of dead Pl is problematic. Need more flexibility to go into stands that are <50% dead.
- The 30% width restriction can isolate timber. Instead manage the width of clearcut or the riparian dash distance.
- Focus on partial cutting in LCM.

First Nations:

- Increased protection and better management of terrestrial and aquatic habitats for fish and wildlife, including wetlands are desirable. LCMs provide much of this.

8.1.3.1 Current Condition

In Lakes North a minimum of 70% of the forest in the LCMs is expected to be older than 100 years in the SBS BEC zone and 120 years in the ESSF BEC zone. In this report, stands that meet this requirement are called mature/old.

In Lakes South a minimum of 70% of the forest is also expected to be mature within the LCM. Mature is defined as older than 70 years in the SBS BEC zone and 100 years in the ESSF BEC zone. In addition, deciduous forest older than 40 years is considered mature, as are younger natural stands with mature characteristics; these stands were established prior to 1967, have greater than 25% crown closure and are taller than 15 m.

Table 25 and Figure 30 present the current condition for the seral stages of the connectivity corridors in Lakes North. Note that the corridor SKE_11_29383 has been split into 4 sections due to its large size.

Table 26 shows the current condition for the seral stages of the connectivity corridors in Lakes South. Many connectivity corridors fail to meet the seral targets (highlighted in red). This is also illustrated in Figure 31.

Table 25: Current condition of LCMs, Lakes North

Corridor	CFMLB (ha)	Mature/Old (ha)	Mature/Old (%)
SKE_11_29380	38	29	77%
SKE_11_29381	293	174	60%
SKE_11_29382	169	169	100%
SKE_11_29383_1	8,121	5,419	67%

Corridor	CFMLB (ha)	Mature/Old (ha)	Mature/Old (%)
SKE_11_29383_2	19,481	13,355	69%
SKE_11_29383_3	13,772	7,227	52%
SKE_11_29383_4	18,728	8,361	45%
SKE_11_29384	689	464	67%
SKE_11_29392	768	672	88%
SKE_11_29395	191	93	49%
SKE_11_29396	928	870	94%
SKE_11_29398	1,330	1,242	93%
SKE_11_29399	60	48	80%
SKE_11_29400	140	116	83%
SKE_11_29401	838	504	60%
SKE_11_29403	969	777	80%
SKE_11_29404	699	670	96%
SKE_11_29405	105	96	91%
SKE_11_29407	124	90	73%
SKE_11_29408	144	108	75%
SKE_11_29414	180	83	46%
SKE_11_29418	272	153	56%
SKE_11_29419	129	89	69%
SKE_11_29420	360	346	96%
SKE_11_29421	393	326	83%
SKE_11_29422	182	130	72%
SKE_11_29423	461	415	90%
SKE_11_29424	585	317	54%
SKE_11_29425	254	9	4%
SKE_11_29426	3,130	1,553	50%
SKE_11_29427	245	75	30%
Total	**73,777**	**43,980**	**60%**

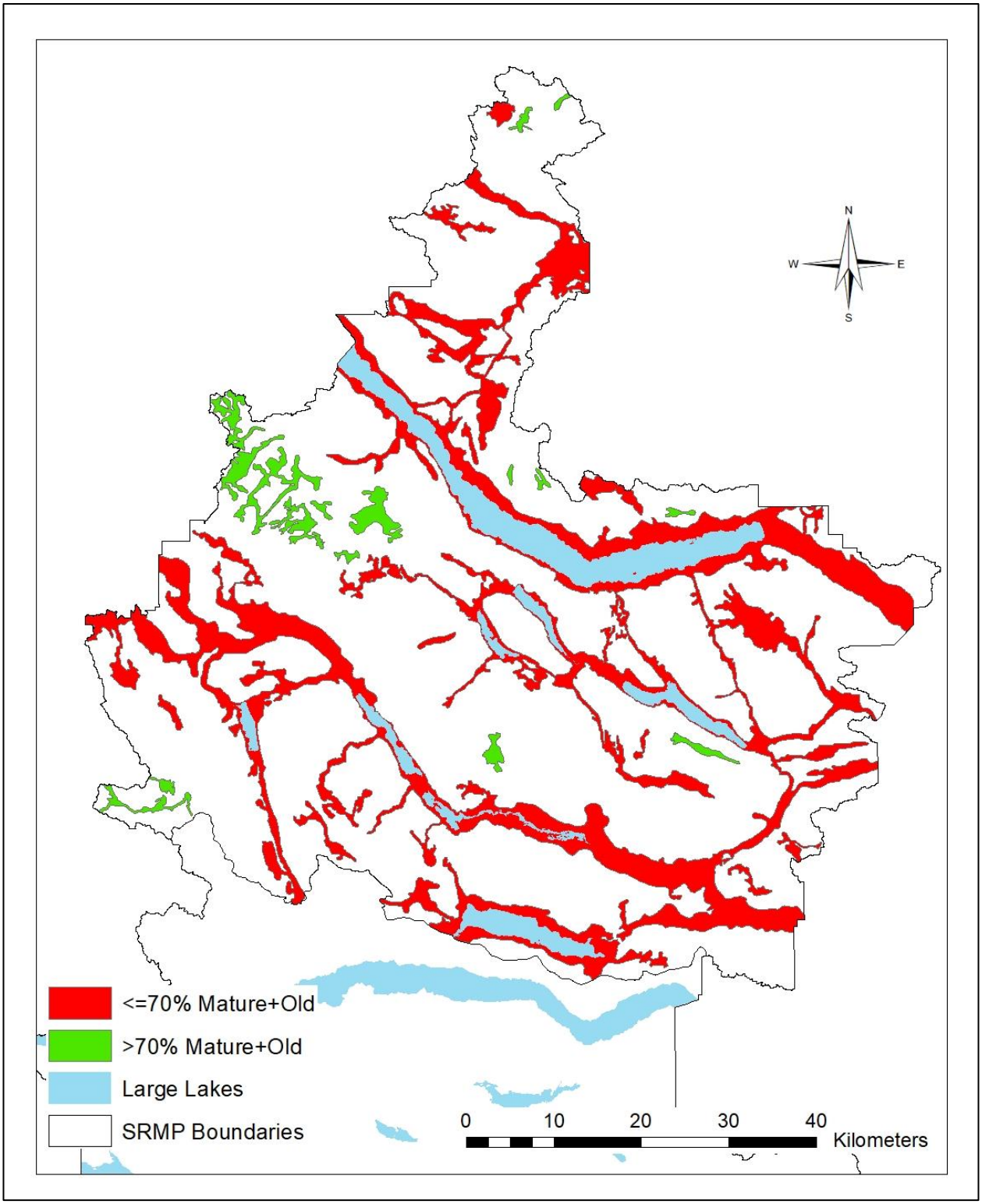


Figure 30: Current condition of LCMs, Lakes North

Table 26: Current condition of LCMs, Lakes South

Corridor	CFMLB (ha)	Mature/ Old (ha)	Mature/ Old (%)	Corridor	CFMLB (ha)	Mature/ Old (ha)	Mature/ Old (%)
SKE_10_10	498	280	56%	SKE_10_64	715	47	7%
SKE_10_100	489	364	74%	SKE_10_65	233	153	65%
SKE_10_11	851	470	55%	SKE_10_66	688	481	70%
SKE_10_13	776	712	92%	SKE_10_67	750	660	88%
SKE_10_15	176	138	78%	SKE_10_68	234	206	88%
SKE_10_16	188	149	79%	SKE_10_69	454	169	37%
SKE_10_20	0	0	100%	SKE_10_70	243	227	94%
SKE_10_21	2	2	100%	SKE_10_71	23	23	100%
SKE_10_23	169	168	99%	SKE_10_72	1,168	1,008	86%
SKE_10_24	945	469	50%	SKE_10_73	458	410	89%
SKE_10_25	30	30	100%	SKE_10_74	985	737	75%
SKE_10_26	7	7	100%	SKE_10_75	806	436	54%
SKE_10_27	356	46	13%	SKE_10_76	285	271	95%
SKE_10_28	16	10	65%	SKE_10_77	572	382	67%
SKE_10_29	334	308	92%	SKE_10_78	577	365	63%
SKE_10_30	26	15	59%	SKE_10_79	962	718	75%
SKE_10_33	100	65	65%	SKE_10_80	515	159	31%
SKE_10_34	77	62	81%	SKE_10_81	400	124	31%
SKE_10_35	26	14	53%	SKE_10_82	759	598	79%
SKE_10_36	309	134	43%	SKE_10_83	856	591	69%
SKE_10_37	608	271	45%	SKE_10_84	434	377	87%
SKE_10_38	13	5	38%	SKE_10_85	357	285	80%
SKE_10_39	126	27	22%	SKE_10_87	825	549	67%
SKE_10_40	418	34	8%	SKE_10_89	286	240	84%
SKE_10_41	398	154	39%	SKE_10_9	633	576	91%
SKE_10_42	616	413	67%	SKE_10_90	996	237	24%
SKE_10_44	340	15	4%	SKE_10_91	526	386	73%
SKE_10_46	0		0%	SKE_10_92	550	281	51%
SKE_10_50	208	57	27%	SKE_10_93	1,064	953	90%
SKE_10_51	329	98	30%	SKE_10_94	542	322	59%
SKE_10_52	200	171	85%	SKE_10_95	676	232	34%
SKE_10_53	396	17	4%	SKE_10_96	36	31	86%
SKE_10_54	573	39	7%	SKE_10_97	840	432	51%
SKE_10_55	64	7	11%	SKE_10_99	512	408	80%
SKE_10_56	409	22	5%	**Total**	**35,641**	**19,914**	**56%**
SKE_10_57	12	2	16%				
SKE_10_58	519	273	53%				
SKE_10_59	917	424	46%				
SKE_10_60	576	478	83%				
SKE_10_61	1,171	187	16%				
SKE_10_62	1,113	410	37%				
SKE_10_63	727	94	13%				

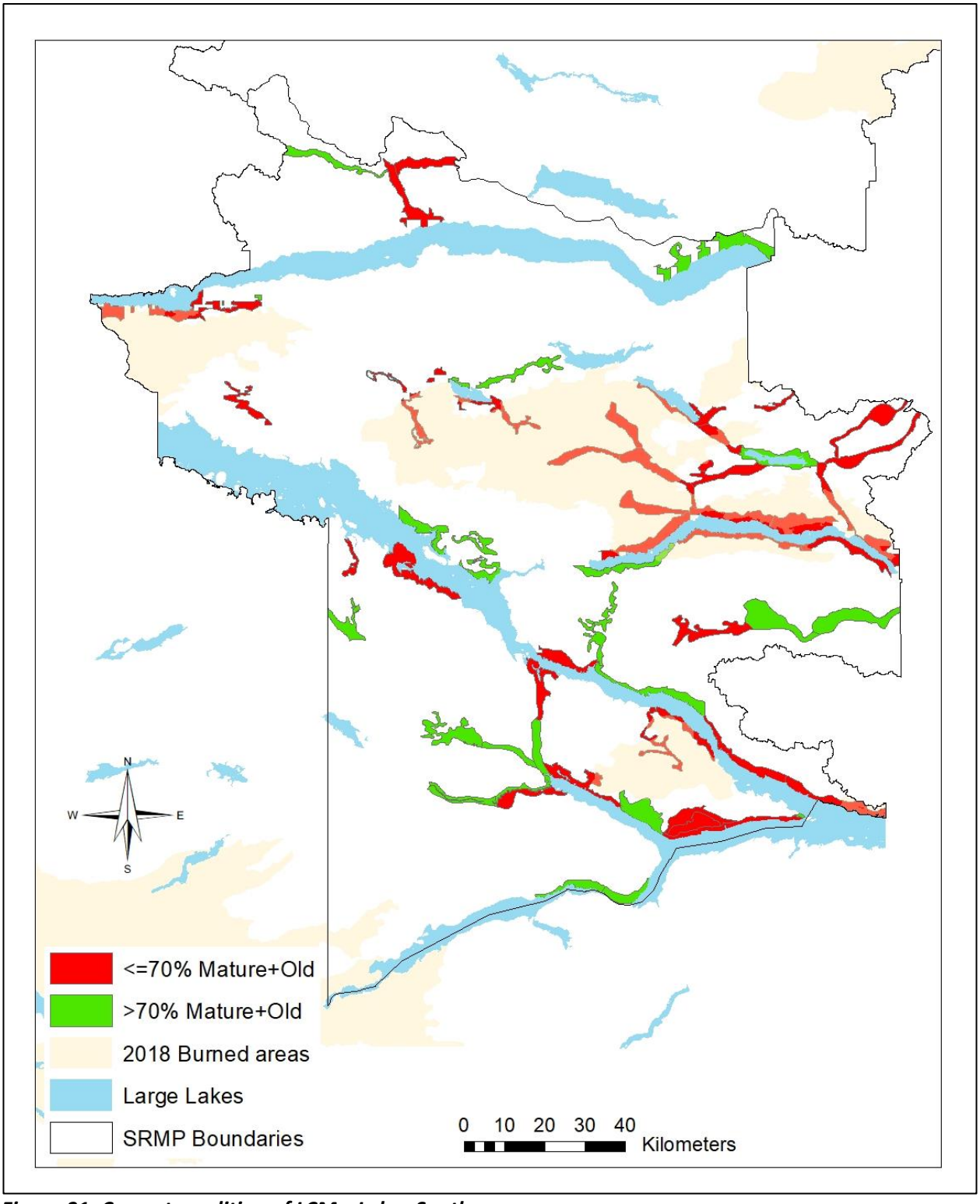


Figure 31: Current condition of LCMs, Lakes South

8.1.4 Patch Size Distribution

A patch size distribution provides a metric for the distribution of the very early seral stage (<=20 years) in the landscape. While definitions for very early and early seral stages in determining patch size distributions vary across the province, 20 years and younger is used in the project area by at least one licensee (BCTS). Harvested blocks belong to the same patch, if they are located within 100 m of each other and are 20 years old or younger. The concept of a patch is fluid in that cut blocks can leave the patch when they age beyond 20 years; however, new blocks can also enter an existing patch upon harvest.

The legal reference and direction along with current practices are described in Table 27.

Table 27: Patch size distribution legal reference and management direction

Legal Value Reference	Direction
Land Use Objective. Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8, FPPR Sec. 67	Attain a pattern of development, over time, across the Lakes South planning area that represents a natural disturbance pattern. The pattern is achieved through patch-size target percentages within Natural Disturbance Type and BEC subzone combinations. This legal patch management objective applies only to the Lakes South SRMP as it is not a legal objective in the Lakes North SRMP. Rather, the Lakes North SRMP provides only guidance regarding representative patch sizes and their distribution.
Current Practice	
Licensees attempt to adhere to the patch-size targets established in the Order for the Lakes South SRMP for small, medium, and large patches. Several licensees indicate they will avoid adding any area to the large patch-size category in NDT 2 and will instead create blocks in the small and medium categories.	
Issues Raised	
Licensees: ➢ Analysis is convoluted. ➢ A patch-size objective is nice because it allows for patches to be connected as opposed to seral stage which ends up being small pockets of non-contiguous areas. ➢ Achieving patch as a verifiable and measurable target is difficult. One must account not only for the block you wish to create but also existing young stands that age out of the young seral stage. Makes it difficult as a legal objective. ➢ More difficult to create areas of small patches within contiguous areas of mature stands. ➢ Seral targets manage rate of harvest versus distribution on the ground. Just end up with slivers if you only manage for seral stage without patch-size distribution. ➢ Natural Range of Variation principles are not conducive to larger patches. ➢ Requirements to salvage limit the ability to meet patch-size requirements.	

The patch targets presented in the two SRMPs are identical. They are shown in Table 28.

Table 28: Patch size targets

NDT	BEC	Patch Sizes and Targets			
2	ESSF	Size	<40 ha	40-80 ha	80+ ha
		Target	30-40%	30-40%	20-40%
3	SBS	Size	<40 ha	40-250 ha	250+ ha
		Target	10-30%	10-30%	40-80%

8.1.4.1 Current Condition

Table 29 shows the current patch size distribution in Lakes North and Lakes South compared to the patch size distribution targets. The patch size distributions are also illustrated in Figure 32 and Figure 33. Across the project area, the large patches – over 80 ha in size – are over-represented in NDT 2 (ESSF) compared to the target of 20 to 40%. In Lakes North 86% of the very early seral is in patches larger than 80 ha in size, while in Lakes South the large patches constitute 75% of very early seral stands. Because of the prevalence of large patches, the targets for smaller patches are not achieved.

In NDT 3 (SBS), the current patch size distribution meets the targets for the large (250+ ha) and medium (40-250 ha) patches in Lakes North. The large patches are overachieved, and medium size patches are underachieved in Lakes South.

The small patches (<40 ha) are in deficit in both Lakes South and Lakes North (Table 29, Figure 33).

Note that the very early seral definition in the patch analysis is based on the MPB and fire severity adjusted seral stages.

Table 29: Current patch size distribution compared to targets

SRMP	BEC Zone	Patch Size			Total Area (ha)
North	**ESSF**	**<40 ha**	**40-80 ha**	**80+ ha**	**10,257**
		910 ha	549 ha	8,799 ha	
	Achieved	9%	5%	86%	
	Target	30-40%	30-40%	20-40%	
	SBS	**<40 ha**	**40-250 ha**	**250+ ha**	**91,862**
		5,859 ha	13,203 ha	72,799 ha	
	Achieved	6%	14%	79%	
	Target	10-30%	10-30%	40-80%	
South	**ESSF**	**<40 ha**	**40-80 ha**	**80+ ha**	**6,972**
		1,218 ha	525 ha	5,229 ha	
	Achieved	17%	8%	75%	
	Target	30-40%	30-40%	20-40%	
	SBS	**<40 ha**	**40-250 ha**	**250+ ha**	**125,959**
		6,155 ha	10,975 ha	108,829 ha	
	Achieved	5%	9%	86%	
	Target	10-30%	10-30%	40-80%	

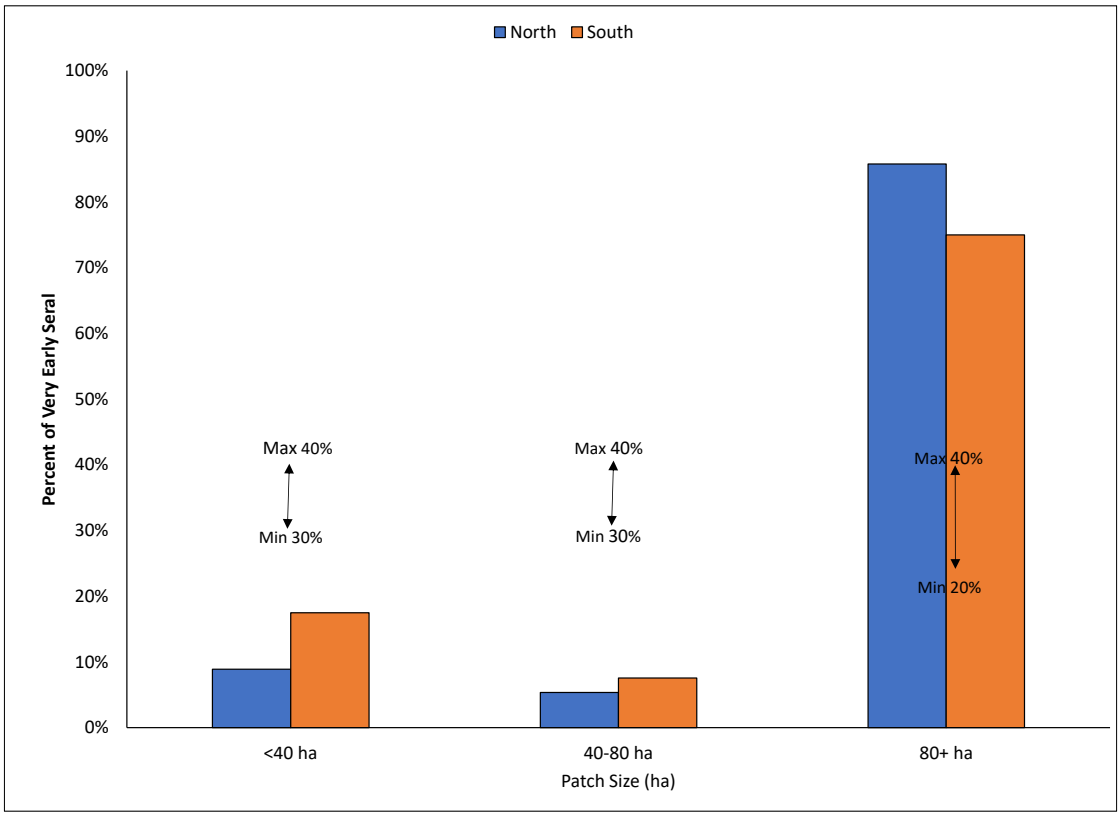


Figure 32: Current patch size distribution in NDT 2 (ESSF) for Lakes North and Lakes South

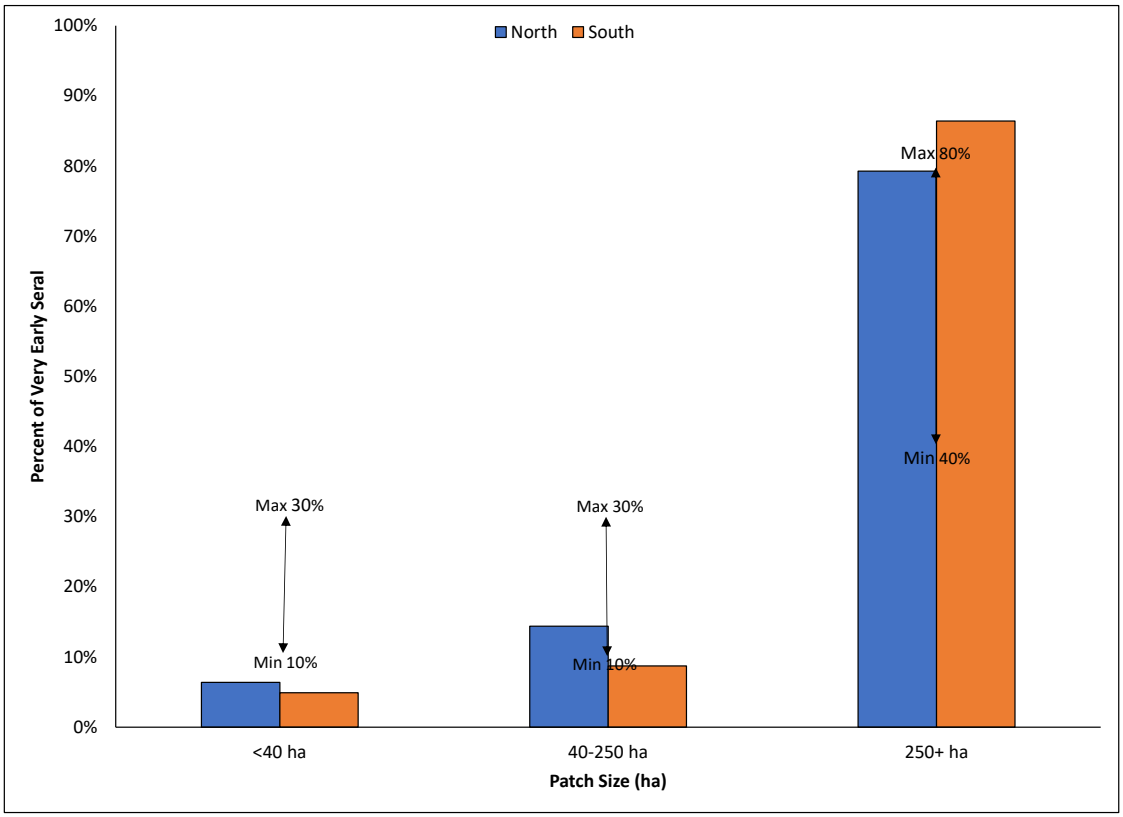


Figure 33: Current patch size distribution in NDT 3 (SBS) for Lakes North and Lakes South

8.1.5 Retention of Wild Young Forest

Both the Lakes North and South SRMPs have objectives for the retention of wild young forest. Wild young forests refer to naturally created, young seral forests, such as young unmanaged post-fire stands, and beetle killed stands. These forests have significantly different characteristics than young plantations and are increasingly rare due to fire suppression, salvage harvesting, and widespread spacing and thinning of naturally regenerated young stands. The objective aims to ensure retention of representative naturally created young seral forest types.

The goal is to ensure retention of naturally created wild young forest by monitoring the establishment of stands with wild young forest attributes and assessing options to ensure retention of up to one percent of the CFMLB across the Lakes North and South planning areas in representative wild young forest stands.

Periodic GIS analysis is completed by one licensee for wild young forest. There are numerous areas in the burnt areas south of Ootsa Lake that meet this non-legal objective. Another licensee indicated this objective is circuitously managed through fire objectives where there is a presence of young natural forest types.

8.1.6 Coniferous and Deciduous Tree Species Diversity

The Lakes North and South SRMPs both have non-legal objectives for coniferous and deciduous tree species diversity. The general objective is to maintain a diversity of coniferous and deciduous species across each LU throughout the rotation that represents the natural species composition of each biogeoclimatic subzone.

This objective is managed in a variety of ways. Species diversity can be controlled through harvesting, planting, and post-harvest practices: deciduous species may be left standing during harvest and particular species may be favoured in planting, while others can be removed through brushing after reforestation.

8.1.7 Omineca ESI Biodiversity Management Areas

The Omineca ESI is a collaborative project between the Province of BC and the Carrier Sekani First Nations (CSFN). The Omineca ESI has identified high value biodiversity areas called Biodiversity Management Areas (BMA). The BMAs were delineated based on a risk assessment to biodiversity which was developed collaboratively through consensus between CSFN and the Province of BC. In the Prince George TSA these areas are deferred from harvesting voluntarily for two years while planning continues to determine which BMAs will be permanently set aside. The set aside areas are subject to a memorandum of understanding (MOU) between the two governments and the forest licensees in the Prince George TSA.

While the Omineca ESI boundary overlaps with the project area, the Omineca ESI planning has prioritized the Prince George TSA and it is not binding on the Lakes TSA licensees. However, the BMAs will be used to inform the Lakes Resiliency Project and the FLP. The Omineca BMAs are shown in Figure 34.

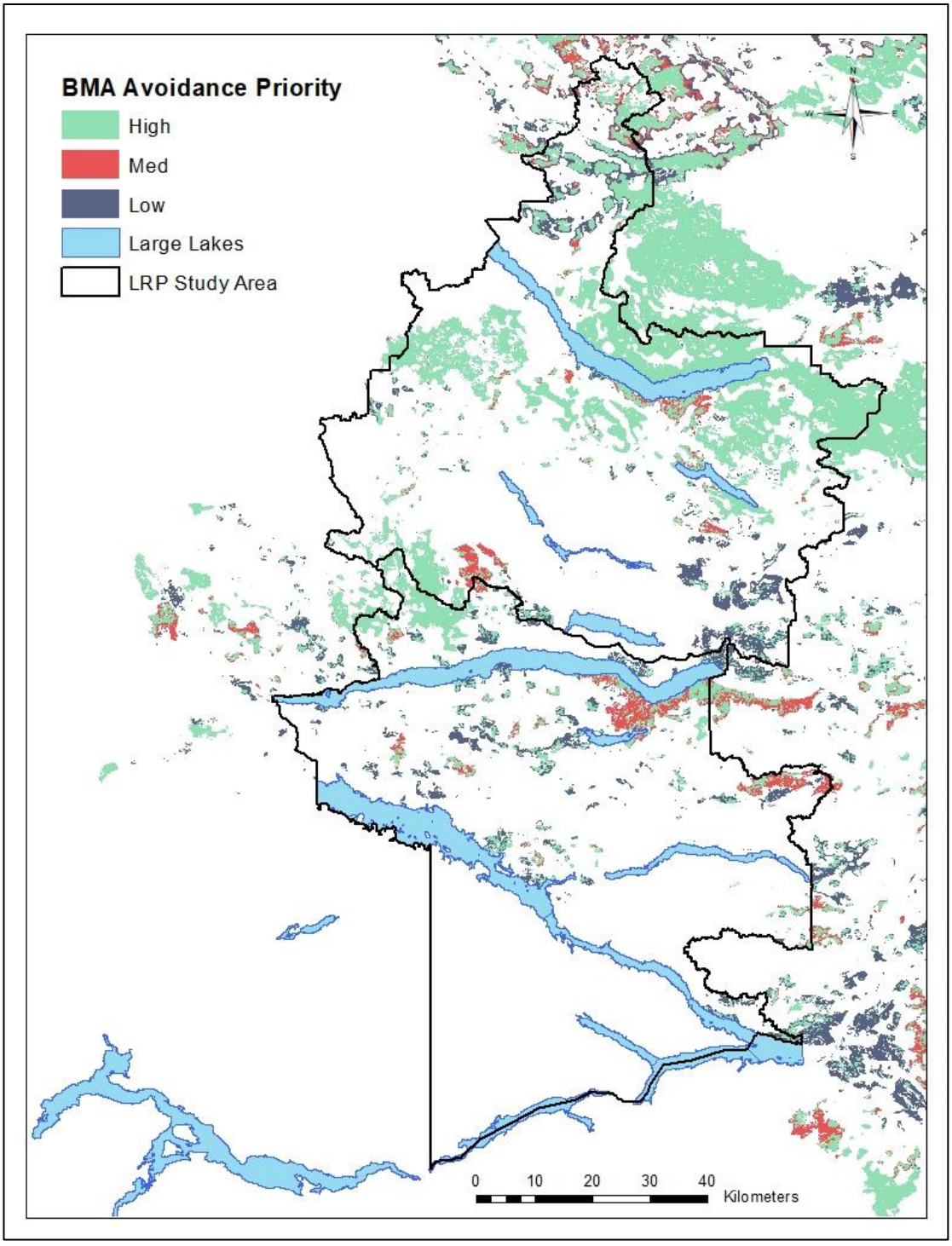


Figure 34: Omineca Biodiversity Management Areas

8.1.8 Cutblock Size

The objective that the government has set for managing wildlife and biodiversity at the landscape level is to create landscapes through harvesting that resemble the patterns of natural disturbance spatially and temporally. This objective is to be met without unduly reducing the supply of timber

and to the extent it is practicable. The legal reference and direction along with current practices are described in Table 30

Table 30: Cutblock size legal reference and management direction

Legal Value Reference	Direction
FPPR Sec. 9, FPPR Sec. 64 & 65	The regulation stipulates the maximum cutblock size and related cutblock adjacency requirements. The maximum cutblock size in the Skeena Region is 60 hectares, with exemptions listed below.
Current Practice	
While the cutblock size within the Skeena Region must not exceed 60 hectares, exemptions apply where timber is recovered due to fire, insects, wind, sanitation treatments, retention of >40% of basal area or if the opening created by harvesting resembles natural disturbance. Adjacency requirements are exempt for the same reasons. All licensees indicate compliance with FPPR Sections 64 and 65; however, one licensee applies patch size distribution targets in the Lakes South instead of maximum cutblock sizes.	

Controlling the sizes of cutblocks is one of the ways that can be used to create desired harvest patterns in the landscape along with patch size distributions as discussed under section 8.1.4.

In theory, there are no adjacent cutblock green-up limitations or cut block size limitations in the Lakes South area as per FPPR subsections 64 (2) and 65 (4), because of the legal patch management objective; however, those licensees who do not manage for patch size distributions, must adhere to the to the FPPR maximum cutblock size limits of 60 ha and corresponding adjacency limitations.

If harvesting operations in Lakes North attempt and succeed in trending towards the desired patch size distribution, the FPPR subsections 64 (2) and 65 (4) would apply and no green-up limitations or cut block size limitations are required. As in Lakes South, if not, operations would have to adhere to the FPPR maximum cutblock size limits of 60 ha and corresponding adjacency limitations.

Within the period between 2011 and 2021 3,471 separate cutblocks (openings) were harvested for a total of 74,552 ha of harvest. The average opening size was 21 ha with the smallest blocks less than1 ha in size and the largest 1,371 ha in size.

8.1.9 Stand Level Biodiversity

Stand level biodiversity is managed by maintaining or restoring important structural attributes such as wildlife trees (including standing dead and dying trees), coarse woody debris, tree species diversity, and understory vegetation diversity[14]. These attributes provide ecological complexity that promotes wildlife habitat, forage, cover and denning sites, and decay and nutrient cycling for invertebrates, insects, mosses, and lichens.

Stand level biodiversity is typically achieved through wildlife tree retention and riparian reserves.

The legal reference and direction along with current practices are described in Table 31.

[14] Biodiversity guidebook page 61 https://www.for.gov.bc.ca/hfd/library/documents/bib19715.pdf

Table 31: Stand level biodiversity legal reference and management direction

Legal Value Reference	Direction
Land Use Objective. Lakes North SRMP Ministerial Order Pursuant to Section 93.4(1) of the Land Act for the purposes of FRPA.	The general direction in the TSA is to maintain stand-level structural diversity by retaining wildlife trees to specified targets in the Orders. When the Lakes North SRMP was completed in 2009, the Chief Forester at the time provided recommendations around increased retention levels (10-25% retention) due to the impacts on biodiversity from the mountain pine beetle epidemic. The increased retention was captured in the wildlife tree retention objective, with further guidance on prioritizing retention around hydro-riparian sites.
Land Use Objective - Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act; continued under the Land Act Section 93.8 FPPR Sec. 67.	The Lakes South SRMP completed in 2003 also had increased retention during the accelerated beetle harvest. The accelerated harvest period has since ended, but most licensees still abide by the increased retention targets. One licensee has reverted to the default retention requirements in FPPR Sec. 67.
Current Practice	
Stand level biodiversity is maintained through wildlife tree retention. A specified percentage is maintained by cutblock area. In the Lakes North SRMP, licensees are to ensure that high wildlife value trees and areas are retained after harvest. Where there are few trees with high value, retention is located either in areas most suitable for long-term wildlife tree recruitment or in areas that are representative of the pre-harvest stand. In the Lakes South SRMP, Wildlife Tree Patches (WTPs) are to contain predominantly coniferous trees with an average age consistent with the stand age. Additionally, WTPs are to have a minimum percentage of crown closure. In general, no harvesting of WTPs occurs in either the North or South SRMP areas. Some licensees have exceptions to only harvest from a WTP if the cutblock upon which the WTP is located has developed attributes consistent with a mature seral condition. Another exception for harvesting WTPs is for forest health reasons, in which case a suitable replacement WTP area must be established.	
Issues Raised	
Licensees: ➢ Has not been difficult to achieve WTRA targets. Often exceeding targets. ➢ Do WTRAs have value with 70% dead Pl? Could the WTRAs be co-located with old growth management areas? First Nations: ➢ Need to increase wildlife tree retention areas.	

