Chapter 8: EFFECTS ASSESSMENT

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8. EFFECTS ASSESSMENT

The sustainability of forest management activities (*i.e.* roads, crossings, harvest, and silviculture) on various ecological, social, and economic elements of the forest are mostly addressed in the Forest Management Plan's chapter 5: Scenario Planning. However, there are several items from the Effects Assessment Guidelines issued in 2018 that are not, which subsequently are discussed in this chapter. These items, or gaps, are from the FML #3 effects assessment guidelines from May 2018. Additionally, detail and recommendations from the Manitoba Clean Environment Commission Report on the Forest Management Approval Process, from 2020, have been incorporated into this section as well where applicable.

8.1 LOCAL AIR QUALITY

This section examines the potential influence of forest management on local air quality. Dust, emissions, and smoke from burning slash and tops are reviewed with regards to applicable forest management activities. The table below shows which aspects of local air quality are applicable to different forest management activities.

	Forest Management Activity				
Local Air Quality Aspect	**Roads**	**Crossings**	**Harvest**	**Wood Haul**	**Silviculture**
Dust	yes	yes	no	yes	no
Engine Emissions	yes	yes	yes	yes	yes (minor)
Wood Smoke	no	no	If softwood slash piles are burnt	no	no

8.1.1 Dust

Loss of fine particles as dust from gravel roads have three potential issues:

1. Safety – large clouds of dust raised by vehicles can obscure a driver's vision;
2. Health - dust particles of 10 micrometers (μm) in diameter (PM_{10}) can be inhaled into the lungs, potentially contributing to respiratory health issues. High levels of dust create a general nuisance that degrades the quality of life.
3. Degradation of the road surface - fine soil particles act as a binder of the coarser sand and gravel. Wash board and potholes are more common due to loss of the fine particles from the road surface. Loss of fines from the road surface may requires additional gravel and fines be spread on the road as maintenance.

Dust can be an issue for wood hauling on forest roads. Winter log haul operations have significantly less dust than summer operations. An average of 70% of all haul activity is in the winter months, when there is little to no dust (Figure 8.1). Dust isn't really an issue on paved highways, but dust can be an issue on both forestry gravel roads and Rural Municipality gravel roads.

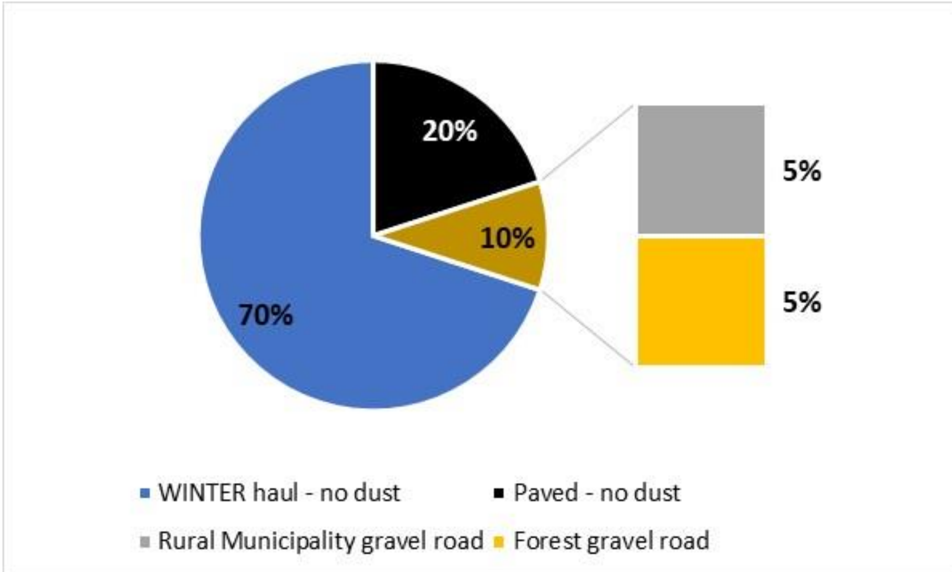


Figure 8.1 Approximate average proportion of wood hauled by road type.

8.1.1.1 Dust Mitigation Efforts

Dust on Rural Municipality (RM) roads can be mitigated by applying dust control on portions of the road. Typically, magnesium chloride, which draws moisture directly from the air into the road and dampens it, is used for dust control. The RM road of Merridale typically has dust control applied during the summer haul from the Upper Dam operating area. In addition, dust control on active haul roads near farm houses is applied on a case-by-case basis.

Fast moving large vehicles stir up road dust. Reducing speed by 25% reduces dust (PM_{10}) by 35%. Most of forestry roads are not high-speed roads, therefore the truck speeds and dust are lower. Average haul speeds on RM roads are 60 kph, while forestry roads average speeds of only 30 kph.

Logging and hauling activities are very dispersed across Forest Management Licence #3. These operations also are in remote areas with little or no habitation. Therefore, there are not any areas of concentrated hauling and road dust. The one exception is the Merridale road which connects the summer operating area Upper Dam to paved highway #83. Dust on the Merridale road is mitigated with dust control.

8.1.2 Engine Emissions

Engine emissions from machinery is applicable to all mechanized forest management activities. The wood haul has the most machinery use of all forest management activities, while silviculture has the least amount of machinery use.

Road and crossing building equipment, as well as logging equipment, and haul trucks burn fuel. Both gasoline and diesel fuel contain carbon. These fuels, when burnt, produce the greenhouse gas carbon dioxide (CO_2) as part of the engine exhaust.

Logging and hauling CO_2 emissions are very small compared to other CO_2 sources, such as actively farming agriculture crop land (Table 8.1). Other CO_2 sources include commercial traffic, recreational travel, and personal vehicle use.

Table 8.1 Annual carbon dioxide emissions by sector.

Sectors within Local area	CO_2 emissions (million tonnes per year)
Forest Industry	0.002 M tonnes hardwood LP 0.002 M tonnes softwood SPL ***0.004 M tonnes total**
Local Agriculture (crop land only)	****0.9 M tonnes annually**
Commercial transportation	Unknown for local area 7.0 M tonnes annually (all of Manitoba)
Recreation and personal travel	unknown

*haul data from scale and payment system times haul truck fuel consumption average (Appendix 1).

**Agriculture fuel consumption averages from MB govt (Appendix 2).

8.1.2.1 Strategic Mitigation

The carbon footprint and Green House Gas emissions of operations is mitigated by:

Hauling full weights wherever possible (less truck trips results in less fuel burned and therefore less CO_2). Maximum truck weight is 62,500 kg, depending on the class of road and season.

The Trucking Productivity Improvement Fund (TPIF) Program is designed to provide an innovative opportunity for shippers or receivers to safely maximize their payloads and enhance their transportation productivity on pre-approved routes. The TPIF Program allows companies the ability to move heavier shipments provided they pay for the additional damage to the highway. Divisible loads, up to RTAC (Road Transportation Association of Canada) maximum weights, are allowed on the lower weight A1 and B1 routes under the TPIF Program. All routes must be pre-approved and the TPIF fees collected are re-invested into highway infrastructure. By paying into this fund we are able to haul larger loads up to RTAC weights on light highways, which means less trips therefore reducing CO_2 emissions.

Night hauling in late winter when the temperature is coldest, increases the chance that we will be issued TPIF permit in late winter. This also allows for maximum weight of wood to be hauled, resulting in less trips, less fuel used, and less CO_2 emissions.

8.1.3 Smoke from burning woody debris

The composition of smoke varies with fuel type and the fire intensity. Smoke contains very fine particulate matter PM_1 (1 micron or less), which is much finer than road dust, which is PM_{10} (10 microns).

Smoke from burning woody debris has a couple of issues:

1. Safety – smoke can reduce visibility, which can be a significant issue if near a highway.
2. Health - dust particles of 1 micrometer (μm) in diameter (PM_1) can be inhaled into the lungs, potentially contributing to respiratory health issues.

In FML #3, burning of wood piles is an uncommon activity. Some top and limb piles that used to be burnt are now ground into hog fuel. Some woody material is used for marten debris piles, while others are used for road closure material.

Woody debris from softwood stockpile and processing sites have been burnt at two or three sites per year. Burning woody debris from stockpile sites is very minor in both quantity and frequency compared to wildfire smoke which can travel airborne from as far away as the province of British Columbia. Wildfire smoke can necessitate evacuations of entire communities.

8.1.3.1 Strategic mitigation

Softwood stockpile and processing sites do not ignite woody debris piles if there is a significant inversion layer that would keep smoke near the ground.

8.2 MAJOR WOOD STORAGE AND PROCESSING AREAS

There is a Manitoba forest practices guideline for wood storage and processing areas entitled 'Biomass Management' (Manitoba Conservation and Water Stewardship 2015). The purpose of this guideline is to provide operational guidelines for the effective management of biomass that accumulates during harvesting operations.

Wood storage and processing areas located on crown land within FML #3 are in scope for this section of the forest management plan. However, most of the existing major wood storage and processing areas are located on private land and are out of scope.

8.2.1 Major Wood Storage Areas

Wood storage areas are often referred to as 'stock pile' sites (Figure 8.2). Minor stock pile sites are temporary and used for two years or less. Major stock pile sites are semi-permanent and used for three years or more on the same site. Future major stock pile sites were asked to be included in Forest Management Plans by the Manitoba CEC (2020).

Figure 8.2 Minor stock pile of chipperwood in an old gravel pit site – Watjask Lake Operating Area.

A temporary or minor stockpile site is depicted in Figure 8.3. These sites store wood for a short period of time, based on operational and weather-related factors.

Figure 8.3 Minor and temporary stock pile of tree-length spruce and aspen.

Normally, wood harvested in the forest is loaded onto a truck and hauled directly to a mill yard. Ideally, 100% of all wood is hauled directly to the mill yards. However, there are circumstances, usually weather-related such as early break-up, that necessitate moving wood from the forest to a stock pile site that has all-weather access. The wood is loaded and unloaded twice at extra cost due to machine hours, labour, and fuel. Forest operations try to avoid extra handling of wood as much as possible.

Anticipated major stock pile sites expected to be used in FML #3 are shown in Table 8.2. Operational caveat – stock piles are permitted annually and need a Work Permit or General Permit. Including future stock piles in this strategic 20-year plan does not preclude permitting additional stock piles that are not listed.

Table 8.2 Anticipated major stock pile sites on Crown land in FML #3.

Major Stock Pile Name	Location (Crown land only)
Beaver Lake	Beaver Lake Road
River Hill	off Hwy #367 near forest boundary
Watjask	Old gravel pit at Watjask

8.2.1.1 Major Wood Storage Mitigation Efforts

The Biomass 2015 guideline recommends spreading, piling, or burning of chipperwood debris, depending upon site-specific circumstances. If a major stock pile site is to be decommissioned, it is planted to softwood seedlings to reforest the site.

8.2.2 Major Wood Processing Areas

Major wood processing areas are usually stock pile sites, since the stock piled wood gets chipped or put through a grinder at the same site. Chipperwood sites take small softwood tops, chip them (Figure 8.4) and are hauled to the pulp mill in The Pas, Manitoba. Grinder wood sites use any kind of wood, grind it into hog fuel, which is then shipped to The Pas. The mill in The Pas uses hog fuel instead of diesel bunker fuel, whenever possible.

Figure 8.4 Chipping small softwood tops into chips.

8.2.2.1 Major Wood Processing Mitigation Efforts

The Biomass 2015 guideline recommends spreading, piling, or burning of chipperwood debris, depending upon site-specific circumstances. If a major stock pile site is to be decommissioned, it is planted to softwood seedlings to reforest the site.

8.3 CUMULATIVE EFFECTS

The working definition of cumulative effects is (Government of British Columbia 2016):

> *"Changes to environmental, social and economic values caused by the combined effect of past, present and potential future human activities and natural processes."*

The Manitoba Clean Environment Commission (2020) specifically mentioned cumulative effects for these values:

- Total km of roads
- Effects on watersheds
- Carbon balance

In addition, the values moose and biodiversity were added to the cumulative effects section. A subsection was created for each value. Note that landscape-level Natural Range of Variation (NRV) fire emulation and indicator bird biodiversity occurs within the biodiversity value, and not as a separate value.

8.3.1 Cumulative Effects Process

The cumulative effects process for each value includes:

- A modified Bowtie risk assessment approach;
- Alternative management scenarios (part of Chapter 5 Scenario Planning);
- Evaluation of projected future roads and harvest for the next 20 years (part of Chapter 5 Scenario Planning);
- Tracking the change and accumulation of key threats to each value in a cumulative effects framework table; and,
- Monitoring of key values (*e.g.* roads, moose habitat) as part of Chapter 7 Monitoring Framework.

A bow tie is diagram of a wholistic view of various aspects of risk to a value, which includes:

- strategic direction from FMP
- Operational procedures (*e.g*. Standard Operating Guidelines, DUC wetland crossing guide)
- Provincial guidelines or policies

8.3.2 Bowtie Risk Assessment Overview

Bowtie risk assessment diagrams are a form of conceptual modeling well-suited to environmental assessment. They are a graphical depiction of pathways from the causes of an event or risk to its consequences. The knot of the bowtie is of the point where the causes converge on the event.

Originally, and most commonly bowtie diagrams are used to address strategies for controlling hazards such as accidents and contamination. More recently, bowties been used to assess threats to environmental policies such as cumulative natural and anthropogenic threats to maintaining a viable and self-sustaining caribou population (Winder *et al.* 2020). Kishchuk (2018) used the bowtie tool to examine forest management impacts on water quality and biodiversity. The bowtie diagram maps how threats can trigger an event that violates or works against a key policy or management objective and identifies actions that can be put in place to eliminate or reduce the severity of the threat. Threats to environmental policy objectives such as the maintenance of biodiversity are almost never in isolation, but rather the result of cumulative anthropogenic and natural actions. The bowtie diagram help identify these threats, the actions in place to control them, and any gaps evident in protection of the policy.

The terminology associated with the bowtie risk assessment model is subtle, but precise. It is therefore important to review the meaning of the wording, and placement of the elements within the diagram. These terms are described in more detail below, with some examples. The key components of the bowtie model are illustrated in Figure 8.5.

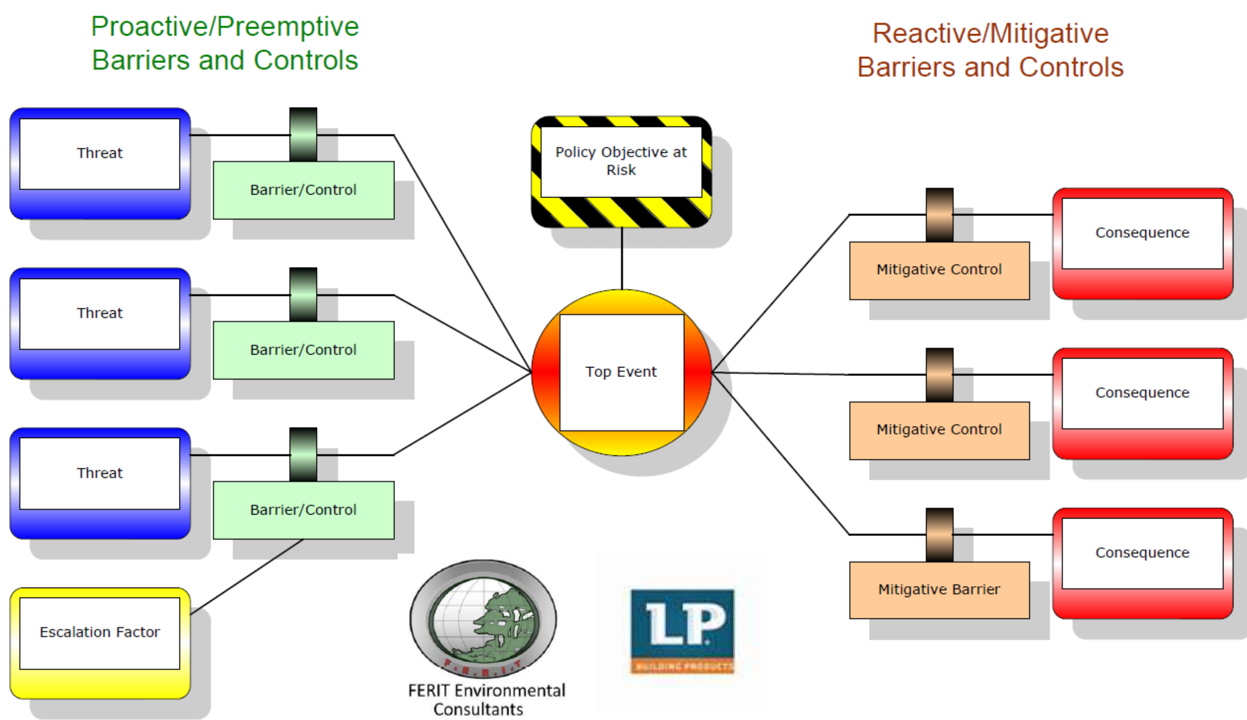
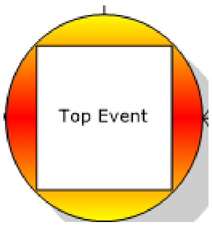


Figure 8.5 Overview of bowtie risk assessment diagram.

1.8.3 ***Hazard*** - *Environmental Policy Objectives at Risk*. These are objectives that can arise from higher level policy documents, or objectives of specific concern (Table 1). The objective is to maintain risk at a level as low as reasonably possible. For example, a key environmental objective is to conserve moose populations.

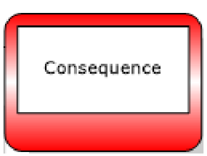


2.8.3 ***Top Event****:* This is the key event to be avoided (e.g., declining moose population). The policy objective (hazard) is in an undesirable state and is the first event in a chain of unwanted states or events. The top event is not a catastrophe yet, but the dangerous characteristics of the hazard are now in the open. Listed in Table 8.3 are the desirable Policy Objectives and Top Events to be avoided.

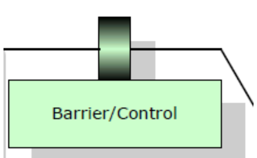
Table 8.3 Key environmental policy objectives to be achieved through the Forest Management Plan.

Desirable Policy Objective	Top Event (to be avoided)
Conserve Moose Population	Declining Moose Population
Conserve Biodiversity	Loss of Ecosystem Integrity
Conserve Wetland Ecosystems and Water Flow	Wetland loss and changes to water flow (degraded hydrological function)
Maintain Carbon Balance	Reduction in Carbon Stocks

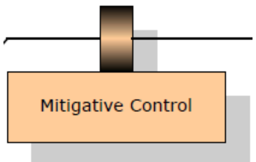
3.8.3 ***Threats*** *(and Drivers):* Often there are several factors that could cause the top event. In bowtie methodology, these are called threats, and are the blue boxes on the left. These threats need to be sufficient or necessary: every threat itself should have the ability to cause the top event.



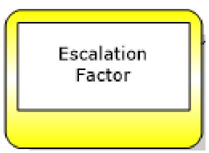
4.8.3 ***Consequences:*** When a top event has occurred (e.g., moose population is declining), it can lead to certain consequences. A consequence is a potential event resulting from the release of the hazard, which results directly in loss or damage (e.g., reduced opportunities for recreational moose hunting). Consequences in bowtie methodology are unwanted events that an organization 'by all means' wants to avoid (red boxes on the right).



5.8.3 ***Barriers (Proactive Control):*** Risk management is about controlling risks. This is done by placing controls between the threat and the top event to prevent the negative event from happening. A barrier (or control) can be any measure taken that acts against some undesirable force or intention to maintain a desired state. If the intent of the control is to prevent negative effects from occurring, it is a proactive action. For example, road decommissioning may help control the negative effects caused by roads on the sustainability of moose populations. To protect a species at risk (e.g., Canada warbler) a preventative control may to conduct summer surveys in cutblocks for bird species at risk, and if detected, avoid summer harvest in those cutblocks during the bird breeding season (May, June, July). Many of the proactive actions are required or suggested under various forest management guides, and additional actions are identified through certification requirements, and under various Federal requirements related to aquatic systems.