8.1.9.1 Current Condition

The WTR requirements and achieved retention are specified in the Lakes South and Lakes North SRMPs as presented in Table 32. The data was provided by the TSA licensees and consisted of the past 10 years of harvest and retention and proposed harvest and retention. The net retention was calculated by accounting for riparian reserve buffers provided by FLNRORD.

As seen in Table 32 the trend in the project area is to retain higher than the required percentage of area in WTRs (gross retention).

Table 32: WTR retention (%)

Landscape Unit	Minimum Requirement (Gross) by BEC		Gross Retention	Net Retention
	ESSF	SBS		
Babine East	10%		19%	11%
Babine West	10%		19%	9%
Bulkley	10%		20%	10%
Burns Lake East	10%		17%	9%
Buns Lake West	10%		15%	8%
Chelaslie	9%	12%	n/a	n/a
Cheslatta	9%	12%	28%	18%
Fleming	10%		23%	9%
Francois East	9%	14%	23%	14%
Francois West	12%	13%	20%	12%
Intata	9%	16%	24%	12%
Ootsa	9%	12%	17%	10%
Taltapin	10%		19%	7%
Total			**20%**	**10%**

8.2 First Nations and Cultural Heritage

The following First Nations have traditional territories within the project area: Wet'suwet'en First Nation, Lake Babine Nation, Ts'il Kaz Koh First Nation, Skin Tyee Nation, Nee Tahi Buhn Indian Band, Cheslatta Carrier Nation, Takla Lake First Nation, Stellat'en First Nation, Nadleh Whut'en Band, Yekooche First Nation, Tl'azt'en First Nation, Ulkatcho First Nation, Binche Whut'en, and the Office of the Wet'suwet'en.

Indigenous Interests as expressed by First Nations range from wildlife and wildlife habitat to access and access management, hunting, trapping, fishing, cumulative effects, biodiversity, economic opportunities, and the ability to practice culture on the land and exert Section 35 rights. Tl'azt'en First Nation (Tl'azt'en Nation, 2016) and the Office of the Wet'suwet'en have created stewardship principles for their respective territories (Office of the Wet'suwet'en, 2016). Indigenous values and issues are discussed further under Section 3 of this document.

Five of the First Nations listed above are signatory to the Carrier Sekani First Nations (CSFN) Pathway Forward Agreement 2.0 with the Province of British Columbia. This agreement facilitates a cooperative relationship between British Columbia and a total of seven signatory First Nations in decision making concerning natural resources management among other topics continuing the

work towards ongoing reconciliation of CSFN titles, rights, and interests. Additionally, five of the First Nations listed above are signatory to the SSAF.

The *Forest Act* defines a cultural heritage resource (CHR) as an object, a site, or location of a traditional societal practice that is of historical, cultural, or archaeological significance to British Columbia, a community, or an aboriginal people.[15] Cultural Heritage Resources include archaeological sites and traditional use sites as well as other heritage sites.

The legal reference and direction along with current practices are described in Table 33.

Table 33: Cultural heritage resource features legal reference and management direction

Legal Value Reference	Direction
FRPA Sec. 149, FPPR Sec. 10	Conserve, or if necessary, protect cultural heritage resources that are the focus of a traditional use by an Aboriginal people that are of continuing importance to that people; and not regulated under the Heritage Conservation Act.
Current Practice	
Licensees ensure that a cultural heritage resource evaluation is conducted on all cutblocks and roads, and that timber harvesting, and road construction is consistent with the recommendations given in a CHR evaluation. Each licensee has slightly different strategies if a previously unidentified CHR is found and how it will be communicated to the applicable First Nations. Most licensees conduct referrals at least annually to the affected First Nations on proposed cutblocks and roads.	
Issues Raised	
Licensees: ➢ The more specific the First Nation can be the more licensees can manage adequately. ➢ No real issues. If a problem arises, just talk to the First Nation. ➢ Issues are more with the archaeology branch and getting an alteration approved. ➢ First Nations do not comment much on FSPs; more interest on the ground with streams and blocks. ➢ Already putting multiple years of blocks up for consultation. ➢ First Nations not open to sharing location of FN values. ➢ Generally, avoid areas that are of First Nation concern. First Nations: ➢ Increased protection and better management of cultural heritage resources such as medicinal and culturally important plants, spiritual and ceremonial areas, berries, etc.	

8.3 Water, Fish Habitat, Riparian Areas (Including Wetlands)

Riparian areas including streams, lakes, or wetlands have specified targets in regulation for riparian reserve zones and riparian management zones. These zones have established buffer widths for different wetland, stream, and lake classes, which together make up riparian management areas.

[15] Reference: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/chr_manual__addendum_to_frep_protocol.pdf

Riparian reserve zones are restricted from harvesting. The legal references and management direction along with current practice are described in Table 34.

Table 34: Legal references and management direction for riparian management

Legal Value Reference	Direction
FPPR Sec. 8, 12(3), FPPR Sec. 47-51, 52(2), 53	Forest operations are to conserve, at the landscape level, the water quality, fish habitat, wildlife habitat and biodiversity associated with riparian areas. The conservation is expected to occur without unduly reducing the supply of timber from BC's forests.
Current Practice	
All licensees are required to specify results and strategies for the retention of trees within riparian management zones. Some licensees employ different riparian area management strategies than what is specified in the regulation. In many cases these strategies have increased retention either by wider buffer widths in riparian reserve zones or by an increased retention in riparian management zones. There are exceptions to road building limitations within riparian management areas for reasons such as reducing the potential risk of sediment delivery to a stream, or if there are no other practicable road building options. Exceptions for harvesting in riparian reserve zones include reasons such as removal of trees for a safety hazard, constructing a stream crossing, carrying out a sanitation treatment, maintaining an interpretive forest site, recreation site, recreation facility or recreation trail, and for yarding.	
Issues Raised	
Licensees: ➢ Generally, no issues meeting the target retention – the target levels are often exceeded. ➢ Increased riparian retention can cause problems with spruce beetle and blowdown. ➢ One licensee has 10 m reserve zones on S4 and S6 streams. Hard boundaries and reserves are easier to manage. There is significant increase of fully functioning streams after the 10 m reserve zones were implemented. ➢ One licensee estimated the THLB impact of increased riparian reserves. It was less than 1%. ➢ Would like to have ESI help monitor streams. ➢ Manage riparian attributes based on whether the forest is dead or not. If not dead, then leave a wider riparian buffer. If dead, then use FPPR minimums. First Nations: ➢ Increased protection and better management of terrestrial and aquatic habitats for fish and wildlife, including wetlands. ➢ Improved water quality and quantity.	

8.3.1 Current Condition, Fish and Fish Habitat

Fish and Fish Habitat is one of the five values chosen by SSAF (see section 3.8.1 for more information on the SSAF) ESI. A state of value report was released by SSAF ESI for fish and fish habitat in 2021 where the assessment results suggest that indicators in the moderate to high

categories should be given further management attention. The indicators are assessed at the freshwater assessment unit scale (assessment watersheds are mesoscale aquatic units based on groupings of fundamental watersheds using FWA watershed code and local code, with a target size of between 2,000 ha and 10,000 ha).

Watershed pressure indicators including roads (density, crossing density, etc.), flows (ECA, water allocation, etc.), disturbance (riparian or total land), and pollution (point source) predominate in the southern portions of the project area and are generally at a moderate to higher risk. Watershed sensitivity such as summer and winter low flow indicators occur across all the SSAF ESI study area, including overlapping areas in the Lakes TSA, and are generally at moderate to high risk. Fish and spawning habitat vary over the study area but lack more detailed data.[16]

Many of the SSAF ESI indicators for fish habitat are beyond the scope of this project. The following will be reported below, based on subject matter expert opinion:

- Road Density
- Equivalent Clearcut Area (ECA)
- Young Second Growth
- Riparian Disturbance
- Salmonid Habitat
- Salmon Spawning

The original SSAF ESI work was completed for a much larger area than the project area. This analysis limits the current condition reporting for fish and fish habitat indicators to the project area. The indicators are reported by aquatic unit of which there are 275. Only those aquatic units where at least 5% of the aquatic unit area falls within the project area are considered, a total of 227 aquatic units.

8.3.1.1 Road Density

Road Density is defined as the total length of roads divided by total aquatics assessment unit area (km/km^2). Road density can affect both water quantity and water quality as it can influence peak flow, low flow, and water temperature by increasing surface runoff and modifying subsurface flows (Meehan 1991; MOF 1995a; Smith and Redding 2012). Roads may also increase coarse and fine sediment delivery to streams depending on surficial geology and terrain stability. Eroded fine sediments can be easily delivered to water courses during wet periods, where they can cover salmonid spawning beds, reduce oxygenation of incubating eggs, and increase turbidity which reduces foraging success for juveniles (Meehan 1991).[17]

The current condition as reported in Table 35 and Figure 35 is based on the data compiled for this project. The data is shown spatially in Figure 36.

The current road density is classified as a high concern in 81% of the aquatic unit area. Only 19% of the aquatic unit area is classified as a low or moderate concern.

[16] Reference: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/skeena-region/ssaf_fish_and_fish_habitat_state_of_the_value_report_feb2021.pdf

[17] This paragraph was authored by Carolyn King, Land and Resource Specialist, Smithers

Note that data limitations exist regarding road density data. Road status and quality are inconsistently tracked across the study area, and accuracy and completeness of data may vary. No recovery curve has been applied to roads that may be rehabilitated, and all roads are considered equal in terms of impact, including roads that may be overgrown or degraded.[18]

Table 35: Road density (fish habitat), current condition

Classification		Number of Watersheds	Net Area[19] of Watersheds (ha)	% Of Area
Low Concern	<0.4 km/km^2	16	49,178 ha	5%
Moderate Concern	>=0.4, <=1.2 km/km^2	31	126,118 ha	14%
High Concern	>1.2 km/km^2	180	754,255 ha	81%
Total		**227**	**929,551 ha**	**100%**

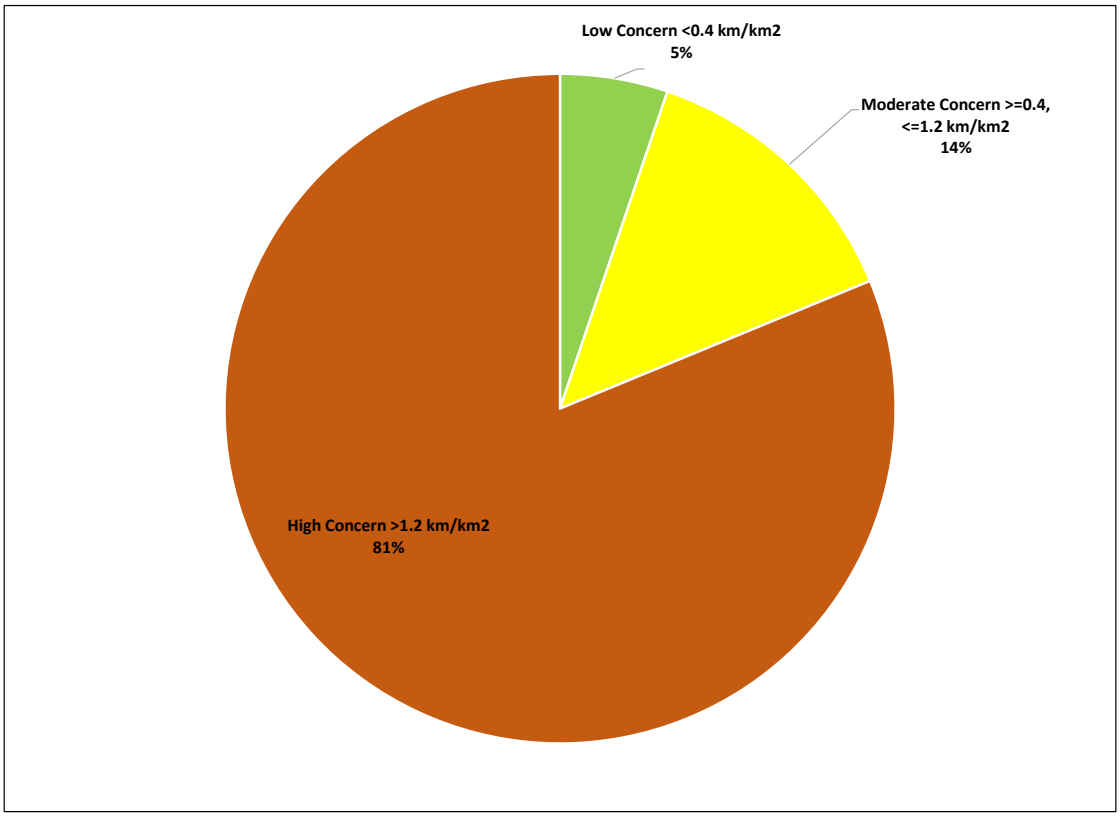


Figure 35: Road density (fish habitat), current condition

[18] This paragraph was authored by Carolyn King, Land and Resource Specialist, Smithers

[19] Net area is the total area of the aquatic unit excluding lakes

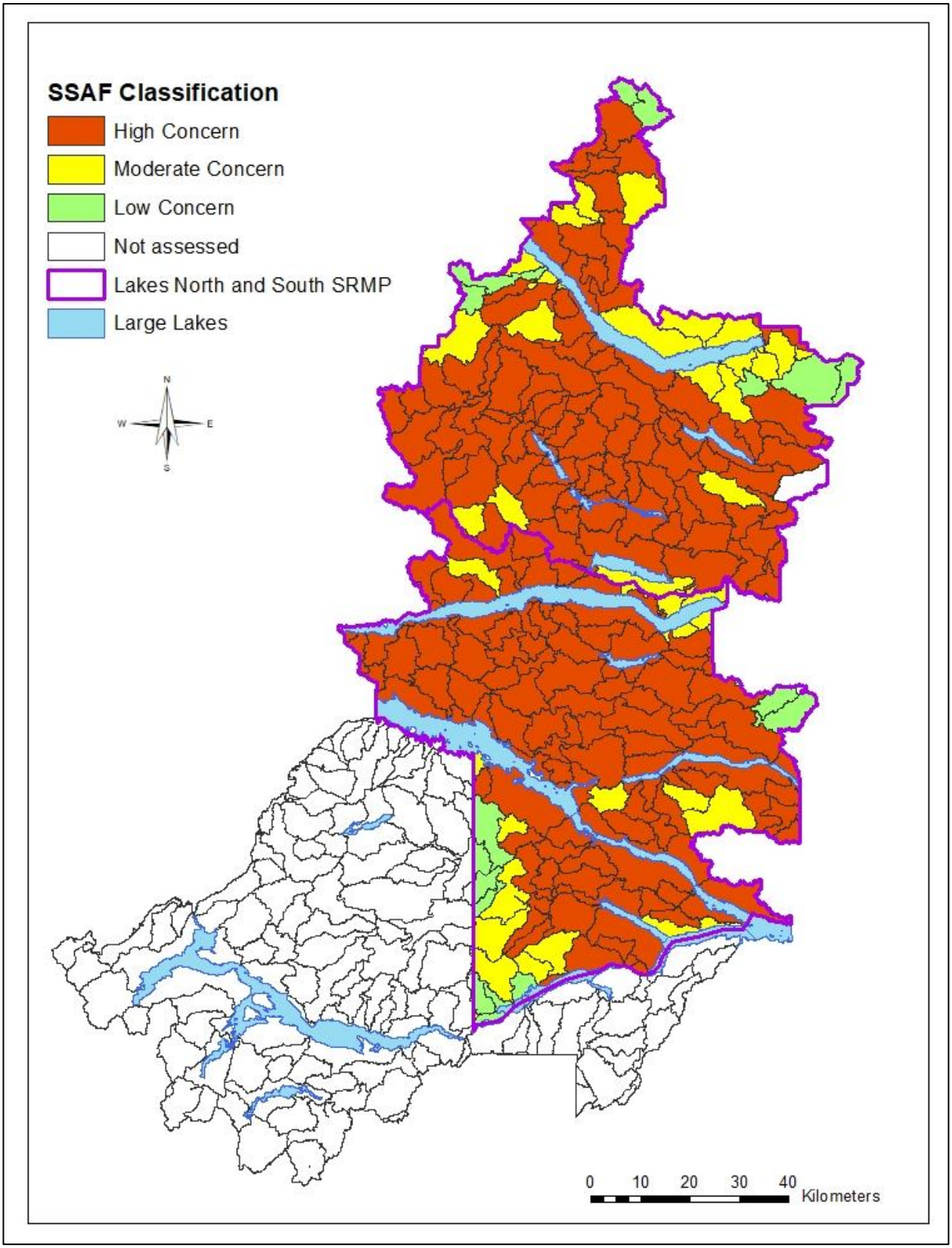


Figure 36: Road density (fish habitat), current condition by aquatic unit

8.3.1.2 Equivalent Clearcut Area (ECA)

The impact of timber harvesting on hydrological processes in watersheds is often estimated through the equivalent clearcut area (ECA). ECA is a measure of how much of the total area of an assessment unit is considered comparable to a clearcut forest. It is expressed as a percentage.

The equation commonly used for ECA is:

ECA = A x (1-HR)

A depicts the area of each stand within a watershed or basin, while HR stands for hydrological recovery. Timber supply analyses have traditionally used the Forest Practices Code Watershed Assessment Procedure Guidebook (Guidebook) from 1991 to guide the modelling of ECA. The Guidebook contains a default recovery curve (height curve) to aid modelling. In this analysis, the HR was modeled using the following equation by Winkler (Pers. Com):

HR (%) =100*(1-EXP(-0.24*(Ht-2)))^2.909

Ht is the average dominant/codominant tree height and 2 is the maximum snow depth in the stands for which the equation was derived.

The use of the above formula is not possible in unharvested MPB impacted areas and recent wildfire areas. The remaining tree cover in these areas must be accounted for in the ECA calculation. The ECA for burned areas was adjusted based on the burn severity and the ECA for MPB impacted stands was estimated using a ECA look-up table from the SSAF ESI (Table 36).

Table 36: Estimated stand-level ECA for non-salvaged stands based on % of stand dead and earliest non-logging disturbance from VRI (Lewis and Huggard, 2010)

BEC Subzone	% Dead	Years Since Attack/Fire										
		0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	45-50	51-55
Dry	0-30	0	0	0	0	0	0	0	0	0	0	0
	31-50	5	10	20	30	30	25	20	15	10	5	5
	51-70	10	30	40	50	50	40	30	20	15	10	5
	>70	15	50	60	70	70	60	50	40	30	20	15
Moist and Wet	0-30	0	0	0	0	0	0	0	0	0	0	0
	31-50	5	10	15	20	20	15	10	5	0	0	0
	51-70	5	15	20	30	30	20	15	10	10	5	0
	>70	10	30	40	45	45	40	30	25	20	10	5

Table 36 above can only be used for manual calculations. It cannot be used in forecasting.

The current condition for ECA was completed using the following steps:

- Calculate preliminary ECA using the ECA formula above using VRI heights. Ensure all cutblocks 5 years old or younger are set to height = 0. If VRI height is null, it is set to 0.
- For all areas of human-caused disturbance, as defined by the CEF, set ECA = 100%
- Natural non-forest areas have ECA of 0%.
- For all forested stands older than 5 that were burned in 2017/2018 fires, set ECA as 90% for high severity burn areas, 50% for medium severity burn areas, and 10% for low severity burn areas.
- Remaining stands >=80 years old in 2022 that have MPB attack, use the lookup table (Table 36) to assign ECA value.

- Use preliminary ECA for all other stands (not impacted by MPB or fire).

The MPB attack year was acquired from the VRI non-logging disturbance date where disturbance type = IBM and year >= 1998. For all other stands with dead pine, it was assumed that the disturbance year is 2012.

Dry BEC is SBSdk and SBSdw. Moist BEC is all others.

ECA is classified as a high concern in 86% of the aquatic unit area, while 14% of the aquatic unit area is classified as a low or moderate concern (Table 37, Figure 37). The aquatic units and their classification are shown in Figure 38.

Table 37: ECA, current condition

Classification		Number of Watersheds	Total Area of Watersheds (ha)	% Of Area
Low Concern	<15%	19	65,954	7%
Moderate Concern	>=15%, <=20%	14	69,737	7%
High Concern	>20%	194	818,164	86%
Total		**227**	**953,854**	100.0%

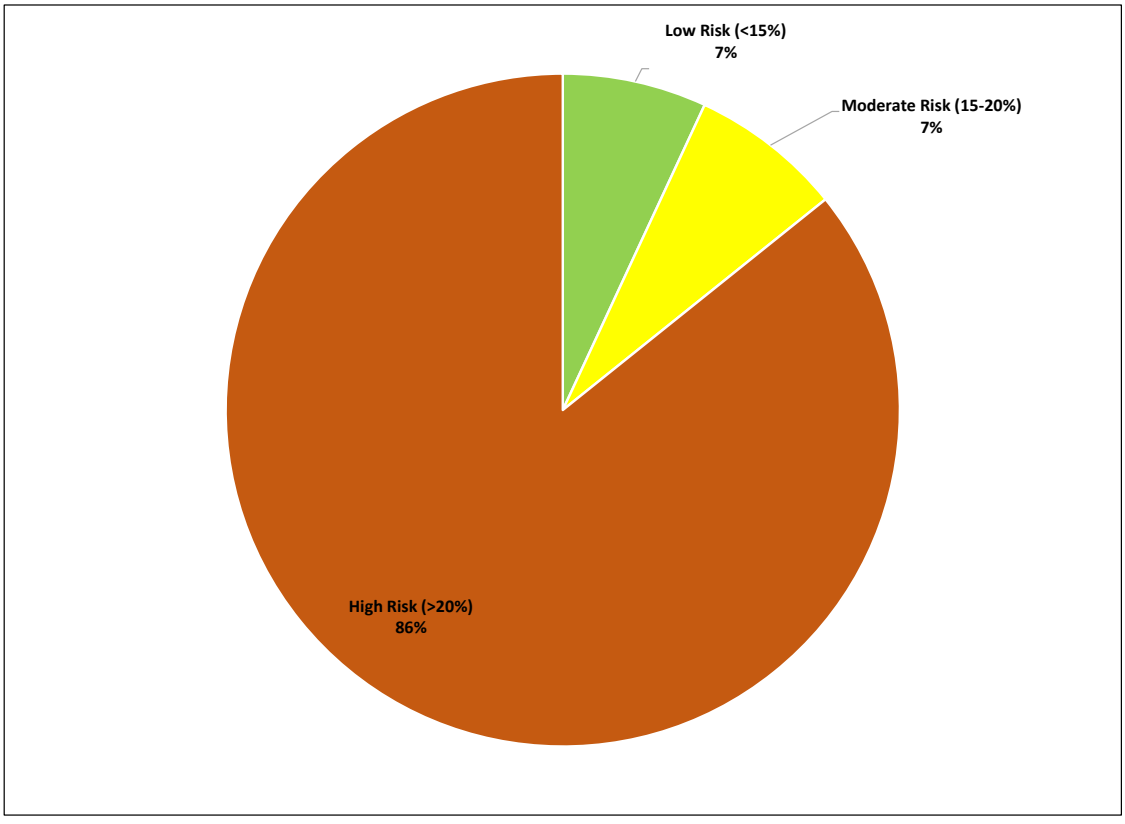


Figure 37: ECA, current condition

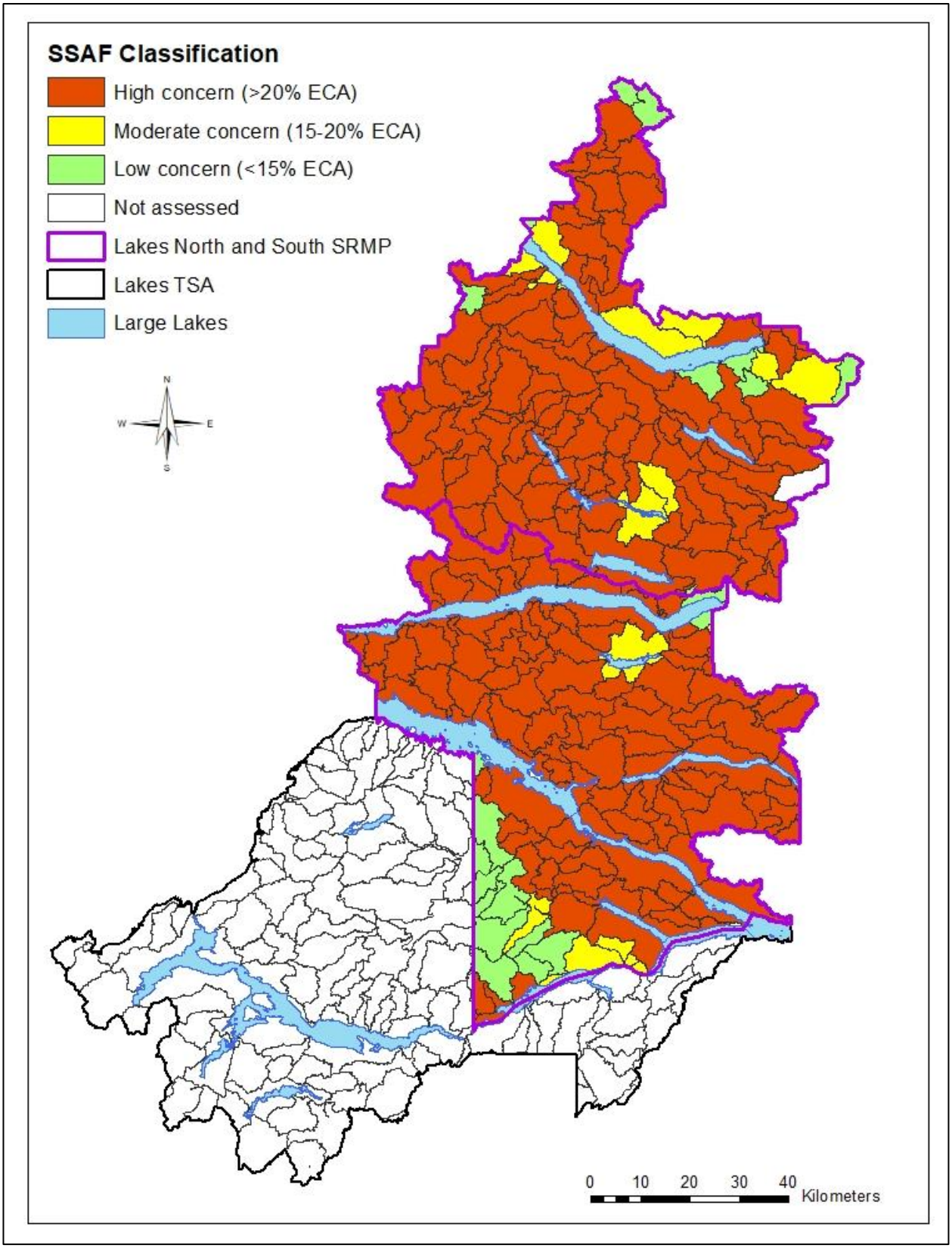


Figure 38: ECA classification for aquatic units in the project area.

8.3.1.3 Young Second Growth – Summer Low Flow Implications

Evidence from the US Pacific Northwest indicates that rigorously regenerating forest plantations can reduce summer stream flows (water quantity) relative to mature and old growth forest (Hicks et al. 1991; Jones and Post 2004; Perry et al. 2017; Grosdahl et al. 2019).[20]

Widespread transformation of mature and old-growth forests through past and ongoing logging practices may contribute to summer water yield declines (water quantity) over large basins and regions, reducing stream habitats, and exacerbating stream warming (Post and Jones 2016; Gronsdahl et al. 2019). Data are limited but may suggest the beginning of a significant second growth effect on low flows beginning at around 25 years, a maximum effect at 50 years, and cessation at approximately 75-80 years (D. Tripp, pers. comm.).[21]

Within the SSAF Study Area the extent of forest aged < 80 years was identified to reflect the general extent of this potential forest regrowth effect on summertime low flows. Further research is required at both stand and catchment levels to more accurately clarify the time scales and specific conditions under which reductions in low flows would occur (Grosdahl et al. 2019). Low flow response will conceivably vary with climate, elevation, and the physiology of the dominant tree species (Grosdahl et al. 2019).[22]

Young Second Growth is defined as the percentage of total net area of an aquatics assessment unit that is comprised of regenerating young second growth stands (<80 years old). The current condition as reported in Table 38 and Figure 39 is based on the data compiled for this project. It is shown spatially in Figure 40.

Young Second Growth is classified as a high concern in 73% of the aquatic unit area, while 27% of the aquatic unit area is classified as a low or moderate concern.

Table 38: Young Second Growth, current condition

Classification		Number of Watersheds	Net Area of Watersheds (ha)	% Of Area
Low Concern	<5%	7	17,072	2%
Moderate Concern	>=5%, <25%	53	235,526	25%
High Concern	>=25%	167	679,377	73%
Total		**227**	**953,854**	**100%**

[20] This paragraph was authored by Carolyn King, Land and Resource Specialist, Smithers

[21] This paragraph was authored by Carolyn King, Land and Resource Specialist, Smithers

[22] This paragraph was authored by Carolyn King, Land and Resource Specialist, Smithers

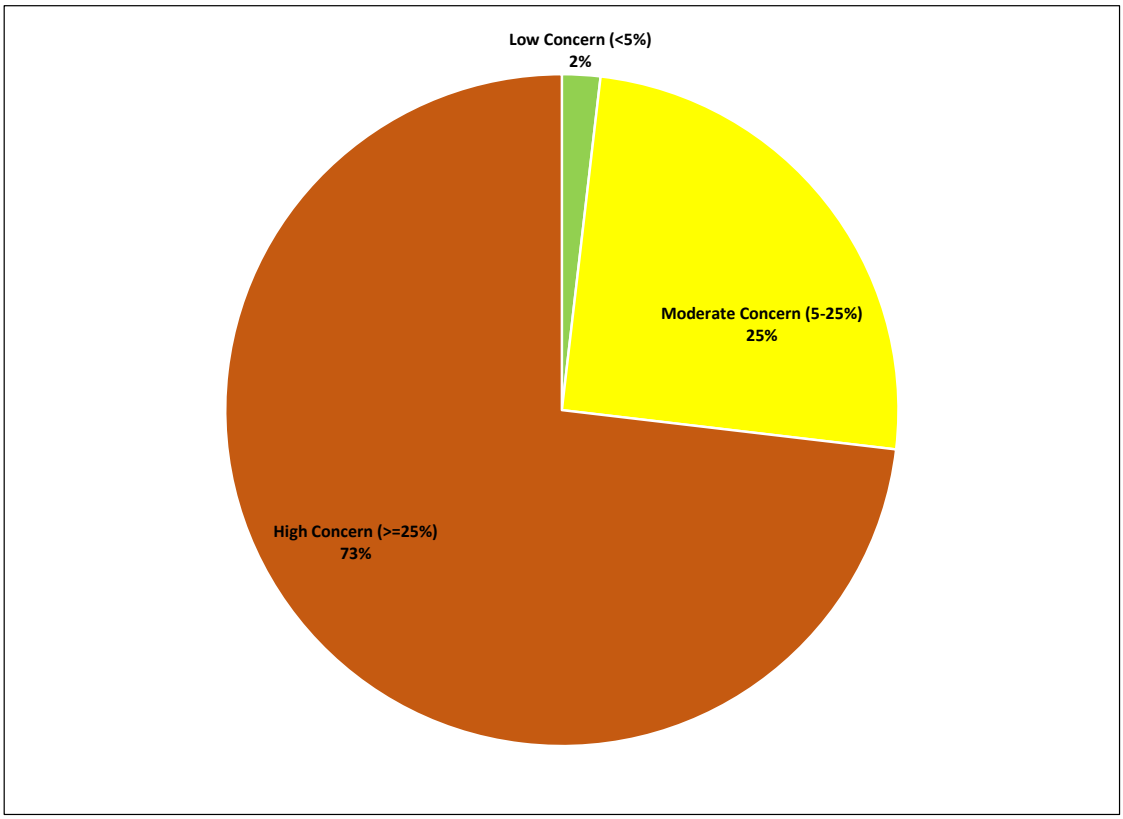


Figure 39: Young Second Growth, current condition

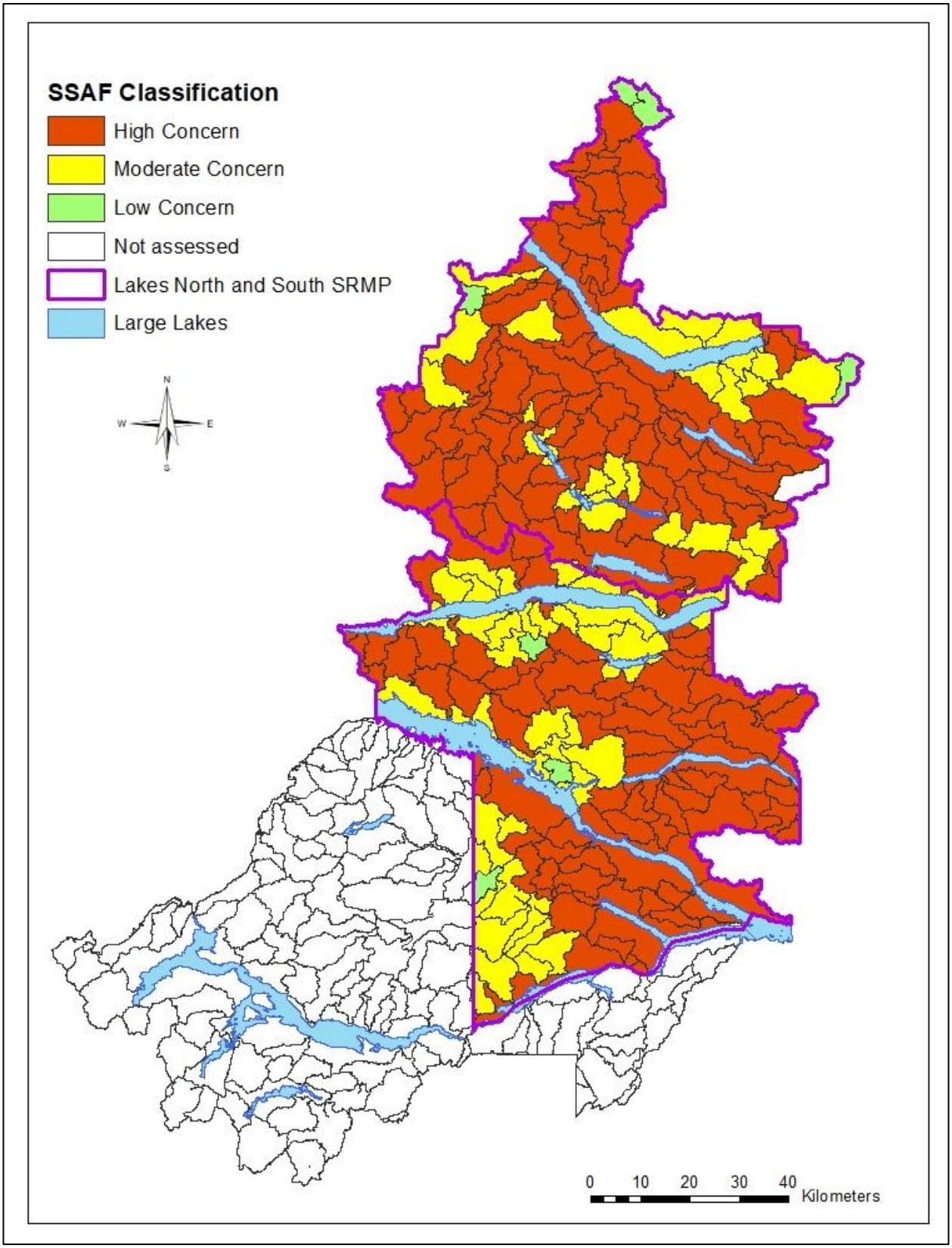


Figure 40: Young Second Growth, current condition by aquatic unit

8.3.1.4 Riparian Disturbance

This indicator reports the percentage of 30 m riparian buffer zones around all streams in an aquatics assessment unit that have experienced recent human or natural disturbance (i.e., fire, insects). The SSAF ESI disturbance data is derived from intersections of streams with the province's custom 'Development' layer which incorporates current (within last 20 years) and historic disturbance data from various sources such as current and historic fire perimeters, Tantalis, OGC, BTM, FAIB Consolidated Cutblocks, and VRI (insect disturbance) layers.[23]

The current condition as reported in Table 39 and Figure 41 is based on the SSAF ESI data.

Riparian Disturbance is classified as a high concern in 80% of the aquatic unit area, while 20% of the aquatic unit area is classified as a low or moderate concern.

Table 39: Riparian Disturbance, current condition

Classification		Number of Watersheds	Total Area of Watersheds (ha)	% Of Area
Low Concern	<5%	23	77,916	8%
Moderate Concern	>=5%, <=15%	26	111,292	12%
High Concern	>15%	178	764,662	80%
Total		**227**	**953,870**	**100%**

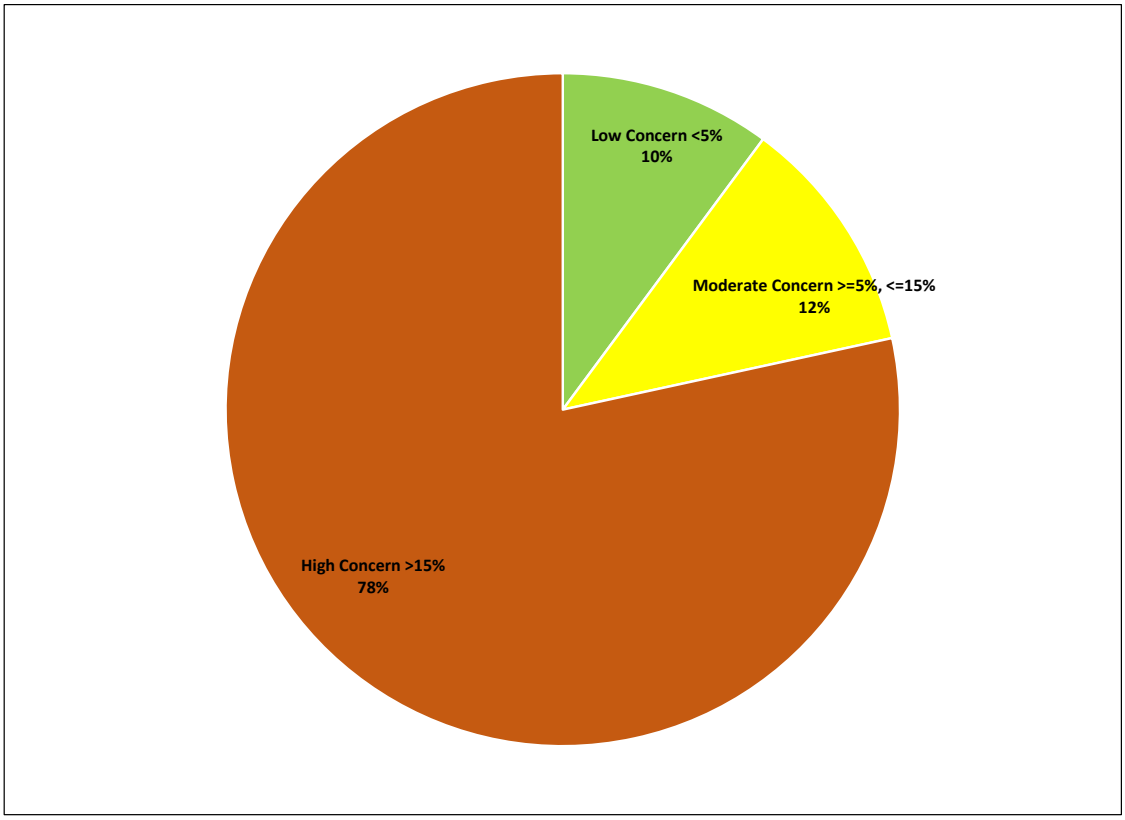


Figure 41: Riparian Disturbance, current condition

[23] This sentence was authored by Carolyn King, Land and Resource Specialist, Smithers

8.3.1.5 Salmonid Habitat

This indicator reports the total length of known or inferred salmonid habitat within an aquatics assessment unit. The current condition as reported in Table 40 and Figure 42 is based on the SSAF ESI data.

Approximately 99% of the area within the aquatics assessment unit is classified as moderate or low salmonid habitat in the project area.

Table 40: Salmonid Habitat, current condition

Classification		Number of Watersheds	Total Area of Watersheds (ha)	% Of Area
Low	<50 km	77	189,518	20%
Moderate	>=50 km, <=200 km	149	755,841	79%
High	>200	1	8,871	1%
Total		**227**	**954,230**	**100%**

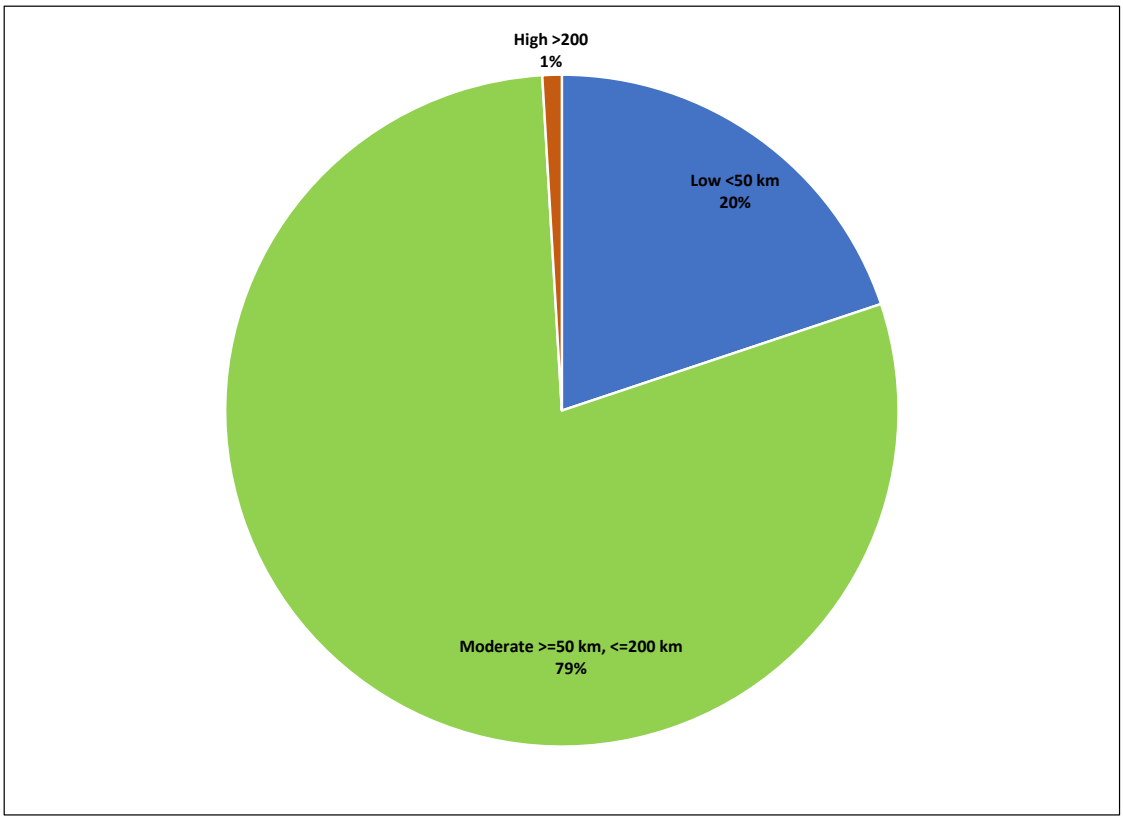


Figure 42: Salmonid Habitat, current condition

8.3.1.6 Salmon Spawning

This indicator reports the total length of mapped salmon spawning streams within an aquatics assessment unit. The current condition as reported in Table 41 and Figure 43 is based on the SSAF ESI data.

Approximately 96% of the area within the aquatics assessment units is classified as having low salmon spawning habitat in the project area.

Table 41: Salmon Spawning, current condition

Classification		Number of Watersheds	Total Area of Watersheds (ha)	% Of Area
Low	<5 km	220	913,109	96%
Moderate	>=5 km, <=20 km	3	21,374	2%
High	>20	4	19,387	2%
Total		**227**	**953,870**	**100%**

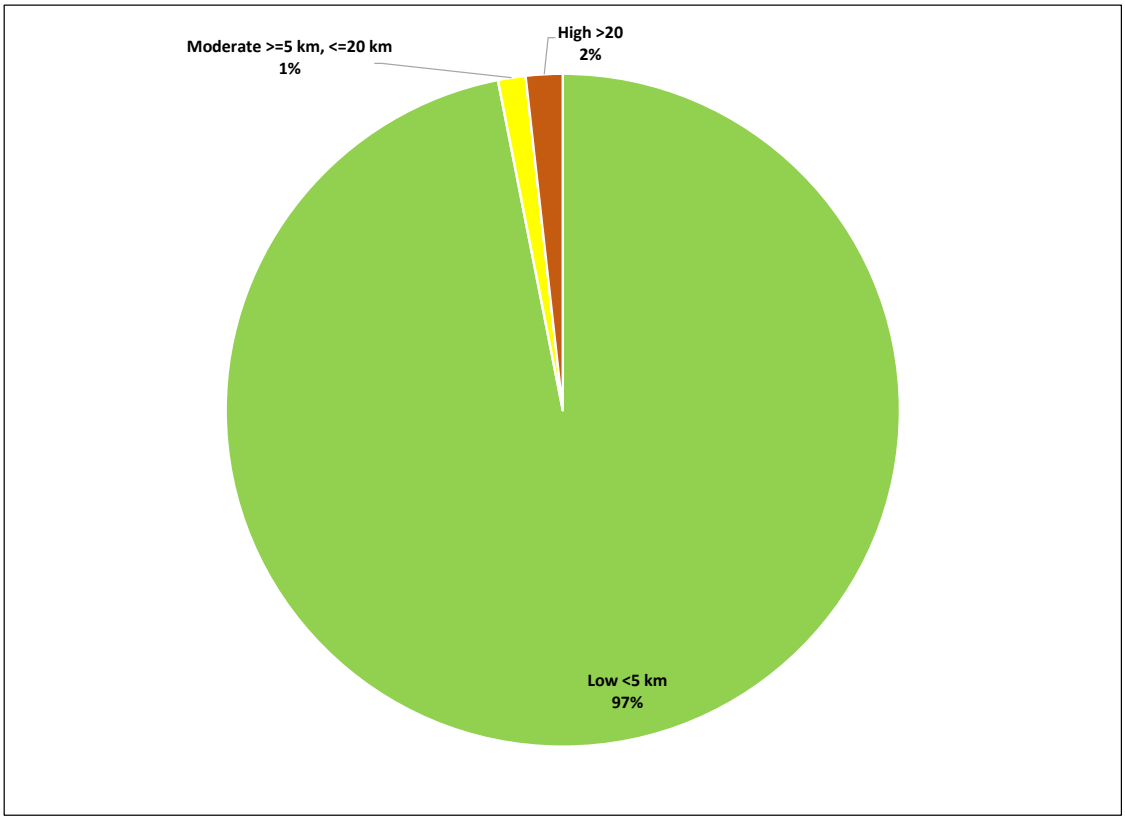


Figure 43: Salmon Spawning, current condition

8.3.2 Current Condition, Water – Wetlands

Wetlands is another SSAF ESI value with a draft state of value report produced in 2021. Indicators are separated in three major types: stressors, functions, and benefits. While road density appears to be the main stressor, the report notes that data scarcity is problematic for proper wetland assessment. However, the report also notes that the breadth of analysis for wetlands undertaken by the SSAF ESI is unprecedented in BC. The report provides several broad management actions such as limiting operational crossings on wetlands to wintertime, utilizing existing roads, and avoiding bird breeding season. Additional management recommendation work is ongoing.

The current condition is presented below for selected indicators:

- Road Density within a wetland buffer area
- Intactness of contributing area
- Wildlife habitat connectivity

The wetlands used in the SSAF ESI analysis include considerably more area than is traditionally used in forest estate modelling or timber supply review. In particular, the SSAF ESI used additional criteria to define wetlands – areas where the VRI soil moisture regime component 1 = 6 (hygric) are considered wetlands. The same criteria were used in this report for the current condition analysis.

8.3.2.1 Road Density within Buffer Area

Each wetland (7,608) was buffered by 100 m separately (the buffers overlap if the wetlands are close together) and the road data from the 2019 CEF was added. Within each wetland buffer, the total length (in km) of roads was calculated, then divided by the buffer area (km^2) to determine the road density. The density was linked back to the individual wetland and each wetland was then classified into the following density classes:

- None (no roads within 100m of wetland)
- <0.08 km/km^2
- 0.08-0.16 km/km^2
- >0.16 km/km^2

The current condition is shown in Table 42 and in Figure 44.

Table 42: Wetlands, road density within buffer area (100 m)

Classification	Number of wetlands	Wetland area (ha)	% of wetland area
None	3,716	18,554	31%
<0.08 km/km^2 – lower risk	37	1,068	2%
0.08-0.16 km/km^2 – moderate risk	61	2,335	4%
>0.16 km/km^2 – higher risk	3,794	37,552	63%
Total	**7,608**	**59,510**	**100%**

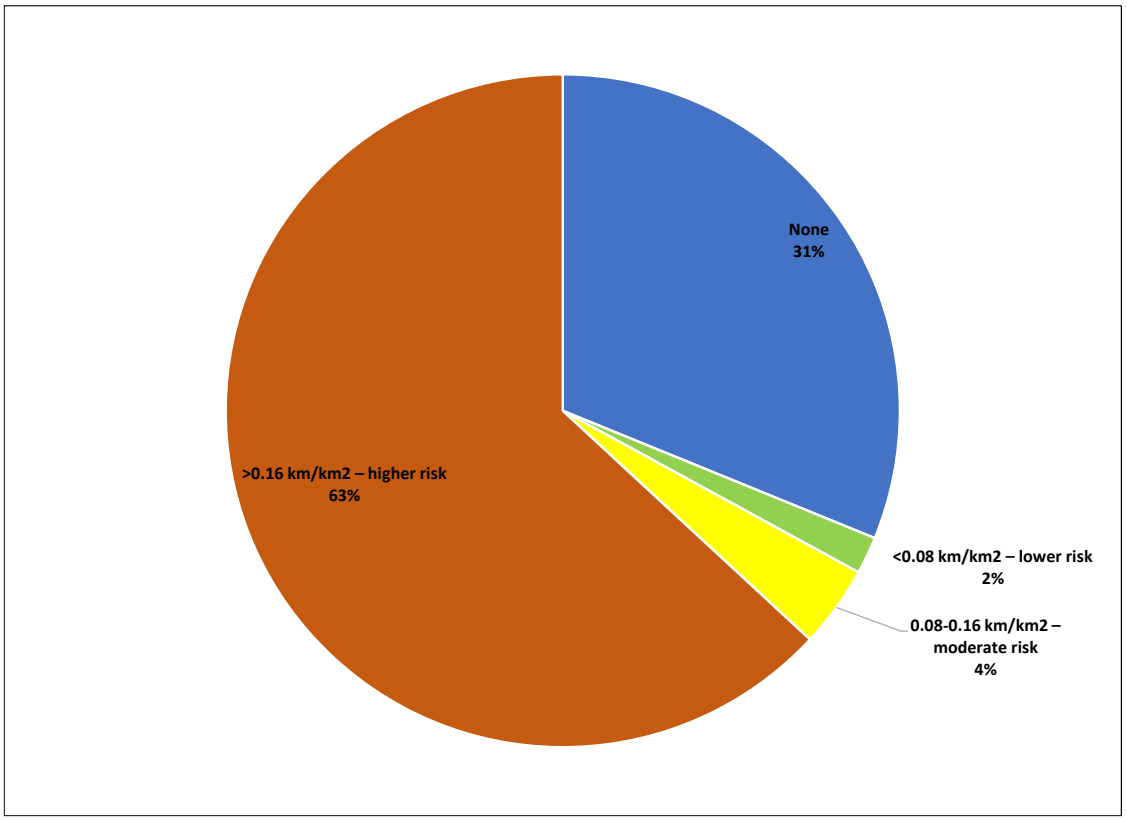


Figure 44: Wetlands, road density within buffer area (100 m)

8.3.2.2 Intactness of contributing area

This indicator presents the percent of natural and semi-natural land cover within 2 km buffer of wetlands. The indicator values were taken directly from the SSAF ESI data. The current condition is shown in Table 43 and Figure 45.

Table 43: Wetlands, Natural and Semi-natural percentage within 2km buffer (SSAF ESI data)

Classification (Threat)	Number of wetlands	Wetland area (ha)	% of Wetland Area
Low (>90%)	7,559	52,487	88%
Moderate (60-90%)	910	6,782	11%
High (<60%)	91	494	1%
Total	**8,560**	**59,764**	**100%**

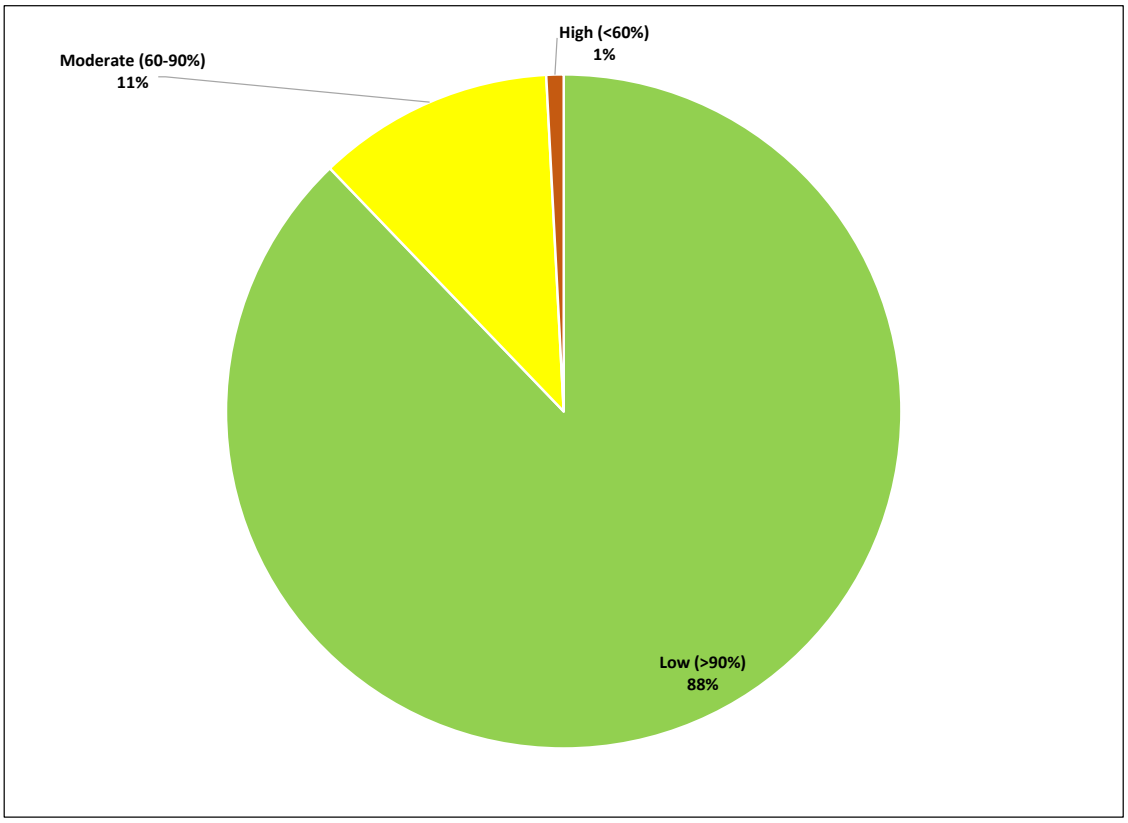


Figure 45: Wetlands, Natural and Semi-natural percentage within 2km buffer (SSAF ESI data)

8.3.2.3 Wildlife habitat: connectivity

For each wetland, the percent of mature and old seral forest within a 2 km buffer is compared to the mature and old forest target for the LU/BEC combination where the wetland is located. Each wetland was assigned to the largest LU/BEC unit within its boundaries. The seral target was applied to the entire 2 km buffer area. Using the seral stage attributes compiled for the biodiversity indicators, the area of mature and old forest within each wetland 2 km buffer was summed, and then divided by the total CFMLB area within the buffer. This percentage was applied to the wetland itself. The seral stage distribution accounts for fire and MPB impacts.

The current condition is presented in Table 44 and Figure 46. Most of the wetlands (60%) meet the target for mature and old forest.

Table 44: Wetlands, Wildlife habitat: connectivity

Meets M+O target	Number of wetlands	Wetland area (ha)	% Of Wetland Area
No	3,316	23,724	40%
Yes	4,271	35,686	60%
Total	**7,587**	**59,410**	**100%**

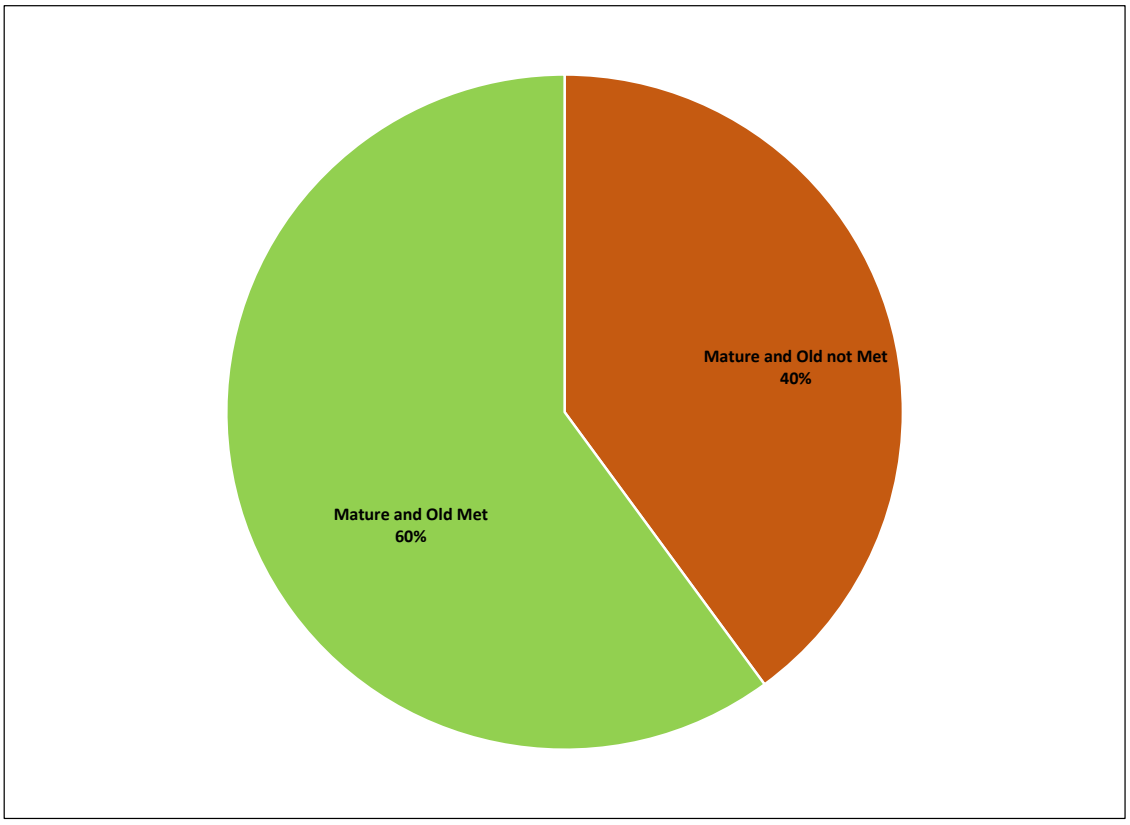


Figure 46: Wetlands, Wildlife habitat: connectivity

8.4 Invasive Plants and Range

Forest stewardship plans currently lay out measures that licensees undertake with respect to invasive plants and natural range barriers.

8.4.1 Invasive Plants

Invasive plants are those that are not native to BC or are outside their natural distribution areas. They can spread rapidly, outcompete, and predate on native species. They can dominate natural and managed areas and alter biological communities. Invasive plants can negatively impact BC's environment, people, and economy. They are recognized globally as the second greatest threat to biodiversity after direct habitat loss due to humans.[24]

The legal references and management direction along with current practice are described in Table 45.

[24] Reference: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species

Table 45: Invasive plants legal references and management direction

Legal Value Reference	Direction
FRPA Sec. 47, FPPR Sec. 17 Canadian Seed Act Regulation	Specify measures to prevent the introduction or spread of species of plants that are invasive under the Invasive Plants Regulation, if the introduction or spread is likely because of the person's forest practices. All grass seeding shall use Canada Common #1 Forage Mix, Canada No 1 ground cover mixture or equivalent as defined by the Canadian Seed Act Regulation.
Current Practice	
Licensees specify measures to seed and if needed re-seed disturbed areas within a certain time following harvest or road building. Some licensees indicate they will notify the Northwest Invasive Plant Council of any discovered invasive plants. Most licensees indicate that their staff is trained in identifying, reporting, and conducting best practices with respect to invasive plants. The Northwest Invasive Plant Council is responsible for much of the monitoring and control of invasive plants within the project area.	
Issues Raised	
Licensees: ➢ Grass seed everything for erosion control. ➢ Legumes attract bears on roadsides. Try to avoid legumes. However, legumes and high nutrient grasses are beneficial for cattle health. ➢ Monitoring is an issue. Needs more capacity. Doing some monitoring with First Nations. ➢ Current management is not meeting the objective of mitigating invasive plants. Lots of invasive plants along highway corridors. ➢ First Nations have concerns over invasive plants because of their impact on riparian areas. ➢ Northeast does good work with invasive plants.	

8.4.2 Range

Rangeland is land that supports vegetation consumed by livestock or wildlife. BC's private and Crown rangelands encompass ecosystems such as alpine, subalpine, community pastures, forestlands (logged or unlogged), grasslands, parklands, shrub lands, and riparian areas.

The rangelands include dense coniferous forests, open coniferous forests maintained by fire, dry valley bottoms with bunchgrasses, moist/wet meadows, hardwood forests, mixed prairie, and alpine environments. About 80 percent of rangeland in BC is on Crown land. The rest is privately owned.

Rangeland faces increased pressure from many different sectors. Proper management of these unique landscapes and the sensitive and sometimes rare ecosystems they are home to ensure that rangelands continue to support recreationists, ranchers, and First Nations' interests.[25]

The legal reference and direction along with current practice are described in Table 46.

[25] Reference: https://www2.gov.bc.ca/gov/content/industry/rangelands

Table 46: Range resource features legal reference and management direction

Legal Value Reference	Direction
FRPA Sec. 48 FPPR Sec. 18	The current forest practices measures are limited to the management of natural range barriers. Licensees must specify measures to mitigate the effect of removing or rendering natural range barriers ineffective.
Current Practice	
Licensees inform the range tenure holder who may be affected by harvesting and road construction within a specified timeframe. If a natural range barrier might be impacted by forest operations, licensees will work to reach an agreement with the range tenure holder on mitigative measures and work to implement them. If an agreement cannot be made, licensees will work with FLNRO to determine and implement mitigative measures within a certain timeframe.	
Issues Raised	
Licensees: ➢ Not much range overlap. Contact range owners when needed. ➢ Knowing where natural range barriers are is the biggest issue. ➢ Range and wildfire mitigation by fuel reduction work well together. Cows graze down the fuel loading. ➢ Over-grazing is an issue where cattle stay in one spot for various reasons. There has been exploration with virtual remote collars. ➢ We need to think more creatively for our grazing management systems – like using looped pastures moving animals in one direction and then use alternating rest periods. Can be complex but we need to go there. ➢ To understand range health, need to do soil analysis.	

8.4.1 Current Condition

Current condition data for range is limited. Licensees only manage for natural range barriers as described above in current practice. However, range is a significant economic driver in the Lakes area. In 2021, there were 99 grazing licenses and permits granted in the Lakes area, authorizing 24,652 animal unit months of grazing. An Animal Unit Month (AUM) is the amount of forage consumed by an animal unit grazing for one month. An animal unit is equal to a 450 kg cow with or without her calf with a daily intake requirement of 11.8 kg of dry matter forage. Other types of animals are assigned AUM equivalents based on metabolic body weight.

The AUM is used to balance animal numbers with forage/browse production (bro46.pdf (gov.bc.ca), Province of Manitoba | agriculture - Animal Unit Months, Stocking Rate and Carrying Capacity (gov.mb.ca)).