6.8.3 ***Barrier (Reactive/Mitigative Controls)***: There are also reactive controls (on the right side of the top event) that prevent or slow the top event from further causing unwanted consequences. In contrast with the preventative (left) side of the diagram, the reactive (right) side of the diagram deals with crisis management. For example, a reduction in moose hunting tags may be required as a reactive control to prevent extirpation of the moose population in response to an observed annual decline in the population. For moose, the goal is to avoid reactive solutions through sound proactive forest harvest and road management, habitat management, and wildlife population management.



7.8.3 ***Escalating Factors***: In an ideal situation, a barrier will stop a threat from causing the top event. However, there are conditions that can interfere with the barrier to reduce its effectiveness. In bowtie methodology, these are called escalation factors. An escalation factor is a condition that leads to increased risk by defeating or reducing the effectiveness of a barrier. For example, if loss of thermal protective habitat is a threat to moose, and a proactive control is to ensure sufficient lowland conifer is left on the landscape, then there is a concern that climate change (warmer/dryer summers) will work against the effectiveness of the habitat management prescription.

One of the first bowtie analysis diagrams used for assessing the ecological sustainability of forest management, was created by Kishchuk et al. 2018. The Bowtie tool was applied to terrestrial ecosystem management in northern Ontario. Specifically, water quality and biodiversity were examined and analyzed.

8.3.3 Roads

Roads are a necessity to allow trucks to haul the wood harvested out of the forest to a mill yard. Wood is hauled from a temporary forest road to the existing permanent road network of gravel roads and paved highways. Due to their temporary nature, forest roads are built to a very minimal standard, and are usually decommissioned in the same operating year they are constructed. All-season roads are multi-year, and have a Forest Roads Development Plan, which is submitted with the Operating Plan as part of the Government of Manitoba requirements in the 2012 Roads Guideline.

8.3.3.1 Scoping

The scope of this roads section includes forest roads built and decommissioned by Quota Holders or LP. Most of these roads in FML #3 are in the Duck Mountain (Forest Management Unit 13), but a few short forest roads exist in Forest Management Units 10 and 11. In addition, planned future roads during the term of the 20-Year Forest Management Plan are also considered.

The roads cumulative effects section does not include:

- Provincial highways (paved or gravel);
- Rural Municipality roads;
- all previously closed forest roads; and,
- all trails, both active or abandoned.

8.3.3.2 Analysis of Potential Effects

The potential cumulative effects of roads are shown in Table 8.4.

Table 8.4 Cumulative effects framework for roads.

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
PAST roads		No natural linear disturbances	Building gravel highways #366 and #367 in the Duck Mtns has allowed all-season access to recreational lakes (e.g. Wellman, Blue Lks, Child's, Singuish). Forest roads enhance many of the non-consumptive uses of the forest (e.g. harvest medicinal plants) Access to areas – recreation and trails Access to areas – sport fishing, sport hunting		Past roads have provided access to harvest areas and facilitated small sawmills across the mountain. Access to areas – small Quota Holders (cut & haul) Access to areas – commercial non-timber forest products Access to areas - outfitters	

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
PRESENT roads	Permanent road network is stable. No new permanent roads are being built. Existing roads are maintained.		Forest roads enhance many of the non-consumptive uses of the forest (e.g. harvest berries, medicinal plants, forest craft materials such as birch bark) Access to areas – recreation, sport fishing, sport hunting		Access to harvest areas – wood haul Access to areas – small Quota Holders (cut & haul); private firewood Access to areas – non-timber forest products Access to areas - outfitters	
FUTURE roads	Accessing first 10 years of FMP blocks would require 61% existing roads and 39% new roads		Forest roads enhance many of the non-consumptive uses of the forest (e.g. harvest medicinal plants) Access to areas – recreation and trails Access to areas – sport fishing, sport hunting		Access to harvest areas – wood haul Access to areas – small Quota Holders (cut & haul) Access to areas – non-timber forest products Access to areas – outfitters; potential for eco-tourism	

8.3.3.3 Bowtie diagram for roads cumulative effects

A bowtie diagram was purposefully not created for roads, since roads are not an objective. However, roads can be a threat to other objectives (*e.g*. moose, biodiversity). Therefore, roads are included as a threat in both the watersheds, moose, and biodiversity bowtie diagrams.

8.3.3.4 Mitigation Strategies

8.3.3.4.1 Proactive

Proactive mitigation prevents negative effects occurring from roads.

The Forest Management Plan has a strategy to reduce the total length of roads, while still harvesting the same amount of wood. The aggregated harvest pattern described in the 'Moose Emphasis' scenario in Chapter 5 forecasts a reduction in new road construction by 23% over the 20-year period.

New road construction is proactively avoided or minimized by utilizing the existing road network of forest roads, gravel roads, and paved highway as much as possible. In the last three operating years, existing roads were utilized:

- 87% in 2017-2018;
- 57% in 2018-2019; and
- 60% in 2019-2020.

Both Quota Holders (softwood and hardwood) and LP (hardwood) use the same roads to access many cut blocks, thus further minimizing the length of new road built.

8.3.3.4.2 Reactive

Reactive mitigation also prevents negative effects occurring from roads. Typically, this involves road and crossing monitoring. If there is a potential for a negative effect (e.g. a beaver plugs a culvert, but no damage has yet occurred) the situation is reacted to in an appropriate fashion.

8.3.3.5 Evaluation of Significance

Road construction and road decommissioning is generally in balance. Therefore, there will not be a significant change in the total length of active roads in FML #3. Nor will there be a significant change in the accessibility of the forest at a landscape level.

8.3.3.6 Monitoring and Follow up

Monitoring of road construction and decommissioning is reported in the two-year report for FML #3. In each Forest Management Plan five-year report, five years of existing road use and new road construction will be summarized. We will evaluate if the Moose Emphasis forest management scenario achieved a 23% reduction in roads, compared to the Baseline scenario. However, the strategic modeling was done in 10-year increments, so there could be potential issues with five-year reporting on 10-year increments.

Operational monitoring of active roads and crossings already occurs. In addition, decommissioned crossings are monitored twice a year (spring and fall) for two years.

8.3.4 Watersheds

LP's Environment Act Licence (2191E) states in Section 17 (ii) that:

> *The Licencee shall: "limit the area in a watershed which is in a harvested and not sufficiently regenerated state, as determined by subsection 17(i) of this Licence"*

Consultation with the federal Department of Fisheries and Oceans determined that 30% in a harvested state was the watershed threshold that would not affecting stream flow spring run-off. Harvest blocks are in a 'harvested state' for five years following harvest for hardwood species, and 10 years post-harvest for softwood species. After green-up, cut blocks are in a 'sufficiently regenerated state' no longer in a 'harvested state'. The Duck Mountain watersheds (Figure 8.6) are currently well below the 30% maximum disturbance threshold and are projected to continue to be well below the 30% threshold.

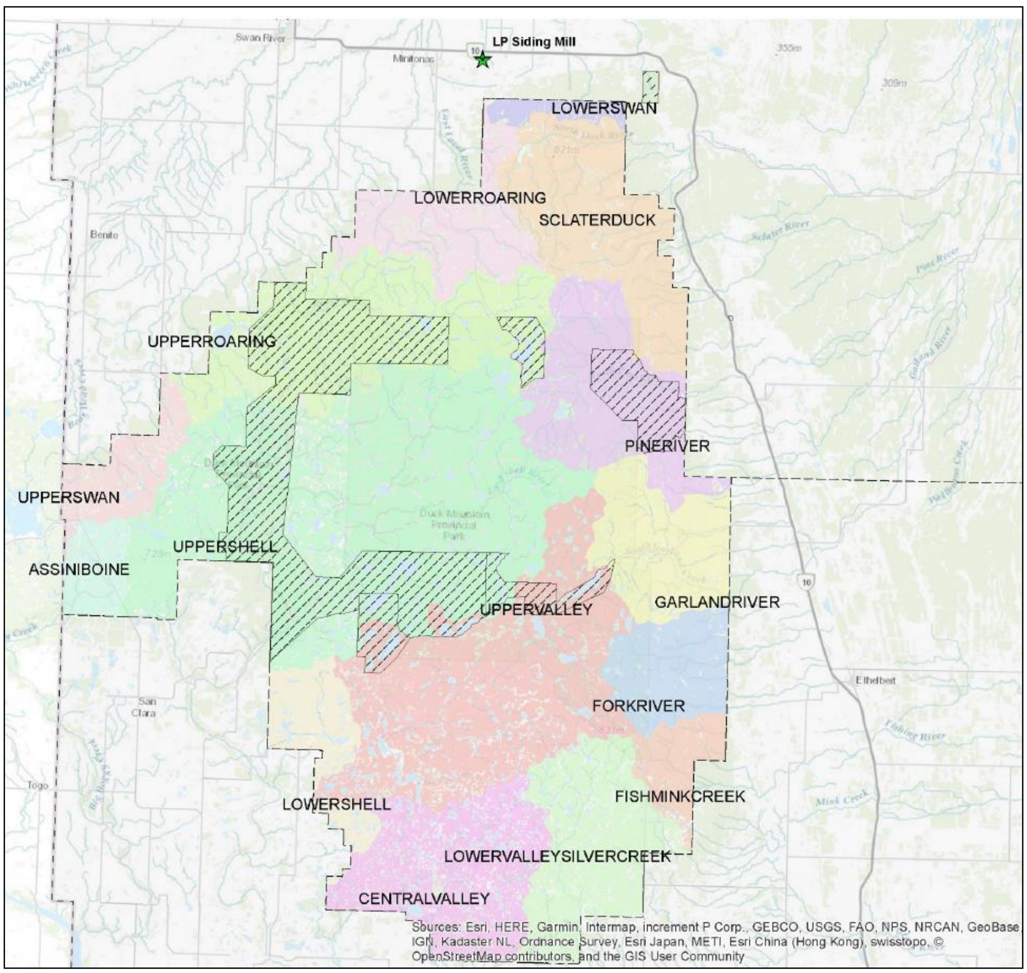


Figure 8.6 Watersheds in the Duck Mountain Provincial Forest.

8.3.4.1 Scoping

Geographically, the scope of watershed cumulative effects is the Duck Mountain Provincial Forest. The private agricultural and forest land surrounding the Duck Mountain Provincial Forest is out of scope.

8.3.4.2 Analysis of Potential Effects

The cumulative effects framework for watersheds is shown in Table 8.5.

Table 8.5 Cumulative effects framework for watersheds.

	ENVIRONMENT		**SOCIAL**		**ECONOMIC**	
	Human	Natural	Human	Natural	Human	Natural
PAST watersheds	1996 – determined a 30% watershed threshold as a maximum. Combined forest operations of Spruce Products Ltd., LP, and Quota Holders combined has always been under the 30% threshold.	Fires and burnt areas temporarily (5 – 10 years) contribute to increased water runoff. Large fire in **1890**'s burnt approximately 85% of the entire Duck Mountain forest – likely significant water runoff followed. **1961** burn was the last large fire in the Duck Mtn. (21,000 ha) **2012** there was ~27,000 ha of blow down Beavers can cause flooding in local areas.				
PRESENT watersheds	Current (2020) watershed disturbance level is: average = 0.8% minimum = 0.0% maximum = 4.4%	Very little recent fires. Spruce budworm outbreak in Arm Lake and Valley River areas. Beavers can cause flooding in local areas.				

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
FUTURE watersheds	20-year period (2020-2039) watershed disturbance limits are estimated to range from 0 to 3.9%, far less than the 30% threshold. This assumes the full harvest level of softwood and hardwood are cut every year for 20 years.	unknown				

8.3.4.3 Bowtie Diagram for Watersheds

The risks, threats and controls to maintaining hydrologic flow are shown in Figure 8.7.

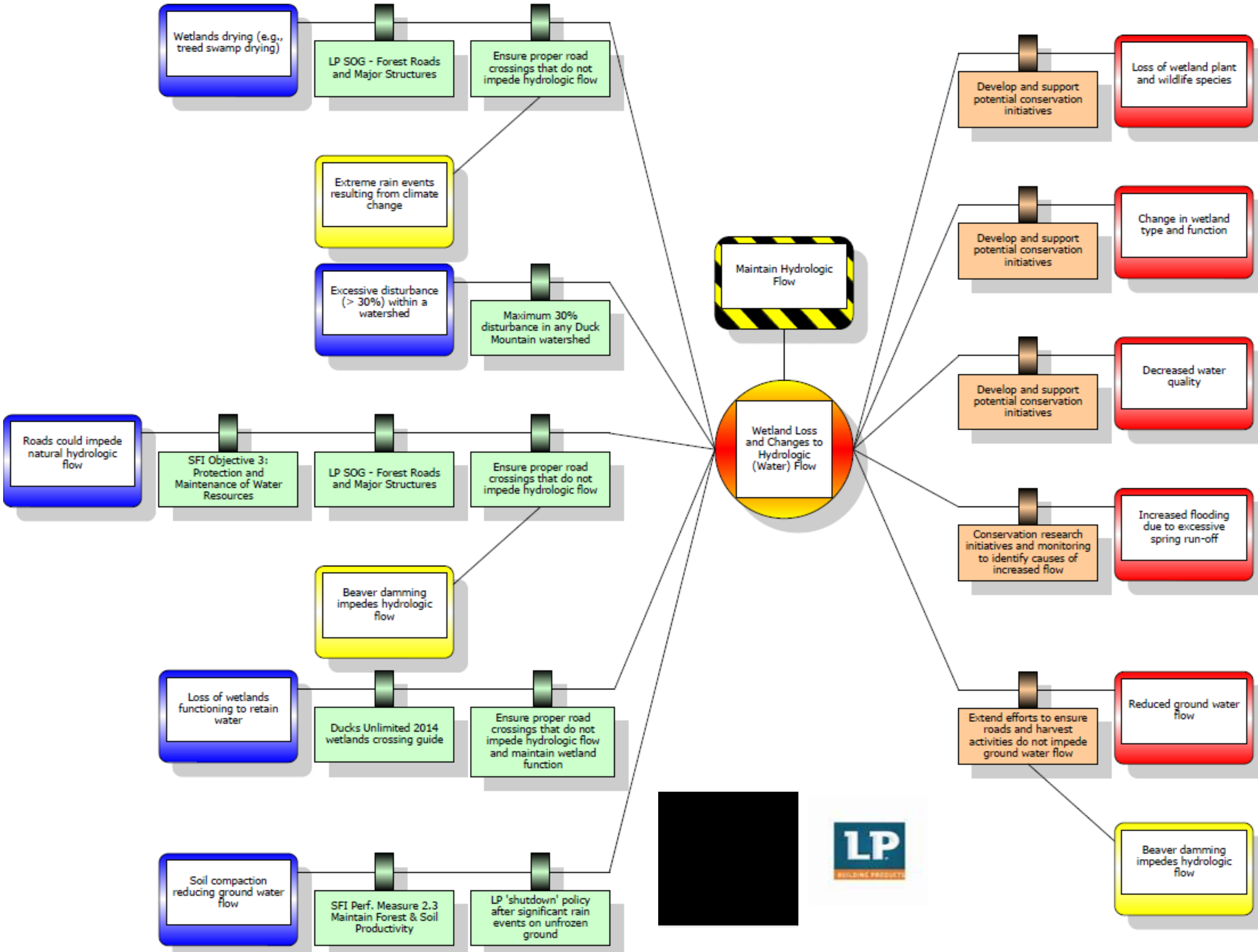


Figure 8.7 Bowtie diagram for watersheds.

8.3.4.4 Mitigation Strategies

8.3.4.4.1 Proactive

We are proactively planning to stay below the 30% of a watershed's area in a harvested state in the FML #3 two-year Operating Plans. Furthermore, in the strategic 20-Year Forest Management Plan, we are also ensuring the next 20 years of proposed harvest are within the 30% watershed threshold.

Prompt, rapid regeneration of both softwood and hardwood proactively assists with mitigating watershed disturbances. Harvested softwood sites are planted each spring with large seedlings, ensuring rapid reforestation of softwood sites.

Choosing snow and ice temporary crossings instead of culverts, proactively minimizes soil disturbance in the stream bank. This action protects the watershed from potential sediment entering streams.

The use of pipe bundles during bridge installation, helps minimize stream and stream bank disturbance. This also prevents potential sediment from entering streams, and protects water quality and the watershed.

8.3.4.4.2 Reactive

If a road crosses a wetland, staff identify the wetland type. The wetland crossing guide (Ducks Unlimited Canada 2014) is then used as guidance for wetland crossing options that will maintain hydrologic flow. This in turn protects the watershed.

During the harvest of hardwood sites, LP ensures no rutting or compaction of soil with their 'shutdown policy' (*i.e.* skidding ceases after a significant rainfall, or winter skidding on unfrozen soil), which allows rapid natural hardwood regeneration.

The combined proactive and reactive mitigation strategies provide multiple layers of protection for watersheds and wetlands.

8.3.4.5 Evaluation of Significance

The percent of individual watersheds in a disturbed state is estimated to fluctuate over the next 20 years. Some watershed will rise slightly, others will decrease. The average percent disturbance across all watersheds is projected to decrease slightly over the next 20 years. The decrease is a result of young cutover that was in a 'harvested state' growing taller trees, shading the snow on site, and no longer being in a 'harvested state'. More cutover is transitioning out of a harvested state that new cutover being in a harvested state.

The average percent watershed disturbance in the Duck Mountain is currently 0.8% and is projected to decrease to 0.67%. These disturbances are all below 1%, which is far below the 30% threshold. Therefore, the significance of watershed disturbance in the Duck Mountain is low. Please note that watershed disturbance is not tracked in the adjacent agricultural land.

8.3.4.6 Monitoring and Follow up

Harvest planning in each two-year Operating Plan is constrained at or below the 30% threshold. The actual watershed threshold is operationally tracked in the two-year reports for FML #3.

Operational monitoring of crossings already occurs. In addition, decommissioned crossings are monitored twice a year (spring and fall) for two years.

Strategically, the estimated watershed disturbance and actual watershed disturbance will be monitored in the Forest Management Plan's five-year report. This is described in FMP Chapter 7 Monitoring.

8.3.5 Carbon Balance

The current forest condition of carbon stocks for upland ecosystems was calculated by applying Johnston's (2005) upland carbon yield curves to the land base. It is estimated that there are approximately 52.5 million tonnes of upland carbon in the Duck Mountain Provincial Forest (Table 8.6). There is a very significant amount of carbon in soils (72%), compared to the amount of carbon in trees (28%).

Table 8.6 Upland and wetland carbon estimates for the Duck Mountain Provincial Forest.

Ecosystem Portion	Tonnes Carbon	Proportion of Total Carbon (%)
***UPLANDS** (80% of land base)		
Soil carbon (C)	37,781,300	72%
Tree stem Biomass C	11,136,823	21%
Tree roots, stump, top, branches Biomass C	3,570,245	7%
Upland subtotal	**52,488,368**	**100%**
****WETLANDS** (20% of land base)		
Soil C	39,604,185	88%
Vegetation –above ground C	5,187,810	12%
Wetland subtotal	**44,791,995**	**100%**

*314,093 ha within FMU 13 - utilizing the Forest Lands Inventory

**79,417 ha within FMU 13 -utilizing the Enhanced Wetland Classification by Ducks Unlimited

Carbon calculations for organic soils in wetlands were quantified from the carbon in wetlands project (Johnston *et al*. 2019). Although there is less wetlands area in FML #3 than uplands area, the wetlands account for almost half of the carbon sequestered in the Duck Mountain. Upland forest ecosystems range from 50 to 300 tonnes of carbon per hectare, while wetland ecosystems range from 250 to 1,200 tonnes of carbon per hectare.

8.3.5.1 Scoping

Carbon calculations are for both uplands and wetlands in the entire Duck Mountain Provincial Forest, also referred to as Forest Management Unit 13. The remainder of FML #3 (outside the Duck Mountain) has carbon calculations for upland forest and wetlands, but not the farm land which is most of the land area.

8.3.5.2 Analysis of Potential Effects

Upland carbon is sequestered mostly in the upper soil horizons (*i.e.* LFH and Ah horizons). The soil contains the largest upland carbon pool (72% in the Duck Mountain). Lesser upland carbon pools are in the trees. Harvesting softwood and hardwood stems, while leaving the tree roots, stump, branches, and top removes some carbon from harvested sites.

Young regenerating forests rapidly sequester atmospheric carbon into the trees stem, roots, and branches (Natural Resources Canada 2007). This carbon gain from young regeneration matches the carbon loss from harvesting at the landscape-level (Figure 8.8). Therefore, the carbon balance is estimated to be sustainable even when harvesting the full softwood and hardwood Annual Allowable Cut every year for the next 200 years.