There is existing MOF range health data for the Lakes TSA that assesses proper functioning condition (PFC) for range uplands, wetlands, and streams. The results of the range health data between 2010-2021 are summarized below in Table 47:

Table 47: Proper functioning condition (PFC) in the Lakes TSA

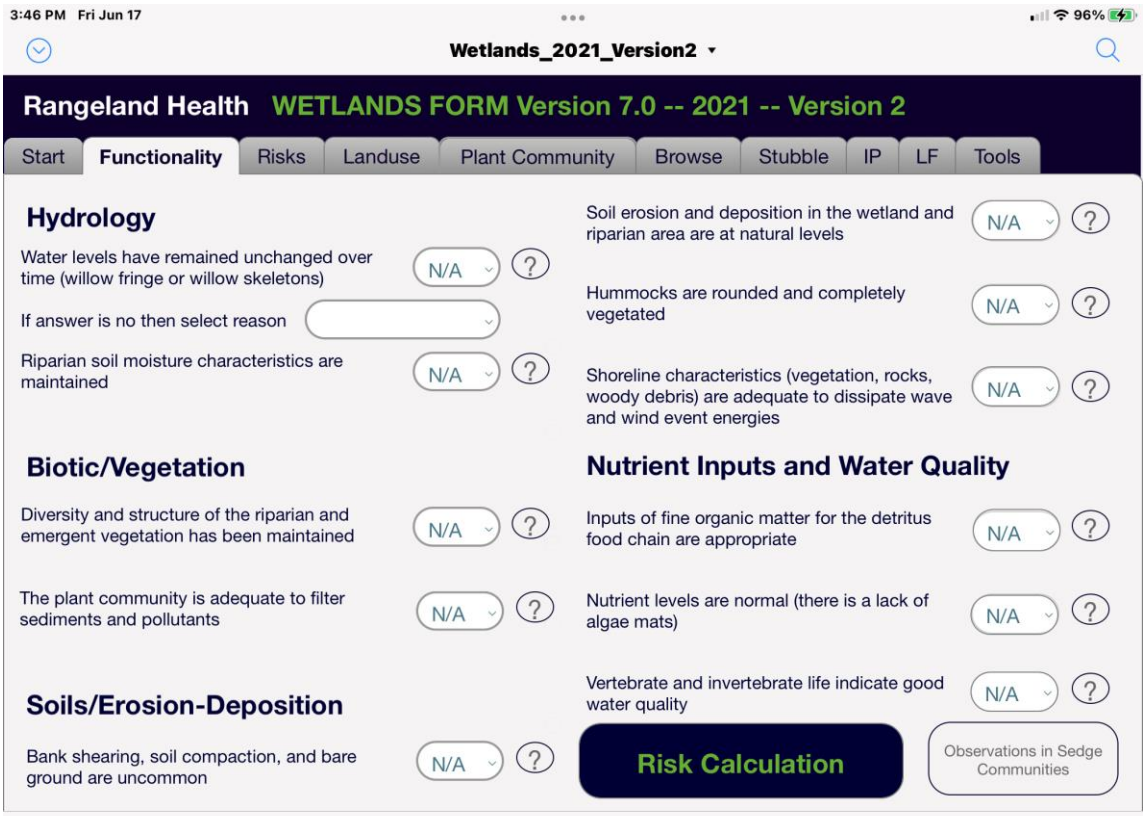
Type	Source_Year	LAT	LON	Functionality	RISKPCT
Upland	2010	53.9228	-125.77	PFC	100
Upland	2010	53.9668	-125.86	PFC	95
Upland	2013	53.7196	-125.11	PFC	100
Upland	2013	54.0189	-125.46	PFC	100
Upland	2013	53.8743	-125.83	PFC	100
Upland	2013	53.8942	-126	PFC	95
Upland	2017	54.4741	-126.22	PFC	90
Upland	2017	54.4741	-126.22	PFC	90
Upland	2018	53.8107	-126.09	Highly at Risk	20
Upland	2019	53.9376	-125.84	Moderately at Risk	60
Upland	2020	54.1223	-125.17	Moderately at Risk	60
Upland	2020	54.0504	-125.76	PFC	100
Upland	2020	54.0504	-125.76	Slightly at Risk	75
Upland	2020	54.0504	-125.76	Moderately at Risk	45
Upland	2020	54.0504	-125.76	PFC	80
Upland	2020	54.4191	-126.24	PFC	100
Upland	2020	54.3388	-126.17	PFC	100
Upland	2020	53.8158	-125.8	PFC	100
Upland	2020	53.778	-125.66	Moderately at Risk	55
Upland	2020	54.0448	-126.21	PFC	90
Upland	2020	53.9708	-125.86	PFC	95
Upland	2020	54.1223	-125.17	PFC	100
Upland	2021	54.4106	-126.02	PFC	92
Upland	2021	54.0412	-126.09	PFC	100
Stream	2020	53.9732	-125.86	Moderately at Risk	54
Wetland	2013	53.8979	-126	PFC	95
Wetland	2010	53.8931	-125.86	Slightly at Risk	75
Wetland	2020	53.9731	-125.86	PFC	82

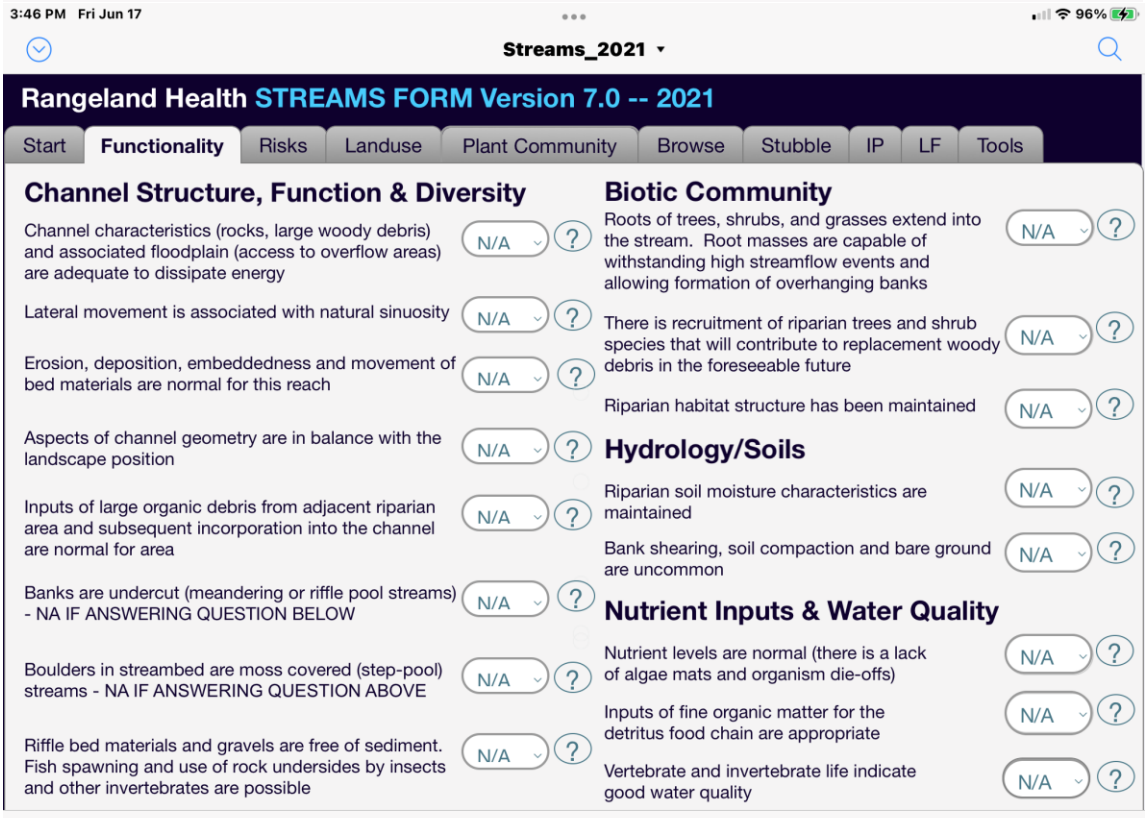
Risk ratings are based on a set of questions for three different rangeland health forms where 'yes' is always the positive answer. To get percent functionality, the number of 'yes' answers are divided by the total number of questions and multiplied by 100. Examples of the range health forms for uplands, wetlands, and streams to determine risk ratings are shown below.
While this information can help inform the current condition of range health within the Lakes TSA, a caveat should be noted where this information is difficult to adequately model in this project, because the project data is prepared only for forested areas of the study area. Background on how rangeland health is assessed can be found here:

rangeland_health_brochure1.pdf

Examples of the assessment forms are shown below.


3:46 PM Fri Jun 17
96%
Uplands_2021
Rangeland Health UPLANDS FORM Version 7.0 -- 2021
Start
Functionality
Risks
Landuse
Plant Community
Browse
Stubble
IP
LF
Tools
Hydrologic and Soils
Organic material (plant litter, standing vegetation) protects soil surface from raindrop impact and evaporative effects from sun and wind
N/A
Water will easily infiltrate the soil surface (surface soils peds present, absence of physical soil crusting, capping)
N/A
Subsurface soil conditions support infiltration (compaction layers are uncommon).
N/A
Vegetation and plant litter detain overland water flow and trap sediment
N/A
Biotic/Vegetation
The plant community is showing good vigour (including recruitment of decreasers)
N/A
A diversity of habitat structure for vertebrate and invertebrate life is evident
N/A
The plant community reflects a fully occupied root zone
N/A
Erosion/Deposition
Evidence of rills, gullies, pedestaling, and other excessive soil movement is uncommon
N/A
Mineral Cycle
Plant cover and litter create micro-site environment conducive to biological breakdown
N/A
Biological soil crusts and nitrogen fixing forbs and shrubs are present as in the reference condition
N/A
Risk Calculation
Observations in Aspen Plant Communities


3:46 PM Fri Jun 17
96%
Wetlands_2021_Version2
Rangeland Health WETLANDS FORM Version 7.0 -- 2021 -- Version 2
Start
Functionality
Risks
Landuse
Plant Community
Browse
Stubble
IP
LF
Tools
Hydrology
Water levels have remained unchanged over time (willow fringe or willow skeletons)
N/A
If answer is no then select reason
Riparian soil moisture characteristics are maintained
N/A
Soil erosion and deposition in the wetland and riparian area are at natural levels
N/A
Hummocks are rounded and completely vegetated
N/A
Shoreline characteristics (vegetation, rocks, woody debris) are adequate to dissipate wave and wind event energies
N/A
Biotic/Vegetation
Diversity and structure of the riparian and emergent vegetation has been maintained
N/A
The plant community is adequate to filter sediments and pollutants
N/A
Soils/Erosion-Deposition
Bank shearing, soil compaction, and bare ground are uncommon
N/A
Nutrient Inputs and Water Quality
Inputs of fine organic matter for the detritus food chain are appropriate
N/A
Nutrient levels are normal (there is a lack of algae mats)
N/A
Vertebrate and invertebrate life indicate good water quality
N/A
Risk Calculation
Observations in Sedge Communities


3:46 PM Fri Jun 17
96%
Streams_2021
Rangeland Health STREAMS FORM Version 7.0 -- 2021
Start
Functionality
Risks
Landuse
Plant Community
Browse
Stubble
IP
LF
Tools
Channel Structure, Function & Diversity
Channel characteristics (rocks, large woody debris) and associated floodplain (access to overflow areas) are adequate to dissipate energy
N/A
Lateral movement is associated with natural sinuosity
N/A
Erosion, deposition, embeddedness and movement of bed materials are normal for this reach
N/A
Aspects of channel geometry are in balance with the landscape position
N/A
Inputs of large organic debris from adjacent riparian area and subsequent incorporation into the channel are normal for area
N/A
Banks are undercut (meandering or riffle pool streams) - NA IF ANSWERING QUESTION BELOW
N/A
Boulders in streambed are moss covered (step-pool) streams - NA IF ANSWERING QUESTION ABOVE
N/A
Riffle bed materials and gravels are free of sediment. Fish spawning and use of rock undersides by insects and other invertebrates are possible
N/A
Biotic Community
Roots of trees, shrubs, and grasses extend into the stream. Root masses are capable of withstanding high streamflow events and allowing formation of overhanging banks
N/A
There is recruitment of riparian trees and shrub species that will contribute to replacement woody debris in the foreseeable future
N/A
Riparian habitat structure has been maintained
N/A
Hydrology/Soils
Riparian soil moisture characteristics are maintained
N/A
Bank shearing, soil compaction and bare ground are uncommon
N/A
Nutrient Inputs & Water Quality
Nutrient levels are normal (there is a lack of algae mats and organism die-offs)
N/A
Inputs of fine organic matter for the detritus food chain are appropriate
N/A
Vertebrate and invertebrate life indicate good water quality
N/A

8.5 Recreation and Resource Features

The Lakes TSA has an abundance of recreation opportunities including fishing, hiking, mountain biking, boating, sight-seeing, and more. The Kager Lake recreation site offers world-class mountain biking and cross-country ski trails that have become popular over the years. There are 28 campgrounds in the Lakes TSA that are regularly maintained, and most of them are surrounded by managed forests.

The legal reference and direction along with current practice are described in Table 48.

Table 48: Recreation resource features legal reference and management direction

Legal Value Reference	Direction
FRPA Sec. 180(i), (j), (k), 181 Order to establish objectives for a recreation site, recreation trail or interpretive forest site (Sec 6.3 FPC).	Maintain or enhance a diverse range of recreational values and opportunities.
Current Practice	
One licensee has objectives for three recreation sites that fall within their management area (Mollice Lake recreation site, Indian Bay recreation site, and Walkadab recreation trail). Objectives consist of managing for a road access recreation experience, a trail recreation experience, retaining lakeshore features and managing overstory vegetation. Another licensee has objectives for several recreation trails that fall within their management area (Bear Dens recreation trail and Guyishton Lake recreation trail). Bed rock formations are protected and all overstorey vegetation is maintained on either side of the recreation trails. All licensees indicate they will not construct roads or harvest timber within or near established recreation site boundaries. One licensee indicates they will work with the FLNRO recreation officer to develop measures necessary to mitigate the potential impact of a cutting or road permit on the integrity of the recreation site, trail, or interpretive forest site that has no established objectives or has established objectives. No harvesting or road construction is allowed within established recreation site boundaries.	
Issues Raised	
Licensees: ➢ Not many recreation issues in the Lakes. ➢ Valuable learning experience gained at Boer Mountain. Communication is key.	

8.6 Soils

Soil supports the growth of fiber and food, acts as a filter for air and water, affects global climate through gas exchange and storage, contains a diverse array of organisms and supports natural ecosystems.[26] In forestry operations, soil is managed through established soil disturbance limits.

[26] Reference: https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil

Access management has been repeatedly identified as a concern from First Nations; high road density leads to increased soil disturbance and impacts wildlife and fish habitat.

The legal reference and direction along with current practice are described in Table 49.

Table 49: Soils legal reference and management direction

Legal Value Reference	Direction
FPPR Sec. 5, FPPR Sec 35 & 36.	Conserve the productivity and the hydrologic function of soils without unduly reducing the supply of timber. The province has incorporated explicit maximum percentage limits for site disturbance and construction of permanent access structures into the FPPR, s. 36. The target is to have the average site disturbance for the province at less than 5 %.
Current Practice	
Licensees comply with the default soil disturbance limit targets set in regulation. Targets are set by a percentage of soil disturbance limits for sensitive soils, non-sensitive soils, roadsides, and permanent access structures in a cutblock. Soil disturbance limits can be exceeded: ➢ When removing root disease-infected stumps or salvaging windthrow. ➢ When constructing a temporary access structure where the limits are not exceeded by >5% ➢ If there is no other practicable option regarding size, topography, engineering constraints, road safety, and requirement for harvesting systems or if additional permanent access structures are required for access beyond the cutblock.	
Issues Raised	
Licensees: ➢ More of a visual assessment of site degradation preferred. ➢ Mineral soil exposure = good germination of Sx. Can help promote tree growth but is bad for soil degradation. ➢ Have requested exemptions on soil disturbance limits where raking is done for fire prevention treatments. ➢ One licensee has results and strategies in new FSP for soil disturbance with respect to wildfire mitigation.	

8.6.1 Current Condition

The Provincial Timber Management Goals and Objectives (FLNRORD 2017) set high-level provincial timber management goals, objectives, and targets for site capacity. The achievement of targets in individual management units (TSA) are monitored and reported annually. The monitoring evaluates performance for percentage of permanent access structures. According to the most recent (September 2021) monitoring results, the area-weighted Permanent Access Structures (PAS) percent reported to RESULTS between 2008 to 2019 is between 6% and 7% in the Lakes TSA.

8.7 Timber

The rights to harvest timber from public forests are granted by the provincial government through a wide variety of licences and tenure agreements. Within the geographic boundary of the Lakes planning area, there are 35 woodlots, two First Nations woodland licences, three community forest agreements, eight replaceable forest licences and a timber sale licence program.

The number and diversity of licences and tenure agreements in the TSA reflects the dependence of the local economy on the regional forest industry. There are three lumber mills and one pellet plant currently in operation within the project area. These mills all rely on the timber harvested from the project area and from neighbouring TSAs. In addition, there is a lumber mill in Fraser Lake that receives a significant portion of its volume from the project area (Lakes TSA Discussion Paper 2019).

8.7.1 Growing Stock

The current growing stock of the CFMLB and the GHLB are estimated at 88.8 million m^3 and 69.9 million m^3 respectively (Table 50). Approximately 26% of the volume is classified as dead in both land bases. Most of the live growing stock volume consists of spruce (35%), pine has a share of 17% and 19%, while 12% of the CFMLB and the GHLB volume is made up of balsam (Table 50, Figure 47, Figure 48). The location of dead timber is shown in Figure 49. Approximately 84% of the dead timber is in the SBS BEC zones with the balance in ESSF.

Table 50: Total growing stock by species

Species	CFMLB Volume (m^3)	CFMLB %		GHLB Volume (m^3)	GHLB %
Pine	15,309,099	17%		13,186,446	19%
Spruce	30,721,545	35%		24,214,159	35%
Balsam	10,822,587	12%		8,627,488	12%
Other	8,433,463	10%		5,529,298	8%
Dead	23,466,651	26%		18,303,734	26%
Total	**88,753,345**	**100%**		**69,861,126**	**100%**

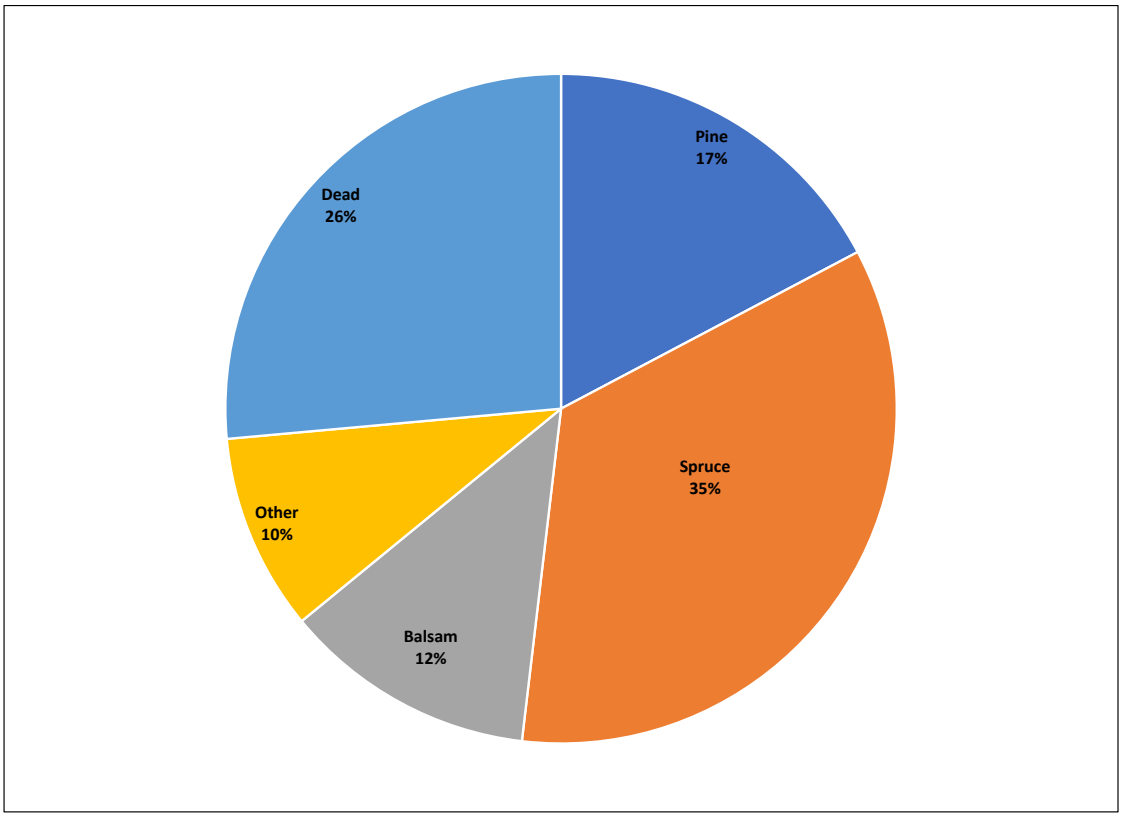


Figure 47: CFMLB growing stock by species (%)

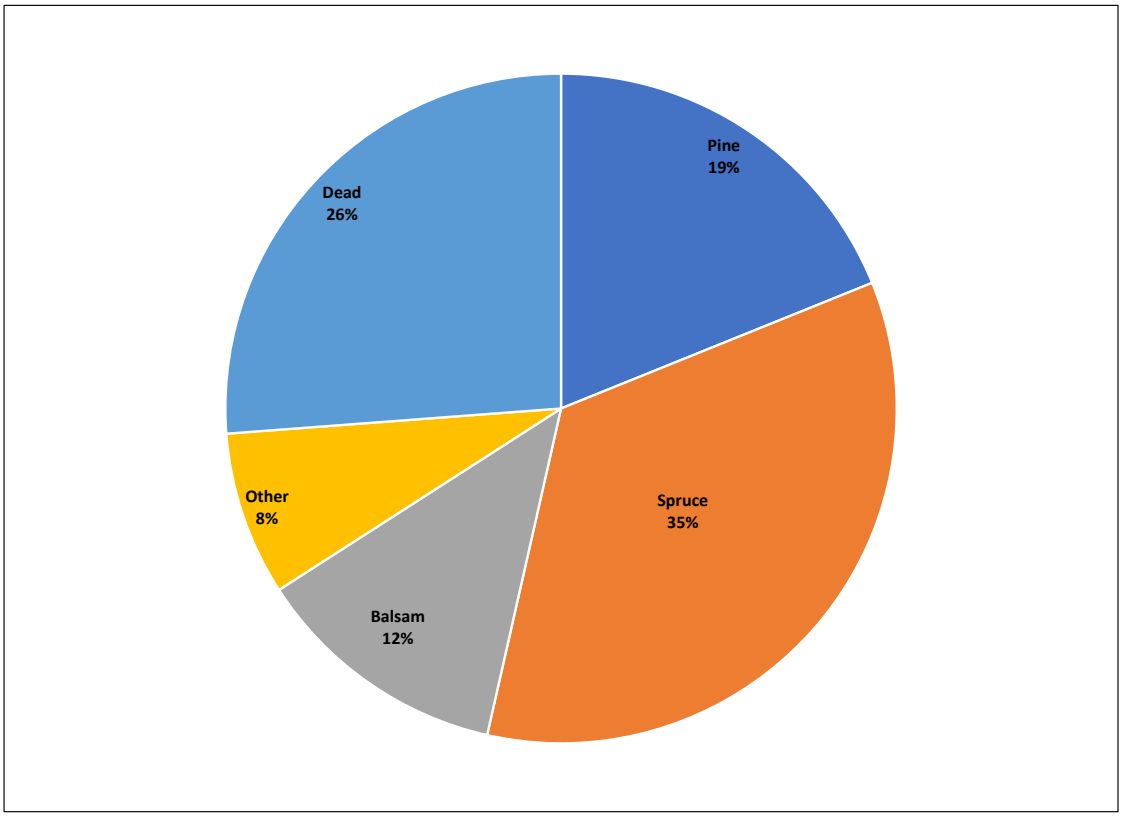


Figure 48: GHLB growing stock by species (%)

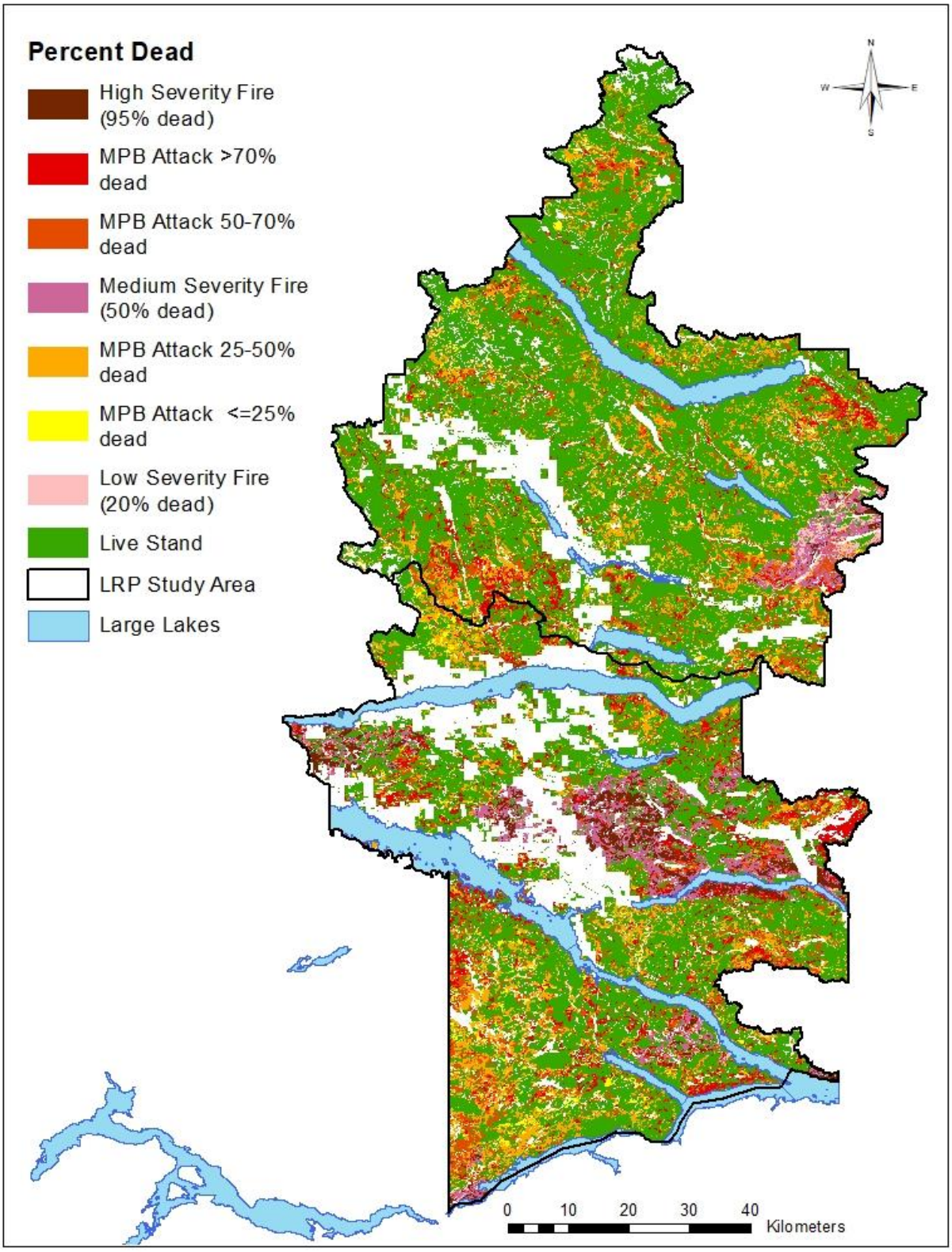


Figure 49: Location of dead timber in the project area

8.7.2 Age Class Distribution

The current age class distribution in the project area for the CFMLB is illustrated in Figure 50. The CFMLB is made of the GHLB and permanent reserves. The age classes shown account for moderate and high severity fires, and the MPB attack; the fire areas are considered non-sufficiently restocked (NSR, or age class 0), while the areas where the MPB mortality is 70% or higher are classified as age class 1.

The MPB infestation in the project area required prompt salvage harvesting of the dead and damaged timber. Due to the salvage activities and recent wildfires a significant portion of the area is less than 40 years old. This can be seen in Figure 50; age classes 0, 1 and 2 (NSR, 1 to 20 years and 21 to 40 years) occupy 37% of the total CFMLB. The areas where the seral stages and age classes have been adjusted because of the wildfires and MPB mortality are called wild young forest.

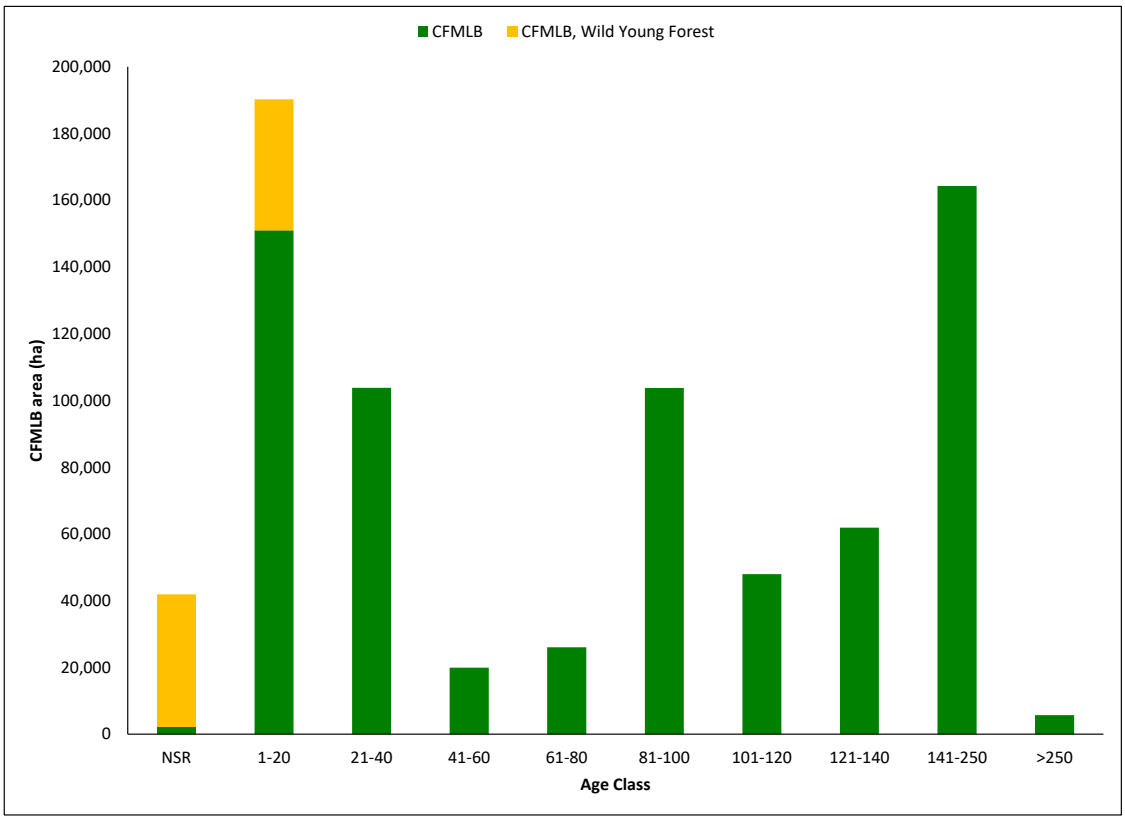


Figure 50: Age class distribution, project area (CFMLB)

8.7.3 Volume per Hectare

The 2019 TSR reviewed the licensee cutting permit cruise data from 2010 to 2017. During that period, the average net volume of harvested stands declined from 286 m^3 per ha to 236 m^3 per ha. A similar reduction was found in the minimum volume of harvested stands; it declined from 218 m^3 per ha in 2010 to 169 m^3 per ha in 2017.

The 2019 TSR set the minimum harvestable volume per ha to 140 m^3. This minimum volume consisted of both live and dead timber.

There are 380,983 ha of natural stands in the GHLB in the study area. Natural stands are those established prior to 1967 (55 years old or older in 2021). According to the VRI, approximately 36% (138,855 ha) of the natural stands in the GHLB have less than 140 m^3 of dead and live timber per ha

(Figure 51 and Table 51). The natural stands that have less than 140 m^3 of live timber per ha, but when combined with dead timber meet the 140 m^3 per ha threshold, constitute 22% (82,844 ha) of the GHLB. The balance of the natural stand GHLB area (159,283 ha, 42%) consists of stands where the live volume is 140 m^3 per ha or more.

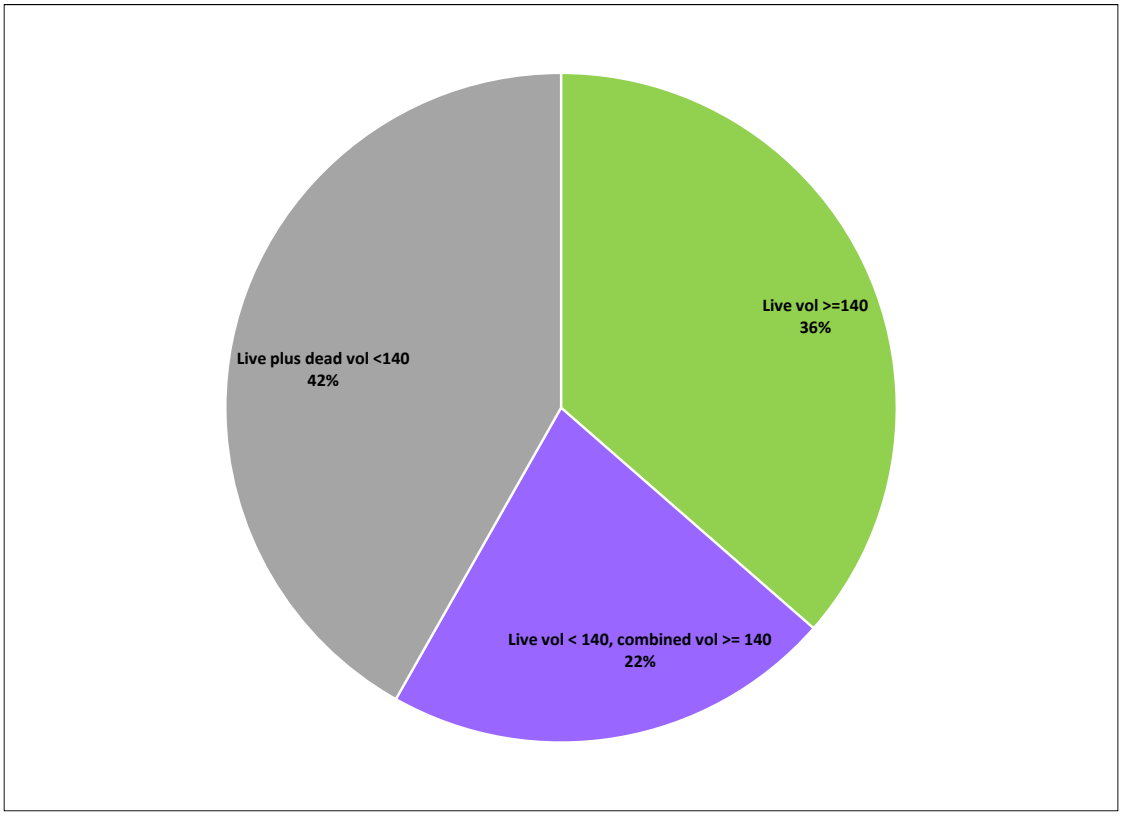


Figure 51: Natural stands in the GHLB by volume/hectare

Table 51: Natural stands in the GHLB by volume/hectare

Description	Area (ha)	%
Live plus dead < 140m^3/ha	138,855	36%
Live <140m^3 per ha, combined dead and live >=140m^3/ha	82,844	22%
Live >=140m^3/ha	159,283	42%
Total	**380,983**	**100%**

8.7.4 BEC Variants and Site Index

Figure 52 depicts the CFMLB in the project area by BEC variant. Approximately 44% of the CFMLB is in the SBSmc2 variant, while almost 38% is in the SBSdk variant. ESSFmc represents 13% of the CFMLB.

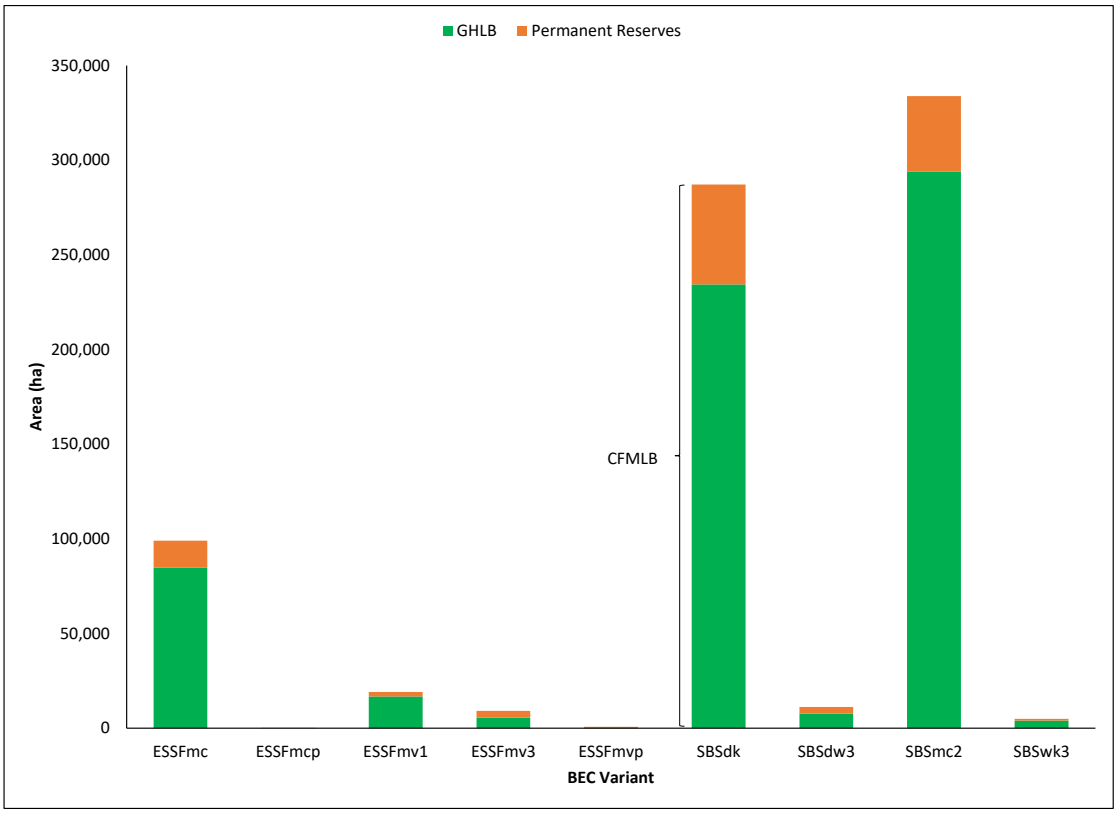


Figure 52: CFMLB by BEC variant

Table 52 presents the average area weighted site indices by BEC variant for the project area. The site indices are for managed stands, and they are based on the provincial site productivity layer estimates, which are considered the best estimates of site productivity for modelling managed stands.

Table 52: Area weighted average site index on the GHLB

BEC variant	GHLB area (ha)	Avg Pl site index (m)	Avg Sx site index (m)
ESSFmc	84,808	16.5	19.2
ESSFmcp	186	15.3	13.2
ESSFmv1	16,814	16.6	19.2
ESSFmv3	5,639	16.7	18.6
ESSFmvp	49	15.1	11.8
SBSdk	234,452	19.6	18.4
SBSdw3	7,800	19.7	18.8
SBSmc2	294,062	18.1	19.0
SBSwk3	4,029	18.5	18.2

8.7.5 Historical and Current Allowable Annual Cut (AAC)

The current (2019) AAC in the Lakes TSA is 970,000 m^3 per year of which 400,000 m^3 is attributable to live conifer volume and 550,000 m^3 to dead volume. An additional 20,000 m^3 is attributable to

live deciduous volume. The partitions set in 2019 are intended to encourage the harvesting of dead timber while protecting the midterm timber supply by limiting the harvest of live timber.

The historical and current Lakes TSA AAC are shown in Table 53. The increases in the AAC in 2001 and 2004 were in response to the MPB epidemic; the objective was to target moderately and severely impacted pine stands. The 2011 partition was put in place to maximize the mid-term harvest by controlling the harvest of non-pine species.

The expansion of the Burns Lake Community Forest, and the establishment of the Chinook Community Forest, the Lake Babine Nation Woodland Licence and the Nee Tahi Buhn Band First Nations Woodland Licence led to the decrease of the TSA's AAC in 2016.

The AACs for the area-based tenures in the project area are shown in Table 54. The current total AAC for the area-based tenures is 357,753 m^3 per year. The total AAC for the project area (sum of the TSA AAC and the area-based tenures AAC) is 1,327,753 m^3 per year.

Table 53: Historical and current AAC, Lakes TSA

AAC (m^3)		1982	2001	2004	2011	2016	2019
		1,500,000	2,962,000	3,162,000	2,000,000	1,648,660	**970,000**
Partition	Non-Pine				350,000	288,516	
	Live Conifer						400,000
	Live Deciduous						20,000
	Dead						550,000

Table 54: AAC for area-based tenures in the project area

Tenure	Licensee	Issued	Initial AAC	Current AAC
Community Forest Agreement	Burns Lake Community Forest	2005	86,000	194,226
	Cheslatta Carrier Nation	2007	16,613	73,397
	Chinook Comfor	2016	150,000	65,000
First Nations Woodland License	Lake Babine Nation Forestry[27]	2016	18,930	18,930
	Nee Tahi Buhn	2016	6,200	6,200
Total			277,743	**357,753**

8.7.6 Apportionment of the AAC and TSA Licensees

Table 55 shows the current apportionment of the AAC to various license types within the Lakes TSA. The apportionment is substantially larger than the current AAC, because the Minister of Forests, Lands, Natural Resource Operations and Rural Development has yet to apportion the latest AAC.

Babine Forest Products Limited and West Fraser Mills Ltd. are the largest license holders in the TSA (Table 56).

[27] Lake Babine FNWL: 55,222 m^3 per year in Morice leaves 18,930 m^3 per year for the Lakes. Total Lake Babine FNWL AAC is 74,152 m^3 per year.

Table 55: Apportionment, Lakes TSA[28]

Tenure	Total (m^3)	%
Forest Licenses Replaceable	868,604	43.98
Forest Licenses Non-Replaceable	589,466	29.85
First Nations Woodlands Tenure	79,164	4.01
BCTS Timber Sale License	284,506	14.41
Community Forest Agreement	150,000	7.59
Forest Service Reserve	3,261	0.17
Total	**1,975,000**	**100.00**

Table 56: Licence AAC commitments in the Lakes TSA[29]

Tenure	License	Licensee	Total (m^3)
Forest Licenses Replaceable	A16821	Nechako Lumber Co. Ltd.	13,084
	A16823	Babine Forest Products Limited	334,951
	A16824	West Fraser Mills Ltd.	43,627
	A16825	Babine Timber Limited	94,748
	A16826	West Fraser Mills Ltd.	332,194
	A92915	Cheslatta Carrier Nation	6,833
	A96136	Babine Forest Products Limited	10,000
	A96137	Babine Timber Limited	10,000
	A97063	West Fraser Mills Ltd.	10,000
	A97064	West Fraser Mills Ltd.	10,000
	Sub Total		**875,437**
Forest Licenses Non-Replaceable		YLP Woodlands GP Limited	6,196
Total			**881,633**

8.7.7 Current Timber Supply Situation

8.7.7.1 Timber Supply Review (TSR)

Figure 53 illustrates the latest Timber Supply Review (TSR) base case harvest forecast for the Lakes TSA. It consists of two separate harvest forecasts: one for dead timber and the other for live mature timber. The TSR base case projected a total harvest level of 800,000 m^3 per year, equally split between dead and live timber, over the first 10 years of the planning horizon.

The harvest of dead timber is projected to fall to an average of 75,000 m^3 per year at year 11 and remain at this level until year 60. According to the base case harvest forecast, after year 60 dead volume no longer contributes to the harvest.

[28] As of March 30, 2021

[29] As of March 30, 2021

It is uncertain how long (shelf life) after death the mountain pine beetle killed trees are usable as sawlogs. Given that the peak of the MPB infestation occurred in 2005, it is likely that the trees killed by the MPB are nearing the end of their shelf life. The TSR did not consider shelf-life in the timber supply analysis.

The harvest of live timber is projected to be sustainable at 400,000 m^3 per year until year 60, after which the harvest forecast for live timber (and total) increases to 900,000 m^3 per year until the end of the planning horizon.

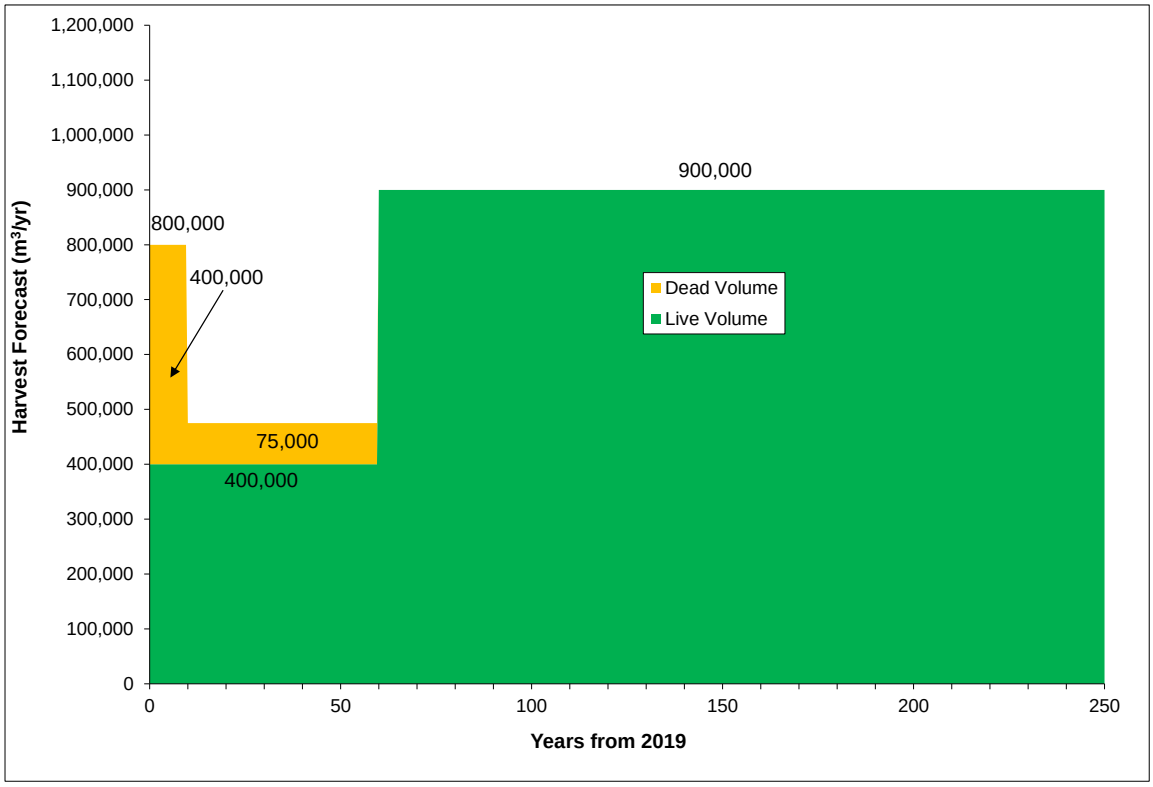


Figure 53: Timber supply forecast (TSR 2019)

The base case harvest forecast contains important assumptions regarding the ongoing harvest operations, the quality of natural stands, the growth and yield and the associated quality of managed stands.

7. The base case assumes that 400,000 m^3 of MPB killed dead timber is available for harvest annually for 10 years. Given that the MPB epidemic peaked in 2005, the MPB killed stands are likely approaching the end of their shelf life and it is not certain whether the volume as forecasted in the TSR is available in the short term.

8. The base case also assumes that some dead timber (75,000 m^3 per year) may be available until year 60. The longer-term availability of this timber is unlikely. The same may be the case with the fire killed timber.

9. The base case assumes that the available dead timber is harvested by the licensees in the Lakes TSA.

   The quality of the dead timber may be such that its utilization is not feasible by the licensees operating in the area. If the harvest of dead timber falls significantly short from the level

assumed in the TSR base case, the dead stands are not reforested and the long-term timber supply and the overall productivity of the THLB may be compromised.

10. The base case assumes that the minimum harvest volume (live and dead) is 140 m^3 per ha. This assumption is combined with a minimum harvestable age requirement of 80 years. Both conditions must be met for the stand to be eligible for harvest.

    Figure 54 illustrates the average live volume harvested in the TSR base case harvest projection. At the beginning of the planning horizon the live volume is approximately 130 m^3 per ha increasing to 150 m^3 per ha by year 10; it stays at this level until year 30.

    According to the Lakes Timber Supply Area Timber Supply Analysis Discussion Paper (April 29, 2019), the lowest average minimum harvest volume observed in the last eight years (before 2019) was 170 m^3 per ha. The TSR tested the sensitivity of the timber supply to a higher minimum volume per ha. Increasing it to 170 m^3 per ha (except for low productivity sites) reduced the short-term harvest forecast by 22 %. The long-term reduction was 9%.

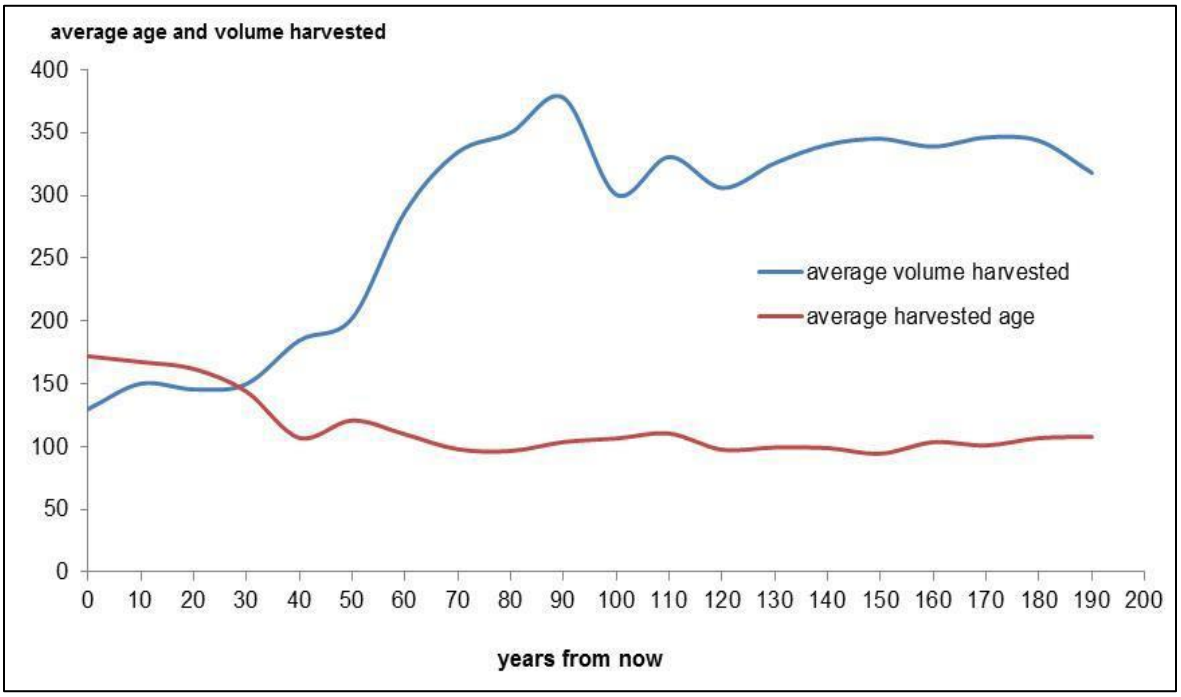


Figure 54: Average age and average volume of the live volume harvested in the Lakes TSA in the latest TSR. Source: Lakes Timber Supply Area Timber Supply Analysis Discussion Paper (April 29, 2019)

11. The base case assumes that the timber in lower productivity stands included in the THLB in the TSR is harvested as modelled; 292,000 m^3 per year of live volume and 268,000 m^3 per year of dead volume are expected to be harvested in stands where the harvest volume per hectare is low.

    - Assumed minimum live volume per ha in balsam-leading stands is 125 m^3. With the dead component also present, these stands contain at least 140 m^3 per hectare.

- Assumed minimum live volume per ha in pine-leading stands 80 m^3. With the dead component also present, these stands contain at least 140 m3 per hectare.
- Assumed minimum live volume per ha in spruce-leading stands 82 m^3. With the dead component also present, these stands contain at least 140 m^3 per hectare.

The above volumes are low and difficult to achieve economically unless the harvest of low volume stands can be combined with stands of higher volume per ha.

12. At year 60, approximately 90% of the harvest is assumed to come from managed stands meeting the minimum harvest criteria of 140 cubic metres per hectare and 80 years of age.

    Much of the timber in the Lakes TSA is used for lumber production. This requires that the harvested managed stands be of adequate quality for lumber production. Monitoring the quality and volume of managed stands is required to improve future analyses.

As discussed under section 8.7.5, the current AAC in the Lakes TSA is 970,000 m^3 per year of which 400,000 m^3 is attributable to live conifer volume and 550,000 m^3 to dead volume. An additional 20,000 m^3 is attributable to live deciduous volume. The AAC determined by the chief forester is different from the TSR base case harvest forecast because the chief forester included additional salvage opportunities in stands impacted by the 2018 wildfires and recognized the potential demand for deciduous for pellet production.

The Chief Forester's implementation instructions encouraged the ministry staff and the licensees to help reduce the uncertainty that is associated with some of the key factors in the TSR. Table 57 summarizes the Chief Forester's implementation direction.

Table 57: Chief Forester's AAC implementation direction

Issue	Direction	Organization
Riparian Management	Work on a comprehensive stream classification	Ministry and licensees
Minimum harvest age and volume	Plan and monitor harvest performance in low live volume stands and report back annually	Ministry and licensees
Landscape level biodiversity	Develop and implement a strategy to recruit and manage old growth. Implementation through FSPs and CP application process	Ministry (approval) and licensees
Wildlife habitat areas	Complete a comprehensive regional wildlife assessment to evaluate the condition and distribution of species, and effectiveness of current tools in management and recovery.	Ministry
Hydrology	Complete a comprehensive watershed assessment	Ministry

Issue	Direction	Organization
Cumulative effects	Inventory existing roads according to risk to forest values and prepare management guidelines to manage the risk to aquatic ecosystems and grizzly bear.	Ministry
Climate change mitigation	Implement mitigation options to lessen climate change impacts.	Ministry and licensees
Climate change and forest health monitoring	Enhance climate and forest health to decrease uncertainty and improve model projections	Ministry
Climate change modelling	Work on integrating climate change projections into timber supply, growth and yield, and natural disturbance models.	Ministry

8.7.8 Harvest Performance and Trends

8.7.8.1 Lakes TSA and Community Forest Agreements and First Nations Woodland Licences

Figure 55 and Table 58 illustrate the scaled volume for the Lakes TSA and area-based tenures -CFAs and FNWLs-between years 2012 and 2020. Historically the scaled volume has been substantially less than the AAC except for 2020, when the harvest exceeded the project area AAC. Note that all licensees in the planning area are on a 5-year cut control system. Within the system the harvest vs. AAC is monitored over a 5-year period and annual surpluses and shortfalls are common.

Over time the share of area-based tenures of the total harvest has increased. In 2012 approximately 13% of the scaled harvest cam from area-based tenures. In 2020 their share had increase to 30%.

Figure 56 and Table 59 show the scaled volume for the Lakes TSA and area-based tenures -CFAs and FNWLs- between years 2012 and 2020 by species. Most of the harvest since 2012 has been pine. It together with spruce is the most common species in the area; the salvage of the MPB killed stands has further increased pine harvest. It is expected that the harvest of pine will be reduced significantly in the short and medium term as most of the merchantable dead stands have been salvaged.

Figure 55: Harvest 2012 – 2020, CFA, FNWL and Lakes TSA (m^3)[30]

Table 58: Harvest 2012 – 2020, CFA, FNWL and Lakes TSA (m^3)

Scale Year	TSA Harvest (m^3)	Area-Based Harvest (m^3)	% of Total	Total Harvest (m^3)	AAC (m^3)	% AAC
2012	1,130,609	164,720	13%	1,295,329	2,309,211	56.1%
2013	1,083,949	219,535	17%	1,303,484	2,309,211	56.4%
2014	1,248,589	172,517	12%	1,421,106	2,149,211	66.1%
2015	1,472,344	362,863	20%	1,835,207	2,149,211	85.4%
2016	1,850,120	306,943	14%	2,157,063	2,449,341	88.1%
2017	1,055,264	491,243	32%	1,546,507	2,098,001	73.7%
2018	1,004,826	410,797	29%	1,415,623	2,098,001	67.5%
2019	1,179,159	508,277	30%	1,687,436	1,968,001	85.7%
2020	1,129,825	488,682	30%	1,618,508	1,313,527	123.2%

[30] Source: TSA harvest; TSR until 2018, provincial scale 2019 – 2020 for the Lakes TSA. Provincial Scale for area-based tenures

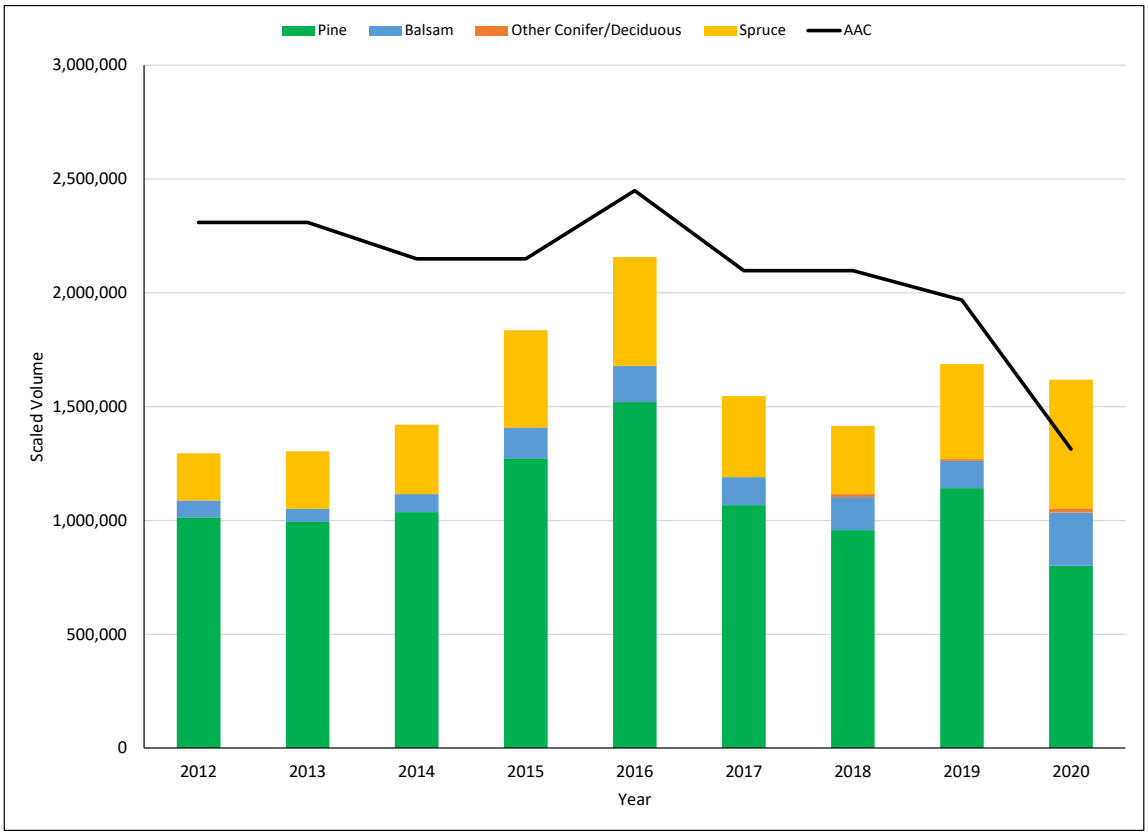


Figure 56: Harvest by species 2012 – 2020; CFAs, FNWL and Lakes TSA Lakes TSA (m^3)[31]

Table 59: Harvest by species 2012 – 2020; CFAs, FNWL and Lakes TSA Lakes TSA (m^3)

Scale Year	Balsam	Other Conifer / Deciduous	Pine	Spruce	Total (m^3/yr)
2012	73,302	1,968	1,013,658	206,400	1,295,329
2013	56,978	893	993,604	252,007	1,303,482
2014	78,953	575	1,036,587	304,992	1,421,107
2015	134,136	2,458	1,272,774	425,839	1,835,207
2016	158,326	861	1,520,044	477,797	2,157,028
2017	123,432	373	1,067,038	355,663	1,546,506
2018	140,456	13,414	896,999	278,572	1,329,440
2019	99,333	7,543	1,099,803	384,722	1,591,401
2020	195,999	18,207	745,116	513,650	1,472,972

[31] Source: TSA harvest; TSR until 2018, provincial scale 2019 – 2020 for the Lakes TSA. Provincial Scale for area-based tenures

8.7.8.2 Lakes TSA

Figure 57 illustrates the scaled harvest volume in the Lakes TSA (area-based tenures are excluded). The harvest has not met the AAC between years 2012 and 2019; on average less than 70% of the AAC was harvested during this time (Table 60). In 2020 the harvest exceeded the AAC.

Harvesting of the MPB impacted stands within the Lakes TSA contributed to the high share of pine harvest (Figure 57 and Table 60). Since 2012 approximately 70% of all harvest in the TSA has been pine, while the rest of the harvest consists mostly of spruce (approximately 20%) and balsam.

Until 2019 the AAC in the TSA included a non-pine partition to direct harvest to MPB impacted stands. The past harvest generally abided by the partition as shown in Table 61 and Figure 58. The live conifer partition set in 2019 (400,000 m^3/year) was exceeded in 2019 and 2020 and the harvest of dead[32] conifer fell short of the target in 2020 (Table 61 and Figure 59).

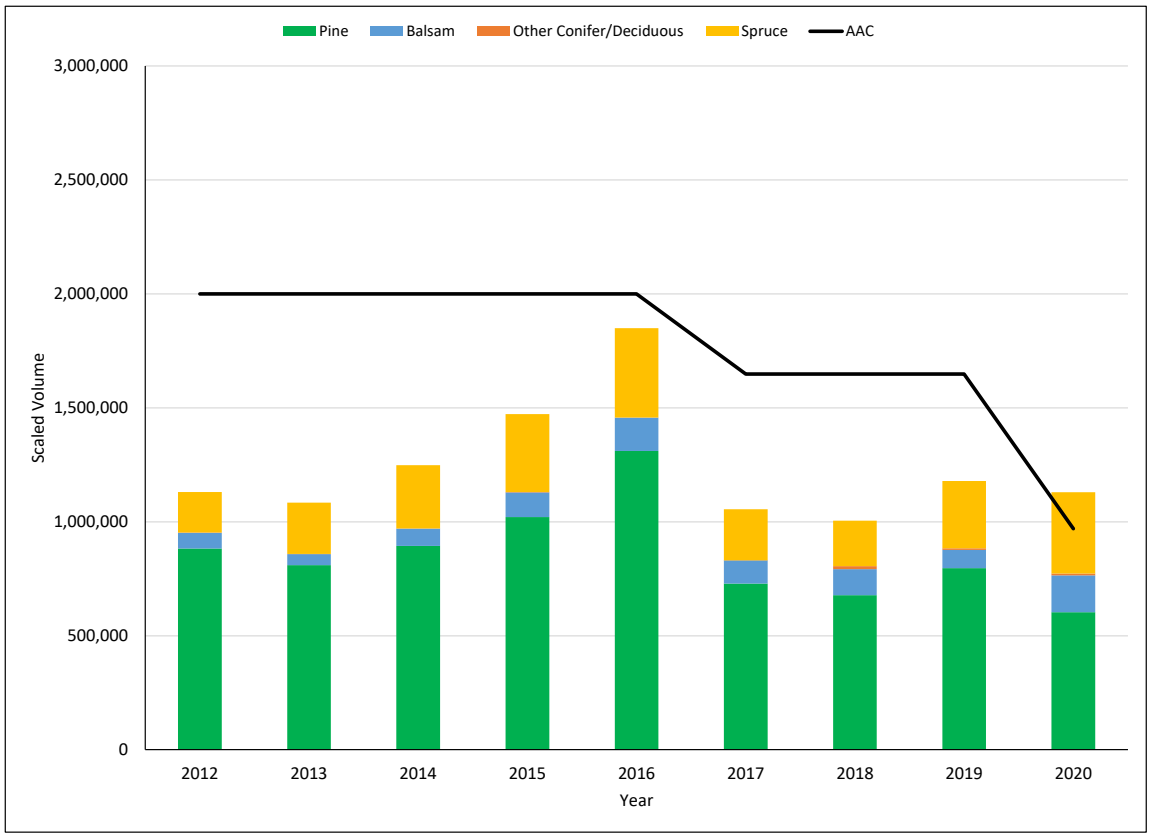


Figure 57: Harvest by species in the Lakes TSA (m^3)

[32] Dead as recorded in Provincial scale data

Table 60: Harvest by species 2012 – 2020, Lakes TSA (m^3)[33]

Scale Year	Balsam	Other Conifer / Deciduous	Pine	Spruce	Total	AAC	% AAC
2012	68,613	1,956	882,578	177,462	1,130,609	2,000,000	56.5%
2013	48,116	862	810,224	224,747	1,083,949	2,000,000	54.2%
2014	75,894	568	893,870	278,257	1,248,589	2,000,000	62.4%
2015	107,833	1,588	1,021,097	341,826	1,472,344	2,000,000	73.6%
2016	145,824	630	1,310,782	392,883	1,850,120	2,000,000	92.5%
2017	102,201	279	728,825	223,959	1,055,264	1,648,660	64.0%
2018	114,686	13,412	677,674	199,054	1,004,826	1,648,660	60.9%
2019	79,307	7,114	797,106	295,632	1,179,159	1,648,660	71.5%
2020	160,940	8,524	603,658	356,703	1,129,825	970,000	116.5%

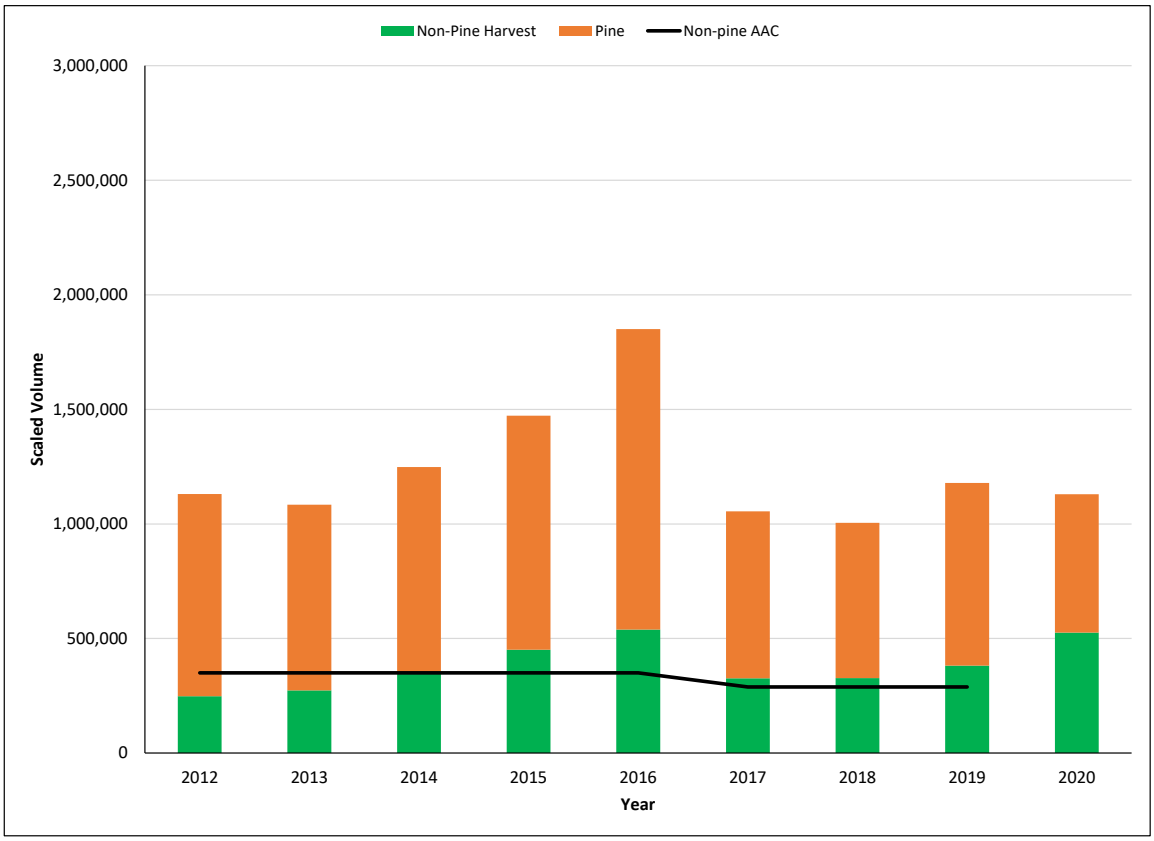


Figure 58: Harvest by pine and non-pine species 2012 – 2020, Lakes TSA (m^3)

[33] Source TSR until 2018. Provincial scale 2019 - 2020

Table 61: Harvest by pine and non-pine species 2012 – 2020, Lakes TSA (m^3)[34]

Scale Year	Non-Pine AAC	Live Pine	Dead Pine/Conifer	Non-Pine	Total
2012	350000	221,575	661,003	248,031	1,130,609
2013	350000	194,946	615,278	273,725	1,083,949
2014	350000	161,613	732,257	354,719	1,248,588
2015	350000	144,894	876,203	451,247	1,472,343
2016	350000	173,113	1,137,669	539,338	1,850,120
2017	288516	122,718	606,107	326,439	1,055,264
2018	288516	156,049	521,625	327,152	1,004,826

Scale Year	Live Conifer AAC	Live Conifer	Dead Conifer	Total
2019	400,000	653,232	525,927	1,179,159
2020	400,000	843,069	286,756	1,129,825

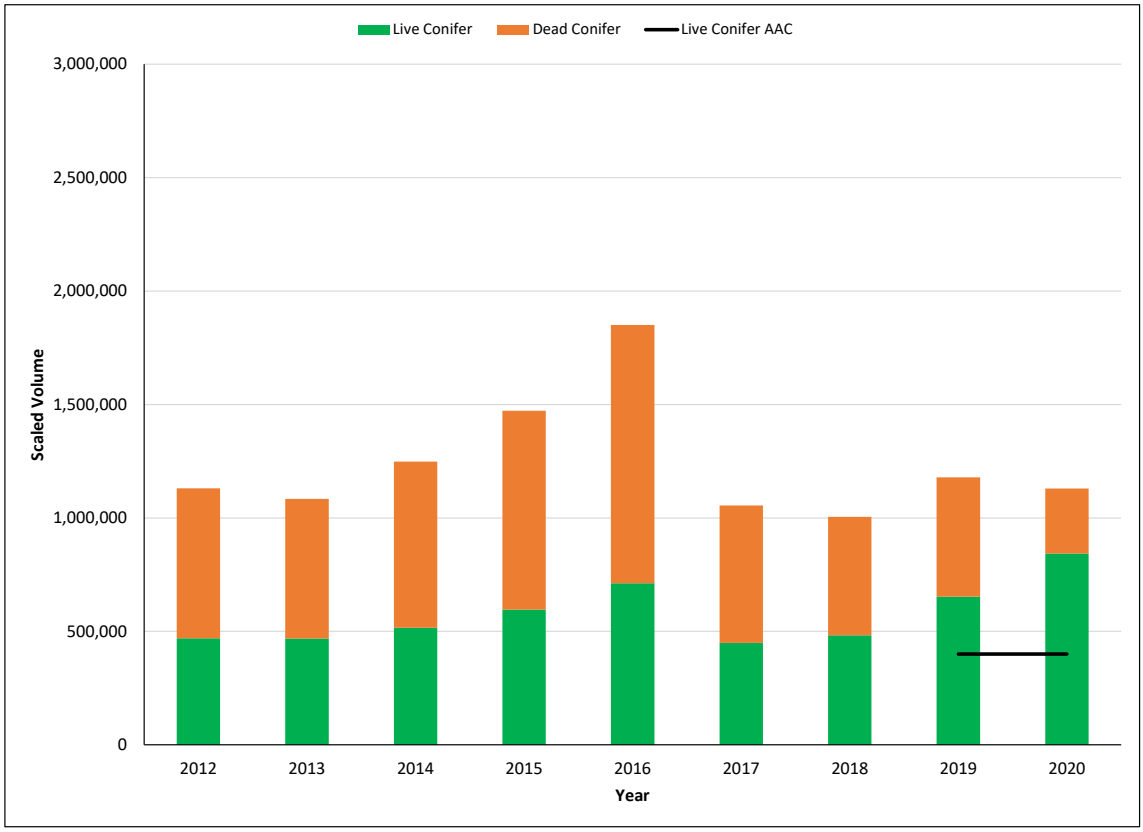


Figure 59: Harvest by dead and live conifer 2012 – 2020, Lakes TSA (m^3)

[34] Source TSR until 2018. Provincial scale 2019 - 2020

8.7.8.3 Community Forest Agreements and First Nations Woodland Licences

Figure 60 and Table 62 present the harvested volume by species for Community Forest Agreements and First Nations Woodland Licences between 2012 and 2020. Harvest levels have fluctuated significantly over time; however as noted above the licensees in the planning area are on a 5-year cut control system.