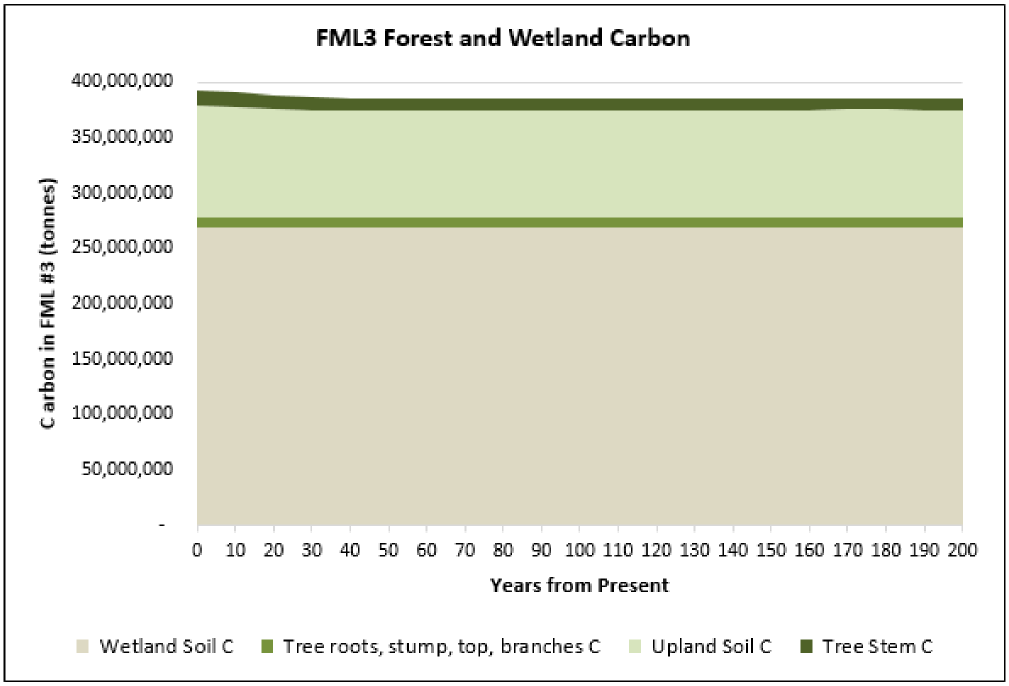


Figure 8.8 Combined upland and wetland carbon stocks is estimated to be stable over time in FML #3.

Road building blades stumps and displaces the litter layer (*i.e.* LFH horizon) and the upper mineral soil 'black soil' (*i.e.* Ah horizons) into a roadside pile (Figure 8.9). When the road is decommissioned, the roadside pile with stumps and organic soil is spread back over the reclaimed road.

Figure 8.9 Roadside pile of organic soil, roots, and stumps (left). Organic soil spread back over a decommissioned road (right).

Area planting softwood seedlings with no site preparation leaves the carbon-rich LFH and Ah soil horizons undisturbed. Area planting leaves the soil carbon sequestered in its' original place. Therefore, there is likely no potential effect on the carbon balance.

The great majority of wetland carbon occurs as peat deposits. Local peat depths vary from 0.5 to 9 m (Johnston *et al*. 2019). Peat is not removed as part of forest operations. However, improper road crossings over peatlands have the potential to impede hydrological flow on the up-flow side, while drying out the peat on the down-flow side of the crossing. Drying out peatlands can lead to peat decomposition, and release of carbon into the atmosphere.

The cumulative effects framework for the carbon balance of FML #3 is shown in Table 8.7.

Table 8.7 Cumulative effects framework for carbon balance.

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
PAST carbon	Land clearing forest into agricultural land in the valley will have changed the C balance.	Young forests rapidly accumulate carbon as they grow. Old forest loses carbon via individual tree mortality and decomposition (87% to atmosphere, 13% into surface organic soil). Fires rapidly oxidizes above-ground carbon, releasing carbon into atmosphere, but regenerate to young forest which accumulates carbon – repeats cycle. Wetlands accumulate carbon as layers of peat.				
PRESENT carbon	Duck Mtn only – current estimate of 97 M tonnes of carbon (upland and wetland combined). Wetland carbon maintained in place by good crossings that maintain hydrologic flow.					
FUTURE carbon	Duck Mtn. carbon balance estimated to be stable and sustainable. Small amount of carbon removal (logs) is easily replaced by natural system of young forest sequestering carbon.					

8.3.5.3 Bowtie Diagram for Carbon Balance

The risks, threats and controls to balancing carbon are shown in Figure 8.10Figure 8.7.

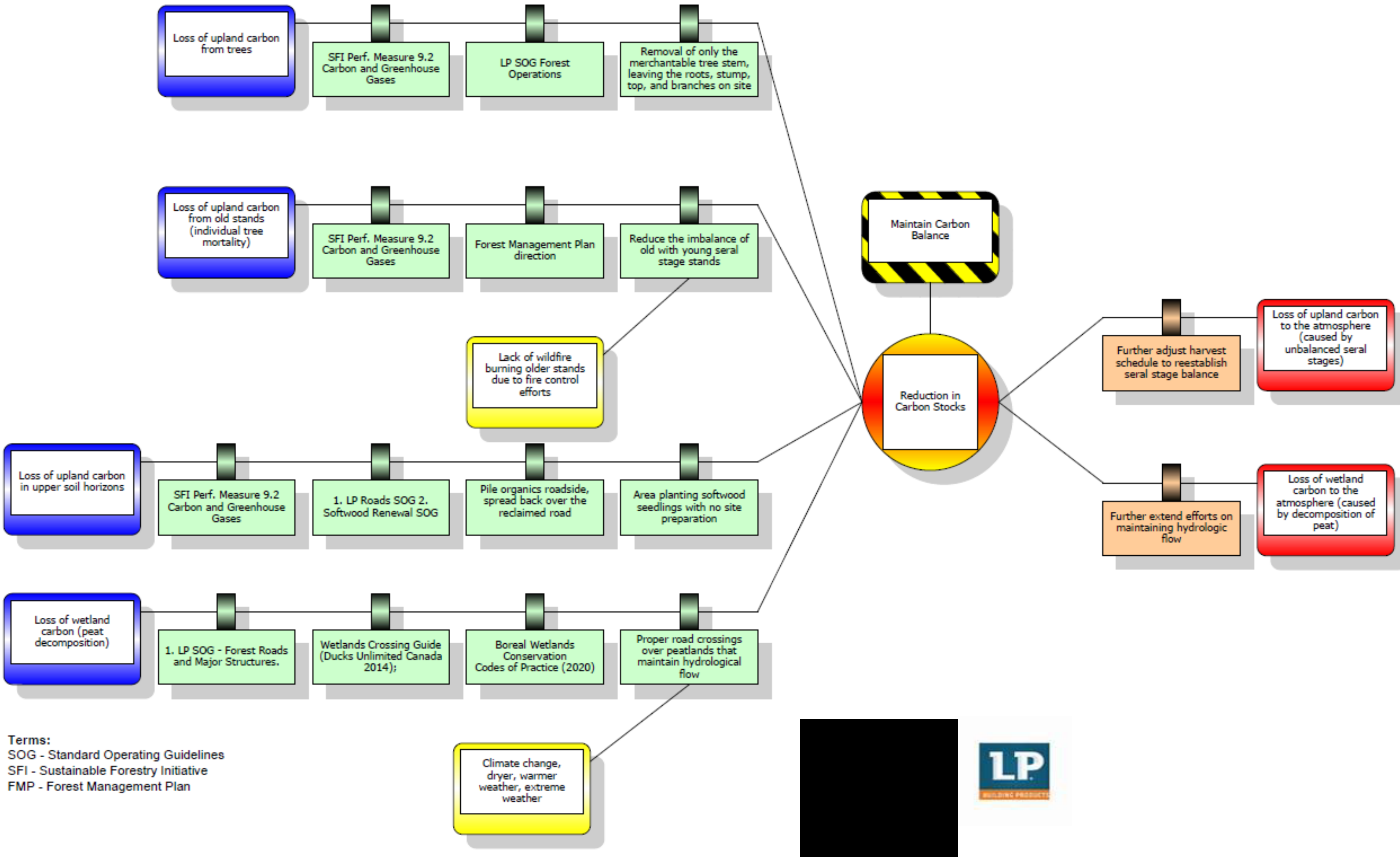


Figure 8.10 Bowtie diagram for maintaining the carbon balance.

8.3.5.4 Mitigation Strategies

Uplands –100% of sites harvested are regenerated to either hardwood, softwood, or mixedwoods. Young regenerating trees rapidly sequester carbon. If any sites fail to meet the provincially mandated 80% stocking requirement, they are promptly planted to ensure the 80% stocking requirement is met or exceeded.

Area planting softwood seedlings with no site preparation leaves the carbon-rich LFH and Ah soil horizons undisturbed. Area planting leaves the soil carbon sequestered in its' original place.

Wetlands - We identify the wetland type using the DUC wetland field guide (2015). We then use the DUC wetland crossing guide (2014) to ensure that all crossings installed over wetland maintain hydrologic flow. This prevents any unnatural peat decomposition and carbon release. Furthermore, all active crossings are inspected by LP operations staff twice a year, in case of beaver damming or other flow impediments that need correcting.

8.3.5.5 Evaluation of Significance

8.3.5.5.1 Proactive

The upland carbon balance is sustainable under harvesting the full Annual Allowable Cut. The wetland carbon balance is also sustainable, due to proactive best practices that maintain the wetland hydrological flow, protecting the existing peat and carbon deposits. Therefore, forest operations have an insignificant effect on the carbon balance.

8.3.5.5.2 Reactive

The amount of carbon dioxide released through harvesting is small compared with what is typically experienced through forest fires and other natural disturbances (FPAC 2015; Natural Resources Canada 2020). Seedre and Chen (2010) also found differences between the carbon dynamics of boreal mixedwood stands after wildfire and harvesting for these reasons:

- Stand-replacing wildfire consumes most of forest floor and vegetation (understory and overstory), which results in low carbon on site immediately after disturbance;
- harvested stands generally had more aboveground live carbon than post-fire stands, which was attributed to residual live trees left after logging; and
- harvested and managed forest stands had higher carbon sequestration rates than unmanaged fire-origin stands at comparable ages up to 27 years (time-since-disturbance) in the boreal mixedwood forests.

The proactive and reactive mitigation strategies provide multiple layers of protection to maintain the carbon balance in FML #3.

8.3.5.6 Monitoring and Follow up

A landscape-level re-evaluation of the carbon stocks and changes would be appropriate for the second five-year Forest Management Plan (FMP) monitoring report, 10 years after FMP approval.

8.3.6 Moose

Moose is a socially important wildlife species. Moose (*Alces alces*) are consistently important to most people. Different groups of people have different reasons for moose being important. Moose hold cultural significance for many Indigenous peoples who harvest moose as an important traditional food source, social, and ceremonial purposes (Nepinak 2018). Moose are a spectacular animal for wildlife viewing and photography. Some people collect shed moose antlers from the forest, which can used for crafts or sold.

In the recent past, moose have had locally declining populations. The rapid population decline has led to a Conservation Closure (*i.e.* no moose hunting) in this area. However, moose is not on the Manitoba, Canadian, or international endangered species list. This Forest Management Plan considers moose a species of social concern. Moose have an intrinsic value within the natural ecosystem, and for the people of Manitoba (Nepinak 2018).

8.3.6.1 Scoping

The existing forest can be influenced to create better moose habitat. In Chapter 5.7 of this Forest Management Plan, a 'Moose Emphasis' scenario and harvest pattern are described. This scenario improves and benefits moose habitat, while still meeting many other ecological and economic sustainability objectives. Specifically, moose habitat improvements can be made by creating young forest (browse) adjacent to mature forest (cover).

Forest management cannot directly influence moose populations. The moose habitat improvements to be implemented in this plan will likely indirectly increase moose populations. The Manitoba government can influence moose populations by implementing a moose conservation closure, levels of enforcement for illegal hunting, future tag limits, forest road access policy, wolf bounty *etc.*

There are significant factors to moose populations, such as ticks, brain worm, and road kill on highways. Extreme weather may also stress, but not directly kill moose. These are all factors that forest management cannot control.

8.3.6.2 Analysis of Potential Effects

The cumulative effects framework for moose is shown in Table 8.8.

Table 8.8 Cumulative effects framework for moose.

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
PAST moose	Subsistence hunting has occurred for a long time. Sport hunting has also been active in the past.	Between 1920 and 1980, moose populations have been very cyclical. Ticks have previously reduced moose populations to very low levels.	Moose have had a role for Indigenous communities as a cultural species.		Subsistence hunting and food security have an economic benefit	
PRESENT moose	Moose are affected by: • Unregulated hunting • Regulated hunting • Road kill • Unmanaged access winter moose habitat maps for time 0 years (2020)	Moose are affected by: • Predation (wolves, bears) • Parasites (ticks) • Parasites (brain worm) • Lack of browse close to cover	Moose currently have a role for Indigenous communities as a cultural species.		Subsistence hunting and food security have an economic benefit	
FUTURE moose	Winter moose habitat maps for time 10 years (2030); and 20 years (2040) both show an estimated improvement to winter moose habitat.	Moose may be directly affected by weather extremes (e.g. prolonged hot periods in summer). Moose may be indirectly affected by weather extremes (e.g. increased ticks from early warm springs)				

8.3.6.3 Bowtie Diagram for Moose

The risks, threats and controls to conserving moose populations are shown in Figure 8.11.

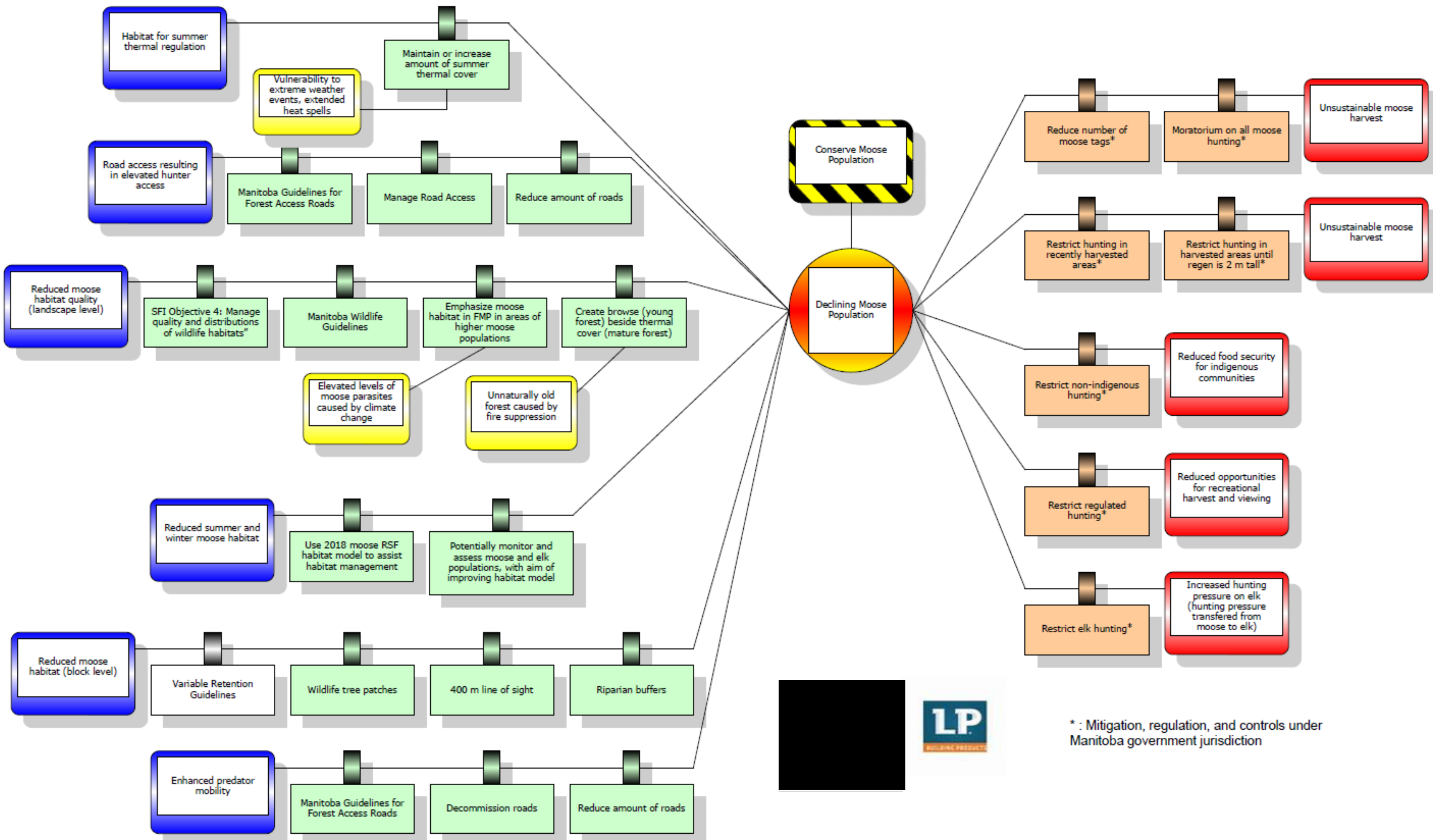


Figure 8.11 Bowtie diagram for conserving moose populations.

Zabihi-Seissan (2018) created the Resource Selection Function (RSF) for winter moose habitat by combining winter moose aerial survey data from the years 2010, 2012, and 2017. Three survey variables were statistically significant across all surveys:

1. Distance to water (closer to water is better for moose);
2. Forest age (young forest is better, since it provides feeding or forage areas); and,
3. Distance to roads (further away from roads is better).

The graphs for these variables are shown in Figure 8.12.

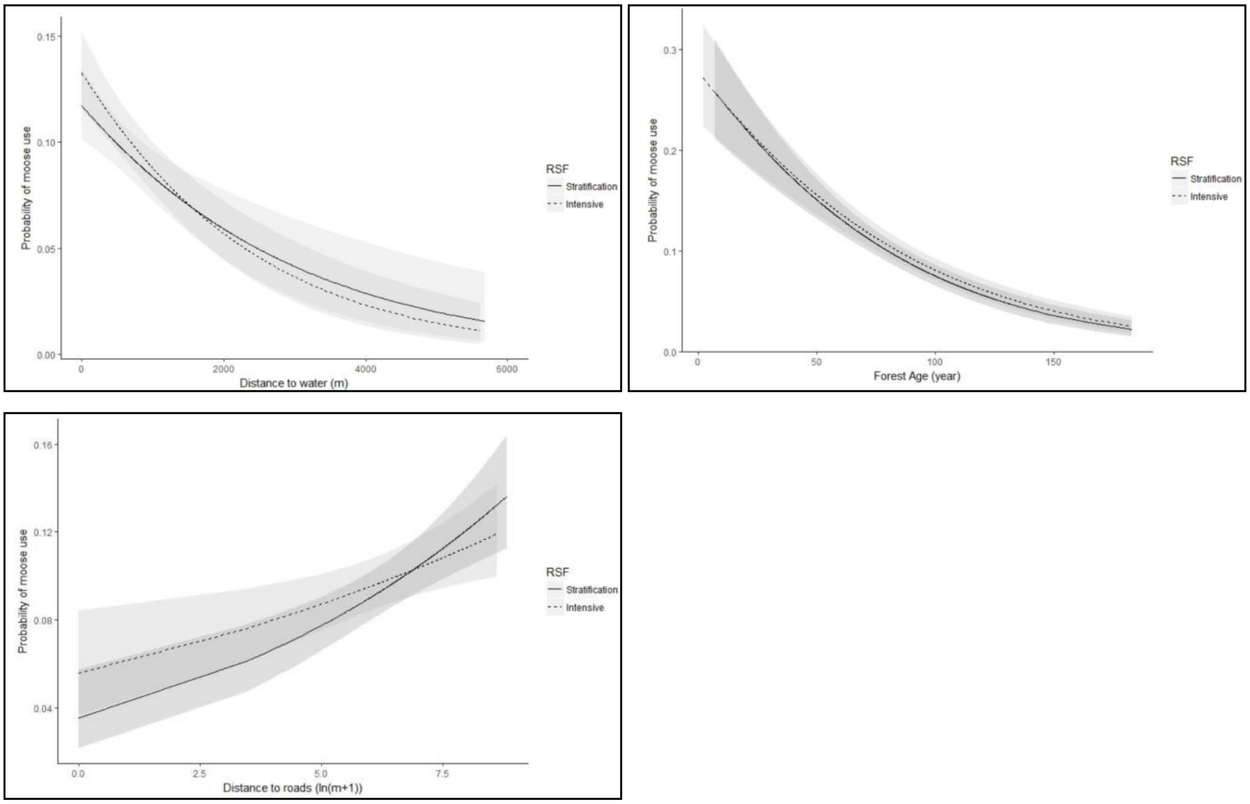


Figure 8.12 Winter moose habitat resource selection function significant variables. Shaded area consists of 95% confidence intervals.