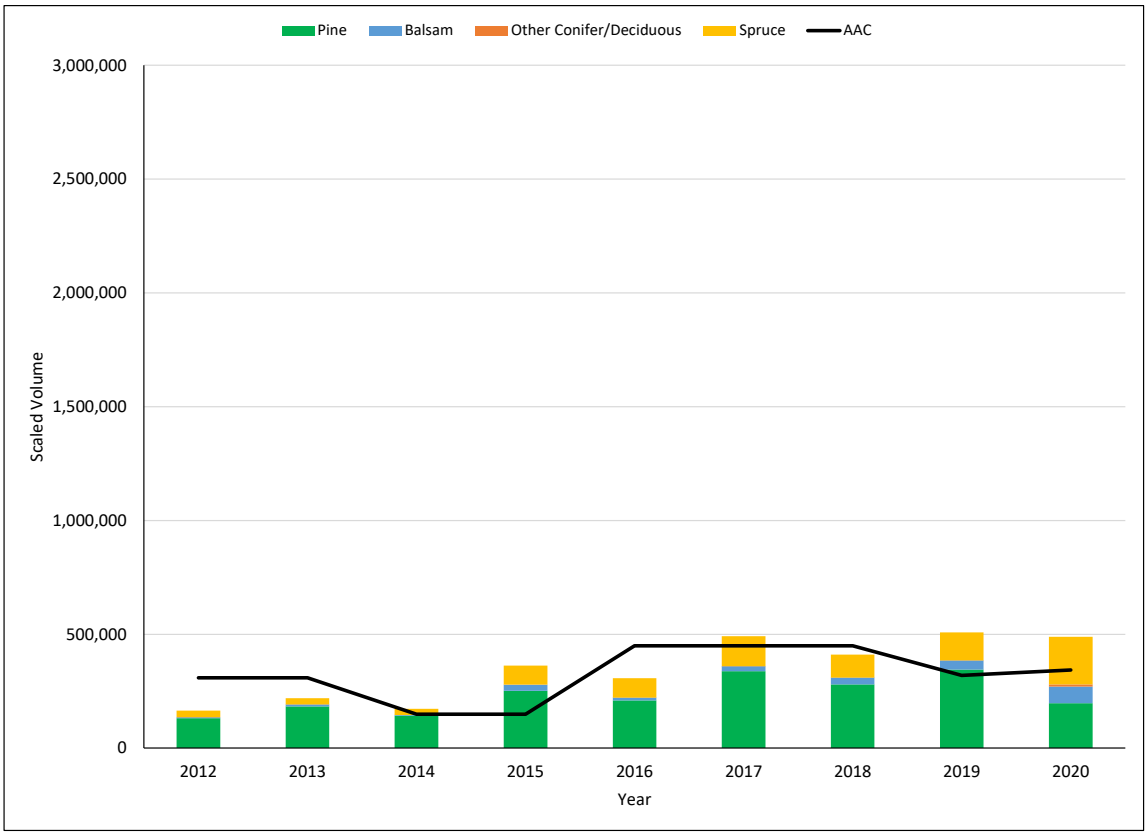


Figure 60: Harvest by species 2012 – 2020, CFA and FNWL (m^3)[35]

Table 62: Harvest by species 2012 – 2020, CFA and FNWL (m^3)

Scale Year	Balsam	Other Conifer / Deciduous	Pine	Spruce	Total	AAC	% AAC
2012	4,689	12	131,080	28,938	164,720	309,211	53.3%
2013	8,861	34	183,380	27,260	219,535	309,211	71.0%
2014	3,059	6	142,717	26,734	172,517	149,211	115.6%
2015	26,303	870	251,677	84,012	362,863	149,211	243.2%
2016	12,502	266	209,262	84,913	306,943	449,341	68.3%
2017	21,231	95	338,213	131,704	491,243	449,341	109.3%
2018	30,502	13	279,442	100,840	410,797	449,341	91.4%
2019	40,554	441	344,602	122,680	508,277	319,341	159.2%
2020	72,812	9,716	197,420	208,734	488,682	343,527	142.3%

[35] Source: Provincial scale 2012 - 2020

8.7.9 Timber Quality

The current provincial target is to produce a minimum of 10% premium grades annually from B.C.'s forests, both now and in the future (FLNRORD 2017). In the past, premium grades frequently referred to such characteristics as species, taper (lack of), tightness of grain, clear wood, and size, and often diameter. Today many of the above-listed traits still signify quality; however, size tends to be less important. Also, different forestry companies may value different quality aspects in their operations.

Past analyses have demonstrated that the harvest volume of larger stems can be increased significantly by increasing the rotation ages past the mean annual increment (MAI) culmination age, usually at the cost of total volume harvested, at least in the short and medium terms. Stem sizes can be increased through various incremental silviculture regimes as well.

The Lakes TSA resiliency project will include stakeholder-determined definitions for timber quality. It may also recommend strategies to maintain or enhance the quality of current and future managed stands.

This project will also attempt to assess future managed-stand values resulting from different regeneration and treatment regimes, including varying establishment densities and species compositions.

8.7.10 Silviculture

8.7.10.1 Basic Silviculture

Basic silviculture includes all activities that are required to ensure that a harvested stand is reforested and eventually becomes free growing. Free growing in this context refers to a condition that is believed to ensure that the stand produces an acceptable volume per ha at rotation. Major licensees, timber sales managers, community forests, woodlots and the small-scale salvage program all have the legal responsibility for basic silviculture, which commonly involves reforestation (mostly through planting or natural means in some cases), regeneration surveys to provide proof that the newly reforested area is adequately stocked, and free growing surveys to ensure that the stand remains stocked with the desirable species composition and is free from competing vegetation.

Basic silviculture obligations are achieved through stocking standards, which specify the acceptable species, target stocking and minimum stocking for both regeneration and free growing. The recent trend has been to increase stocking and stand densities in areas where timber production is considered important, and to counter the impacts of hard pine stem rusts and climate change. This is believed to increase the resiliency of stands against pests and diseases and provide options in the future for incremental silviculture treatments.

Most of the harvest stands are planted as illustrated in Figure 61. Note that reporting for 2014-2020 is incomplete. On average the planting densities in the Lakes TSA have decreased somewhat over time as shown in Figure 62.

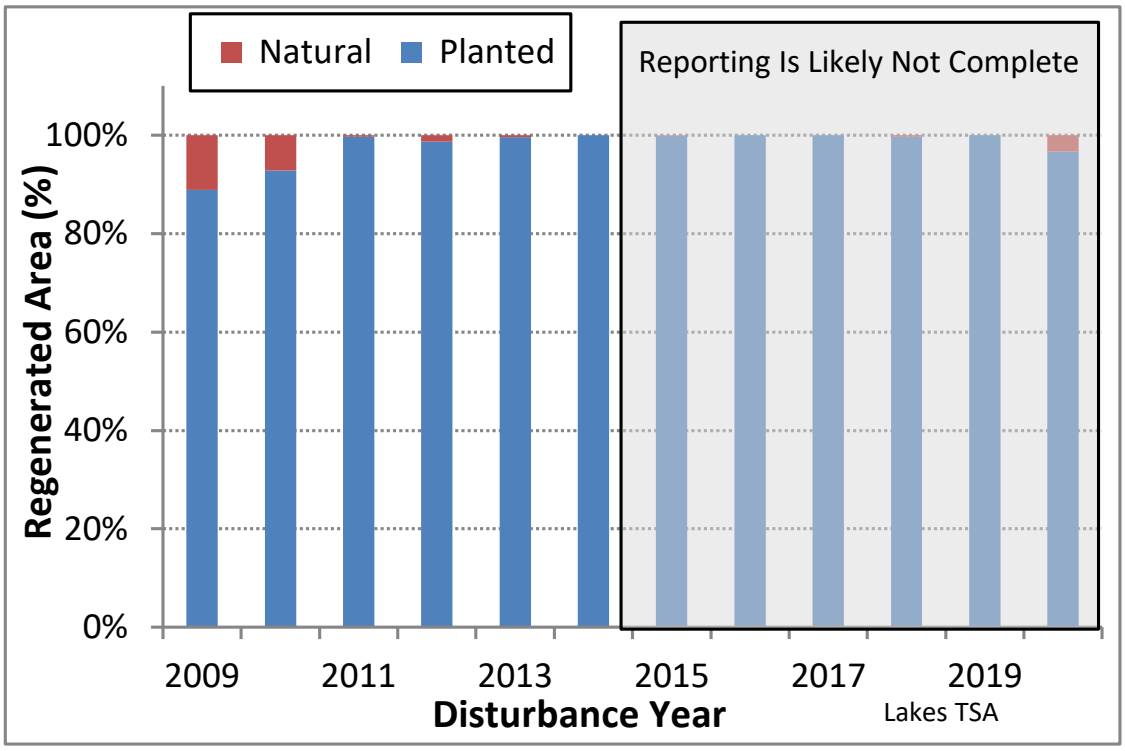


Figure 61: Regenerated area: natural versus planting, Lakes TSA[36]

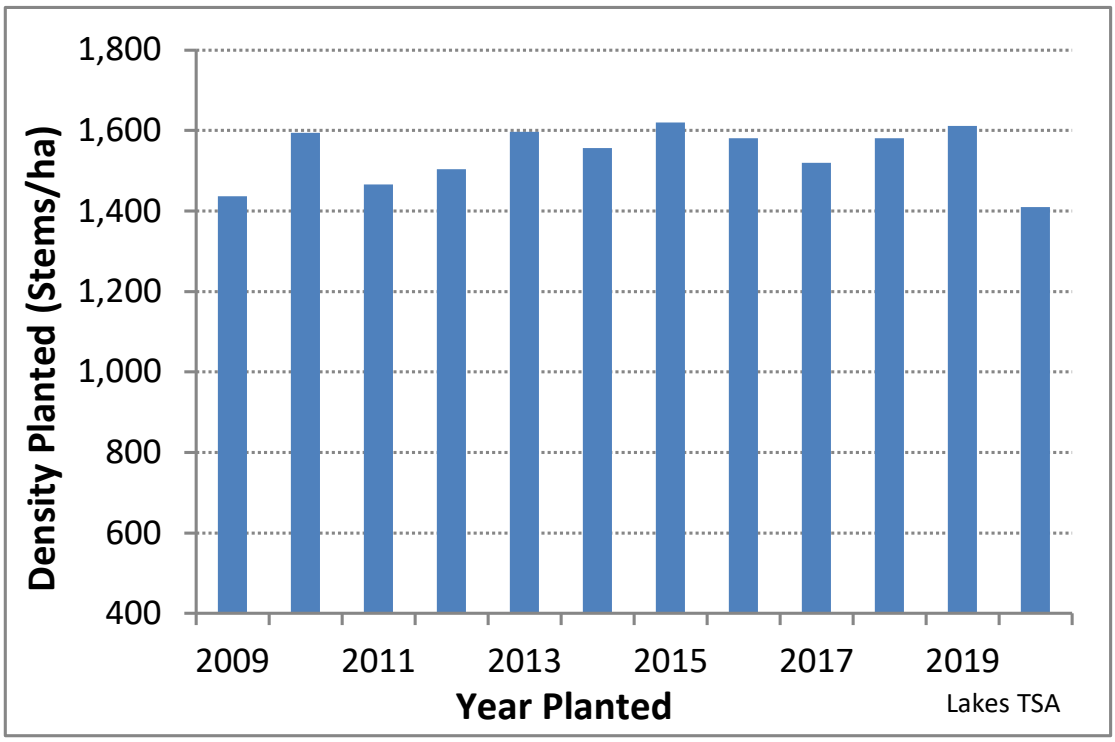


Figure 62: Planting density in the Lakes TSA[37]

[36] Source: Provincial Timber Management Goals, Objectives & Targets, Management Unit Targets, Lakes TSA 2021

[37] Source: Provincial Timber Management Goals, Objectives & Targets, Management Unit Targets, Lakes TSA 2021

Over the last 10 years 90% of the planted trees in the Lakes TSA were either pine or spruce with approximately equal shares (FLNRORD 2019). These species are commonly planted in the same sites with varying proportions. Other species were also planted; however, their shares are small: Fd (6%), Lw (3%) and Bl (1%) (FLNRORD 2019). Species planted in the Lakes TSA between 2009 and 2020 are illustrated in Figure 63.

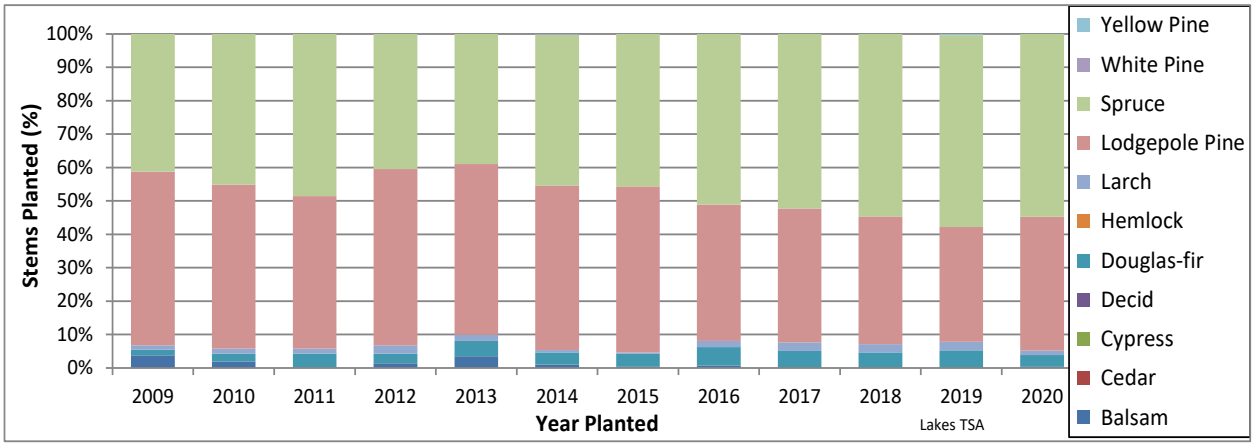
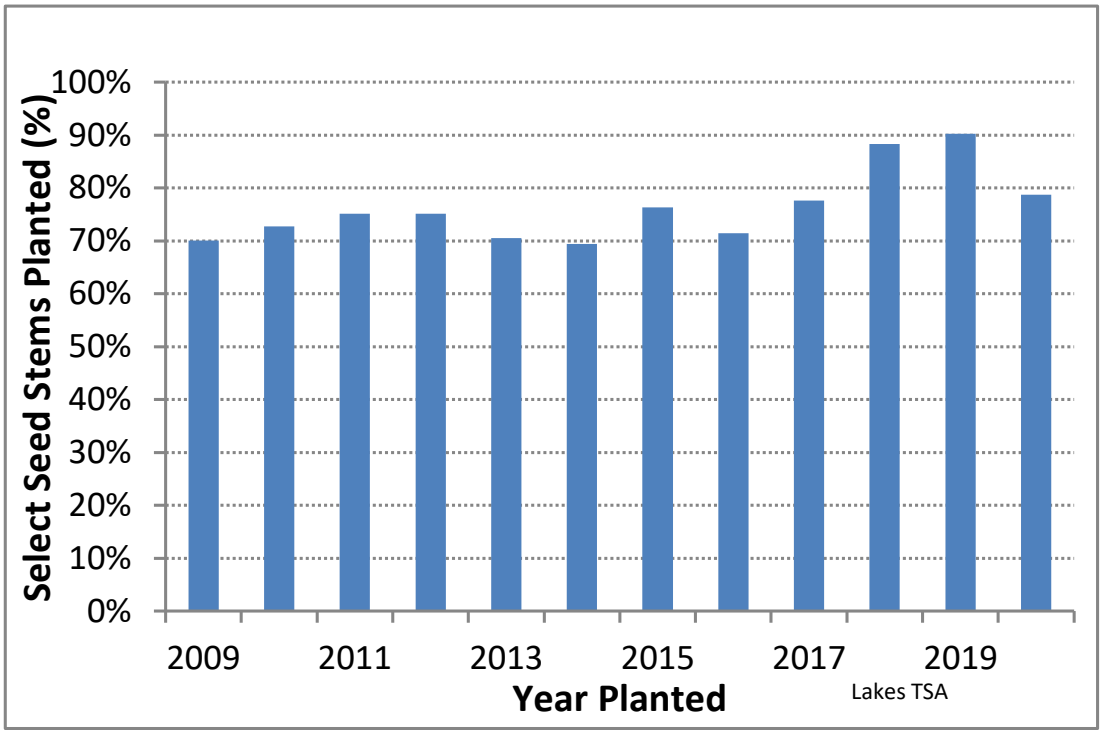


Figure 63: Species planted (%) in the Lakes TSA between 2009 and 2020 [38]

Select seed are used in planting in most cases. Figure 64 shows the percent of all stems planted with select seed with an average genetic gain of at least 20% between 2009 and 2020 in the Lakes TSA.



[38] Source: Provincial Timber Management Goals, Objectives & Targets, Management Unit Targets, Lakes TSA 2021

Figure 64: Percent of select seed planted with at least 20% genetic gain[39]

The success of basic silviculture is crucial to future timber supply. Basic silviculture is also the basis for future incremental treatments. The following questions are being discussed throughout British Columbia:

- Are the initial densities sufficient to ensure the production of a reasonable volume of timber on a given site?
- Are the initial densities sufficient to provide the quality of timber for future markets?
- Are the initial densities sufficient to buffer against future abiotic and biotic damaging agents?
- Are the initial densities appropriate for habitat and non-timber values?
- Should there be a mix of densities, where ecologically feasible, for various resource management objectives?
- Should there be a mix of species, where ecologically feasible, to buffer against future abiotic and biotic damaging agents? This question applies to both block and landscape levels.
- What is the potential impact of climate change on species choices; should some species be demoted or promoted?

As noted in section 8.7.7.1 the TSR projects that at year 60, approximately 90% of the harvest is assumed to come from managed stands meeting the TSR set minimum harvest criteria of 140 cubic metres per hectare and 80 years of age. It is expected that the harvested managed stands produce timber of adequate quantity and quality. Continued monitoring of the quality and volume of managed stands is required. Monitoring of managed stands is discussed under section 4.10.

8.7.10.2 Incremental Silviculture

Spacing, fertilization and pruning have been carried out in the Lakes TSA in the past. Incremental silviculture treatment areas between 2012 and 2021 are shown in Table 63.

Table 63: Incremental silviculture in the Lakes planning area between 2012 and 2021

Lakes Planning Area	Fertilization Area (ha)	Juvenile Spacing Area (ha)	Pruning Area (ha)	Total Area (ha)
CFAs and FNWLs	4,679	42	22	4,742
Lakes TSA	7,426	16	0	7,442
Total	12,105	58	22	12,184

8.8 Visual Quality

British Columbia is known for its scenic beauty that attracts tourists from all over the globe. The Forest and Range Practices Act explicitly identifies the management of scenic values to ensure that the scenic quality expectations of the public and the tourism industry are met. Visual quality objectives exist to guide forest management activities on a landscape. The visual quality objectives are based on different levels of alteration from full retention to maximum modification, depending on the viewscapes.

[39] Source: Provincial Timber Management Goals, Objectives & Targets, Management Unit Targets, Lakes TSA 2021

Current condition can only be determined in a two-dimensional space. Large areas with dead timber pose a problem, because maintaining visual quality may not be possible, or in some cases the visual quality objectives may conflict with other values, such as fire protection of communities.

The legal reference and direction along with current practice are described in Table 64.

Table 64: Visual quality legal reference and management direction

Legal Value Reference	Direction
GAR 7(1), GAR 7(2)	Scenic areas are those established under GAR 7(1). Associated visual quality objectives established under GAR 7(2) correspond to the scenic areas. Alterations resulting from the size, shape, and location of cutblocks and roads is to maintain the established visual quality objectives.
Current Practice	
Licensees must ensure that the alteration resulting from harvesting and road construction in scenic areas is consistent with established visual quality objectives when evaluated from significant viewpoints. Visual quality objective categories include preservation, retention, partial retention, modification, and maximum modification. One licensee is exempt from achieving the established VQOs within certain polygons in their landscape fire management plan for community protection.	
Issues Raised	
Licensees: ➢ Some visual polygons were not identified well. Some areas are outside of VQOs that need to be in, and others are inside VQOs that should be removed. ➢ Visual inventory is a big issue with visual polygons, particularly around absorption capacity. Needs to be updated. ➢ More wildfire risk reduction is required in visual polygons. ➢ Generally, the licensees do not apply for exemptions in VQOs because it is costly and often exemption is not approved. ➢ Need criteria in FLP for allowing exemptions in visual polygons for wildfire risk reduction. The criteria for exemptions should consider risks, not just use a percentage of dead Pl as criteria for granting exemptions. ➢ Nadina district should identify areas where licensees can go for wildfire risk reduction. ➢ Need better data for visuals. ➢ No consistency between TSAs. There are clearcut R polygons in Fraser Lake to address salvage and wildfire. This cannot be done in the Lakes. ➢ Most problems occur in dead stands. Salvaging them often requires clearcutting, especially burnt stands. Beetle-killed stands can still have some green. ➢ Not an easy way to get exemptions for visually sensitive areas. In Houston a VQO was removed for wildfire mitigation near the community. ➢ Could spatialize where blocks can go in VQOs over next 10 years. ➢ Need to manage visuals on a block-by-block basis. ➢ Get rid of VQOs. Licensees need more flexibility. The LRMP allows for that flexibility.	

8.8.1.1 Current Condition

Forest level analyses, such as TSR, assess visual quality objectives two-dimensionally. This results in an incomplete assessment due to the three-dimensional nature of viewscapes. Table 65 presents the current visual condition in the project area using a two-dimensional analysis. Each VLI polygon was assessed, and the results were summarized by VQO code. Because MPB and fire impacted stands often meet visual quality objectives, Table 65 does not account for MPB/fire adjusted seral stages. Their additional impact is presented in Table 66.

Approximately 77,476 ha (35%) of the CFMLB in scenic areas are in violation of the visual quality objectives when analyzed two-dimensionally.

Table 65: Achievement of visual quality objectives in the project area

VQO Code	Number of Polygons	CFMLB (ha)	Max % alteration limit	Polygons in Violation	CFMLB Area of polygons in Violation (ha)
M	71	24,366	43.30%	6	1,112
PR	335	150,906	14.92%	113	48,356
R	114	46,180	2.50%	43	28,008
Total	**520**	**221,452**		**162**	**77,476**

If all the MPB impacted stands where at least 70% of the volume has been killed and stands with a burn severity rating of high or medium are considered not meeting the VQOs, almost the entire CFMLB (96%) in scenic areas would be in violation of VQOs (Table 66).

Table 66: Achievement of visual quality objectives in the project area; seral stage of MPB and fire impacted stands adjusted

VQO Code	Number of Polygons	CFMLB (ha)	Max % alteration limit	Polygons in Violation	CFMLB Area of polygons in Violation (ha)
M	71	24,366	43.30%	58	23,330
PR	335	150,906	14.92%	286	146,122
R	114	46,180	2.50%	89	44,116
Total	**520**	**221,452**		**433**	**213,569**

The Forest and Range Evaluation Program monitors the achievement of visual quality objectives among other objectives. As per the FREP Dashboard (FREP Dashboard (arcgis.com)) the VQOs in the Lakes TSA were achieved in 74.4% of the cases and not achieved in 25.6% of the cases. The data is based on 43 samples up to 2021.

8.9 Wildlife

British Columbia is home to the broadest diversity of wildlife and ecosystems in Canada. Wildlife provides many environmental, cultural, social, and economic benefits to our way of life and that of future generations. Furthermore, wildlife offers significant contributions to mental and physical well-being through aesthetic, spiritual, educational, and recreational values. Wildlife populations are an important food, cultural, and ceremonial source to Indigenous peoples. Additionally, wildlife habitat and population management have significant importance to reconciliation.

Wildlife contributes to the local and provincial economy through hunting, guide outfitting, trapping, viewing, tourism, and research. British Columbia's wildlife and wildlife habitat are facing challenges due to a changing climate and increased human activity with competing pressures on the land base.[40]

Several wildlife species are managed in the project area through different legal mechanisms. These species include grizzly bear, moose, mule deer, mountain goat, and caribou. While these species are of continuing importance, there are many other species without a legal mandate that provide species diversity and biodiversity benefits. Examples include marten, fisher, and Interior northern goshawk. Fisher is a red listed species that is being considered for listing under the federal Species at Risk Act. Northern Goshawk is a blue-listed species and both fisher and goshawk have similar habitat requirements of mature and old forest, and both have had their habitat significantly reduced by natural disturbance and logging. Work is underway both provincially and regionally to provide habitat suitability mapping for proactive management of wildlife. Additional work done by the Skeena SSAF ESI is also underway for moose and grizzly bear.

8.9.1 Grizzly Bear

The Francois Grizzly bear population is provincially ranked at high risk, while the Babine population is ranked at moderate risk. Human and bear conflict between range lands and grizzly bear habitat is a key driver of the high risk to the Francois Lake population. Landscape connectivity corridors, seral targets, OGMAs, and un-roaded refugia areas are important for maintaining grizzly bears in the project area.

Grizzly Bear is one of the five SSAF ESI values. A state of value report was published by SSAF ESI for Grizzly Bears in 2020. The report flags issues requiring further habitat management attention.

The legal reference and direction along with current practice are described in Table 67.

Table 67: Grizzly Bear management legal reference and management direction

Legal Value Reference	Direction
FPPR Sec. 7(2)	FPPR Sec. 7(2) directs forest operations to conserve wildlife habitat in terms of amount of area, distribution of areas and attributes of those areas for: a) the survival of species at risk b) the survival of regionally important wildlife c) the winter survival of specified ungulate species. The conservation is expected to occur without unduly reducing the supply of timber from BC's forests.
Current Practice	
Grizzly Bear is managed through a FPPR Section 7 Notice around the indicators of the amount, distribution, and attributes of wildlife habitat required for the survival of species at risk in the Nadina Natural Resource District. The Notice specifies attributes for forest cover constraints by a percentage of area, age, and height. The Notice applies to 4,310 hectares of crown managed forest landbase (CMFLB), of which 1,346 hectares are within the timber	

[40] Together for wildlife strategy, https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/together-for-wildlife/together-for-wildlife-strategy.pdf

harvesting landbase (THLB). The size, spatial distribution, connectivity and BEC zones are identified in the species account for Grizzly bear in the Accounts and Measures for Managing Identified Wildlife (Identified Wildlife Management Strategy 2004).

All licensees follow the forest cover constraints set out in the Notice. One licensee has specific management objectives within the Klaytahnkut around harvest restrictions in major riparian zones and buffer zones.

Issues Raised

Licensees:

- Need a common GIS methodology and layer between all licensees that identifies appropriate habitat for moose, grizzly bear, and deer FPPR Sec. 7 Notices. All licensees should work from the same layer.
- Constraints in Notices are difficult to model. PEM and TEM info is helpful.
- Notices should be clear.
- UWRs could be broken up into more discreet units.
- First Nations' perspective should be taken into consideration on wildlife management.
- Have done significant Grizzly bear habitat assessment work. If the grizzly bear work meets the management plan intent, don't see the need for legal objectives.

First Nations:

- Increased protection and better management of terrestrial and aquatic habitats for fish and wildlife, including wetlands.

In addition to the legal direction above, The SSAF ESI identified at risk LUs for various Grizzly bear population and habitat indicators. Within the project area, the following LUs have been flagged as higher risk to Grizzly bears:

- Burns Lake West
- Cheslatta
- Francois East
- Francois West
- Burns Lake East
- Babine West
- Ootsa
- Taltapin

All the above LUs have been assessed against ten indicators, several of which are high value indicators (core security area, hunter day density, road density, and quality habitat protected). These LUs have been flagged for management attention as they are currently exceeding the indicator thresholds.[41].

[41] Reference: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/skeena-region/ssaf_grizzly_bear_state_of_the_value_report_sept2020_final.pdf

While the SSAF have developed 10 indicators, for the purpose of this report, only road density and mid-seral dense conifer were selected to be reported out on for Grizzly bear. These two indicators were selected based on expert input from subject matter experts in order to keep this report succinct.

8.9.1.1 Current Condition

8.9.1.1.1 Age and Height Constraints within the High Value and Very High Value Grizzly Bear Habitat

As noted above in Table 67, all licensees attempt to follow the forest cover constraints set out in the FPPR Section 7 Notice. In practise this has been challenging, because there is no explicitly defined spatial high value grizzly bear habitat layer available yet. For this reason, the area licensees are not using a common spatial reference area for grizzly bear management.

The FLNRORD Skeena Region recently published preliminary explicit boundaries for the management of grizzly bear habitat. The preliminary grizzly bear habitat model is not fully verified and has not been vetted by SSAF. The preliminary high and very high value grizzly bear habitat boundaries are used in this analysis for reference. They are shown in Figure 65.

As per FPPR Section 7 Notice, within the grizzly bear habitat areas, it is required that no more than 50% of the forest cover is younger than 121 years old and no more than 33% of the forest cover is younger than 28 years old, or less than 5 m tall. The current condition for this indicator is presented in Table 68 by landscape unit. As the height information is not available for many areas, the information is presented using age only. Seven out of the 13 landscape units do not currently meet the age defined habitat targets.

Table 68: Grizzly Bear habitat in the project area

LU Name	Total Area (ha)	CFMLB (ha)	Age <121 (ha)	% Age <121	Age <28 (ha)	% Age <28
Babine East	1,631	993	382	39%	50	5%
Babine West	1,498	839	339	40%	138	16%
Bulkley	2,378	1,028	387	38%	125	12%
Burns Lake East	3,431	1,333	930	70%	405	30%
Burns Lake West	2,158	708	381	54%	102	14%
Chelaslie	2,704	1,395	348	25%	212	15%
Cheslatta	2,275	763	616	81%	418	55%
Fleming	230	208	66	32%	23	11%
Francois East	2,256	746	508	68%	246	33%
Francois West	2,757	522	314	60%	96	18%
Intata	1,039	448	274	61%	100	22%
Ootsa	600	129	72	56%	27	21%
Taltapin	1,556	836	288	34%	167	20%
Total	**24,511**	**9,950**	**4,906**	**49%**	**2,110**	**21%**

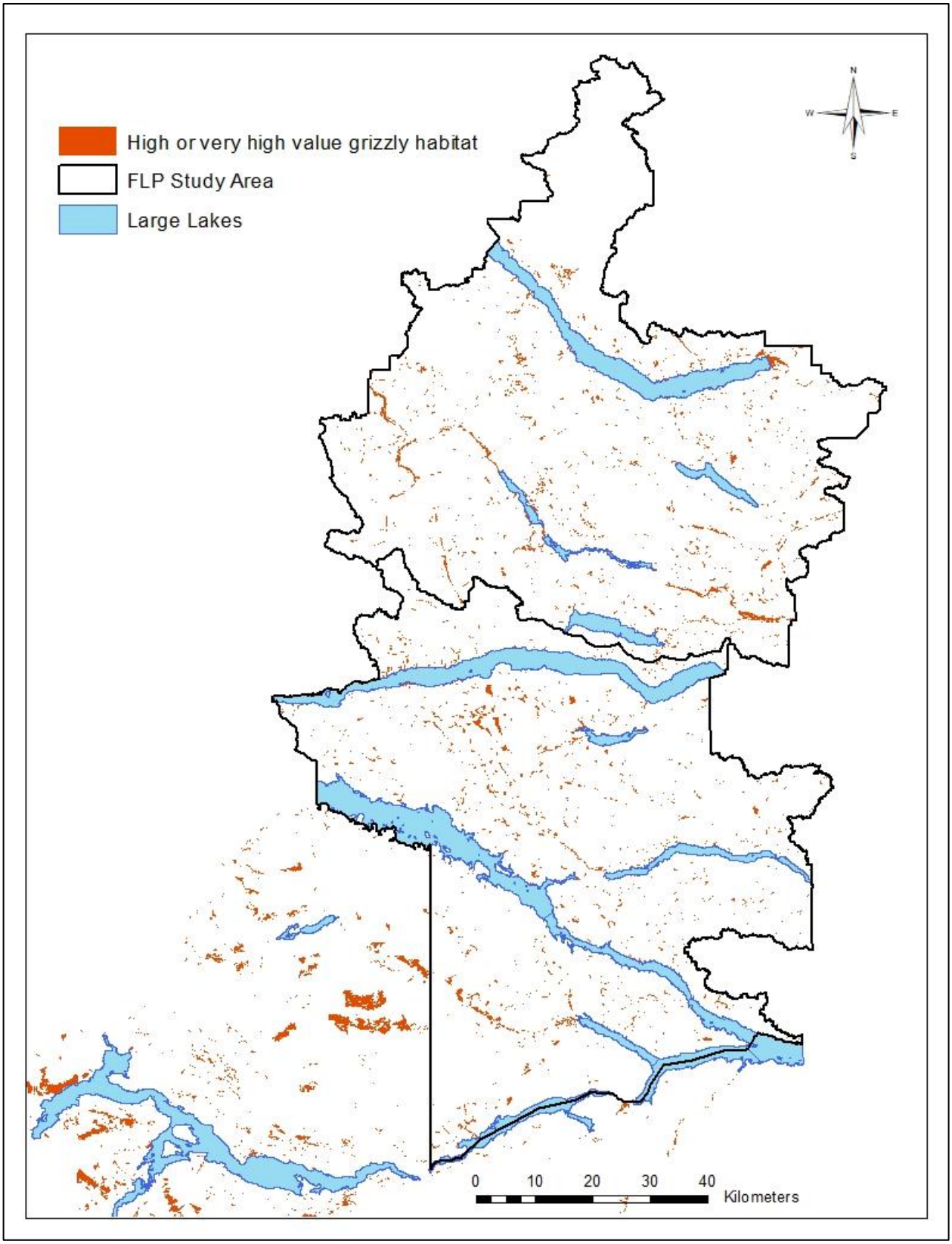


Figure 65: High or very high value Grizzly Bear habitat

8.9.1.1.2 Road Density

Road density is a population indicator for grizzly bear. Road density poses a high risk to grizzly bear populations and habitat. Roads cause habitat loss, fragmentation, and population isolation and decline (Skeena Sustainability Assessment Forum's State of Values Report for Grizzly Bear, 2020). They also facilitate human-bear interactions.

The road density classes are defined in Table 69.

Table 69: Road density classes[42]; grizzly bear population indicator

Road Density Class	Description
Class 0 [Negligible risk]	Roadless densities of 0.00 km/km2 are no risk to grizzly bears.
Class 1 [Low risk]	Road densities of 0.01 - 0.30 km/km2 are low risk to grizzly bears.
Class 2 [Moderate risk]	Road densities of 0.31 - 0.60 km/km2 are moderate risk to grizzly bears.
Class 3 [High risk]	Road densities of 0.61 - 0.75 km/km2 are high risk to grizzly bears.
Classes 4 to 7 [Very High risk]	Road densities greater than 0.75 km/km2 are very high risk to grizzly bears. This group [Very High road density] has been further split into 4 sub-classes to provide more detailed information on road density. This level of result gradient is intended to assist in communicating risk.

This analysis used the SSAF ESI methodology to determine road density for grizzly bear management. The status for this indicator is shown in Table 70. Road density in all LUs exhibit a very high risk for Grizzly Bear populations except for Babine East (high risk). Both high- and high-risk classes are problematic to grizzly bear.

[42] Skeena Sustainability Assessment Forum's State of Values Report for Grizzly Bear, 2020

Table 70: Grizzly Bear population indicator, road density

LU NAME	Total Area (ha)	Area (km^2)	Road Length (km)	Road Density (km/km^2)	Road density Class	Risk Level
Babine East	53,104	531	324	0.61	3 (0.6-0.75)	high (0.6-0.75)
Babine West	70,804	708	1,004	1.42	5 (1.26-1.75)	very high (>0.75)
Bulkley	77,435	774	1,450	1.87	6 (1.76-2.25)	very high (>0.75)
Burns Lake East	97,140	971	1,642	1.69	5 (1.26-1.75)	very high (>0.75)
Burns Lake West	71,716	717	2,116	2.95	7 (>2.25)	very high (>0.75)
Chelaslie	109,695	1,097	1,066	0.97	4 (0.76-1.25)	very high (>0.75)
Cheslatta	121,560	1,216	1,931	1.59	5 (1.26-1.75)	very high (>0.75)
Fleming	56,155	562	783	1.39	5 (1.26-1.75)	very high (>0.75)
Francois East	91,543	915	1,458	1.59	5 (1.26-1.75)	very high (>0.75)
Francois West	94,403	944	1,704	1.80	6 (1.76-2.25)	very high (>0.75)
Intata	58,441	584	1,127	1.93	6 (1.76-2.25)	very high (>0.75)
Ootsa	57,317	573	614	1.07	4 (0.76-1.25)	very high (>0.75)
Taltapin	80,385	804	1,572	1.96	6 (1.76-2.25)	very high (>0.75)

8.9.1.1.3 Mid Seral Dense Conifer

Open canopy forests support greater berry production, which is an important food source for grizzly bears. This indicator flags potential LUs where forage supply could be an issue for grizzly bear due to excess mid seral forest in certain BEC zones[43].

Mid Seral Dense Conifer is a SSAF ESI Grizzly Bear habitat indicator. Mid-seral is defined by the Biodiversity Guidebook as ages between 41 and 100 for the SBS BEC variant, and 41 to 120 for the ESSF BEC variant. The SSAF ESI defines conifer density as follows:

- Low density (high value habitat) = mid seral stands with >=30% deciduous component with the basal area <=50 m^2/ha.
- Moderate density = mid seral conifer stands with <=30% crown closure
- High density (low value habitat) = all other mid-seral stands

The data used for the analysis was updated to 2021, and high severity burns and MPB attacked stands were set to early seral.

LUs with less than 30% of area in mid-seral dense conifer are low risk to grizzly bears, while LUs with 30% or more of the area in mid-seral dense conifer are high risk to grizzly bears and are flagged for management attention. As shown in Table 71 Burns Lake East and Ootsa LUs fail to meet the mid-seral dense conifer target. In both cases the target is exceeded in the ESSF BEC zone.

[43] This paragraph by Carolyn King

Table 71: Grizzly Bear habitat indicator, mid seral dense conifer

Landscape Unit	CFMLB area (ha)			High Density Mid-Seral Conifer Area (ha)			Percent High Density Mid-Seral Conifer		
	ESSF	SBS	Total	ESSF	SBS	Total	ESSF	SBS	Total
Babine East	11,850	32,115	**43,965**	2,626	3,514	**6,141**	22%	11%	**14%**
Babine West	14,149	44,621	**58,769**	634	3,815	**4,450**	4%	9%	**8%**
Bulkley	14,804	45,326	**60,130**	1,329	5,319	**6,648**	9%	12%	**11%**
Burns Lake East	11,506	66,495	**78,001**	4,316	16,614	**20,930**	38%	25%	**27%**
Burns Lake West	1,692	45,031	**46,723**	159	5,883	**6,041**	9%	13%	**13%**
Chelaslie	29,678	61,969	**91,647**	1,555	2,926	**4,481**	5%	5%	**5%**
Cheslatta	3,518	84,663	**88,181**	451	5,739	**6,190**	13%	7%	**7%**
Fleming	9,719	39,152	**48,870**	688	1,834	**2,522**	7%	5%	**5%**
Francois East	1,966	60,522	**62,488**	194	5,716	**5,910**	10%	9%	**9%**
Francois West	3,570	45,791	**49,362**	543	5,173	**5,716**	15%	11%	**12%**
Intata	3,903	40,666	**44,569**	359	4,229	**4,588**	9%	10%	**10%**
Ootsa	2,495	22,818	**25,312**	754	3,295	**4,049**	30%	14%	**16%**
Taltapin	19,549	48,146	**67,694**	2,500	5,703	**8,203**	13%	12%	**12%**

8.9.2 Caribou (Takla Herd)

On January 4, 2021, a Government Actions Regulation Order established Ungulate Winter Range (UWR) U-6-013 for the Takla Caribou herd (Figure 66). Caribou in the project area is also managed through caribou migration corridors as discussed in section 8.1.1.

The legal reference and direction along with current practice are described in Table 72.

Table 72: Caribou management legal reference and management direction

Legal Value Reference	Direction
GAR Sec. 9 GAR Sec. 12	Maintain high and medium value caribou winter range as defined by the General Wildlife Measures in the Ungulate Winter Range Order U-6-013.
Current Practice	
Licensees follow the general wildlife measures for caribou which includes: No primary forest activities are permitted within high value caribou habitat. Harvesting restrictions apply during certain times of the year within medium value caribou habitat. Furthermore, there are restrictions around percent volume removal per cutblock every 80 years. Further restrictions apply around cutblock size, road construction, and distribution of openings. Harvesting is allowed for forest health reasons but only if it does not cause a material adverse impact on the ungulate winter range.	

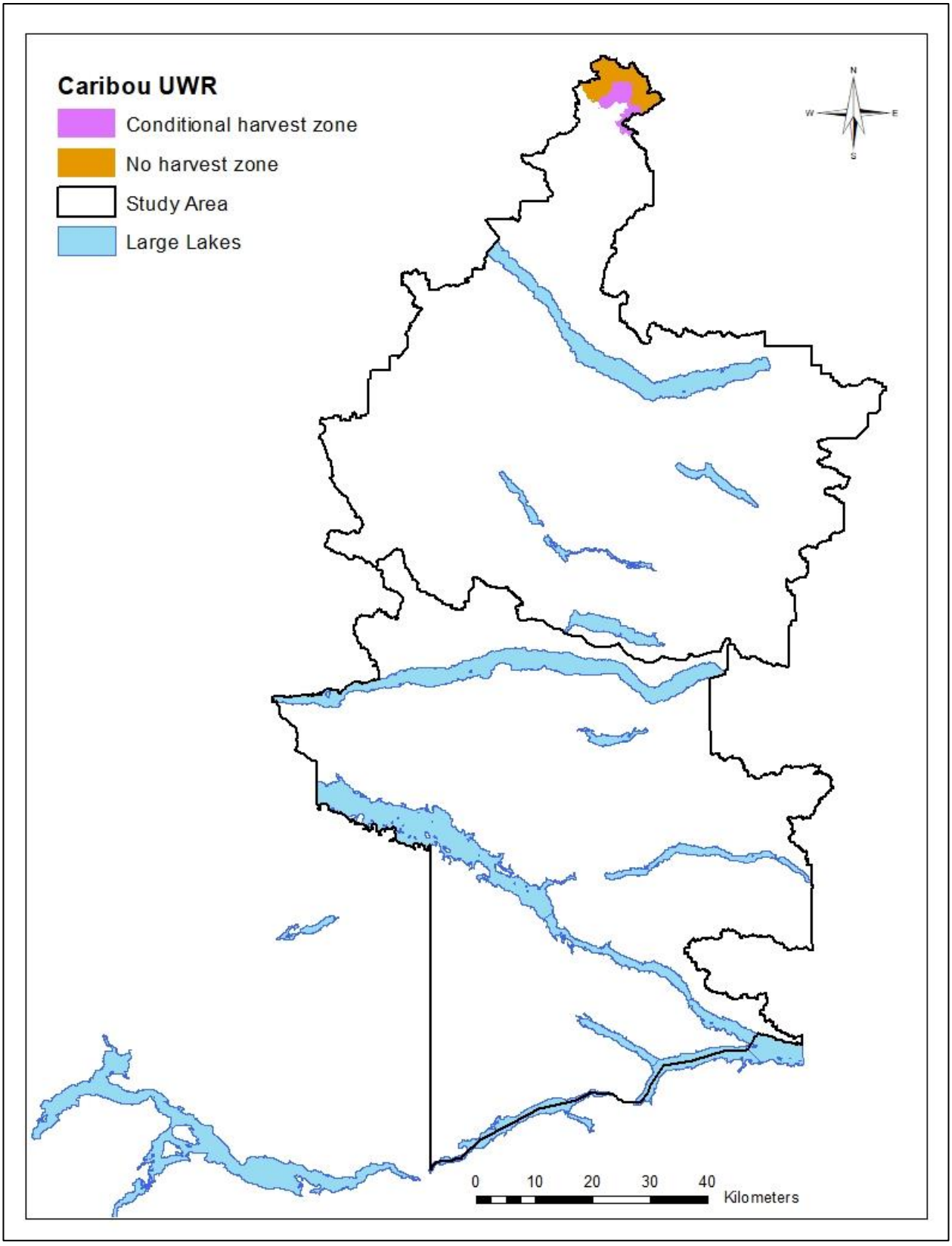


Figure 66: Ungulate Winter Range (UWR) U-6-013 for the Takla Caribou herd

Note that the management of Caribou habitat is also facilitated through the Lakes South SRMP Ministerial Order Section 4(2) of FPC of BC Act and continued under the Land Act Section 93.8. The Lakes South SRMP has seral stage targets for the Caribou Migration Corridor which include targets for the percent of forest in early, mature, and old seral stage by seral management zone as described in section 8.1.1.

8.9.2.1 Current Condition

It is assumed that the areas identified in the UWR Order U-6-013 meet the caribou habitat requirements.

Little logging or natural disturbance history is evident within the caribou habitat area. Age class 8 (stands older than 140) are most common in the no harvest and conditional harvest zones. Less than 2% of the area is younger than 80 years old.

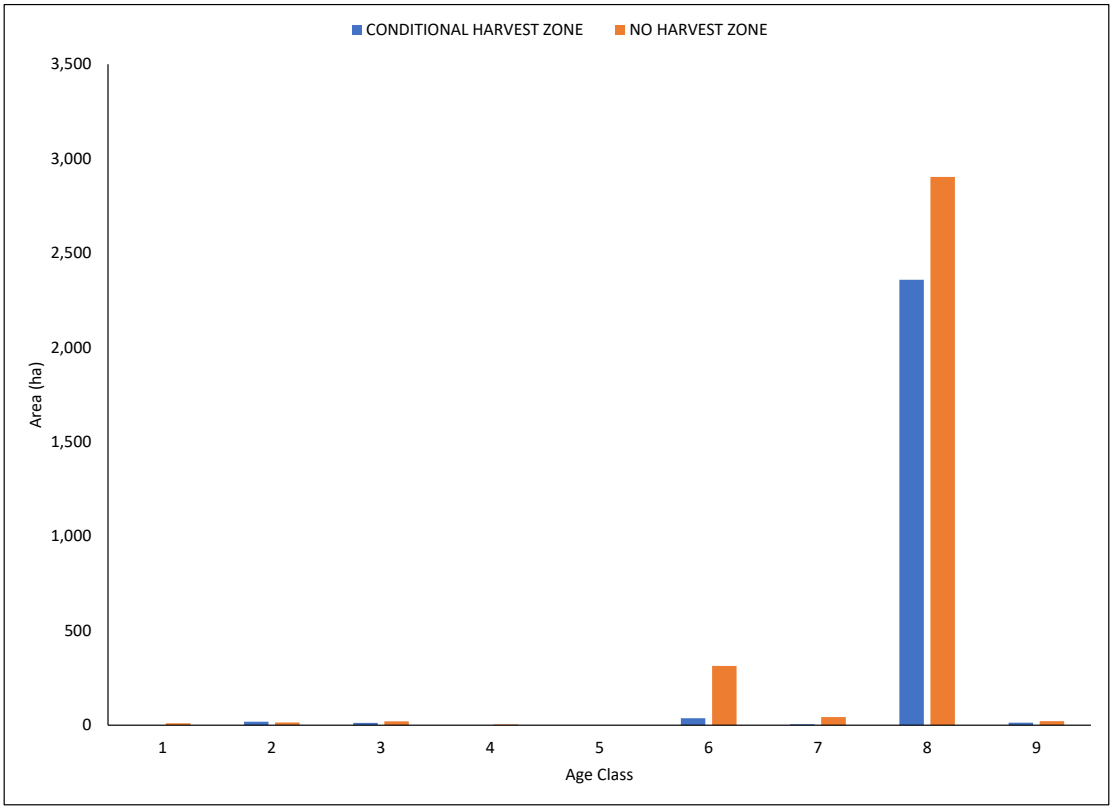


Figure 67: UWR Age class distribution (CFMLB)

8.9.3 Caribou (Tweedsmuir Herd)[44]

The Tweedsmuir-Entiako caribou (TEC; *Rangifer tarandus*) herd is a subpopulation of southern mountain caribou in west-central BC that is designated as threatened under the federal Species at Risk Act (ECCC 2014). The earliest estimate of the TEC herd was approximately 600 caribou in the early 1960s, which sharply and steadily declined to the most recent estimates that range between 150-200 animals (2015-2021; Roberts & Grant 2018). The decline in the TEC herd coincides with

[44] This paragraph was authored by Chris Schell

dramatic landscape change due to the mountain pine beetle (MPB) infestation, harvesting and, more recently, wildfire. These disturbances created large areas of early seral habitats, which support increased numbers of other ungulate species, such as moose, deer and elk, which, in turn, support larger number of wolves. These wolves also prey on caribou, which is likely the proximate cause for caribou decline.

The province, through the Caribou Recovery Program, is actively pursuing habitat protection and restoration measures to decrease the amount of disturbance in critical caribou range. However, it will likely take decades for habitat and predator-prey dynamics to recover to a natural state. In the interim, the province initiated a predator management program in 2019-2020 within the TEC herd boundary to reduce wolf predation on caribou. The preliminary results from these management actions are encouraging for TEC, but it is still early in the implementation.

8.9.4 Mule Deer

The legal reference and direction for the management of mule deer along with current practice are described in Table 73.

Table 73: Mule deer management legal reference and management direction

Legal Value Reference	Direction
FPPR Sec. 7(2)	FPPR Sec. 7(2) directs forest operations to conserve wildlife habitat in terms of amount of area, distribution of areas and attributes of those areas for: a) the survival of species at risk b) the survival of regionally important wildlife c) the winter survival of specified ungulate species. The conservation is expected to occur without unduly reducing the supply of timber from BC's forests. The notice sets out a maximum of 10,877 ha of which 1,332 ha is within the timber harvesting landbase. Forest cover attributes include constraints by a percentage of area, age, and height as follows: ➢ Forest cover: A minimum of 50% of the area > 101 years. ➢ Green up: A maximum of 33% of the area < 3 m or 17 years. In addition, preferred characteristics are specified for: ➢ Topographic features ➢ Winter forage ➢ Snow interception cover ➢ Thermal and hiding cover ➢ Forest structure:
Current Practice	
Licensees manage mule deer by following the FPPR Section 7 Notice around the indicators of	

the amount, distribution, and attributes of wildlife habitat required for the winter survival of ungulate species in the Lakes TSA. The objective is to provide winter range habitat throughout SBSdk and SBSmc. No harvesting is undertaken by licensees unless they can comply with the targets.

The FLNRORD Skeena Region has developed draft boundaries for a proposed UWR to meet the FPPR Section 7 Notice. Mule deer habitat for this draft area is shown in Figure 68. The current condition of critical habitat by habitat class is shown in Table 74 for the draft area. All the habitat areas are in deficit for mature forest. This likely due to historic natural disturbance; only 146 ha of the CFMLB show harvest history in the VRI.

Table 74: Mule deer habitat in the project area

DWR Habitat Class	Gross area (ha)	CFMLB (ha)	Age >101 (ha)	% >101	Age <17 (ha)	% <17
High	2,273	1,568	566	36%	104	7%
Moderate	29,118	14,652	5,146	35%	1,483	10%
Low	40,695	18,474	6,338	34%	3,562	19%

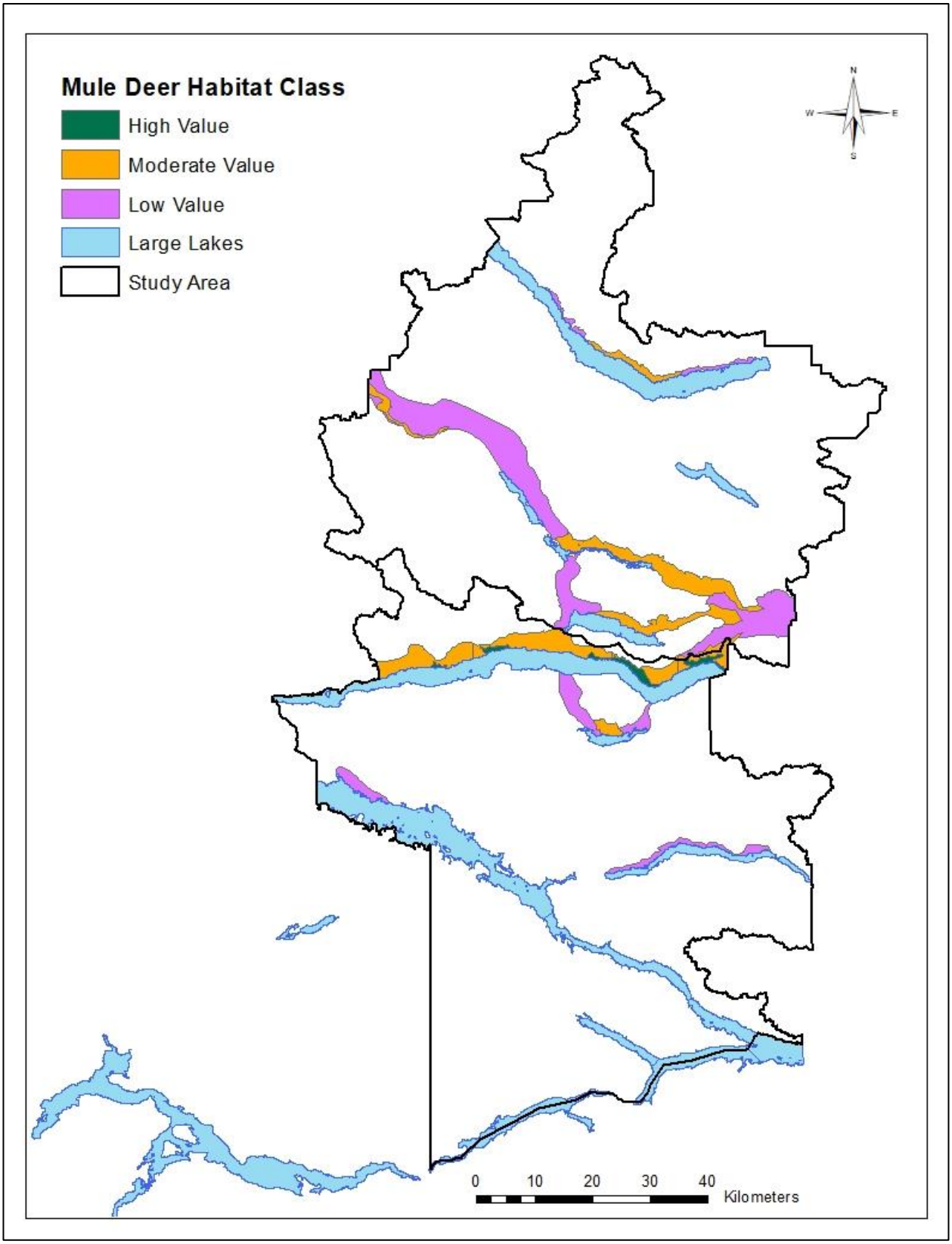


Figure 68: Critical mule deer habitat in the project area

8.9.5 Moose

The legal reference and direction for the management of moose along with current practice are described in Table 75.

Table 75: Moose management legal reference and management direction

Legal Value Reference	Direction
FPPR Sec. 7(2)	FPPR Sec. 7(2) directs forest operations to conserve wildlife habitat in terms of amount of area, distribution of areas and attributes of those areas for: a) the survival of species at risk b) the survival of regionally important wildlife c) the winter survival of specified ungulate species. The conservation is expected to occur without unduly reducing the supply of timber from BC's forests. The notice sets out a maximum of 218,142 ha of which 156,427 ha is within the timber harvesting landbase. Forest cover attributes include constraints by a percentage of area, age, and height as follows: ➢ Forest cover: A minimum of 30% of the area > 101 years. ➢ Green up: A maximum of 33% of the area < 3 m or 17 years. In addition, preferred characteristics are specified for: ➢ Topographic features ➢ Ecosystems and forest structure ➢ Winter forage ➢ Food availability from security cover ➢ Snow interception cover ➢ Age classes, stand types and openings ➢ Mature and old conifers in deciduous types
Current Practice	
Licensees manage moose by following the FPPR Section 7 Notice around the indicators of the amount, distribution, and attributes of high value habitat required for the winter survival of ungulate species in the Lakes TSA. The objective is to provide winter range habitat throughout SBSdk and SBSmc. No harvesting is undertaken by licensees unless they can comply with the targets.	

Moose is a SSAF ESI and Omenica ESI value. The Bulkley Valley and Lakes population management unit population is declining, particularly in the Lakes TSA.

Moose habitat is impacted by road access, and it is further altered by timber harvesting. Moose and moose habitat are consistently identified as priorities for the First Nations whose territories overlap with the Lakes planning area.

8.9.5.1 Current Condition

As noted above in Table 75, all licensees attempt to follow the forest cover constraints set out in the FPPR Section 7 Notice. The FLNRORD Skeena Region recently published preliminary explicit boundaries for the management of moose habitat. The preliminary moose habitat model is not finalized or published. It has been developed in collaboration with ESI/SSAF First Nations; however, it has not yet been approved or supported by them. The preliminary moose habitat boundaries are used in this analysis for reference (Figure 69).

The preliminary moose habitat boundaries consist of core areas and moose winter range management zones (MWRMZ). The proposed management regime would not allow harvest in the core areas, while harvest in the MWRMZs would be constrained as follows:

- No harvest if >70% of the stand is mature deciduous.
- Otherwise >=33% of the stand must be mature, i.e., taller than 16 m with a crown closure >55%.

Table 76 presents the current condition for moose habitat based only on tree height; Crown closure information is not consistently available for the project area.

Table 76: Moose habitat in the project area

UWR Category	CFMLB (ha)	>16m	Pct >16m
Core	74,835	45,097	60%
MWRMZ	153,710	65,509	43%
Total	**228,545**	**110,606**	**48%**

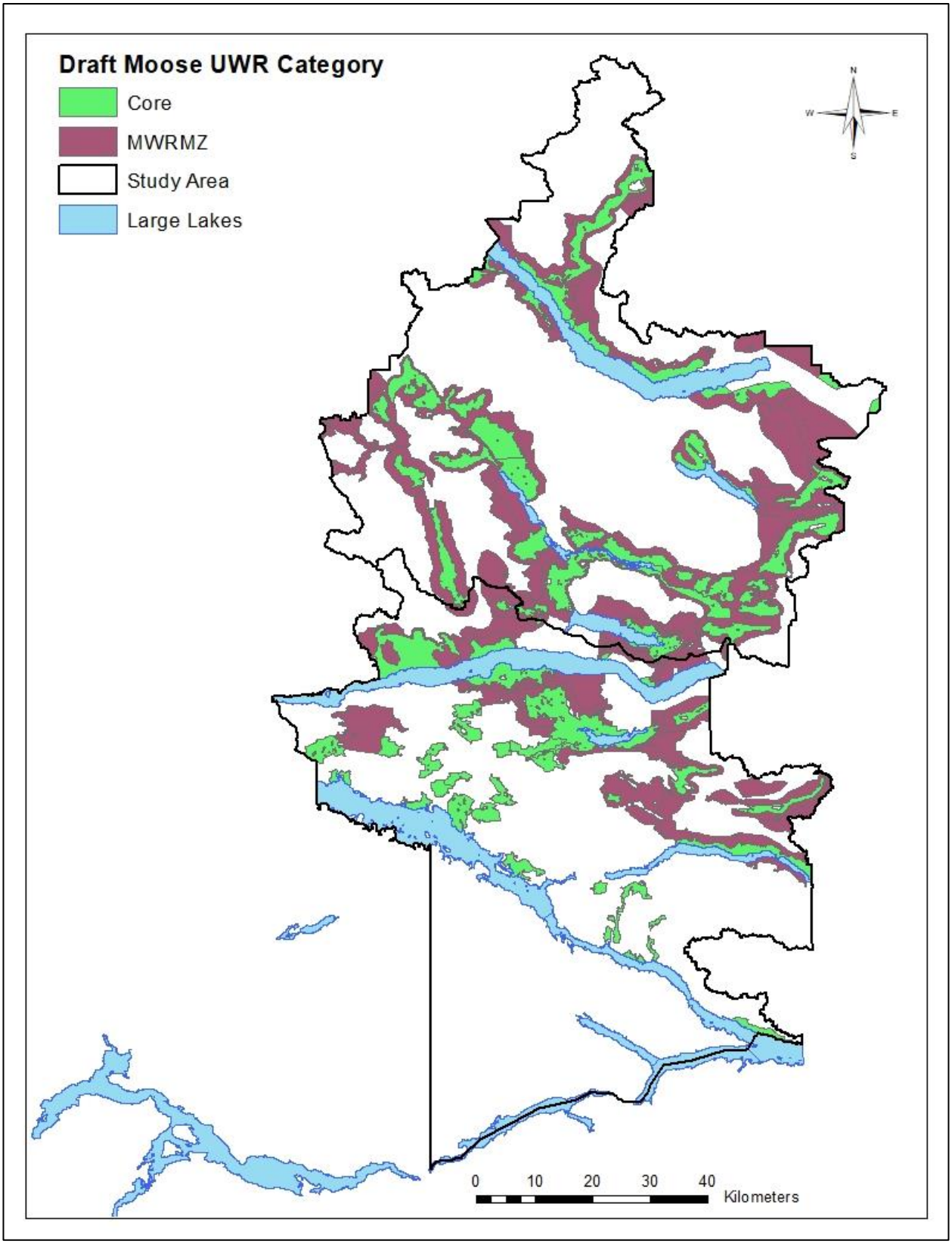


Figure 69: High or very high value moose habitat in the project area

As noted earlier in this document, the Omineca ESI boundary overlaps with the project area. The Omineca ESI has identified key areas of importance for the protection of moose habitat. This project will incorporate the Omineca moose habitat areas to help inform value discussions at the planning table. The Omineca moose UWR candidate areas are illustrated in Figure 70.

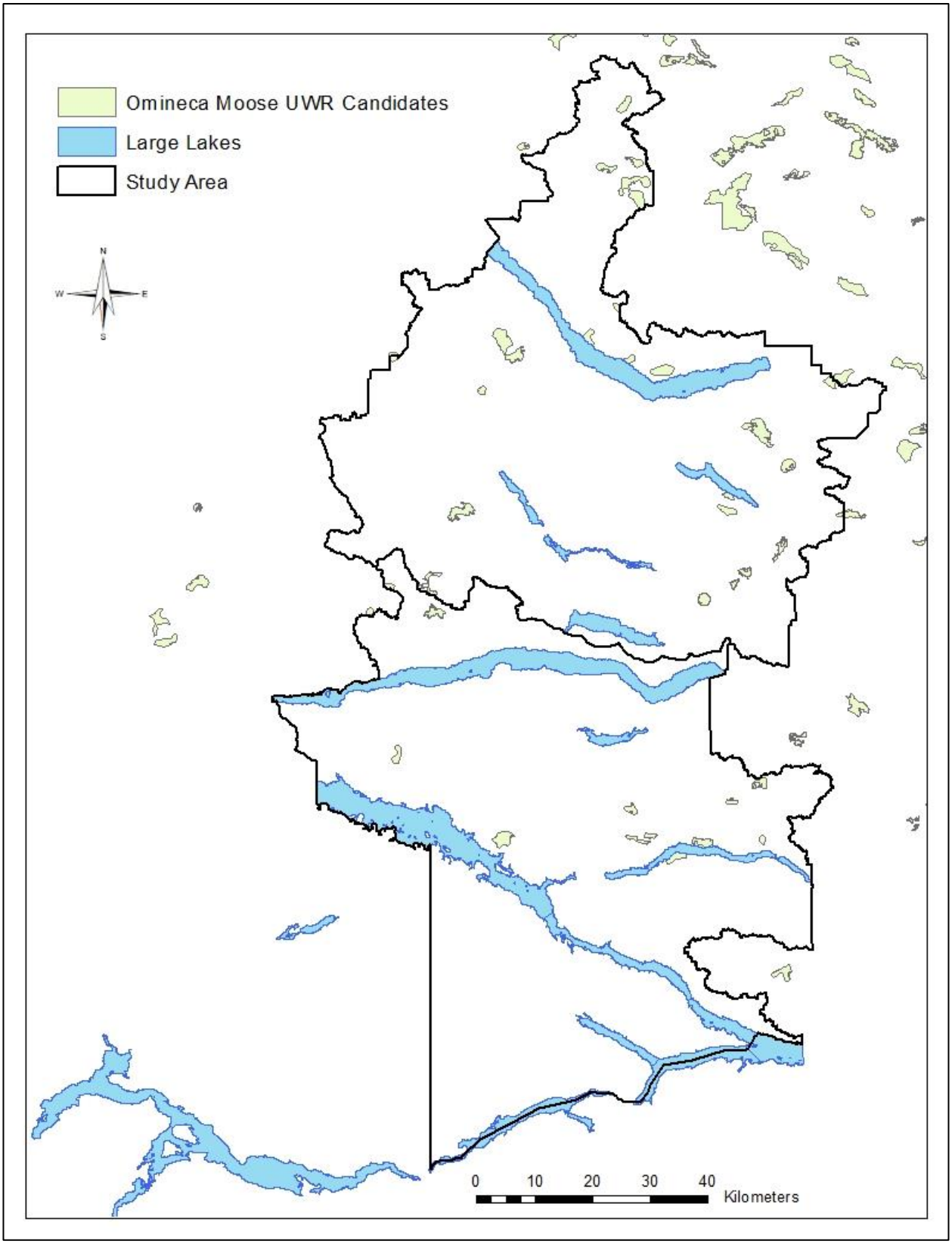


Figure 70: Omineca moose UWR candidate areas

8.9.6 Mountain Goat

The legal reference and management direction for managing mountain goat habitat along with current practice are described in Table 77. The UWR area is shown in Figure 71.

Table 77: Mountain goat management legal reference and management direction

Legal Value Reference	Direction
GAR Sec. 9, GAR Sec. 12	Maintain the ungulate winter habitat requirements for mountain goat as identified in Ungulate Winter Range Order U-6-017.
Current Practice	
There are general wildlife measures that apply to forest activities. No harvesting or road construction is permitted within defined mountain goat Ungulate Winter Range (UWR) polygons. Any forest activities that occur within a 1-kilometer horizontal distance from a defined mountain goat UWR polygon must not result in material adverse disturbance to goats and must only occur during a specified time of year. Lastly, there are stipulations for road construction and helicopter-logging or blasting within a certain number of kilometers from a defined mountain goat UWR. There are exceptions for falling trees for the purposes of removing danger trees, installing guy-line anchors or tail-hold trees to address a safety issue. Licensees must follow the general wildlife measures set out in this ungulate winter range order.	

8.9.6.1 Current Condition

It is assumed that the areas identified in the UWR Order U-6-017 meet the mountain goat habitat requirements.