8.3.6.4 Mitigation Strategy

8.3.6.4.1 Proactive

The 20-year Forest Management Plan proactively plans to create better moose habitat. This is accomplished by planning harvest in areas of mature forest and creating young forest (moose browse) adjacent to mature forest (cover). Wildfire can create young forest and moose browse, but there have been almost no significant wildfires in the Duck Mountains since 1961. Therefore, it is more important for harvesting to create young forest and moose browse in the absence of fires.

The forest is dynamic and changes with time. Young forest that is excellent moose browse now, will only be adequate moose browse five years from now. Therefore, the Moose Emphasis scenario and proposed harvest pattern was designed to maintain a continuous supply of excellent moose browse (young forest) adjacent to cover (mature forest) over the next 20 years.

Unmanaged road access can be detrimental to moose populations. Easy road access can greatly increase hunter success, but lower moose populations. Therefore, managing road access proactively is very important to protecting moose populations.

The 20-year Forest Management Plan can strategically reduce the length of roads by 23%, while still harvesting the same amount of softwood and hardwood. This is accomplished by aggregating harvest blocks, resulting in less new road being built.

Summer thermal regulation areas for moose are proactively planned for, by ensuring lowland softwood is left unharvested. These areas provide important shade and cool moss for moose to bed down and cool off.

8.3.6.4.2 Reactive

Enhanced predator (*e.g*. wolves and bears) mobility can be mitigated by closing roads with slash, stumps, and debris. These efforts remove mobility along the road, reducing predator success.

The proactive and reactive mitigation strategies provide multiple layers of protection for moose. Unfortunately, there are no controls to reduce the amount of moose parasites, including winter ticks and brain worm.

8.3.6.5 Evaluation of Significance

Implementation of the 20-year Forest Management Plan is projected to improve moose habitat. Harvesting will create young forest and much-needed moose browse, that is not being generated by fires. Improving moose habitat has a positive significance.

Moose populations can have a neutral significance, assuming the roads and access control are tightly managed. Moose populations can be sustained in the absence of uncontrolled road access.

Currently, there is a moratorium on moose hunting. However, once hunting is re-opened, it could have a significant effect on moose populations. Likewise, parasites such as winter ticks and brain worm could significantly affect moose populations.

8.3.6.6 Monitoring and Follow up

Moose habitat across the landscape will be monitored as part of the Forest Management Plan's (FMP) monitoring efforts. The five-year FMP report will re-evaluate moose habitat and compare it to the base line level of moose habitat quality from the year 2020.

8.3.7 Biodiversity

Biodiversity is a very important feature and function in the uplands and wetlands of FML #3. Ecological integrity is tightly linked to biodiversity, as functioning of intact ecological systems contributes to biodiversity, and loss of biodiversity threatens important ecosystem services and ecological processes. Ecological integrity includes the ability of an ecosystem to support a community of organisms with a similar species composition and function as found in an equivalent unaltered natural system (Rempel *et al*. 2016).

Rempel *et al*. (2016) developed an indicator system for ecological integrity based on natural disturbance dynamics and indicator species. The three-dimensional 'biodiversity box' shows the full natural range of variation (NRV) in forest condition that results in a range of habitat combinations (Figure 8.13) that would be expected under a natural disturbance regime. This is referred to as 'habitat niche space' (Rempel *et al*. 2016), and this range of conditions supports a complex forest animal and plant community adapted to the disturbance dynamics operating in the boreal forest. For example, the bottom-left front corner of the 3-D box represents young softwood with low interspersion. **Cover type** refers to the gradient of pure softwood, mixedwoods, and pure hardwood stands. **Age** classes range from young, immature, mature, and old forest stands. Low **interspersion** represents homogenous areas of one age class, and/or one cover type. High interspersion would have a mix of age classes and/or mixed cover types.

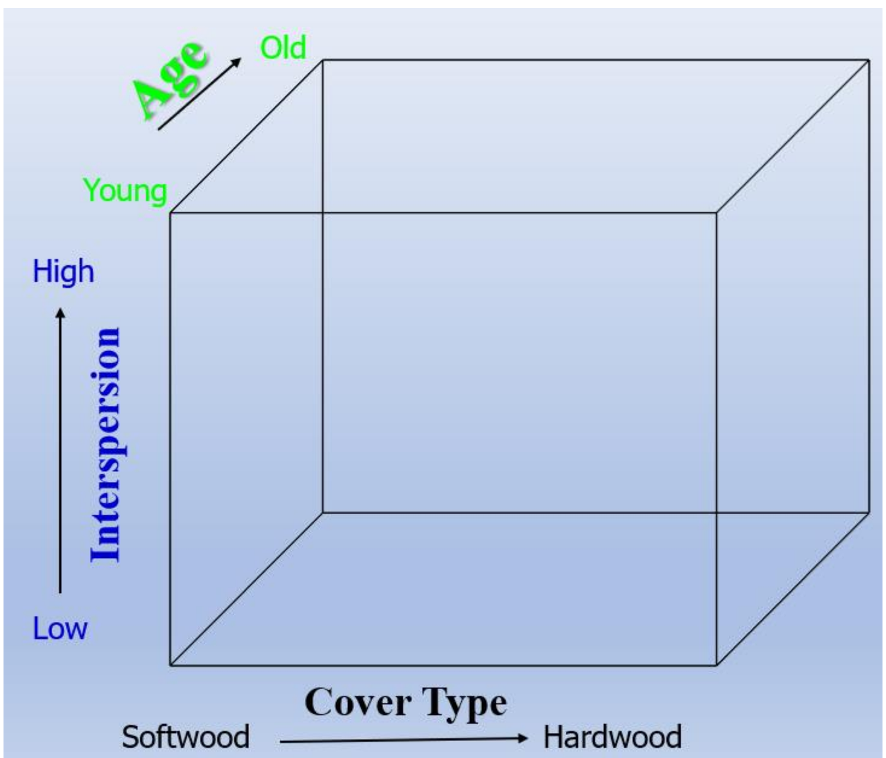


Figure 8.13 3-D box represents the range of biodiversity whose axes are cover type, age class, and interspersion (Rempel *et al*. 2016).

Through bird research that we supported, 17 indicator (focal) bird species have been utilized to identified that occupy different parts of the habitat niche box (Table 8.9). As an example, three of the indicator birds are displayed on the 3-D biodiversity box to emphasize the indicator species concept as it relates to natural range of variation (Figure 8.14).

Table 8.9 17 Coarse-Filter Biodiversity Indicator Bird Species.

Reference number	4 letter bird short form	Common bird name
1	AMRE	American redstart
2	BCCH	Black-capped chickadee
3	BHCO	Brown-headed cowbird
4	BHVI	Blue-headed vireo
5	BOCH	Boreal chickadee
6	BRCR	Brown creeper
7	COYE	Common yellowthroat
8	CSWA	Chestnut-sided warbler
9	GCKI	Golden-crowned kinglet
10	HETH	Hermit thrush
11	OVEN	Oven bird
12	REVI	Red-eyed vireo
13	SWTH	Swainson's thrush
14	VEER	Veery
15	WIWR	Winter wren
16	YBSA	Yellow-bellied sapsucker
17	YWAR	Yellow warbler

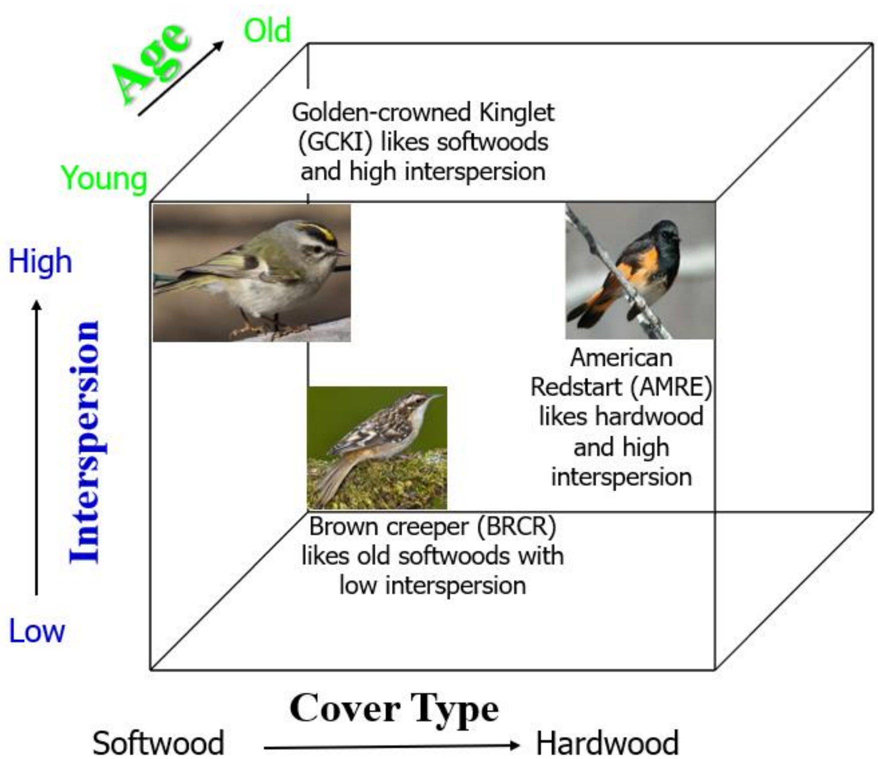


Figure 8.14 Three indicator bird species located on their habitat niches.

Birds that are indicator species can tell us whether we did a good job of emulating the Natural Range of Variation (NRV) through forest planning or not (*i.e.* maintaining habitats and variability of habitats) (Rempel *et al.* 2016). An example of why NRV and ecological processes are necessary to conserve biodiversity - is the informative case study on the linkage of birds to NRV elements is the Kirtland warbler (*Setophaga kirtlandii*) in Michigan, USA. In 1967, the Kirtland warbler was identified as being at risk of extinction. The birds' populations dipped to an all-time low of only 167 pairs in the early 1970's.

The severe population decline was due in part to inadequate habitat as a result of wildfire suppression, which nearly eliminated large areas of young jack pine ecosystems (Michigan DNR 2015), which is represented in the lower left corner of the biodiversity box. Eliminating a natural disturbance factor had significant consequences for many species of animals, plants, and insects who depend on large areas of jack pine ecosystems. This critical missing habitat element of low interspersion (large areas of young jack pine) was identified.

Kirtland's Warbler is now considered a conservation-reliant species since it cannot survive without continued regeneration of its habitat (Michigan DNR 2015). Therefore, intensive habitat management that mimics the regeneration effects of wildfire (primarily harvesting and reforesting jack pine) is a critical part of maintaining the Kirtland's Warbler population. Restoration efforts to re-introduce this critical NRV element was successful in helping Kirtland warbler populations rebound (Figure 8.15). This is the state of Michigan's biggest conservation success story, and illustrates how, in the absence of natural fire, well-designed forest management can contribute to maintaining ecological integrity.

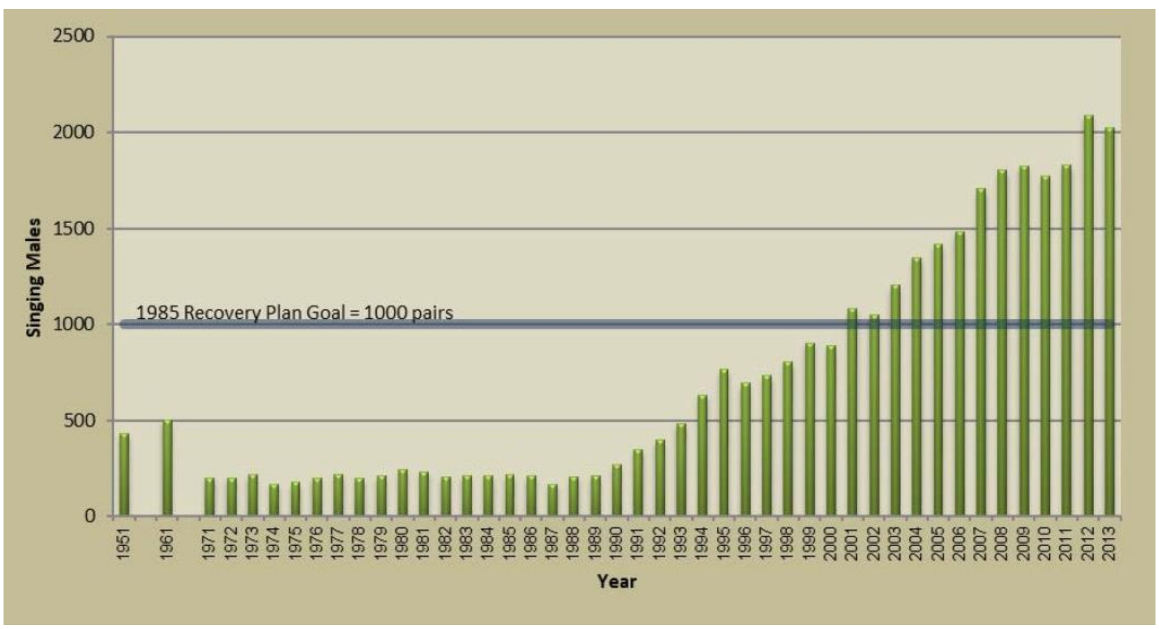


Figure 8.15 Kirtland's warbler range-wide breeding census results 1951 to 2013 (Michigan DNR 2015).

8.3.7.1 Scoping

The scope of the biodiversity cumulative effects section includes the uplands and wetlands in the Duck Mountain. This excludes any management of disturbance in the Duck Mountain Provincial Park backcountry and recreational land use categories. Crown forest in Forest Management Units 10 and 11 are also included. However, all private land is excluded from the biodiversity section.

8.3.7.2 Analysis of Potential Effects

The cumulative effects framework for biodiversity is shown in

Table 8.10. Note that there are many aspects to biodiversity. Most of the biodiversity aspects are coarse-filter biodiversity, or at the landscape-level scale. These include the Natural Range of Variation (NRV) aspects of seral stages (ages), disturbance sizes (interspersion), and cover types (softwoods, mixedwoods, and hardwoods). Please note that all three NRV aspects form the three axes on the biodiversity box. Other coarse-filter potential effects include wetlands and roads. Fine-filter biodiversity is the appropriate scale for bird species-at-risk, such as the Canada warbler.

Table 8.10 Cumulative effects framework for biodiversity.

	ENVIRONMENT		SOCIAL		ECONOMIC	
	Human	Natural	Human	Natural	Human	Natural
PAST biodiversity	Human effects from purposeful burning. Settlement effects from land-clearing for agriculture. Also harvesting softwood for shelters and fencing.	<u>NRV - seral stage</u> historically more wildfire resulted in a younger forest, historical seral stages used as the baseline <u>NRV – disturbance sizes</u> historical disturbance sizes used as the baseline <u>NRV – cover types</u> historical cover types variable				
PRESENT biodiversity	<u>NRV - seral stage</u> presently outside natural state (excessive mature forest) due to successful fire suppression <u>NRV – disturbance sizes</u> currently outside natural state (too small) <u>NRV – cover types</u> current is the baseline					
FUTURE biodiversity	<u>NRV - seral stage</u> estimated to be closer to natural state <u>NRV – disturbance sizes</u> estimated to be closer to natural state <u>NRV – cover types</u> estimated to remain in balance					

8.3.7.3 Bowtie Diagram for Biodiversity

The risks, threats and controls to conserving biodiversity are shown in Figure 8.16. Natural Range of Variation (NRV) or fire emulation at the landscape-level is built into the biodiversity bowtie diagram. NRV is a tool to maintain biodiversity and is not an objective unto itself.

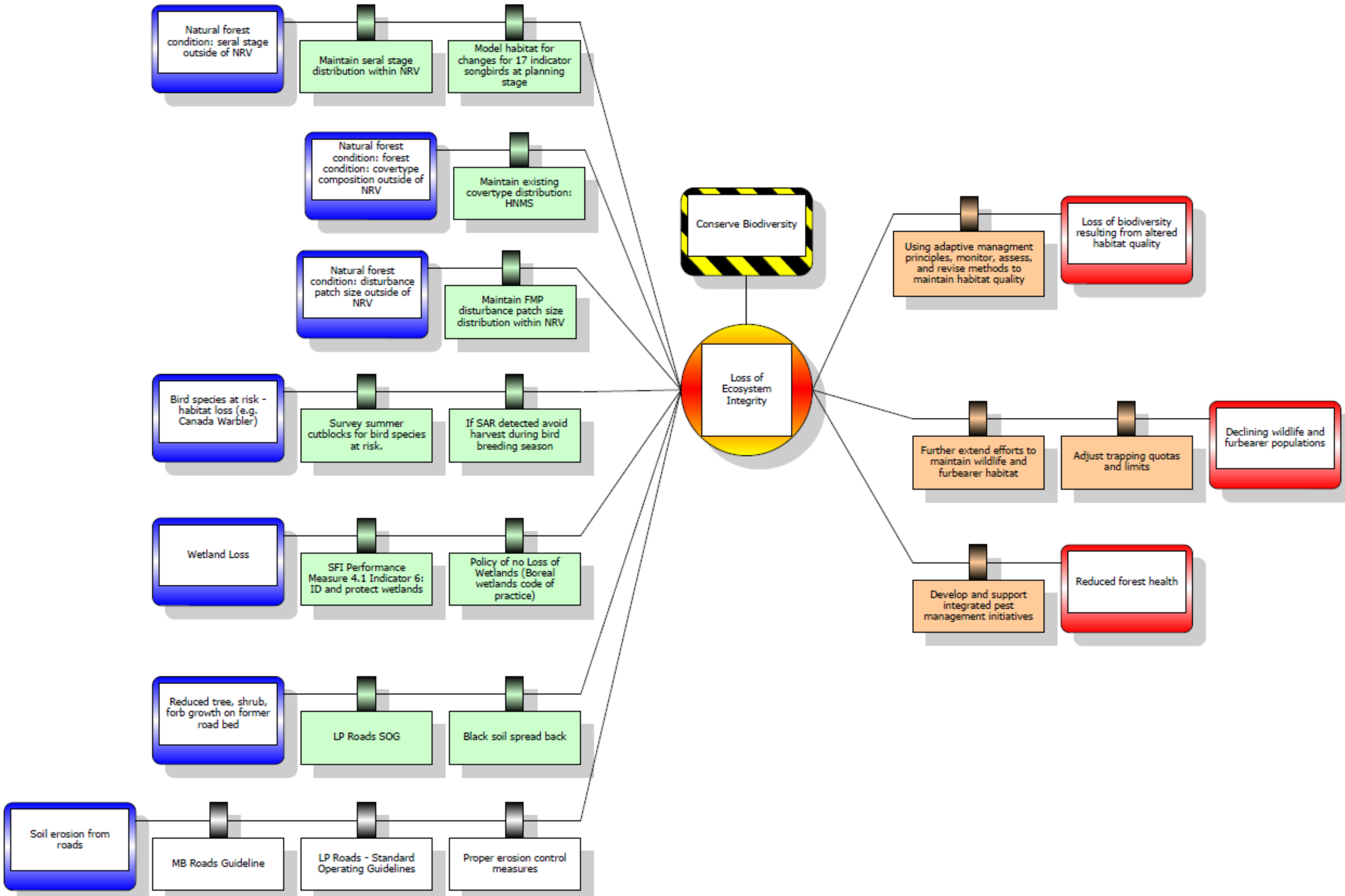


Figure 8.16 Bowtie diagram for conserving biodiversity.