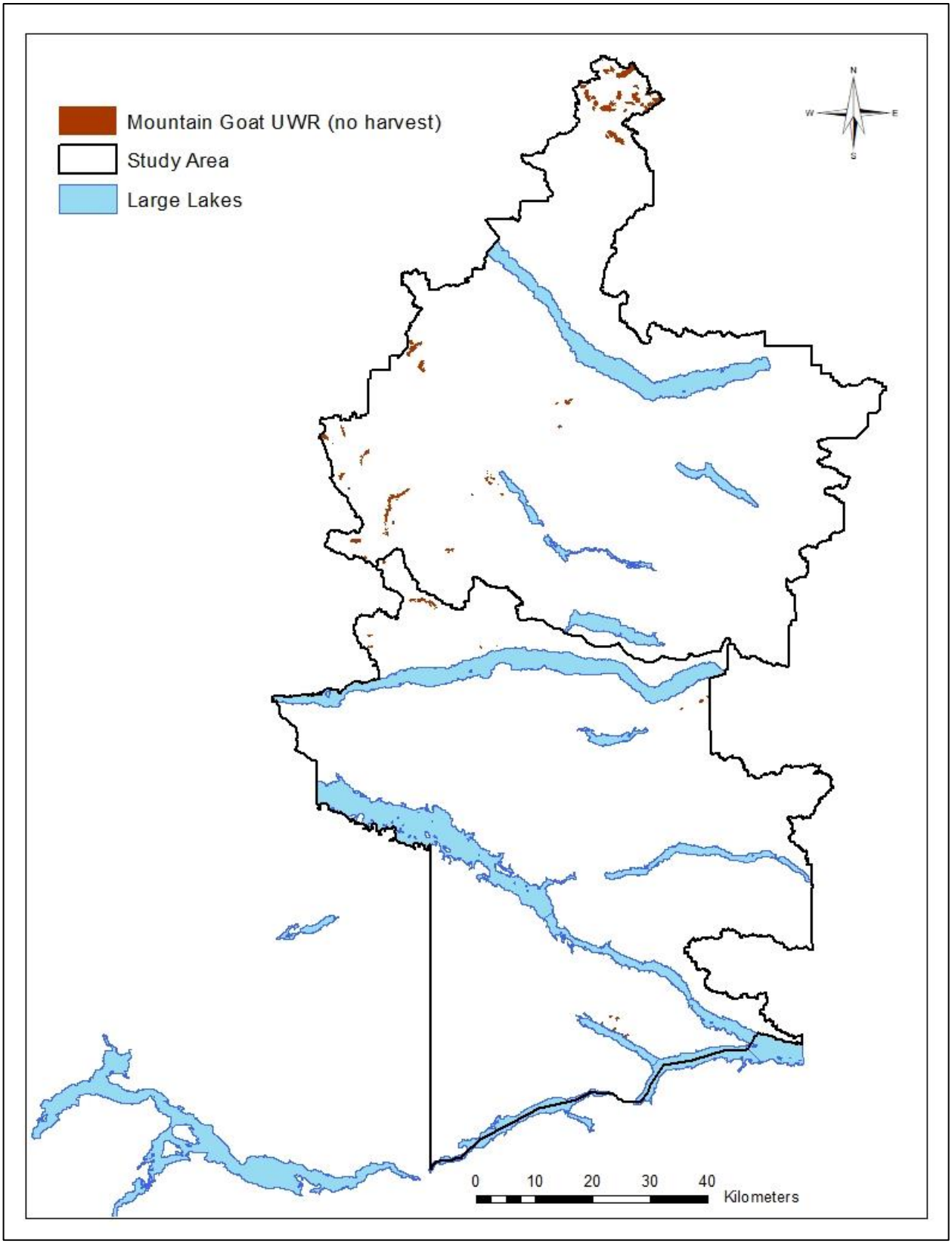


Figure 71: Mountain goat UWR in the project area

8.9.7 Northern Goshawk

The northern goshawk (NOGO) population in the project area is at risk (Chris Schell, pers. Communication, 2022) No official direction currently exists for managing NOGO in the area.

The Skeena Region has identified 60 potential NOGO breeding areas covering approximately 7,800 ha of the CFMLB. Each breeding area is associated with a potential nest site. Out of the 60 breeding areas, 4 have active nests, while the rest are hypothetical nest sites. The potential breeding habitat areas are shown in Figure 72.

Breeding areas (existing and hypothetical) are surrounded by forage areas, which range in size; on average forage areas are approximately 2,600 ha. There are 64 potential forage areas within the project area (4 have predicted breeding areas outside of the TSA boundaries) covering 144,699 ha of the CFMLB.

Approximately 49% of the CFMLB in the forage areas are in permanent reserves and visually sensitive areas, while 26 out of the 64 forage areas are at least 60% located in permanent reserves and visually sensitive areas (Table 78).

Table 78: NOGO forage areas in permanent reserves

Forage Area CFMLB (ha)	Permanent Reserves or VQO (ha)	%	>60% in Permanent Reserves or VQO (ha)	%
144,699	71,593	49%	56,491	39%

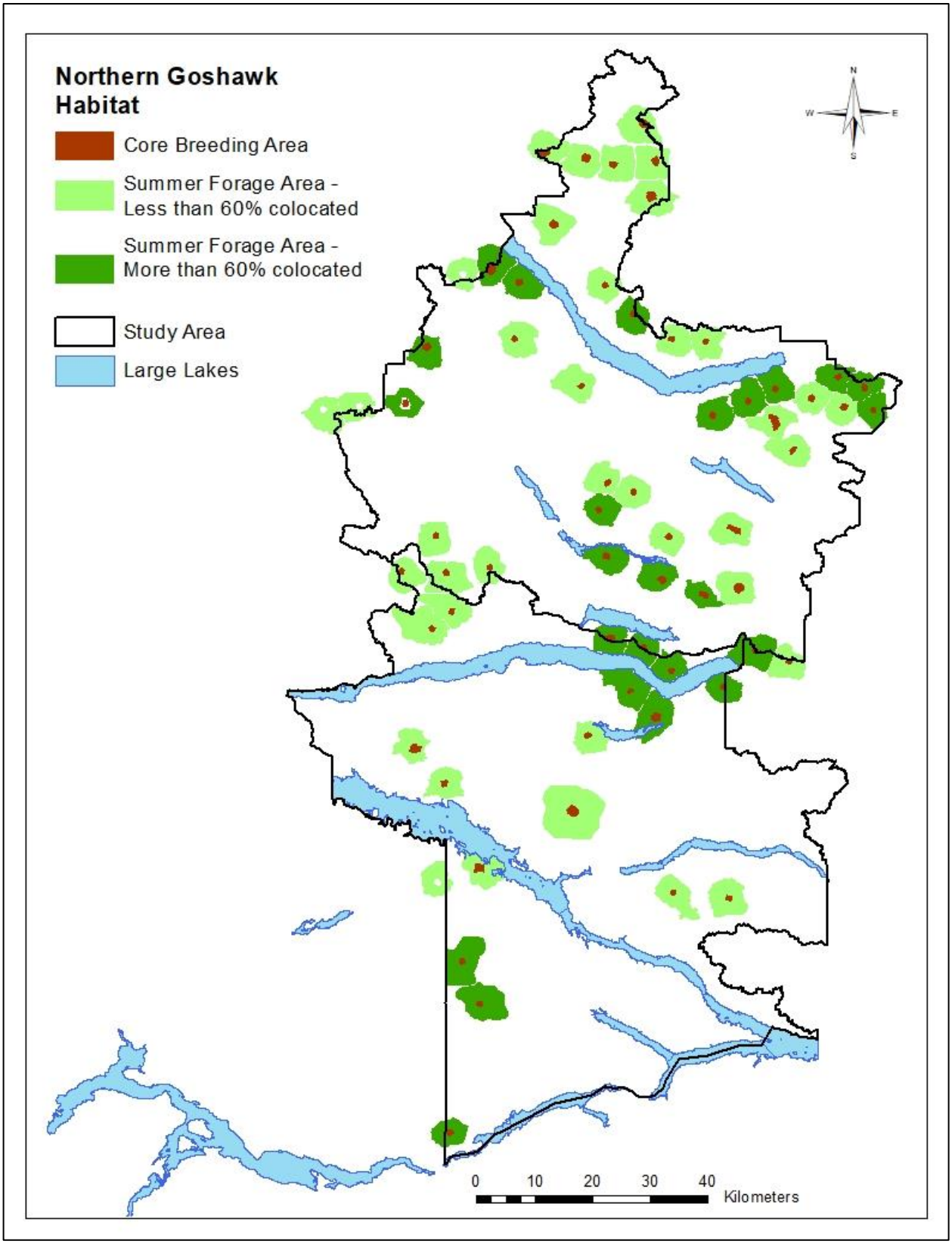


Figure 72: Potential northern goshawk habitat in the project area

8.9.8 Marten

Coarse woody debris (CWD) is considered a critical component of suitable marten habitat. Late seral stage is used as a surrogate for CWD and marten habitat in this analysis. Late seral is defined as 140 years for the SBS BEC zones and 250 years for the ESSF BEC zones.

Table 79 illustrates the predicted marten habitat by LU in the project area. The MPB and recent fires are not considered in the marten habitat definition.

Table 79: Marten habitat in the project area

LU	CFMLB (ha)	Marten Habitat (Old ha)	% Marten Habitat
Babine East	44,342	7,746	17.5%
Babine West	59,836	10,904	18.2%
Bulkley	64,859	7,215	11.1%
Burns Lake East	82,018	7,511	9.2%
Burns Lake West	54,384	7,412	13.6%
Fleming	49,767	9,111	18.3%
Taltapin	69,452	15,016	21.6%
Cheslatta	91,361	10,605	11.6%
Francois East	66,268	10,959	16.5%
Francois West	56,697	8,848	15.6%
Intata/Ootsa North	37,428	4,099	11.0%

8.9.9 Fisher

BC Fisher Habitat Working Group (BCFHWG) maintains a website (http://www.bcfisherhabitat.ca/) that contains fisher habitat models for operational planning and strategic planning. There are 4 fisher habitat zones in British Columbia. The zones are based on BEC subzones and two of them exist in the project area. These are the sub-boreal dry and the sub-boreal moist habitat zones. The sub-boreal dry fisher habitat zone consists of SBSdw, SBSdh and SBSdk BEC subzones, while the sub-boreal moist is defined as SBSwk, SBSmk, SBSmc, SBSmm, and SBSmw.

The BCFHWG has divided the habitat zones into hexagonal cells of approximately 3,000 ha in size. These cells represent potential female fisher territories. Each hexagon is given a score for the different habitat types (denning, resting, foraging, movement) based on the forest inventory attributes such as species, basal area, crown closure, age, and height. These scores are combined using the Mahalanobis distance methodology to obtain an overall score. This overall score indicates the distance from ideal habitat for fisher. The longer the distance, the less likely the hexagon would be suitable habitat for fisher. For the sub-boreal dry zone, the maximum distance score for suitable habitat is 6.63, and for the sub-boreal moist zone, the maximum score is 6.01.

There are 326 hexagons within the Lakes project area. Each hexagon was assigned to the largest zone within it, and then compared to the maximum score for the zone, as shown in Table 80. Note that 18 of the hexagons fall mostly outside the habitat zones. Only a small percentage of the hexagonal cells currently meet the requirements for suitable fisher habitat.

Table 80: Fisher denning habitat in the project area

Habitat Zone	Number of Cells	Meets Habitat Score	CFMLB (ha)	CFMLB Meets Habitat Score (ha)	% Meets Habitat Score
N/A	18	1	31,585	803	2.5%
Sub-Boreal dry	210	19	324,747	27,314	8.4%
Sub-Boreal moist	98	2	203,258	5,175	2.5%
Total	**326**	**22**	**559,590**	**33,293**	**5.9%**

References

Archer CRM, 2009. Cultural Heritage Resource Identification and Management in Forestry Developments: A Supplement to the FREP Protocol. 30p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/chr_manual__addendum_to_frep_protocol.pdf

B.A.Blackwell and Associates Ltd, 2019. Burns Lake Community Forest Landscape Fire Management Plan. 72p. https://blcomfor.com/wp-content/uploads/2019/05/Burns-Lake-LFMP_14May2019_FINAL.pdf

BC Ministry of Agriculture and Lands, 2009. Ministerial Order: Order to Cancel Objectives 1-5 and 7 of Lakes Land and Resource Management Plan 2000. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakesdistrict-lrmp/lakes_lrmp_amend_order_cancelling_signed.pdf

BC Fisher Habitat Working Group, 2021. Fisher Habitat Management Decision Table – Sub-Boreal Forests. 7p. http://www.bcfisherhabitat.ca/

BC Forests and Range Evaluation Program, 2013. Multiple Resource Value Assessment (MRVA) Lakes Timber Supply Area Nadina Natural Resource District November 2013. 15p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/mrva-lakes-tsa.pdf

BC Forest Service, 1995. Forest Practices Code of British Columbia Biodiversity Guidebook. 110p. https://www.for.gov.bc.ca/hfd/library/documents/bib19715.pdf

B.C. Ministry of Forests (MOF). 1995a. Interior watershed assessment procedure guidebook (IWAP). http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/iwap/iwap-toc.htm

BC Ministry of Forests, 1996?. Rangelands of British Columbia, Brochure #46, 8p. https://www.for.gov.bc.ca/hfd/pubs/docs/bro/bro46.pdf

BC Ministry of Forests and Range, 2010. Order to Establish, Amend, and Repeal Visual Quality Objectives within the Lakes Timber Supply Area Portion of the Nadina Forest District. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/bulkley-lrmp/lakes_district_visual_quality_order.pdf

BC Ministry of Forests, Lands, and Natural Resource Operations, 2016. Order to Amend Objective 2: Preserve Old Growth Management Areas as Identified on Map 2, Lakes North Sustainable Management Plan, 2009. 2p https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakesnorth-srmp/lakesnorth_smrp_luor_ogma_amend_14july2016.pdf

BC Ministry of Forests, Lands, and Natural Resource Operations, 2016. Order to Amend Old Growth Forest Objective Amendment 2007, Lakes South Sustainable Resource Management Plan Area. 2p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakessouth-srmp/lakessouth_luor_amend_ogma_07july2016.pdf

BC Ministry of Forests, Lands and Natural Resource Operations 2016. Provincial-Level Projection of the Current Mountain Pine Beetle Outbreak. Current Projection Results (Year 13). https://www.for.gov.bc.ca/hre/bcmpb/year13.htm

BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development, 2017. Reviewed by the Office of the Wet'suwet'en & Wet'suwet'en First Nation. Natural Resource Stewardship Monitoring and Assessment Report for the Wet'suwet'en Hereditary Territory nrsmonitoringandassessmentreport-wetsuweten.pdf (gov.bc.ca)

BC Ministry of Forests, Range, Natural Resource Operations and Rural Development, 2017. Provincial Timber Management Goals, Objectives & Targets. 18p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/timbergoalsobjectives2017apr05_revised.pdf

BC Ministry of Forests, Lands, and Natural Resource Operations, 2017. Ministerial Order to Amend Objective 4 of the Lakes North Sustainable Management Plan. 4p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakesnorth-srmp/plan_59_lcm_ordermap.pdf

BC Ministry of Forests, Lands and Natural Resource Operations, 2018. Young Stand Monitoring in the Lakes & Morice TSAs: Plot Establishment Report. 50p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/inventory-analysis/provincial-monitoring/lakesmorice_ysm_dec_18.pdf

BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development, 2017. Order – Government Action Regulation, Ungulate Winter Range U-6-017 Lakes TSA Mountain Goats (Oreamnos americanus), Nadina Natural Resource District. 8p. https://www.env.gov.bc.ca/wld/documents/uwr/u-6-017_ord.pdf

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2019. Lakes Timber Supply Area Timber Supply Review Data Package Update. 84p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/14tsdp_update_apr2019.pdf

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2019. Lakes Timber Supply Area Timber Supply Analysis Public Discussion Paper. 51p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/14ts_tsr_dp_2019.pdf

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2019. Lakes Timber Supply Area Rationale for Annual Allowable Cut (AAC) Determination. 48p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/14tsra_2019.pdf

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Nadina Resource District, 2020. Nadina Resource District Fire Management Plan 2020.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2020. Together for Wildlife, Improving Wildlife Stewardship and Habitat Conservation in British Columbia. 16p. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/together-for-wildlife/together-for-wildlife-strategy.pdf

BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development, 2021. Order – Government Action Regulation, Ungulate Winter Range U-6-013 Takla Caribou – Nadina Natural Resource District. 9p. https://www.env.gov.bc.ca/wld/documents/uwr/UWR-6-013_Takla_GAR%20order_Final.pdf

BC Ministry of Forests and Range - Apportionment System, Skeena Natural Resource Region Report, Effective Date: 2017-03-23, Lakes TSA AAC, Apportionment and Commitments. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-tenures/apportionment/2021-2022/aptr011_lakes.pdf

BC Ministry of Environment, 2004. Notice – Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Winter Survival of Ungulate Species in the Lakes Timber Supply Area. 3p. https://www.env.gov.bc.ca/esd/distdata/ecosystems/frpa/Approved_FRPR_sec7_WLPPR_sec9_Notices_and_Supporting_Info/UWR/Timber_Supply_Areas/Lakes_TSA/Notice/Lakes_TSA_UWR.pdf

BC Ministry of Environment, 2004. Notice – Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Survival of Species at Risk in the Nadina Forest District. 3p. https://www.env.gov.bc.ca/esd/distdata/ecosystems/frpa/Approved_FRPR_sec7_WLPPR_sec9_Notices_and_Supporting_Info/Species_at_Risk/Nadina_FD/Notice/Nadina%20FD_SAR.pdf

BC Ministry of Sustainable Resource Management, Skeena Region, 2003. Lakes South Sustainable Resource Management Plan. 47p https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakessouth-srmp/lakessouth_srmp_plan.pdf

Dave Daust and Karen Price Consulting, 2019. Island Lake Wildfire Ecosystem Restoration Plan. 93p. https://sernbc.ca/uploads/library/additional_related/wildfire_recovery/Island_Lake_Wildfire_Ecosystem_Restoration_Plan_Revised_Sept_2019.pdf

Dave Daust and Karen Price Consulting, 2019. Shovel Lake Wildfire Ecosystem Restoration Plan. 94p. https://sernbc.ca/uploads/library/additional_related/wildfire_recovery/Shovel_Lake_Wildfire_Ecosystem_Restoration_Plan_September_11_2019.pdf

Forsite Consultants Ltd, 2013. Lakes TSA – Type IV Silviculture Strategy Working Data Package. 36p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/silviculture-strategies/lakes_typeiv_data_package_v21_20130606.pdf

Forsite Consultants Ltd., 2013. Lakes TSA – Type IV Silviculture Strategy Modelling and Analysis Report. 41p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/silviculture-strategies/lakes_modelling_analysis_20130912.pdf

Forsite Consultants Ltd., 2014. Lakes TSA – Type IV Silviculture Strategy: Silviculture Strategy. 41p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/silviculture-strategies/lakes_silviculture_strategy_dec_2013.pdf

Forsite Consultants Ltd. 2019. Burns Lake Community Forest (K1A) Timber Supply Analysis Report in Preparation of Management Plan #4 (with a 7 Generations View). 289p.

Government of British Columbia, 2000. Order Establishing Resource Management Zones and Resource Management Zone Objectives for the Lakes District Pursuant to Sections 3(1) and 3(2) of the Forest Practices Code of British Columbia Act. 4p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakesdistrict-lrmp/lakes_hlp_final.pdf

Government of BC, 2002. Forest and Range Practices Act. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_02069_01

Government of BC, 2004. Forest and Range Practices Act: Forest Planning and Practices Regulation [Last amended March 11, 2021 by B.C. Reg. 64/2021]. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004

Government of BC, 2004. Forest and Range Practices Act: Government Actions Regulation [Last amended March 11, 2021 by B.C. Reg. 64/2021]. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/582_2004

Government of British Columbia, 2017. Forest Health Strategy, Nadina District 2016-2017. 66p. https://www.for.gov.bc.ca/ftp/DND/external/!publish/Forest_Health/2016-2017_DND_Forest%20Health%20Strategy_Final.pdf

Government of British Columbia, n.d. Invasive Species. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species

Government of British Columbia, n.d. Rangelands. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species

Government of British Columbia, n.d. Soils. https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil

Government of Canada, 1985. Seeds Act. https://laws-lois.justice.gc.ca/eng/acts/s-8/page-1.html

Gronsdahl, S., R.D. Moore, J. Rosenfeld, and R. McCleary. 2019. Effects of forestry on summertime low flows and physical fish habitat in snowmelt-dominant headwater catchments of the Pacific Northwest. Hydrological Processes: Special Issue Paper.

Gyug, L., Hamilton, T., and Austin, M. 2004. Accounts and Measures for Managing Identified Wildlife: Grizzly Bear. 21p. https://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_grizzlybear.pdf

Hicks, B.J., R.L. Beschta, and R.D. Harr. 1991. Long-term changes in streamflow following logging in western Oregon and associated fisheries implications. Journal of the American Water Resources Association 27: 217-226.

Integrated Land Management Bureau, 2007. Lakes South Sustainable Resource Management Plan, Old Growth Forest Objective Amendment. 9p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakessouth-srmp/lakessouth_srmp_plan.pdf https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakessouth-srmp/lakes_south_ogma_amendment_11may2007.pdf

Integrated Land Management Bureau, 2009. Lakes North Sustainable Management Plan. 60p. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/lakesnorth-srmp/lakes_north_srmp.pdf

Integrated Land Management Bureau, 2010. Order to Establish, Amend, and Repeal Scenic Areas within the Lakes Timber Supply Area Portion of the Nadina Forest District. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/bulkley-lrmp/lakes_district_scenic_areas_order.pdf

Jones, J.A. and D.A. Post. 2004. Seasonal and successional streamflow response to forest cutting and regrowth in the northwest and eastern United States. Water Resources Research 40, W05203, doi: 10.1029/2003 WR002952.

Lewis, Doug & Huggard, D.. (2010). A model to quantify effects of mountain pine beetle on equivalent clearcut area. Streamline Watershed Management Bulletin. 13. 42-51.

Meehan, W.R. 1991. Influences of forest and rangeland management on salmonid fishes and their Habitats. Bethesda, Maryland. American Fisheries Society. 751

Perry, T.D. and J.A. Jones. 2017. Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology 10(2): 1-13.

Office of the Wet'suwet'en & Wet'suwet'en First Nation 2016. Natural Sector Multiple Resource Value Assessment Report (NRS –MRVA) - Wet'suwet'en Hereditary Territory.

Office of the Wet'suwet'en 2016. Wet'suwet'en Yin Tah Stewardship Principles, Practices & Pprescriptions.

Pacific Climate Impacts Consortium, 2012. Climate Summary for Skeena Region. 4p. https://www.pacificclimate.org/sites/default/files/publications/Climate_Summary-Skeena.pdf

Skeena Sustainability Assessment Forum's (SSAF) State of the Value Report for Grizzly Bear. 2020. Draft prepared by Tania Trip of Madrone Environmental Services, Anthony (Tony) Hamilton, Don Morgan Ministry of Environment and Climate Change, and Jesse Fraser and Mykayla Riley Ministry of Forests, Lands, Natural Resource Operations and Rural Development for the Skeena East Environmental Stewardship Initiative Science and Technical Committee (STC). 92 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/skeena-region/ssaf_grizzly_bear_state_of_the_value_report_sept2020_final.pdf

Skeena Sustainability Assessment Forum's (SSAF) State of the Value Report for Wetlands. 2020. Prepared by Neil Fletcher, Molly Dubé, and Alana Higginson BC Wildlife Federation, Don

Morgan Ministry of Environment and Climate Change, Jesse Fraser Ministry of Forests, Lands, Natural Resource Operations, and Rural Development, and Simon Casley and John Arnett Chartwell Consultants Ltd. for the Skeena East Environmental Stewardship Initiative Science and Technical Committee (STC). 150 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/skeena-region/ssaf_wetlands_state_of_the_value_report_dec2020.pdf

Skeena Sustainability Assessment Forum (SSAF). 2021. Skeena Sustainability Assessment Forum's State of the Value Report for Fish & Fish Habitat. Final draft prepared by Carolyn King and Jesse Fraser of Ministry of Forests, Lands, Natural Resource Operations, and Rural Development for the Skeena Environmental Stewardship Initiative Science and Technical Committee (STC). 190 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/skeena-region/ssaf_fish_and_fish_habitat_state_of_the_value_report_feb2021.pdf

Smith, R. and T. Redding. 2012. Cumulative effects assessment: Runoff generation in snowmelt dominated montane and boreal plain catchments. Streamline Watershed Management Bulletin 15(1): 24-34.

Tesera Systems Incorporated, 2009. Morice and Lakes Timber Supply Areas IFPA. Lakes Type II Analysis and Preferred Silviculture Strategy Report. 51p. https://www.for.gov.bc.ca/ftp/hfp/external/!publish/fft_standards_on_cms_web/SilvicultureStrategyDocuments/Lakes_TSA_14/LakesType2AnalysisReport_Mar31_2009.pdf

Tl'azt'en Nation 2016. Tl'azt'en Nation Land Use Plan.

Woods, A.J., Nussbaum, A., and Golding, B. 2000. Predicted impacts of hard pine stem rusts on lodgepole pine dominated stands in central British Columbia. Canadian Journal of Forest Research 30(3):476-481.

Woods, A. and Bergerud W. 2008. Are Free-Growing Stands Meeting Timber Productivity Expectations in the Lakes Timber Supply Area? BC Forests and Range Evaluation Program Report #13, 34p. https://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/reports/FREP_Report_13.pdf

Climate Change

Associated Environmental Consultants Inc. 2022. Summary of updated climate change anomalies for TSA and TFL boundaries across BC. Report for the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. March 10, 2022.

Bonsal, B.R., Peters, D.L., Seglenieks, F., Rivera, A., and A. Berg. (2019): Changes in freshwater availability across Canada; Chapter 6 in Canada's Changing Climate Report, (ed.) E. Bush and D.S. Lemmen; Government of Canada, Ottawa, Ontario, p. 261–342.

Burgess, M., J. Ritchie, J. Shapland, and R. Pielke. 2020. IPCC baseline scenarios over-project CO2 emissions and economic growth. SocArXiv 18 Feb. 20:doi:10.31235/osf.io/ahsxw.

Carroll, A.L., Taylor, S.W., Régnière, J., and L. Safranyik. 2004. Effects of climate change on range expansion by the mountain pine beetle in British Columbia. Mountain Pine Beetle Symposium: Challenges and Solutions. October 30-31, 2003, Kelowna, British Columbia. T.L. Shore, J.E. Brooks, and J.E. Stone (editors). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Information Report BC-X-399, Victoria, BC. 298 p.

DeLong, S.C., H. Griesbauer, C.R. Nitschke, V. Foord, and B. Rogers. 2019. Development of a drought risk assessment tool for British Columbia forests using a stand-level water-balance approach. Prov. B.C., Victoria, B.C. Tech. Rep. 125. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr125.htm

Doyle, F. 2015. Occupancy and status of northern goshawk breeding areas in the Coast Mountains (Kalum), Nadina and Skeena Stikine Resource Districts: harvesting and climate changes. Wildlife Dynamics Consulting.

Foord, V. 2016. Climate patterns, trends, and projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia. Prov. B.C., Victoria, B.C. Tech Rep. 097. https://www.for.gov.bc.ca/hfd/pubs/docs/TR/TR097.htm

Forests, Lands and Natural Resource Operations. 2016. Adapting forest and range management to climate change in the Skeena Region: Considerations for practitioners and Government staff. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/skeenaen151125.pdf

Hausfather, Z., and G. P. Peters. 2020. Emissions - the "business as usual" story is misleading. Nature 577:618–620.

Hennon, P.E., Frankel, S.J., Woods, A.J., Worral, J.J., Ramsfield, T.D., Zambino, P.J., Shaw, D.C., Ritóková, G., Warwell, M.V., Norlander, D., Mulvey, R.L. and C.G. Shaw III. 2021. Applications of a conceptual framework to assess climate controls of forest tree disease. Forest Pathology. https://doi.org/10.1111/efp.12719

Jackson, S.I. 2014. Streamflow trends in the Skeena Region. BC Ministry of Environment. https://a100.gov.bc.ca/pub/acat/documents/r43821/43821_Apr_22_1429816412723_9812613246.pdf

Kirchmeier-Young, M.C., Gillet, N.P., Zweirs, F.W., Cannon, A.J. and F.S. Anslow. 2018. Attribution of the influence of human-induced climate change on an extreme fire season. Earth's Future, 7(1): 2-10. https://doi.org/10.1029/2018EF001050

Kirilenko, A.P. and R.A. Sedjo. 2007. Climate change impacts on forestry. Proceedings of the National Academy of Science USA, 104: 19697–19702. https://doi.org/10.1073/pnas.070142410

MacKenzie, W. H., and C. R. Mahony. 2021. An ecological approach to climate change-informed tree species selection for reforestation. Forest Ecology and Management 481:118705.

Mahony, C. R., T. Wang, A. Hamann, and A. J. Cannon. 2022. A global climate model ensemble for downscaled monthly climate normals over North America. International Journal of Climatology:1–21.

Natural Resources Canada. 2022. Fire weather. https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/forest-change-indicators/fire-weather/17776. Accessed May 27, 2022.

Pojar, J. 2019. Forestry and carbon in BC. Report prepared for SkeenaWild Conservation Trust and Skeena Watershed Conservation Coalition. https://skeenawatershed.com/resource_files/Pojar-ForestsAndCarboninBC-2019.pdf

Price, K. and D. Daust. 2013. Development of a climate change index of stress using future projected BEC: Proof of concept for the Nadina TSA.

Price, K. and D. Daust. 2016. Climate change vulnerability of BC's fish and wildlife: First approximation. Internal report prepared for the BC Ministry of Forests, Lands and Natural Resource Operations Competitiveness and Innovation Branch, Jun 8, 2016. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/adaptation/climate20change20vulnerability20of20bcs20fish20and20wildlife20final20june6.pdf

Price, K. and D. Daust. 2020. Adding climate change to Skeena values: Climate exposure, vulnerability and monitoring in the Environmental Stewardship Initiative study area. Internal report prepared for the Skeena Environmental Stewardship Initiative, Science and Technical Committee, March 18, 2020.

Stadnyk, T.A. and S.J Déry. 2021. Canadian continental-scale hydrology under a changing climate: A review. Water, 13(7), 906. https://doi.org/10.3390/w13070906

Stiff, H.W., Hyatt, K.D., Stockwell, M.M. and A.J. Cannon. 2018. Downscaled GCM trends in projected air and water temperature to 2100 due to climate variation in six sockeye salmon watersheds. Canadian Technical Report of Fisheries and Aquatic Sciences 3259: vi + 83 p.

Vore, M.E., Déry, S.J., Hou, Y, and X.Wei. 2020. Climatic influences on forest fire and mountain pine beetle outbreaks and resulting runoff effects in large watersheds in British Columbia, Canada. Hydrological Process, 34: 4560-4575. https://doi.org/10.1002/hyp.13908

Wang, T., E. M. Campbell, G. A. O'Neill, and S. N. Aitken. 2012. Projecting future distributions of ecosystem climate niches: Uncertainties and management applications. Forest Ecology and Management 279:128–140.

Wang, T., Hamann, A., Spittlehouse, D., and C. Carroll. 2016. Locally downscaled and spatially customizable climate data for historical and future periods for North America. PLoS ONE 11(6): e0156720. doi: 10.1371/journal.pone.0156720.

Woods, A.J., Coates, K.D., Watts, M., Foord, V., and E.I. Holtzman. 2017. Warning signals of adverse interactions between climate change and native stressors in British Columbia forests. Forests, 8, 280. https://doi.org/10.3390/f8080280

Wotton, B.M., Flannigan, M.D. and G.A. Marshall. 2017. Potential climate change impacts on fire intensity and key wildfire suppression thresholds in Canada. Environmental Research Letters 12. https://doi.org/10.1088/1748-9326/aa7e6e

List of Acronyms

Acronym	Definition
AAC	Annual Allowable Cut
AUM	Animal Unit Month
BA	Basal Area
BCFHWG	BC Fisher Habitat Working Group
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
BLCF	Burns Lake Community Forest
BMA	Biodiversity Management Area
CEF	Cumulative Effects Framework
CFA	Community Forest Agreement
CFMLB	Crown Forest Management Land Base
CHR	Cultural Heritage Resource
CMIP6	Coupled Model Intercomparison Project, Phase 6
CWD	Coarse Woody Debris
DBH	Diameter at Breast Height
ECA	Equivalent Clearcut Area
ECCC	Environment and Climate Change Canada
ESI	Environmental Stewardship Initiative
FAIB	Forest Analysis and Inventory Branch
FLNRORD	Ministry of Forest, Lands, Natural Resource Operations and Rural Development
FLP	Forest Landscape Plan
FMP	Fire Management Plan
FNWL	First Nations Woodland License
FOP	Forest Operation Plan
FPC	Forest Practices Code
FPPR	Forest Planning and Practices Regulation
FREP	Forest and Range Evaluation Program
FRPA	Forest and Range Practices Act
FSP	Forest Stewardship Plan
FTA	Forest Tenure Administration
FWA	Fresh-water Atlas
GAR	Government Actions Regulation
GHLB	Gross Harvestable Land Base
HR	Hydrologic Recovery
IFPA	Innovative Forest Practice Agreement

Acronym	Definition
IM	Immediate Forest Management Measures
IWMS	Identified Wildlife Management Strategy
LCM	Landscape Connectivity Matrix
LRMP	Land and Resource Management Plan
LRP	Lakes Resiliency Project
LU	Landscape Unit
MOU	Memorandum of Understanding
MPB	Mountain Pine Beetle
MRVA	Multiple Resource Value Assessment
NDT	Natural Disturbance Type
OGMA	Old Growth Management Area
PAS	Permanent Access Structures
PFC	Proper Functioning Condition
SDM	Stand Development Monitoring
SERNbc	Society for Ecosystem Restoration in Northern British Columbia
SFMP	Sustainable Forest Management Plan
SRMP	Sustainable Resource Management Plan
SSP	Shared Socioeconomic Pathways
SSAF	Skeena Sustainability Assessment Forum
TEC	Tweedsmuir-Entiako Caribou
THLB	Timber Harvesting Land Base
TSA	Timber Supply Area
TSR	Timber Supply Review
UWR	Ungulate Winter Range
VRI	Vegetation Resource Inventory
WLPPR	Woodlot Licence Planning and Practices Regulation
WTP	Wildlife Tree Patch
WTRA	Wildlife Tree Retention Area
YSM	Young Stand Monitoring