8.3.7.4 Mitigation Strategy

8.3.7.4.1 Proactive

The 20-year Forest Management Plan proactively conserves existing biodiversity by implementing coarse-filter, landscape-level strategies such as implementing Natural Range of Variation (NRV), or fire emulation. NRV elements provide the framework for the three-dimensional 'biodiversity box' which is an indicator system for ecological integrity based on natural disturbance dynamics and indicator species. The indicator species used are the 17 indicator songbirds which each occupy a specific habitat niche (e.g. brown creeper songbird occupies contiguous areas of old softwood).

Variable retention harvest purposefully plans for leaving behind wildlife tree patches, single trees, softwood understory, snags, and buffers. All these elements contribute to maintaining or enhancing biodiversity. Kishkchuk (2018) points out that wildlife retention trees contribute to biodiversity. Wildlife retention trees are planned for in all cutblocks as part of variable retention harvesting, except salvage harvest or sanitation harvest for reducing forest insects or diseases.

Wetlands are biologically diverse systems that provide many valuable ecosystem services. Some of these services include enhancing water quality, maintaining stream flows, sequestering carbon, controlling erosion, and providing habitat to both terrestrial and aquatic species. Through proactive planning, we will not impede hydrologic flow and negatively impact wetlands. Our staff helped create the Ducks Unlimited Canada (2015) wetland crossing field guide, and we continue to utilize it for wetland road crossings.

8.3.7.4.2 Reactive

Fine-filter biodiversity efforts are appropriate to protect bird species-at-risk. Proposed summer harvest blocks are surveyed before each bird breeding season in May, June, and July. If any species-at-risk birds are found, the proposed harvest block does not get harvested until after the bird breeding season is over (*i.e.* August or later).

These proactive and reactive mitigation strategies provide multiple layers of protection for conserving biodiversity in FML #3.

8.3.7.5 Evaluation of Significance

Implementing the 20-year Forest Management Plan will maintain both coarse-filter and fine-filter biodiversity.

8.3.7.6 Monitoring and Follow up

In each Forest Management Plan five-year report, these three coarse-filter biodiversity NRV metrics will be evaluated:

1. Seral stages (area (ha) by young, immature, mature, and old seral stages, compared to the 2020 baseline);
2. Disturbance sizes (area distribution of five years of disturbances compared to the target distribution); and,

3. Cover types (area of hardwood, mixed woods, and softwood cover types, compared to the 2020 baseline.

Operationally, proposed summer harvest blocks are surveyed for bird species-at-risk using acoustical recordings. This survey work occurs before each bird breeding season in May, June, and July.

8.4 VISUAL QUALITY

Aesthetics or visual quality is an important social aspect of forest management. Maintaining the natural beauty or aesthetic value of the forest is a benefit. The visual quality of the forest has the capacity to be positive or negative, depending on the forest's aesthetics. Visual quality of forests is more than just scenery. It includes both ecological aesthetics and long-term sustainability of aesthetics.

Visual quality is difficult to quantify or apply numbers to. However, there are general principles that can be applied. For example, longer lines-of-sight tend to have a greater visual quality. Visual quality needs to be actively managed, mostly at the operational scale or cut block level.

8.4.1 Visual Quality of Natural Disturbances

Natural disturbances of the forest include fire (Figure 8.17), blow down (Figure 8.18), insects or disease (Figure 8.19), and mortality from stands aging (Figure 8.20). These various natural disturbances can change the visual quality of the forest. Sometimes this change can be for the better, but often there is a reduction in visual quality. Fortunately, most reductions in visual quality are temporary. In addition to natural disturbances, beavers (Figure 8.21) have a significant influence on the landscape and affect visual quality.

Figure 8.17 (left) Salt Point 2018 fire– low visual quality. (right) Fire 14 one year after the burn event – improved visual quality.

Figure 8.18 Blow down is a natural disturbance but has a low visual quality.

Figure 8.19 White spruce trees killed from spruce budworm defoliation.

Figure 8.20 Slow but steady individual tree mortality without regeneration affects visual quality in very old stands.

Figure 8.21 (left) beaver activity along a stream; (right) Beaver flooded buffer killed the spruce trees - Drifting River area.

8.4.2 Visual Quality Mitigation of Forest Management Activities

There is no mitigation of visual quality for the above-mentioned natural disturbances and beavers. Forest management activities such as roads, crossings, harvest blocks, and silviculture can be mitigated for visual quality. Almost all the mitigative measures mentioned are operational and site-specific.

8.4.2.1 Forest Roads

Road visual quality is mitigated in several ways, including:

- narrow right-of-way (ROW) where only the road surface is stumped and the ditch portion of ROW is not disturbed by stumping (Figure 8.22 - left). If the ROW is stumped, operations ensure smooth side slopes with 3:1 or less slope (Figure 8.22 - right);
- laying out roads to follow natural boundaries;
- Purposefully adding curves in forestry roads to reduce line of sight.

Figure 8.22 Forest road narrow right of way (left) unstumped; (right) stumped.

In-block roads often have leave clump of live trees adjacent to the road (Figure 8.23) to break up line of sight.

Figure 8.23 Leave clumps beside the in-block road break up the line of sight.

8.4.2.2 Crossings

Water crossings have narrow right-of-way with live trees on each side. Typically, there is a buffer on the water feature in addition to the water crossing (Figure 8.24). These efforts maintain existing visual quality.

Figure 8.24 Narrow right-of-way at a crossing, combined with a buffer.

Decommissioned crossings have vegetative erosion control measures, which restores visual quality (Figure 8.25). The formerly exposed soil is vegetated, serving the dual benefits of erosion control and restoring visual quality.

Figure 8.25 Decommissioned crossing with erosion control.

8.4.2.3 Harvest blocks

The variable retention harvest method with wildlife tree patches (small, medium, and large) combined with single tree retention and softwood understory (if present) protection helps maintain visual quality and mitigate reductions in visual quality. These leave trees and clumps provide immediate mitigation.

Like fire, newly disturbed areas have low visual quality, but after one full growing season the regenerating trees greatly increase the site's visual quality (Figure 8.26). Wildlife tree patches also help maintain the site's visual quality.

Figure 8.26 (left) newly disturbed area– low visual quality. (right) one-year old regeneration provides improved visual quality.

Harvest block buffers can maintain visual quality. Unfortunately, some of the buffers blow down from wind and can decrease visual quality. Buffers generally increase visual quality, such as the buffers on the Crocus Trail and Pike's Peak trail.

Figure 8.27 Live windfirm buffers with high visual quality.

8.4.2.4 Silviculture

Regeneration of both softwood and hardwood with harvest blocks mitigates visual quality within one or two years. This regeneration forms the trees that provide long-term visual quality over the life of the forest stand.

Another visual quality improvement is the green-up requirement for harvesting a block next to a previously harvested block. The trees in the previously harvested block must be at least 3 meters high for hardwood and 2 meters high for softwood before adjacent areas can be harvested, unless provincially approved.

Site preparation that exposes a lot of mineral soil can have negative visual quality, especially the ripper tooth plow. In FML #3, site preparation is minimized in favor or area planting without any site preparation.

8.5 Intact Forests

A principal objective of identifying and maintaining intact forest landscapes in LP's 2019 Forest Management Plan is to maintain biodiversity, ecological processes, and ecosystem services (*i.e.*, ecological integrity), while striking a balance between conservation and protection.

Watson et al. (2018) argue that intact forests holds "significant environmental values relative to degraded forests, including imperiled biodiversity, carbon sequestration and storage, water provision, indigenous culture and the maintenance of human health". Note that forest **conservation** involves a range of activities, tools and approaches to achieve forest health and biodiversity objectives, including in managed forests where harvesting occurs. In contrast, forest **protection** refers to the creation of parks and other areas excluded from development to legally protect them from industrial activity.

As argued by Venier et al. (2018) and Lee (2009), and documented in the Review section below, while identifying and mapping Intact Forest Landscapes (IFLs) as defined by Global Forest Watch (GFW in Fig. 8.28) is useful at a global level to track loss of intact forest (Potapov et al. 2008, Potapov et al. 2017, Watson et al. 2018) and to promote national conservation policies. However, Intact Forest Landscapes' rigid methodology fails to meet the needs of more regional and local conservation planning and decision making. This is evidenced by the Riding Mountain National Park failing to be categorized as an 'intact forest'.

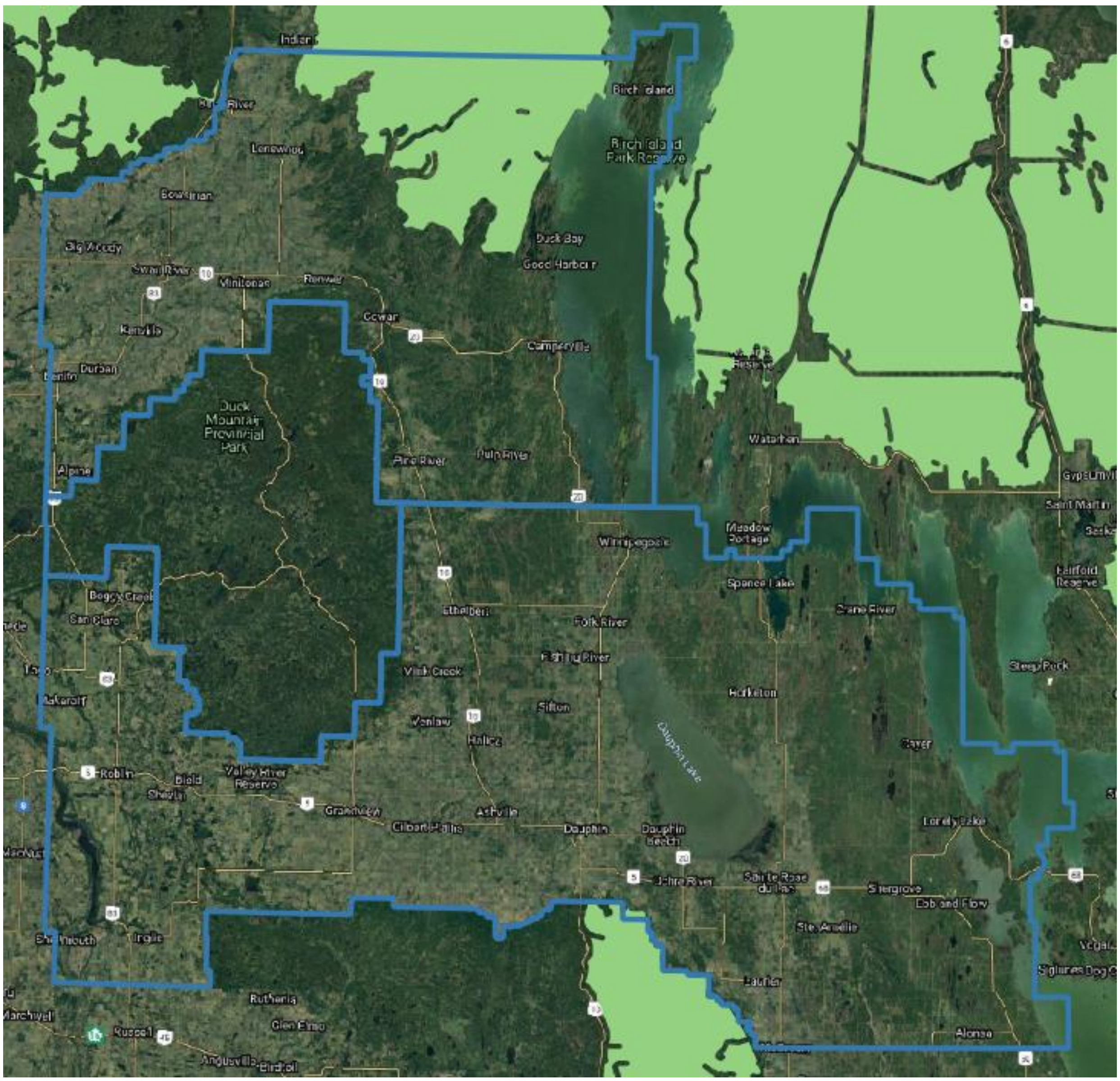


Figure 8.28 Global Forest Watch Intact Forest Landscapes in FML #3 and surrounding area.

A reasonable alternative is to refine and clarify the definition of intact forest to represent a combination and gradient of both impact and ecological values, as illustrated by Global Forest Watch Canada (GFWC) maps of "key ecological values" (Global Forest Watch 2021). For example, GFWC mapped key ecological values using seven key ecological values for all of Canada's intact forest landscapes, including soil organic carbon, species diversity, potential old-growth, and habitat for a key focal species, caribou (Fig. 8.29). Note that this approach expands upon the rigidly defined IFL methodology, and in this example Riding Mountain Park is included in the key ecological values map, whereas it was excluded in the more rigid GFWC IFL map.

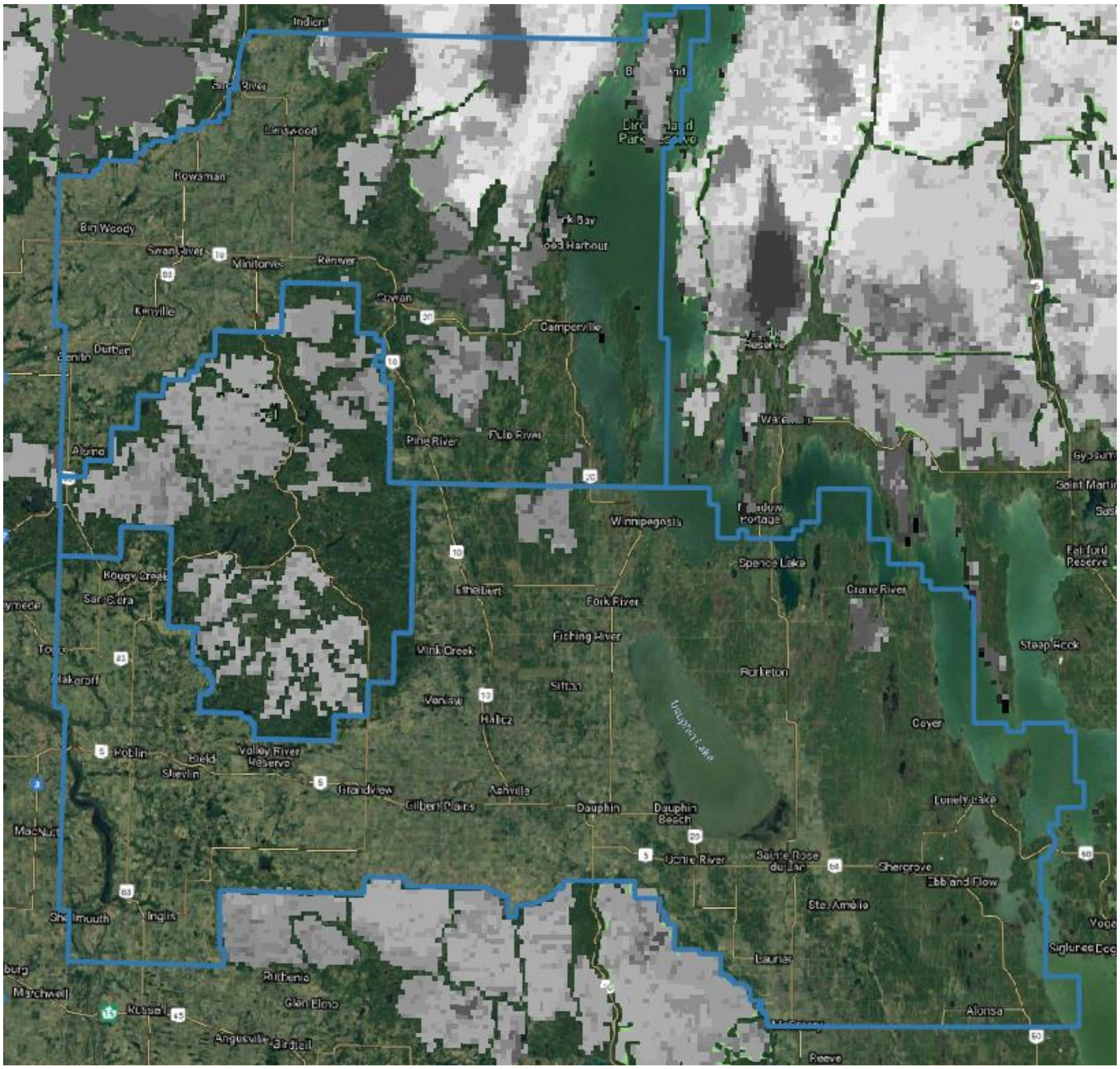


Figure 8.29 Global Forest Watch Canada maps of Intact Forest Landscapes and Key Ecological Values.

Lighter gray = higher ecological value.

link to the GFWC website [Datasets | Data Basin]

8.6 Vegetation

8.6.1 Species of Cultural Importance

We infer that moose are a species of cultural importance. Moose hold cultural significance for many Indigenous peoples who harvest moose as an important traditional food source, social, and ceremonial purposes (Nepinak 2018). The chosen scenario for managing the forest in FML #3 is the 'Moose Emphasis' scenario, described in detail in the FMP's Chapter 5 Scenario Planning.

8.6.2 Plant species at extent of their range.

FML #3 is mostly in the Mid-Boreal Upland Ecoregion, but also has a small section of Aspen Parkland Ecoregion. Plant species that are at the edge of their range are prairie grassland species, that are not found in the forest.

8.6.3 Medicinal Plants

Managing for medicinal plants at a strategic level (200 year period) is best done through coarse-filter biodiversity targets and maintaining existing cover types. This forest management plan uses Natural Range of Variation (NRV) to ensure the FML #3 Licence area maintains a constant supply of seral stage habitat and cover types across the Licence area. Medicinal plants are also managed at the operations level through cutblock and road mitigation, engagement and field work to mitigate site level impacts.

8.6.4 Harvesting and gathering sites that are locally important

Managing for harvesting and gathering sites at a strategic level (200 year period) is also best done through coarse-filter biodiversity targets and maintaining existing cover types. This forest management plan uses Natural Range of Variation (NRV) to ensure the FML #3 Licence area maintains a constant supply of seral stage habitat and cover types across the Licence area. The Kettle Hills is a known gathering site. Gathering sites and other locally important sites are dealt with primarily at the operations level through cutblock and road mitigation, engagement and planning field work.

8.7 Wildlife

8.7.1 Habitat Features including but not limited to nesting, denning and calving sites, molting areas, wintering areas, and mineral licks.

Confidential GIS layer 'Wildlife Points' contains known locations of nests, mineral licks, heritage sites, springs, etc.

Pre-Harvest Surveys find, record, map, photograph, and GPS the location of these habitat features. LP staff also find habitat features during field work.

The LP planner typically assigns an appropriate buffer around habitat features, or excludes the habitat feature from the proposed cut block. The 1989 Forest Management Guidelines for Wildlife and the 2017 Forest Management guidelines for Terrestrial buffers are utilized, as are the LP Biodiversity Standard Operating Guidelines. Buffered or excluded habitat features are then reviewed and mitigated by the local provincial government Integrated Resource Management Team (IRMT).

In addition, there are public open houses in local communities where proposed roads and cutblocks are presented for review, and a Stakeholder Advisory Committee meeting dedicated to reviewing the details of the two-year Operating Plan input. The two-year Operating Plan, which contains these blocks with buffered or excluded habitat features, has Indigenous government-to-government consultation.

8.7.2 Threatened or Endangered aquatic species and habitats

8.7.2.1 Species Listed Under The Endangered Species and Ecosystems Act

https://gov.mb.ca/fish-wildlife/wildlife/ecosystems/index.html
Agriculture and Resource Development | Province of Manitoba (gov.mb.ca) [accessed: April 28, 2021]

Aquatic species are highlighted in blue. To the best of our current knowledge, none of these aquatic species are in FML #3.

8.7.2.1.1 Endangered:

- Baird's Sparrow (*Ammodramus bairdii*)
- Burrowing Owl (*Athene cunicularia*)
- Chestnut-collared Longspur *(Calcarius ornatus)*
- Dusky Dune Moth *(Copablepharon longipenne)*
- Eskimo Curlew (*Numenius borealis*)
- Ferruginous Hawk (*Buteo regalis*)
- Gold-edged Gem *(Schinia avemensis)*

- Ivory Gull *(Pagophila eburnea)*
- Least Bittern *(Ixobrychus exilis)*
- Little Brown Bat *(Myotis lucifugus)*
- Loggerhead Shrike (*Lanius ludovicianus*)
- Mapleleaf Mussel *(Quadrula quadrula) (freshwater)*
    - Found in the Red River and some tributaries, the Assiniboine River, and Lake Winnipeg and some tributaries
- Northern Long-eared Bat *(Myotis septentrionalis)*
- Pale Yellow Dune Moth *(Copablepharon grandis)*
- Peregrine Falcon (*Falco peregrinus*)
- Piping Plover (*Charadrius melodus*)
- Poweshiek Skipperling *(Oarisma poweshiek)*
- Prairie Skink *(Eumeces septentrionalis)*
- Red Knot rufa subspecies (Calidris canutus rufa)
- Ross's Gull (*Rhodostethia rosea*)
- Trumpeter Swan *(Cygnus buccinator)*
- Whooping Crane (*Grus americana*)
- Uncas Skipper (*Hesperia uncas*)
- Verna's Flower Moth *(Schinia verna)*
- White Flower Moth *(Schinia bimatris)*

8.7.2.2 Threatened:

- Boreal Woodland Caribou (*Rangifer tarandus caribou*)
- Chimney Swift *(Chaetura pelagic)*
- Canada Warbler *(Cardellina canadensis)*
- Common Nighthawk *(Chordeiles minor)*
- Dakota Skipper *(Hesperia dacotae)*
- Golden-winged Warble *(Vermivora chrysoptera)*
- Great Plains Toad (*Bufo cognatus*)
- Mule Deer (*Odocoileus hemionus*)
- Olive-sided Flycatcher (*Contopus cooperi*)
- Ottoe Skipper *(Hesperia ottoe)*
- Polar Bear (*Ursus maritimus*)
- Red-headed Woodpecker *(Melanerpes erythrocephalus)*
- Sprague's Pipit (*Anthus spragueii*)
- Short-eared Owl *(Asio flammeus)*
- Whip-poor-will *(Caprimulgus vociferus)*
- Western Hognose Snake *(Heterodon nasicus)*

8.7.2.2 Plants

8.7.2.2.1 Endangered:

- Gastown's Cliffbrake *(Pellaea gastonyi)*
- Gattinger's Agalinis *(Agalinis gattingeri)*
- Great Plains Ladies'-Tresses (*Spiranthes magnicamporum*)
- Rough Agalinis *(Agalinis aspera)*
- Smooth Goosefoot *(Chenopodium subglabrum)*
- Small White Lady's-slipper (*Cypripedium candidum*)
- Western Ironweed *(Vernonia fasciculata)*
- Western Prairie Fringed-orchid (*Platanthera praeclara*)

8.7.2.2.2 Threatened:

- Buffalograss (*Buchloë dactyloides*)
- Culver's-root *(Veronicastrum virginicum)*
- Hackberry (*Celtis occidentalis*)
- Hairy Prairie-Clover (*Dalea villosa*)
- Riddell's Goldenrod (*Solidago riddellii)*
- Western Silvery Aster (*Symphyotrichum sericeum*)
- Western Spiderwort (*Tradescantia occidentalis*)

8.7.3 Aquatic species of conservation concern as defined by the Manitoba Conservation Data Centre

FMP does not contain aquatic species of concern, since forest management does not directly affect aquatic systems. Aquatic and riparian areas are actively avoided during forest operations. When a road must cross a riparian area or wetland, that segment of road is mitigated at the operations level and there are guidelines such as the Provincial Forestry Road Management Guide book (2005) and LP's own Stand Operating guidelines (Appendix 4 in Ch.6 FMP Implementation) and the Ducks Unlimited Road and wetland crossing guide (2014) that are followed.

Conservation and Climate | Province of Manitoba (gov.mb.ca)

[accessed April 28, 2021]

Contains two lists:

8.7.3.1 Plant_mbcdc.xlsx - list of 3,261 plants (last updated Dec 2018). All plants are either lichens, bryophytes or vascular plants. There is no data field for terrestrial vs. aquatic plants.

- https://www.gov.mb.ca/sd/pubs/conservation-data-centre/plant_mbcdc.xlsx

8.7.3.2 Animal_mbcdc.xlsx – list of 635 animals. These are categorized by Amphibian, bird, fish, mammal, and reptile.

- https://www.gov.mb.ca/sd/pubs/conservation-data-centre/animal_mbcdc.xlsx

8.7.4 Aquatic species of cultural importance

Natural Range of Variation (NRV) provides coarse-filter biodiversity, a continuous supply of cover type and seral stage habitat for species of cultural importance across the landscape at all times. Forest management activities should not impact aquatic species.

8.7.5 Aquatic species at the extent of their range

Animal_mbcdc.xlsx – list of 635 animals. These are categorized by Amphibian, bird, fish, mammal, and reptile. No ranges or range maps are provided.

8.7.5.1 https://www.gov.mb.ca/sd/pubs/conservation-data-centre/animal_mbcdc.xlsx
Conservation and Climate | Province of Manitoba (gov.mb.ca)

[accessed April 21, 2021]

8.7.6 Wild Rice Production

There is no known wild rice production within FML #3. Forest operations should not impact aquatic species or habitats.

8.8 Hydro and Natural Gas Distribution Systems

Forest operations avoid both above and below ground utilities. When forest operations are to be conducted nearby a utility buffers and site level plans are created at the operational, work permit level.

Below are links to both the Natural Gas and hydro distribution networks within the Province:

8.8.1 Available Electric Supply Capacity [accessed Apr. 28, 2021]

https://experience.arcgis.com/experience/689a9f8287f54232a1609c9196c568f9/page/home/
Manitoba Hydro Capacity Maps (arcgis.com)

8.8.2 Available Natural Gas Supply Capacity [accessed Apr. 28, 2021]

https://experience.arcgis.com/experience/689a9f8287f54232a1609c9196c568f9/page/page_1/
Manitoba Hydro Capacity Maps (arcgis.com)

8.9 Climate Change

8.9.1 Consideration of Climate Change Impacts, Vulnerabilities, Risks and Opportunities as well as Adaptation

Andrews-Key, S.A. 2020. Climate Vulnerability Assessment Adaptation Business Cases LP Swan River, MB. Public copy has business cases removed – See Appendix 4.

Project Conclusions

The outcomes from this climate vulnerability analysis and adaptation identification will aid in a more structured approach to address climate related impacts and vulnerabilities within LP's Sustainable Forest Management system to be more proactive and less reactive for future management and strategic planning. This work provides a better understanding of the

vulnerabilities and of where to focus efforts to increase adaptive capacity and resilience in management and planning.

Andrews-Key, S.A. and H. W. Nelson. 2020. Northern Prairie Forests Regional Integrated Climate Change Assessment – Vulnerability Assessment Summary Report. Final report to NRCAN. 35 pp.

Project Overview

NRCAN funded project with industrial partners Weyerhaeuser Saskatchewan, Edgewood Forest Products, Spruce Products Ltd., and LP Canada. The vulnerability assessments of the forest industry partners' management areas were completed using a practitioner's guidebook developed through the CCFM that looks at both the adaptive capacity of the organization along with existing and potential climate change impacts, the risks they pose, and where possible how to adapt to those risks. On the basis of the vulnerability assessment, each of the organizations saw the need and had the capacity to begin mainstreaming the results into their forest management plan and their SFM system.

Andrews-Key, S.A., LeBlanc, P.A., and H.W. Nelson. 2021. A business case for climate change adaptation by forest industry in central Canada. Forestry Chronicle (*In Publication* - Presented at the CIF-IFC 2020 National Conference and 112th Annual General Meeting held 15-17 Sept. 2020.).

ABSTRACT

Extreme weather events and increasing climatic uncertainty are already affecting the Canadian forest sector. Climate change projections indicate impacts will likely worsen with increasing risk to forest operations and resources. Despite the calls for adaptation, there is little evidence that adaptation is taking place, whether in terms of planning or practices. Much of the forest industry response to date has been ad hoc and reactive. In contrast, Louisiana-Pacific Canada Ltd. (LP) in Swan Valley, MB decided to proactively address climate impacts and risks. A Climate Vulnerability Assessment (CVA) was completed to review past weather-related disruptions, identify their vulnerabilities to both the current weather extremes and to future climates. Through the help of an independent facilitator, the Canadian Council of Forest Ministers' guidebook was tailored to meet LP's context and needs. The CVA team identified a wide range of possible adaptation options and created business cases for short-listed adaption priorities that LP is beginning to pursue and implement. The outcomes from this effort show what is necessary to support an adaptation process that is mainstreamed into company decision-making procedures and can be applied more broadly across the Canadian forest sector. One key innovation was the incorporation of business cases into the assessment. Identifying and quantifying the expected benefits helped support vulnerability implementation in several different ways. Furthermore, at a more systemic level, the experience identifies the importance local knowledge plays in advancing adaptation action and how these local efforts can contribute towards supporting more effective climate adaptation action across the entire forest management system. This work also contributes to laying the groundwork for future policy focus, integrating science, and management into forest management systems.

Johnston, M. 2020. NORTHERN PRAIRIE FORESTS REGIONAL INTEGRATED CLIMATE CHANGE ASSESSMENT. Prepared for Adaptation Program, Natural Resources Canada. Saskatchewan Research Council. Environment and Biotech Division. Saskatoon, Saskatchewan. SRC Publication No. 14403-E01. 38 pp.

Project Overview

The Manitoba FML #3 forested land base was combined with the Saskatchewan Porcupine and Pasquia Hills, forming a combined forested land base area of 1.7 M ha. Climate data were used to project future climate under RCP 8.5 scenario for temperature, precipitation, and derived variables important to ecosystem function (e.g. frost-free period). A landscape-level forest succession model (LANDIS-II) was used to simulate future natural disturbances. Model outputs included future biomass (projected to increase), fire regime (sometime increases), caribou habitat (inconclusive), and spruce budworm (slightly higher with climate change).

8.9.2 Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation

Extreme weather events and increasing climatic uncertainty are already affecting the Canadian forest sector. Climate change projections indicate impacts will likely worsen with increasing risk to forest operations and resources. Despite the calls for adaptation, there is little evidence that adaptation is taking place, whether in terms of planning or practices. Much of the forest industry response to date has been *ad hoc* and reactive. In contrast, Louisiana-Pacific Canada Ltd. (LP) in Swan Valley, MB decided to proactively address climate impacts and risks. A Climate Vulnerability Assessment (CVA) was completed to review past weather-related disruptions, identify their vulnerabilities to both the current weather extremes and to future climates. Through the help of an independent facilitator, the Canadian Council of Forest Ministers' guidebook was tailored to meet LP's context and needs. The CVA team identified a wide range of possible adaptation options and created business cases for short-listed adaption priorities that LP is beginning to pursue and implement. The outcomes from this effort show what is necessary to support an adaptation process that is mainstreamed into company decision-making procedures and can be applied more broadly across the Canadian forest sector. One key innovation was the incorporation of business cases into the assessment. Identifying and quantifying the expected benefits helped support vulnerability implementation in several different ways.

Furthermore, at a more systemic level, the experience identifies the importance local knowledge plays in advancing adaptation action and how these local efforts can contribute towards supporting more effective climate adaptation action across the entire forest management system. This work also contributes to laying the groundwork for future policy focus, integrating science, and management into forest management systems.

Andrews-Key, S.A., LeBlanc, P.A., and H.W. Nelson. 2021. A business case for climate change adaptation by forest industry in central Canada. Forestry Chronicle (*In Publication* - Presented at the CIF-IFC 2020 National Conference and 112th Annual General Meeting held 15-17 Sept. 2020.).

Andrews-Key, S.A. and H. W. Nelson. 2020. Northern Prairie Forests Regional Integrated Climate Change Assessment – Vulnerability Assessment Summary Report. Final report to NRCAN. 35 pp.

8.9.3 Canadian Council of Forest Ministers Climate Change Task Force: http://www.ccfm.org/english/coreproducts-cc.asp

From NRCAN final report on project

As the climate continues to change, forest ecosystems are experiencing stresses that have not been seen in the past. These changes are affecting many facets of the boreal forests around the world. In Canada, the Canadian Council of Forest Ministers (CCFM) has recommended that it is essential to consider both climate change and future climatic variability in all aspects of sustainable forest management (SFM). Forest policy and management practices need to evolve in the face of a changing climate in order to be sustainable.

In order to address these climatic challenges, a vulnerability assessment was conducted to identify, develop, and mainstream tools for adaptation planning and management of the LP land base.

The vulnerability assessment of the LP's management areas was completed using a practitioner's guidebook developed through the CCFM that looks at both the adaptive capacity of the organization along with existing and potential climate change impacts, the risks they pose, and where possible how to adapt to those risks. Based on the vulnerability assessment, each of the organizations saw the need and had the capacity to begin mainstreaming the results into their forest management plan and their SFM system.

Andrews-Key, S.A. and H. W. Nelson. 2020. Northern Prairie Forests Regional Integrated Climate Change Assessment – Vulnerability Assessment Summary Report. Final report to NRCAN. 35 pp.

8.9.4 Manitoba's Made in MB Climate and Green Plan

Forest Vulnerability Assessment

"Forest Vulnerability Assessment Manitoba's forests face many risks under a changing climate, such as increased damage from fires, insects, droughts or reforestation failures. To prepare and adapt, Manitoba has tested a Climate Vulnerability Assessment framework in some forests of the province. Completing further assessments will identify possible vulnerabilities, but more importantly it will identity potential solutions to ensure our forests stay resilient to a changing climate."

Andrews-Key, S.A. 2020. Climate Vulnerability Assessment Adaptation Business Cases LP Swan River, MB. Public copy has business cases removed.

Andrews-Key, S.A., LeBlanc, P.A., and H.W. Nelson. 2021. A business case for climate change adaptation by forest industry in central Canada. Forestry Chronicle (*In Publication* - Presented at the CIF-IFC 2020 National Conference and 112th Annual General Meeting held 15-17 Sept. 2020.).

Andrews-Key, S.A. and H. W. Nelson. 2020. Northern Prairie Forests Regional Integrated Climate Change Assessment – Vulnerability Assessment Summary Report. Final report to NRCAN. 35 pp.

Shelterbelts and Afforestation

As part of our private land wood purchase program, LP staff will offer shelterbelt, reforestation, or afforestation advice to landowners.

LP is also connected with the Manitoba Forestry Association (MFA), and can refer people to the MFA's many services. LP also helps out the MFA regarding local shelterbelts and afforestation projects.

Wildfire Prevention and Preparedness

A 'wildfire protection and suppression plan' is updated each year and submitted with the FML #3 two-year Operating Plans to the Provincial Government.

Carbon Sequestration

See Ch. 8, section 8.5.5. Carbon Balance; or

Ch. 3 Current Forest Conditions - 3.1.4.3 Carbon in the Soil

Boreal Wetlands Conservation Policy

LP was a significant contributor on the Manitoba Forest Practices Committee, who created the 2020 'Boreal Wetlands Conservation Codes of Practice'.

Best Management Practices

LP staff contributed to the creation and testing of the 2015 Ducks Unlimited Canada Wetland Crossing guide. This guide is consistently used in FML #3.

Ducks Unlimited Canada. 2015. Field Guide Boreal Wetland Classes in the Boreal Plains Ecozone of Canada. Version 1.1. Ducks Unlimited Canada, Edmonton, AB. 92 pp.

8.9.5 Pan Canadian Framework Pan-Canadian Framework (PCF) on Clean Growth and Climate Change

Increasing the use of wood for construction:

LP Building Products is a very strong proponent for increasing the use of wood for construction.

LP is also a member of Forest Products Association of Canada (FPAC), who strongly promote the use of wood as a sustainable and green alternative to steel and cement.

Generating bioenergy and bioproducts:

Some use of hog fuel for bioenergy occurs on FML #3. Both the Spruce Products Ltd. and LP Siding mills use wood waste to generate heat, displacing the use of fossil fuels.

Advancing Innovation:

LP Building Products is an innovative engineered wood products company, with patents on internally developed products such as LP SmartSide panels. Innovative Building & Siding Solutions | LP Building Solutions (www.lpcorp.com)

LP is a member of Forest Products Association of Canada (FPAC), which has a strong emphasis on innovation in the forest industry. For example, wood fiber can be used to produce high strength composite auto parts, green chemicals, 3-D printing, and bio-plastic composites.

Wood Innovation - FPAC | The Forest Products Association of Canada

8.10 CONCORDANCE TABLE

Effects assessment guidelines are listed verbatim in the following table (left column). A concordance or cross-reference to where the required information is found in the Forest Management Plan is in the same table, right column.

8.10.1 Existing Environment

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	**20-Year Forest Management Plan addresses in (Chapter and Section)**
3.1 Biophysical Environment	
a) General climate conditions.	3.1.1 General Climate Conditions
b) Geology, topography, and landforms:	3.1.3 Surficial Geology 3.1.1.12 Landforms 3.1.1.14 Topography
• an enduring features description on a natural region or ecoregion basis, indicating which enduring features are currently contained within the designated lands, and what protection standards and management regime are in place for the sites.	3.1.1.11 Enduring Features Description
c) Air:	3.1.2 Air and Atmosphere
• local air quality.	3.1.2.5 Air Quality Health Index
d) Water:	3.1.8 Water
• streams, rivers, lakes, and surface drainage;	3.1.8.3 Streams and Stream Classification
• wetlands;	3.1.7 Wetlands
• stream classification;	3.1.8.3 Streams and Stream Classification
• water quality that includes nutrients (nitrogen and phosphorus species), organic carbon species, and sediment load;	3.1.8.5 Water Quality
• runoff and infiltration regimes;	3.1.8.9 Runoff and infiltration regimes
• locations of groundwater use when these are within 100 m of logging areas; and	3.1.8.6 Groundwater
• shallow aquifers that may be affected by the harvesting operations (spills from machinery and fuel tanks, road construction, etc.).	3.1.8.8 Shallow Aquifers
e) Soils:	3.1.4 Soils
• soil type and depth, including physical, chemical and biological properties;	3.1.4.1 Soil Mapping
• soil stability as it relates to the potential for erosion;	3.1.4.2 Soil Conservation
• soil structure as it relates to the potential for compaction;	3.1.4.2 Soil Conservation

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
• nutrient status; and	3.1.9 Vegetation 3.1.5.2.2 Non-Forested Wetland Ecosites 3.1.8.4 Water Bodies
• moisture regime.	3.1.4.1.1 Soil mapping in the Forest Lands Inventory Figure 3.1.4 Soil moisture regime classes in the Duck Mountain 3.1.5.2.1 Ecosites 3.1.5.2.6 Eco Elements 3.1.9 Vegetation 3.1.9.2 Forest Lands Inventory
f) Vegetation:	3.1.9 Vegetation
• forest land by site classification (based on soil characteristics and moisture status), age class (including old forests), species, area, and volume;	3.1.9.2 Forest Lands Inventory
• intact forests;	8.5 Intact Forests
• classification and area (km^2) of forest land and non-forested land (use ecological land classification where feasible);	3.1.9.2 Forest Lands Inventory
• plant biodiversity;	3.1.9.5 Vegetation Biodiversity
• threatened or endangered plant species or plant communities;	3.1.9.8 Species at Risk - Vegetation
• species of conservation concern (as defined by the Manitoba Conservation Data Centre: http://www.gov.mb.ca/sd/cdc/consranks.html	3.1.9.8 Species at Risk - Vegetation
MBCDC Species of Conservation Concern	
The term "species of conservation concern" includes species that are rare, disjunct, or at risk throughout their range or in Manitoba and in need of further research. The term also encompasses species that are listed under the Manitoba Endangered Species Act (MBESA), or that have a special designation by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC).	3.1.9.8 Species at Risk - Vegetation
• species of cultural importance;	8.6.1 Species of Cultural Importance
• plant species at the extent of their range;	8.6.2 Plant Species at the extent of their range
• medicinal plants;	8.6.3 Medicinal Plants
• unique and protected ecosystems;	3.1.9.7 Endangered Ecosystems
• unique and non-protected ecosystems; and	3.1.5.2.1 Ecosites Table 3.10 Total and percent area by ecosites, sorted from abundant to rare in the Duck Mountain Provincial Forest and Park.
• unique and non-protected ecosystems; and	3.1.5.2.1 Ecosites Table 3.10 Total and percent area by ecosites, sorted from abundant to rare in the Duck Mountain Provincial Forest and

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
	Park.
-harvesting and gathering sites that are locally important.	8.6.4 Harvesting and gathering sites that are locally important
• Wildlife:	3.1.10 Wildlife
• animal species (birds and mammals, plus available data for micro-organisms, insects, reptiles and amphibians), populations, habitat and seasonal use patterns;	3.1.10.1 List of Mammals
• threatened or endangered animal species and associated habitats;	3.1.10.7 Endangered or Threatened Wildlife species
• species of conservation concern (as defined by the Manitoba Conservation Data Centre: http://www.gov.mb.ca/sd/cdc/consranks.html);	3.1.10.7 Endangered or Threatened Wildlife species
• species of cultural importance;	8.6.1 Species of Cultural Importance
• animal species at the extent of their range;	3.1.10. Wildlife section has list of wildlife species found in FML #3.
• wildlife habitat, including sensitive habitats; and	3.1.9.7 Endangered Ecosystems
habitat features including but not limited to nesting, denning and calving sites, molting areas, wintering areas, and mineral licks. (Note: the locations of these sensitive sites should be kept confidential to protect sensitive resources. The locations should be disclosed only to provincial wildlife staff for direction on mitigation and monitoring actions. However, the effects assessment must describe in detail how harvest and access planning has incorporated the presence of sensitive sites, what mitigation tactics will be employed (in the absence of avoidance, which is preferred), and how their effectiveness will be monitored.	3.1.10.2.2 Moose Habitat 8.7.1 Habitat Features Ch. 6 FMP Implementation Appendix 2 Planning SOG
Aquatic species:	
• aquatic species, specifying non-native [aquatic] species;	3.1.7 Wetlands 3.1.8 Water 3.1.8.4 Waterbodies 3.1.9 Vegetation
• aquatic habitat that sustains or supports, or has a potential to sustain or support fish stocks for commercial, recreational or traditional fishing activities;	3.1.8.2 Rivers 3.1.8.3 Streams 3.1.8.4 Waterbodies
• threatened or endangered aquatic species and habitats;	8.7.2 Aquatic threatened or endangered species and habitats
• [aquatic] species of conservation concern (as defined by the Manitoba Conservation Data Centre: http://www.gov.mb.ca/sd/cdc/consranks.html);	8.7.3 Aquatic species of conservation concern
• aquatic species of cultural importance;	8.7.4 Aquatic species of cultural importance

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
• aquatic species at the extent of their range;	8.7.5 Aquatic species at the extent of their range
3.2 Socioeconomic Environment	
Traditional land and resource use, including:	3.3.1 Traditional Land Use
traditional hunting, fishing for sustenance, trapping, and gathering; and	
a) sacred, ceremonial, and burial sites.	3.3.1 Traditional Land Use
• Local economies and industries in the area.	3.2 Economic and Social Environment
• Local and regional infrastructure, including health care facilities, communities and human habitation, emergency services, and roads.	3.3.2 Transportation Health care facilities – there are hospitals in Dauphin, Swan River, and Roblin. 3.2.1 Economic Geography of the Parklands Region (list of communities) Emergency services – listed in each year's fire plan in the two-year Operating Plans.
b) Community values (aesthetic, visual landscape, cultural and spiritual sites, as well as traditional lifestyles).	3.2.7 Economic Profile of the Town of Swan River
c) Employment.	3.2.6 Employment
d) Wild rice production.	8.7.6 Wild Rice Production
e) Mining claims and leases.	3.3.5 Mining Claims and Leases
f) Hydro and natural gas distribution systems.	8.8 Hydro and Natural Gas Distribution
g) Commercial trapping, including existing trapper's trails.	3.3.6 Commercial Trapping
h) Commercial guiding.	3.3.7 Commercial Guiding
i) Commercial fishing, including existing fishermen's portages.	3.3.7 Commercial Guiding
j) Recreational hunting and fishing, including existing recreational portages.	3.3.9.3 Recreational Fishing 3.3.9.4 Licenced Hunting
k) Crown Lands.	3.3.3 Crown and Private Lands
l) Parks and special places:	3.3.9.2 Parks and Special Places
m) Provincial Parks;	3.3.9.5 Campgrounds
n) ecological reserves;	3.3.9.2 Parks and Special Places
• protected areas;	3.3.9.2 Parks and Special Places
• wildlife management areas;	3.3.9.2 Parks and Special Places
• unique or sensitive areas;	3.3.9.2 Parks and Special Places
• any adjacent protected areas (including protected private lands);	3.3.9.2 Parks and Special Places
• areas of special interest;	3.3.9.2 Parks and Special Places
• designated Crown lands (i.e. wildlife refuges, special	3.3.3 Crown and Private Lands

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
conservation areas, and community pastures); and	
• lands under conservation easement or owned by conservation agencies and managed for conservation purposes.	3.3.9.2 Parks and Special Places
• Recreation, including campgrounds and trails (i.e. hiking, ATV, snowmobile).	3.3.9.5 Campgrounds 3.3.9.1 Recreational Trails
• Tourism, including remote lodges and out camps.	3.3.9 Tourism
o) Wildlife outfitting.	3.3.6 Commercial Trapping 3.3.7 Commercial Guiding 3.3.8 Commercial Fishing
p) Public, non-commercial use of forest resources, including:	
q) hunting, trapping, and fishing;	3.3.9.3 Recreational Fishing 3.3.9.4 Licenced Hunting
r) local use of timber; and	3.3.10 Non-Timber Forest Products
• all other non-harvesting forest uses.	3.3.11 Local Use of Timber
• Heritage and cultural resources, including sites or objects of archaeological, paleontological, historical or architectural value, as well as burial sites.	3.2.10 Non-Timber Forest Products
• Highways and roads.	2.3.3 Road Status
s) Hiking, skiing, mountain bike, canoe routes, and snowmobile trails.	3.3.9.1 Recreational Trails 3.3.9.1.7 Cross-country Skiing 3.3.9.1.8 Mountain Biking 3.3.9.1.9 Canoe Routes
t) Existing agreements and claims, including:	
co-management agreements;	3.3 Land Use
u) treaty land entitlements;	3.3. Land Use 3.3.1 Traditional Land Use
• Indigenous/specific land claims; and	3.3. Land Use 3.3.1 Traditional Land Use
• Crown land designations.	3.3.3. Crown and Private Lands
• Demographics:	
• general population measures and trends; and	3.2.2. Population Trends
v) settlement patterns.	3.2.2. Population Trends
• Public and workplace health.	3.2. Economic and Social Environment
3.3 Past and Existing Forest Management Activities	

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
Forestry road system:	
Location, description, and status of existing all weather and seasonal access forestry roads;	
a) current reclamation and decommissioning of all weather and seasonal access forestry roads; and	2.3 Road Construction, Access Management, and Decommissioning
• former road decommissioning success.	2.3.6 Road Decommissioning Success
• Water crossings:	2.4 Water Crossings
• location, type, and condition of existing water crossings; and	2.4.3 Water Crossing Types
b) former water crossing decommissioning success.	2.4.7 Water Crossing Decommissioning Success
• Harvesting practices and associated activities:	2.6 Harvesting Practices and Associated Activities
• past and current harvest areas, including shape, size, harvest methods and equipment used, leave areas, in-block structure retention, riparian management areas, and buffers;	2.5.1. Harvest Shape 2.5.2. Leave Areas 2.5.3. Riparian Management Areas 2.5.4. Buffers 2.5.5. Harvest Methods 2.5.6. Harvest Area
c) species, volumes (compare to Annual Allowable Cut);	2.5.7. Harvest Volumes
• wood storage and processing areas;	2.6.2 Wood Storage and Processing Areas 8.2.1 Major Wood Storage Areas 8.2.2 Major Wood Processing Areas
• storage, handling, and disposal of hazardous, non-hazardous, domestic, and recyclable solid and liquid waste, both on-site and off-site; and	2.6.3 Storage, handling, and disposal of hazardous, non-hazardous, domestic, and recyclable solid and liquid waste
• logging camps, included associated water supplies and wastewater storage and disposal.	2.6.4 Logging camps included associated water supplies and wastewater storage and disposal
• Silvicultural practices:	2.7 Forest Renewal
• site preparation practices;	2.7.2 Scarification and Site Preparation Practices
d) forest renewal methods and regeneration success;	2.7.5 Regeneration Success
• pesticide application, including type and volume used, methods of application, and measures to protect human health, non-target species and the environment.	2.7.6.3 Stand Tending - Methods of Application
• History of natural disturbances (including fire, insects, disease, and blowdown from large wind events) and regeneration of these areas.	2.2 Natural Disturbance
• Forestry and ecological research:	2.8 Research & Monitoring
e) tree improvement program;	6.3.3.1 Forest Renewal Operating Practices
f) methods testing, including harvesting methods, site preparation methods, and site improvement	2.7.2 Scarification and Site Preparation Practices

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018	20-Year Forest Management Plan addresses in (Chapter and Section)
techniques; and	
• research programs such as monitoring programs, forest succession research, pesticide research, etc.	2.8.1 Collaborative Research Projects

8.10.2 Project Description

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	**Forest Management Plan addresses in (Chapter and Section)**
a) Road access:	
• location and description of forestry access roads;	5.7.3.2 Road Network – Active 5.8. Comparison of Baseline and Moose Emphasis Scenarios 5.8.3.2 Roads Comparison between scenarios Figure 5.51 Moose Emphasis Scenario has less roads (full page map of roads in the Duck Mountain Provincial Forest -1:300,000 scale.
• construction methods;	2.3 Road Construction, Access Management, and Decommissioning Ch.6 FMP Implementation - Appendix 4: Forest Roads and Crossings Standard Operating Guidelines (Operational-level guidance) Province of Manitoba Forest Practices Committee's 2017 'ROAD AND CROSSING MANAGEMENT GUIDELINES'
• plans for access management;	2.3.4 Access Management 6.3.2.4 Access Management Province of Manitoba Forest Practices Committee's 2017 'ROAD AND CROSSING MANAGEMENT GUIDELINES'
• [road] maintenance activities, and	Ch.6 FMP Implementation - Appendix 4: Forest Roads and Crossings Standard Operating Guidelines (Operational-level guidance) Resource Roads and Wetlands: A Guide for Planning, Construction and Maintenance" (2016) Ducks Unlimited Canada
• short and long term decommissioning and reclamation.	2.3.5 Road Reclamation and Decommissioning 2.3.6 Road Decommissioning Success Ch.6 FMP Implementation - Appendix 4: Forest Roads and Crossings Standard Operating Guidelines Province of Manitoba Forest Practices Committee's 2017 'ROAD AND CROSSING MANAGEMENT GUIDELINES'
b) Water crossings:	
• location and type of water crossings; and	2.4.1 Water Crossing Locations 2.4.3 Water Crossing Types 6.3.2.3 Road Related Activities Ch.6 FMP Implementation - Appendix 4: Forest Roads and Crossings Standard Operating Guidelines

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
	Resource Roads and Wetlands: A Guide for Planning, Construction and Maintenance" (2016) Ducks Unlimited Canada
• Water Crossing decommissioning.	2.4.5 Water Crossing Decommissioning 2.4.6 Water Crossing Inspections 2.4.7 Water Crossing Decommissioning Success Ch.6 FMP Implementation - Appendix 4: Forest Roads and Crossings Standard Operating Guidelines (Operational-level guidance)
c) Harvesting practices and associated activities:	
• harvesting methods, including methods to protect understory;	2.6. Harvesting Practices and Associated Activities 2.6.1. Harvest Equipment Used 2.5.2. Leave Areas 2.5.5.4. Understory Softwood 6.3.1.5 Understory Protection Approaches
• operating/cutting area design, including shape, size, harvest methods and equipment to be used, leave areas, in-block structure retention, riparian management areas, and buffers;	2.5. Planning and Harvesting 2.5.1. Harvest Shape 2.5.2. Leave Areas 2.5.3. Riparian Management Areas 2.5.4. Buffers 2.6. Harvesting Practices and Associated Activities 2.6.1 Harvest Equipment Used
• wood storage and processing areas; *(duplicate from 3.3c above)*	2.6. Harvesting Practices and Associated Activities 2.6.2 Wood Storage and Processing Areas 8.2.1 Major Wood Storage Areas 8.2.2 Major Wood Processing Areas
• storage, handling, disposal or reuse of hazardous, non-hazardous, domestic, and recyclable solid and liquid waste, both on-site and off-site; and *(duplicate from 3.3c above)*	2.6.3 Storage, handling, and disposal of hazardous, non-hazardous, domestic, and recyclable solid and liquid waste
• logging camps, included associated water supplies and wastewater, and decommissioning. *(duplicate from 3.3c above)*	2.6.4 Logging camps included associated water supplies and wastewater storage and disposal
d) Silvicultural practices:	
• site preparation practices;	2.7.2. Scarification and Site Preparation Practices Ch.6 FMP Implementation - Appendix 7: Swd Silviculture SOP 6.3.3.1 Forest Renewal Operating Practices
• forest renewal method, including natural regeneration and assisted regeneration, and supporting activities such as seed collection and tree	2.7.4.1. Leave-For-Natural 2.7.4.3. Natural Regeneration from Seed

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
improvement operations;	Ch.6 FMP Implementation - Appendix 6: HWD SILVICULTURE SOG 2.7.4.2. Planting Ch.6 FMP Implementation - Appendix 7: SWD SILVICULTURE SOG Ch.2 Report of Past Operations 2.7.1. Cone Collection 6.3.3.1 Forest Renewal Operating Practices
• [silvicultural] methods to maintain and protect biodiversity;	6.3.3.1 Forest Renewal Operating Practices Ch.6 FMP Implementation Appendix 3: Biodiversity Standard Operating Guidelines
• stand tending, including thinning and pruning; and	6.3.3.1 Forest Renewal Operating Practices Ch.6 FMP Implementation - Appendix 6: HWD SILVICULTURE SOG Ch.6 FMP Implementation - Appendix 7: SWD SILVICULTURE SOP
• pesticide application, including type, methods of application, and measures to protect human health, non-target species and the environment.	2.7.6. Stand Tending 2.7.6.1. Type of Herbicide Used 2.7.6.3. Methods of Application 2.7.6.4. Measures to Protect Human Health 2.7.6.5. Measures to protect Non-Target Species 2.7.6.6. Measures to protect the Environment
e) Climate Change:	
• consideration of climate change impacts, vulnerabilities, risks and opportunities as well as adaptation of importance to the forestry sector as provided in:	8.9.1 Consideration of Climate Change Impacts, vulnerabilities, risks and opportunities as well as adaptation Ch.9 Effects Assessment Appendix 4 – Climate Vulnerability Assessment LP Swan Valley, MB
○ the NRCan publication “Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (See Chapter 3, pp. 70-74): https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter3-Natural-Resources_Eng.pdf;	8.9.2 Canada in a changing climate
○ Canadian Council of Forest Ministers’ Climate Change Task Force (CCFM-CCTF): http://www.ccfm.org/english/coreproducts-cc.asp;	8.9.3 Canadian Council of Forest Ministers’ Climate Change Task Force
○ Manitoba’s new Made-in-Manitoba Climate and Green Plan (pp. 44-46): http://mopia.ca/wp-content/media/2017-climategreenplandiscussionpaper.pdf; and	8.9.4 Manitoba’s new Made in Manitoba Climate and Green Plan
○ Pan-Canadian Framework (PCF) on Clean Growth and Climate Change (see pp. 22-23 including but not limited to PCF carbon offset	3.5 Forestry, agriculture, and waste

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
framework that may be put in place).	3.1.4.3 Carbon in the Soil 8.5.5. Carbon Balance 8.9.5 Pan Canadian Framework on Clean Growth and Climate Change
f) Forestry and ecological research.	2.8 Research and Monitoring 7.2 Existing Monitoring 7.3 Five Year Report Monitoring

8.10.3 Sustainability Assessment

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	**Forest Management Plan addresses in (Chapter and Section)**
Although the principles of sustainable development should be addressed throughout the effects assessment, specific information is requested on the following:	
a) Evaluate how the proposed harvesting and regeneration practices will:	
• impact the forest age class structure and distribution at the landscape level;	3.1.9.4.2 Inventory Age 5.8.3.5 Natural Range of Variation
• protect the understory component (when present) of forest stands; and	Ch.6 FMP Implementation Appendix 2 – Planning SOG Ch.6 FMP Implementation Appendix 3 – Biodiversity SOG Ch.6 FMP Implementation Appendix 5 – Forest Operations SOG 6.3.1.5 Understory Protection Approaches
• produce a forest that will support ongoing harvesting at the proposed rate, for the long term.	5.6.2.1 Harvest Volume Levels by FMU and product
b) Evaluate whether sustainability of all forest values, including ecosystems and biological diversity, can be achieved in light of the proposed harvesting and regeneration practices, and proposed mitigation and protection measures.	5.6 Baseline Scenario Outputs 5.7 Moose Emphasis Scenario Outputs 5.8 Comparison of Baseline and Moose Emphasis Scenarios
c) With respect to sustainability, assess the sensitivity of the preferred management approach to significant uncertainties such as:	
• increased or decreased amounts of natural disturbance (i.e. fire, wind, insects and disease); and	5.3 No Harvest Modeling 5.8 Comparison of Baseline and Moose Emphasis Scenarios
• the influence of climate change.	8.9 Climate Change

8.10.4 Mitigation

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	**Forest Management Plan addresses in (Chapter and Section)**
Mitigation Measures	
Describe any steps that will be taken to avoid, eliminate, or reduce any effect identified by the Environmental Assessment, or to sensitive areas that may be identified in the future.	7.2 Existing Monitoring 7.3 Five-year FMP Monitoring 7.4 Future Monitoring 8.3.2 Bowtie Risk Assessment Overview 8.3.4 Watersheds 8.3.5 Carbon balance 8.3.6 Moose 8.3.7 Biodiversity
This should include whether the proposed forestry practices will conform to the policies and principles encompassed in provincial and federal documents related to forestry best practices, and climate change.	7.2.8 Forest Certification Audits
Discuss how past success and lessons learned influenced the selection of mitigation measures.	2.8 Research and Monitoring 4.6.1 Stakeholder Advisory Committee Meetings Appendix 2 Planning SOG Appendix 3 Biodiversity SOG Appendix 4 Forest Roads and Crossings SOG Appendix 5 Forest Operations SOG Appendix 6 Hardwood Silviculture SOG Appendix 7 Softwood Silviculture SOP 7.2.8 Forest Certification Audits
Mitigation of any effect may involve identification of areas where timber harvesting cannot occur until a more detailed assessment is complete, or where constraints are such that no timber harvesting should take place.	5.5 Baseline Scenario Development Controls
It may also involve changes to scheduling and/or location as well as alternative methods and options for: • road construction, access management, retirement and reclamation; • harvesting practices and associated activities; • silvicultural practices; • forest protection practices; • local employment and training; and • research projects.	6.1 Overview to Implementing the FMP
The effects assessment should also include a description of proposed measures to adjust forest management activities for any changes to the land base that may result from a land use review under The Provincial Parks Act.	5.5 Baseline Scenario Development Spatial Controls 6.1 Overview to Implementing the FMP

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
Mitigation Plans	
The following plans must be submitted with the effects assessment in draft form:	
a) **Access management plan**: to address how existing and new access will be managed to avoid impacts to wildlife (developed in consultation with the Wildlife and Fisheries Branch and Regional Wildlife staff of Manitoba Sustainable Development);	2.3.4 Access Management Ch.6 FMP Implementation Appendix 4 Forest Roads and Crossings SOG 6.3.2.4 Access Management Province of Manitoba Forest Practices Committee's 2017 'ROAD AND CROSSING MANAGEMENT GUIDELINES'
b) **Cultural and heritage resources management plan**: for the identification, mitigation, and monitoring of cultural and heritage resources.	Ch.6 FMP Implementation Appendix 2 Planning SOG.

8.10.5 Residual Effects

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
Describe any effect which cannot be prevented, eliminated, or mitigated, and outline any planned compensation programs.	7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring

8.10.6 Monitoring and Research

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	Forest Management Plan addresses in (Chapter and Section)
Monitoring Plan	
Provide a draft monitoring plan, developed in consultation and cooperation with Manitoba Sustainable Development, which includes a description of the plans for:	Ch 7 – Monitoring Framework
a) collection of baseline data;	Ch.3 Current Forest Conditions Ch.5 Scenario Planning
b) studies that may be required to clarify uncertainties regarding any effect of proposed activities;	7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring
c) programs to determine the effectiveness of recommended mitigation measures;	7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring
d) monitoring that may be required to fill any data gaps with respect to the biophysical environment, socioeconomic environment, and existing and past forest management activities; and	7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring
e) sharing of data and reporting of results to Manitoba Sustainable Development *[currently ARD-Agriculture and Resource Development].*	6.2 Strategic linkages to the Operating Plan 7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring
Research	
Describe any research which may be required to inform adaptive management processes.	7.1.1 Adaptive Management 7.3 Five Year Report FMP Monitoring 7.4 Future Monitoring

8.10.7 *Public Input*

Draft Guidelines for the Preparation of an Effects Assessment for a Twenty-Year Forest Management Plan for Forest Management Licence Area # 3 – May 2018 (draft version)	**Forest Management Plan addresses in (Chapter and Section)**
Describe plans to inform the public, Indigenous communities, and resource users of all future forest management activities in the areas managed by the FMP, and ways in which their concerns will be addressed. Include mechanisms to allow public input from affected resource users, e.g. community monitoring committee.	4.1 Communication Plan 4.2 Community summary report of communications 4.3 Community-specific summaries of communications 4.4 Communities with no concerns 4.5 Communities who did not engage 4.6 Stakeholder Advisory Committee – Summary Report of Communications 4.7 Public Information Sharing and Engagement 4.8 Changes and Improvements from all sources of Input 4.9 Conclusions 4.10 Literature Cited 4.11 Appendices

8.11 LITERATURE CITED

Andison, D.W. 2019. Synthesis Report. Pre-Industrial Fires Regimes of the Western Boreal Forest. fRI Research Healthy Landscapes Program, Hinton, AB. 49 pp.

Ducks Unlimited Canada. 2014. Operational Guide – Forest Road Wetland Crossings. v 1.0. Edmonton, AB. 43 pp.

Ducks Unlimited Canada. 2015. Field Guide Boreal Wetland Classes in the Boreal Plains Ecozone of Canada. Version 1.1. Ducks Unlimited Canada, Edmonton, AB. 92 pp.

Government of British Columbia. 2016. Cumulative Effects Framework Interim Policy for the Natural Resource Sector. 30 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/cef-interimpolicy-oct_14_-2_2016_signed.pdf [accessed Mar. 22, 2021]

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency, Hull, Quebec. 49 pp. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/cumulative-effects-assessment-practitioners-guide.html. [accessed Mar. 22, 2021]

Global Forest Watch Canada. 2017. Canada's Intact Forest Landscapes Updated to 2013. Canada's Intact Forest Landscapes Updated to 2013 | Data Basin https://databasin.org/datasets/a1d3559466574164a4f99be6a2445cea/ [accessed Apr. 15, 2021].

Global Forest Watch. 2021. Combined conservation value within Canada's intact forest landscapes. <https://databasin.org/datasets/2d9fcca2dcba406ea1b257df3c4bc376/ >. [Accessed April 6th, 2021].

Johnston, M. 2005. Carbon yield curves for Duck and Porcupine Provincial Forests of Manitoba. Saskatchewan Research Council. Saskatoon, SK. 13 pp.

Johnston, M., LeBlanc, P.A., Coote, J., Badiou, P., Guindon, J. and P. Whittington. 2019. Developing Methodologies and Estimates of Carbon Sequestration in Upland Forests and Wetlands on SFI-Certified Boreal Forest Landscapes. Benchmark #8: Final Report. Prepared for Sustainable Forestry Initiative, Conservation Grants Program. Saskatchewan Research Council Publication No. 13974-1E19. 20 pp.

Lee, P. 2009. Caution against using intact forest-landscapes data at regional scales. Ecology and Society 14.

Kishchuk, B.E., Creed, I.F., Laurent, K.L., Nebel, S., Kreutzweiser, D., Venier, L. and K. Webster. 2018. Assessing the ecological sustainability of a forest management system using the ISO Bowtie Risk Management Assessment Tool. 2018, VOL. 94, No 1. The Forestry Chronicle. Pp. 25 – 34.

Manitoba Clean Environment Commission. 2020. Forest Management Plan Approval Process. Clean Environment Commission. 305-155 Carlton St. Winnipeg, Manitoba, R3C 3H8. 115 pp.

Manitoba Conservation and Water Stewardship. 2012. Forestry Road Management. Forestry Branch. 200 Saulteaux Crescent, Winnipeg, Manitoba R3J 3W3. 24 pp.

Manitoba Conservation and Water Stewardship. 2015. Biomass management. Forest Practices Guidebook. Forestry Branch. 200 Saulteaux Crescent, Winnipeg, Manitoba R3J 3W3. 19 pp.

Manitoba Sustainable Development. 2017. Forest Management Guidelines for Terrestrial Buffers. Forestry Branch. 200 Saulteaux Crescent, Winnipeg, Manitoba R3J 3W3. 22 pp.

Michigan Dept. Natural Resources. 2015. Kirtland's Warbler Breeding Range Conservation Plan. U.S. Fish and Wildlife Service, U.S. Forest Service. 133 pp.

Natural Resources Canada. 2007. Is Canada's Forest a Carbon Sink or Source? Canadian Forest Service. Forest Science-Policy Notes. Oct. 2007. Fo93-1/2-2007E-PDF. 2 pp.

Natural Resources Canada. 2020. State of Canada's Forests. Annual Report 2020, 30th Anniversary Issue. Natural Resources Canada. 88 pp. https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/state-canadas-forests-report/16496

Nepinak, T. 2018. Moose Management in Manitoba. First Nations Elder's Guidance report to Louisiana-Pacific Canada Ltd. 13 pp.

Potapov, P., A. Yaroshenko, S. Turubanova, M. Dubinin, L. Laestadius, C. Thies, D. Aksenov, A. Egorov, Y. Yesipova, and I. Glushkov. 2008. Mapping the world's intact forest landscapes by remote sensing. Ecology and Society 13.

Potapov, P., M. C. Hansen, L. Laestadius, S. Turubanova, A. Yaroshenko, C. Thies, W. Smith, I. Zhuravleva, A. Komarova, and S. Minnemeyer. 2017. The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013. Science advances 3:e1600821.

Rempel, R.S., Naylor, B.J., Elkie, P.C., Baker, J., Churcher, J. and M.J. Gluck. 2016. An indicator system to assess ecological integrity of managed forests. Ecological Indicators. 60 (2016) 860–869.

Seedre, M. and H.Y.H. Chen. 2010. Carbon dynamics of aboveground live vegetation of boreal mixedwoods after wildfire and clearcutting. Can. J. For. Res. 40: 1862–1869 (2010) doi:10.1139/X10-120.

Venier, L. A., R. Walton, I. D. Thompson, A. Arsenault, and B. D. Titus. 2018. A review of the intact forest landscape concept in the Canadian boreal forest: its history, value, and measurement. Environmental Reviews 26:369-377.

Watson, J.E.M., Evans, T., Venter, O. 2018. The exceptional value of intact forest ecosystems. Nature Ecology and Evolution 2, 599–610 (2018). https://doi.org/10.1038/s41559-018-0490-x

Winder, R., Stewart, F.E., Nebel, S., McIntire, E.J.B., Dyk, A. and K. Omendja. 2020. Cumulative Effects and Boreal Woodland Caribou: How Bow-Tie Risk Analysis Addresses a Critical Issue in Canada's Forested Landscapes. Front. Ecol. Evol., 04 February 2020 | https://doi.org/10.3389/fevo.2020.00001

Zabihi-Seissan, S. 2018. Validation of the Moose Habitat Resource Selection Function using Forest Management Data in the Duck Mountain Area. Prepared for: Government of Manitoba. October 31, 2018. 38 pp.

8.12 APPENDICES

APPENDIX 1: Local air quality – forestry CO_2 estimates.

HARVEST_SEASON	Loaded Distance (km)	Total distance travelled (km)	Comments and *assumptions*
2018-19	1,300,802	2,601,604	LP scale data
2019-20	870,382	1,740,764	LP scale data
2020-21	1,159,411	2,318,822	LP scale data
3-year average		**2,220,397**	
			Haul trucks consume 40 liters of diesel per 100 km
		888,159	Annual total liters diesel fuel
			2.62 kgs of carbon dioxide per liter of diesel fuel
		2,326,976	kg of CO_2 annual emissions
		2,327	tonnes of CO_2 annual emissions
		0.002	M tonnes of CO_2 annual (hardwood haul)
		0.002	M tonnes of CO_2 annual (softwood haul)
		0.004	**M (million) tonnes of CO_2 annual FML #3 total**

APPENDIX 2: Local air quality – agriculture CO2 estimates.

how much diesel fuel is used to grow annual crops in MB is found in:
Cost of Production spreadsheets on the Agriculture and Resource Development website:
https://www.gov.mb.ca/agriculture/farm-management/production-economics/cost-of-production.html
use 25 liters of diesel fuel per acre of cropland

Rural Municipality	Annual Cropland Area (ha)	Annual Cropland Area (acres)	Est. annual diesel fuel (25 liters per acre)	kg of CO_2 annual emissions	M tonnes of CO_2 (annually)	Comments
Swan River	91,582	226,208	5,655,189	14,816,594	0.015	
Minitonas	59,839	147,802	3,695,058	9,681,053	0.010	
Mountain North	23,374	57,734	1,443,345	3,781,563	0.004	
Mountain South	10,832	26,755	668,876	1,752,455	0.002	
Ethelbert	16,932	41,822	1,045,551	2,739,344	0.003	
Mossey River	20,863	51,532	1,288,290	3,375,320	0.003	
Shell River	39,161	96,728	2,418,192	6,335,662	0.006	
Shellmouth-Boulton		-	-	-	*0.005*	est. avg
Hillsburg		-	-	-	*0.005*	est. avg
Grandview	51,701	127,701	3,192,537	8,364,446	0.008	
Gilbert Plains	59,994	148,185	3,704,630	9,706,129	0.010	
Dauphin	66,249	163,635	4,090,876	10,718,094	0.011	
Ochre River	12,593	31,105	777,618	2,037,359	0.002	
Ste. Rose	22,579	55,770	1,394,253	3,652,944	0.004	
Alonsa	10,798	26,671	666,777	1,746,954	0.002	
				FML #3 total	**0.089**	

APPENDIX 3: Draft cumulative effects assessment guideline.

1.0 Scoping

- Identify values that are:
  - o sensitive to cumulative effects;
  - o important to the public and Indigenous communities in the region;
  - o that may be affected by the proposed forest management activities; and
  - o can be spatially identified and mapped; and
- Identify spatial and temporal boundaries for each value.

Examples of values that may be considered include: wildlife species of particular concern (moose), biodiversity, hydrology, aquatic ecosystems. The values selected must be approved by the Forestry Branch through consultation with relevant government departments and branches.

2.0 Analysis of Effects

Determine the potential effects of the proposed forest management activities on the selected values.

3.0 Identification of Mitigation

Identify appropriate mitigation strategies to reduce potential cumulative impacts on the selected values as a result of the proposed forest management operations.

4.0 Evaluation of Significance

Predict the remaining effect after mitigation is applied. (Will there be a significant change to the values now or in the future at the ecosystem or regional scale?).

5.0 Monitoring and Follow up

Develop a monitoring and follow-up program to verify the accuracy of the assessment and determine the effectiveness of the proposed mitigation measures. If monitoring reveals that the effects of the forest management activities on the values are not as predicted, develop and implement further mitigation measures.

6.0 Where the cumulative effects assessment may be located within the FMP:

The cumulative effects assessment may be included within the FMP in the following ways:

- within a separate chapter;
- integrated within the FMP in sub-sections at the end of sections related to the values; or
- fully integrated with the FMP as regional issues are raised and examined.

APPENDIX 4: Climate Vulnerability Assessment


Climate Vulnerability Assessment

LP Swan River, MB

By Sheri Andrews-Key, PhD
October 20th, 2020

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About Innovative Climate Strategies

Innovative Climate Strategies

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Building Capacity, Resilience, And the Business Case for Adaptation

We offer services that expand across the natural resource sector for industry, communities, government, and Indigenous agencies, including:

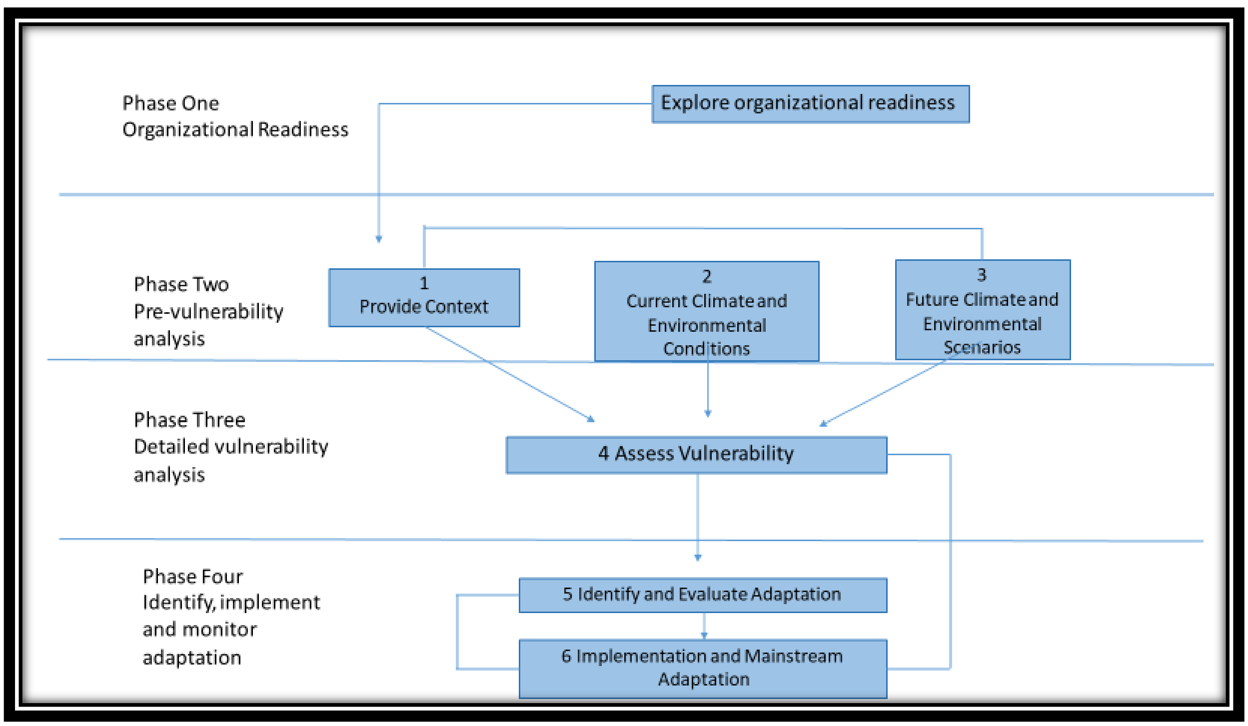
- Climate Vulnerability / Risk Assessments and Adaptation
- Climate-related financial disclosures including assessment and reporting for governance and strategy
- Communication, Education, Engagement
- Policy / Certification / Governance

Climate Vulnerability Assessment Overview

Problem or scope of the work
Climatic and weather extremes of precipitation and temperature have significantly affected forest management operations in the recent past. Extreme weather has been adding excessive uncertainty, which affects our planning and management across the FML.

The LP Forest Resources Division (FRD) is good at adapting to extreme weather on an *ad hoc* basis, due to the high level of skill and experience of the FRD operations staff. However, with future loss of experienced staff through retirement, this knowledge foundation and reactive capacity may be decreased. It is also expected that extremes of weather will continue or potentially become more uncertain in the future. An assessment of LP Swan River's vulnerability to weather extremes was needed to proactively mitigate future weather extreme effects on forest management activities such as road building, harvesting, hauling, and silviculture.

Methods used
The climate vulnerability assessment project looked at the bigger picture of extreme weather and climatic uncertainty in a more structured and strategic fashion. Vulnerabilities were identified, and their potential opportunities explored and evaluated with regards to costs and risks. Workshops for each phase shown in the flowchart below were facilitated by Dr. Sheri Andrews-Key with LP Forest Resources Division operations and planning staff.



Four phases and six components (blue boxes) of adaptation to climate change for Sustainable Forest Management.

Phase 1 was completed in the Fall of 2017 when LP committed to undertake a climate change vulnerability assessment through a larger research project, the Northern Prairie Forests Regional Integrated Assessment ($198,000 paid for 100% by Natural Resources Canada). In a commitment to proactively address increasing climatic uncertainty, LP determined that they were ready to begin the climate vulnerability assessment process.

Phase 2 (pre-vulnerability analysis) involved three steps:

1. Providing context for the assessment;
2. Describing and identifying current climate and forest conditions through trends, relationships between climate, forest conditions and management, and uncertainties and knowledge gaps; and
3. Future climate and forest scenarios.

Each of the steps for Phase 2 culminated with a facilitated workshop with the LP core team of operations and planning staff. Providing context for the assessment, the forest managers for LP determined that climate change and increasing uncertainty are becoming a greater concern for SFM and are already affecting forest management and planning on the Forest Management Licence (FML) area. An example of this is reduced access to sites during winter harvest due to increased frequency of freeze/thaw events. The consensus was that climate change and climate variability would likely increase in the future, so it was justifiable to be proactive in assessing vulnerabilities in order to address adaptive capacity and knowledge gaps. The company also determined that they needed to begin monitoring, evaluating, and developing potential adaptation options for the future. They decided that the scope of the assessment would be for the entire FML area and this would be completed in conjunction with the 2020 Forest Management Plan.

In Phase 2, steps 2 and 3 of the pre-vulnerability analysis, LP staff assessed climate information for the FML that had been previously compiled. These weather records were summarized in the Forest Management Plan, including temperature and precipitation. In addition, climatic impacts of extreme weather observed by LP staff over the last 25 years were documented.

The LP staff decided to use the most extreme climate change scenario RCP 8.5 (Representative Concentration Pathway) over RCP 2.6, 4.0, and 6.0 scenarios for conducting the climate vulnerability analysis. This allowed us to gain a stronger understanding of climate impacts, forest conditions and the dynamic inter-relationships. In addition, if the climate impacts are less, LP is still well-prepared.

Phase 3 was an in-person workshop where 132 potential vulnerabilities were evaluated as to how they would potentially affect planning and operations within LP's Sustainable Forest Management (SFM) system. We then analyzed potential cost increases and risks associated with the impacts and the ability to achieve SFM objectives.

Phase 4 ranked the vulnerabilities and prioritized potential adaptation options (on a scale of 1-high to 4-low). We then identified tools within the existing SFM system that could be used to implement, monitor, and evaluate any adaptation options that would be mainstreamed into planning and management. This allows LP to make more informed decisions for the future while also bringing in the time scale of adaptation beyond just long-term planning and what we may do short-term versus long-term.

Conclusions reached

The outcomes from this climate vulnerability analysis and adaptation identification will aid in a more structured approach to address climate related impacts and vulnerabilities within LP's Sustainable Forest Management system to be more proactive and less reactive for future management and strategic planning. This work provides a better understanding of the vulnerabilities and of where to focus efforts to increase adaptive capacity and resilience in management and planning.

The results of this climate vulnerability assessment and adaptation planning will help build continue best practices on the land base.

United Nations Sustainable Development Goals

The Sustainable Development Goals (SDGs) https://www.un.org/sustainabledevelopment/sustainable-development-goals/ have been developed by the United Nations to provide direction and guidance to achieve a better and more sustainable future around the globe. The Sustainable Development Goals address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace, and justice. Each goal has been developed with a number of targets to help meet success. Goal 13 involves taking climate action. Goal 13 been taken into consideration in LP Swan River's commitment to addressing climate change impacts and adaptation implementation as we move forward in our goals for continued sustainable forest management and adapting best practices to do our part.

UN Sustainable Development Goal 13: Take urgent action to combat climate change and its impacts

Targets**:**

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Integrate climate change measures into national policies, strategies and planning
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
- Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
- Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities