Fort Nelson TSA

Forest Health Strategy

For the term:

April 2011 – April 2012

Prepared for the Fort Nelson District

By Stephanie Wilkie, RPF

Approved by: _____ **Date:** May 5/11

Steve Lindsey, RPF
District Manager - Fort Nelson

Table of Contents

Introduction

The implementation of an effective forest health strategy can augment and stabilize the resources within a Timber Supply Area (TSA) by increasing the success of regeneration practices, increasing the productivity of immature stands, and decreasing losses of mature timber. These benefits imply a reduced risk to silviculture investment and a more stable planning environment, both of which are important to the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) and the forest industry. In addition, ecologically appropriate forest health practices will reduce the risk of wildfires associated with widespread timber mortality, improve public safety in multiple use areas, and lower the risk to non-timber resource values.

Establishment of a proactive framework that emphasizes the early detection of forest health issues and prompt implementation of scientifically sound solutions will allow MFLNRO staff to employ the necessary resources to ensure the efficient and effective implementation of this strategy. It is important to note that this strategy can be effective only through the cooperative management of forest health agents by all players within the TSA, including government agencies, First Nations, licensees and other stakeholders.

The intent of this strategy is to provide an update on the current state of forest health within the Fort Nelson TSA and to provide a framework to co-ordinate and guide future forest health activities. The focus of this forest health strategy is not only pest control, but also other activities, e.g. salvage opportunities (See Appendix II).

The Fort Nelson Forest Health Strategy (FNFHS) follows the guiding principles set out in the Provincial Forest Health Strategy (PFHS). The PFHS incorporates the principles of the Ministry's *Provincial Bark Beetle Strategy*. These principles can be summed up briefly as:

1. Know the land-base and resource management objectives;
2. Manage from an ecological perspective;
3. Don't make the situation worse; and
4. Practice adaptive management.

The *Provincial Forest Health Strategy* (PFHS) provides guidance for conducting forest health activities in British Columbia. The PFHS objectives are to:

1. Protect forest resources from pest damage by direct actions when operationally feasible and justified;
2. Implement stand establishment activities to minimize the expected impact of known forest pests; and
3. Assess pest impacts on forest values to improve estimates of timber yield from British Columbia's forests and prioritize management treatments.

For more information, the Provincial Forest Health Strategy may be viewed online at: http://www.for.gov.bc.ca/hfp/health/Strategy/FH%20Strategy.pdf.

It is the intention of the Fort Nelson District (DFN) to incorporate the principles of forest health management to effectively manage the forest health agents threatening forest management objectives and apply ecologically sound techniques for the protection and enhancement of resource values.

It is not the intention of this strategy to provide detailed pest-specific information. This type of information is available on the provincial Forest Health Website as well as a number of online and other resources.

For more information regarding forest pathogen or insect identification, contact regional specialists Richard Reich, Forest Pathologist at (250) 565-6203 or Robert Hodgkinson, Forest Entomologist at (250) 565-6122.

Fort Nelson TSA Overview

The Fort Nelson Timber Supply Area is located in the North-East corner of British Columbia. It covers almost 9.9 million hectares, and is the second largest TSA in the province. The TSA is administered by the Ministry of Forests, Lands and Natural Resource Operations office located in the town of Fort Nelson, BC. The Fort Nelson District (DFN) boundary is roughly equivalent to the TSA boundary.

The TSA is located, in its entirety, within Canada's Boreal Forest. The central and eastern portions of the TSA are within the Taiga Plains and Boreal Plains Ecozones. While the western portion of the TSA is within the Boreal Mountains Ecozone. The provincial equivalents are the Biogeoclimatic (BEC) zones. The Plains Ecozones are roughly equivalent to the Boreal White and Black Spruce (BWBS) BEC zone, while the Boreal Mountains Ecozone is equivalent to the Spruce-Willow-Birch (SWB) and Alpine Tundra (AT) BEC zones.

An additional note to be aware of is that roughly 3.8 million hectares of the TSA are identified as part of the Muskwa-Kechika Management Area (M-KMA). The M-KMA has its own land use plan and is governed by the Muskwa Kechika Management Area Act. Additional guidelines and restrictions govern activities in the M-KMA. The M-KMA is 6.37 million ha in size and covers portions of three TSAs in the Fort Nelson, Peace and Mackenzie Districts.

Plant species that reach tree-size in the Fort Nelson TSA are listed in Appendix I. In British Columbia, a tree is defined as "a woody plant, usually with a single stem, capable of reaching 10 m in height."

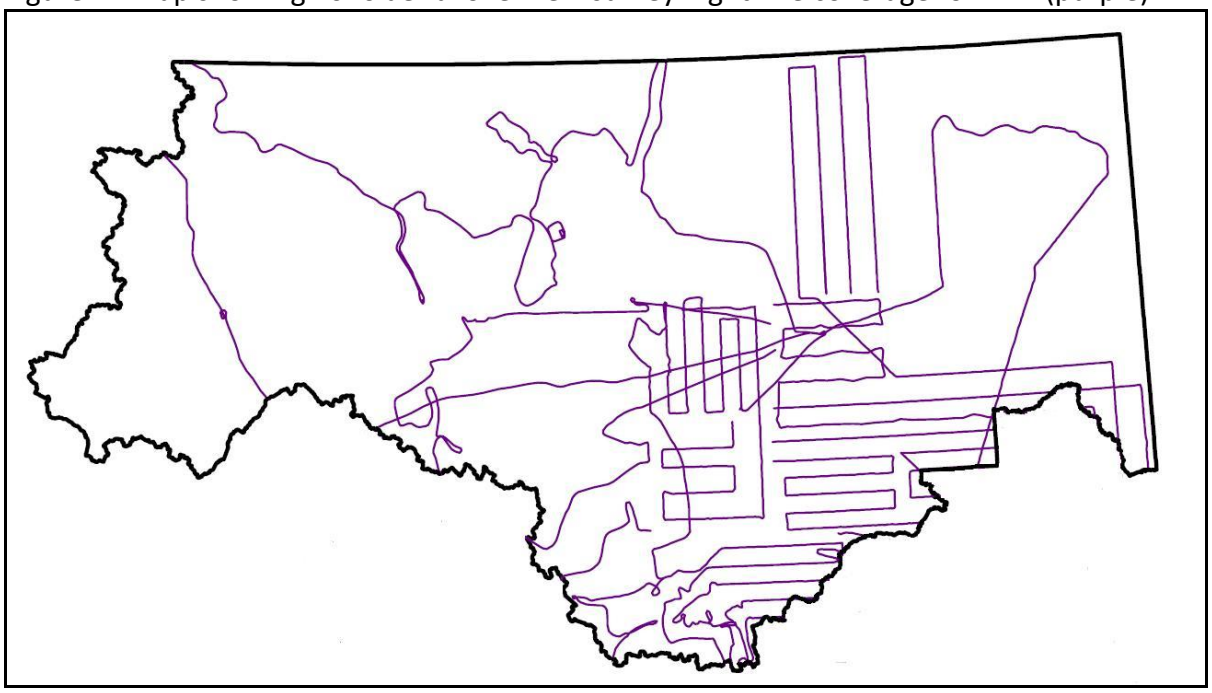
There are two main tree species of commercial importance in the Fort Nelson TSA: white spruce and trembling aspen. In the past, Fort Nelson had a thriving forest industry. Although logging in the District is mainly for oil and gas development, in the future this may change. As the Annual Allowable Cut (AAC) decreases in other parts of the province as a result of mountain pine beetle (MPB) damage, the forest industry may be looking north to the Fort Nelson TSA to meet supply needs.

This document will primarily focus on strategies to manage forest health issues relevant to white spruce and trembling aspen, with some additional focus on potential issues relevant to pine in the TSA. In addition, this document will briefly explore tactics to support the outlined strategies.

Current State of Forest Health

The following information is compiled based mainly on data from aerial overview surveys that are conducted annually by the Forest Practices Branch of the Ministry of Forests, Lands and Natural Resource Operations. The area covered by the 2010 aerial overview surveys is shown on the map below (Figure 1). It is important to keep in mind when comparing damage levels from one year to the next that the area covered may differ from year to year. For detailed information on current and past forest health aerial overview surveys, see the Forest Practices Branch Forest Health – Aerial Overview Survey website: http://www.for.gov.bc.ca/hfp/health/overview/overview.htm

Figure 1. Map showing 2010 aerial overview survey flight line coverage for DFN (purple)



In the Fort Nelson TSA, defoliators are typically of primary concern. Successive defoliation attacks weaken the hosts and as a result cause affected trees to become more susceptible to attacks by other pests.

The damaging agents that have been found to occur in the Fort Nelson TSA include defoliators, bark beetles, weevils, disease-caused dieback and abiotic damage. These agents have been assigned a priority ranking of low, medium or high as shown in Table 1. The rankings are determined with input from Regional Forest Health Specialists and District staff based on the following criteria:

- Known or suspected impacts to the forest resource values;
- Availability of operational detection and treatment methods;

- Costs and benefits of applying detailed detection and treatment activities;
- Proximity to high hazard and risk zones;
- Distribution of pest and current incidence levels;
- Resources that would be required to obtain missing information necessary for management of the pest.
- Results of overview surveys, which can be found on the Forest Practices Branch website or by following the link: http://www.for.gov.bc.ca/hfp/health/overview/overview.htm

Table 1. Priority ranking of forest health damage agents in the Fort Nelson Forest District

Damage Agent	Group	Historical Ranking	Current Ranking
Defoliators			
Eastern spruce budworm	Conifer	High	Low
Forest tent caterpillar	Deciduous	Variable	Low
Bruce spanworm	Deciduous	None	TBA*
Large aspen tortrix	Deciduous	Variable	Low
Aspen leaf miner	Deciduous	Variable	Medium
Willow leaf miner	Deciduous	Low	Medium
Unknown Defoliators	Both	Unknown	Medium
Bark Beetles			
Mountain pine beetle	Conifer	None	Medium
Engraver beetles	Conifer	Unknown	Low
Spruce beetle	Conifer	Medium	Low
Western balsam bark beetle	Conifer	Medium	Low
Lodgepole pine beetle	Conifer	Low	Low
Weevils			
White pine weevil (on spruce)	Conifer	Medium	Low
Disease Caused Dieback			
Venturia spp. (shoot blight)	Deciduous	Unknown	High

*Bruce spanworm priority ranking to be assigned once ground crews can verify the extent of the infestation.

Defoliators

Deciduous defoliators that have historically found to be prevalent in the Fort Nelson TSA were not found to be so in 2010. In previous years, forest tent caterpillar and large aspen tortrix attacking aspen have been common in the TSA. Table 2 identifies defoliators that are common to the District and indicates the area (hectares) of defoliation found within each level of severity.

Table 2. Hectares of defoliation by damage agent and severity class

Defoliators	Severity (ha)					
	Trace	Light	Moderate	Severe	Very Severe	Total
Spruce Budworm	0	0	0	0	0	0
Forest Tent Caterpillar	0	0	0	0	0	0
Bruce spanworm	0	440,379	101,695	4,568	0	546,642
Large Aspen Tortrix	0	0	0	0	0	0
Aspen Leaf Miner	0	4,747	127	< 1	0	4,874
Unknown Defoliators	0	7,616	9,565	0	0	17,181
Total Defoliators	0	452,742	111,387	4,568	0	568,697

Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Eastern Spruce Budworm

From 1985 to 2001 the eastern spruce budworm population exploded to epidemic levels. For the years 2001 through and including 2010, the eastern spruce budworm population has completely crashed. No evidence of spruce budworm attack was detected in 2010.

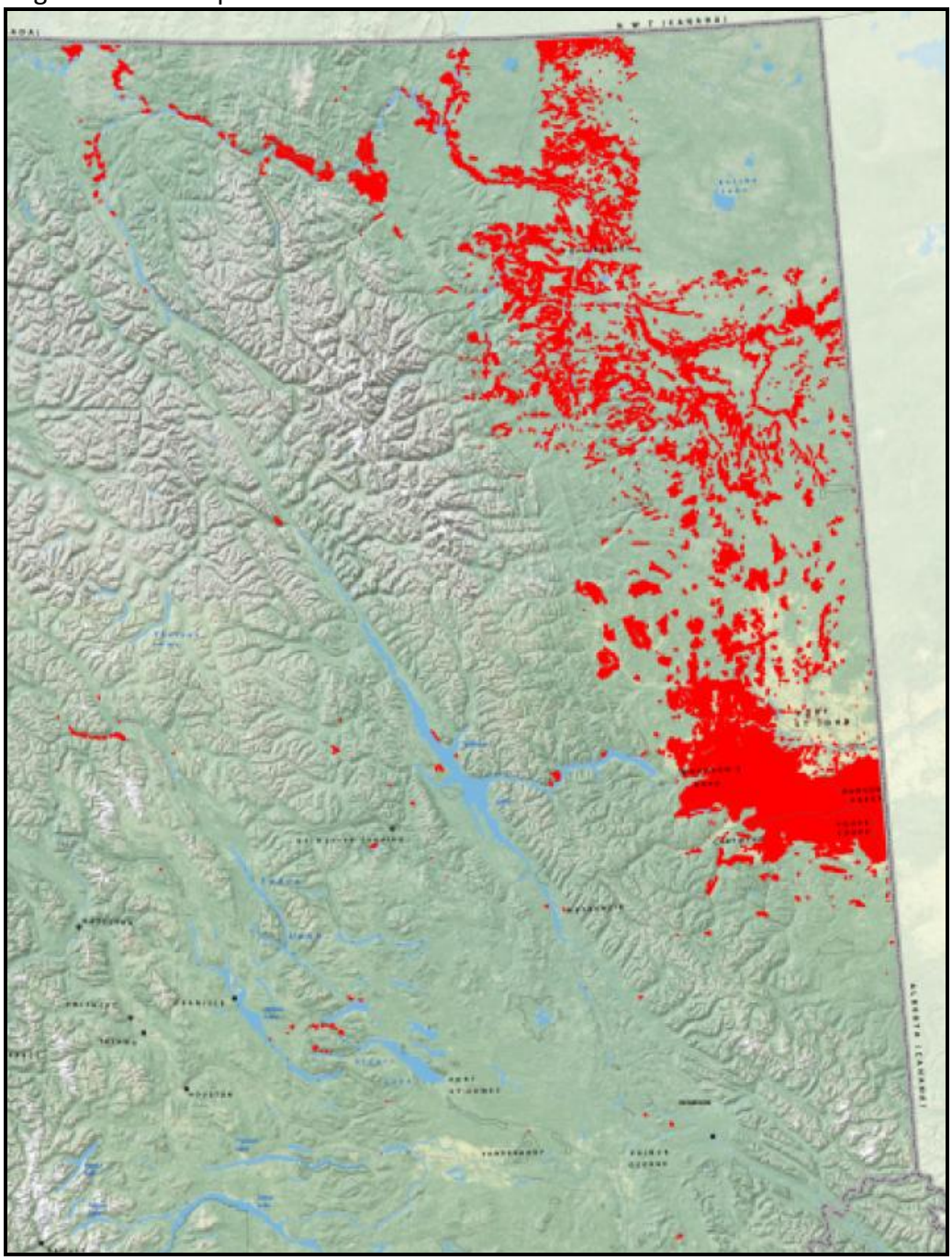
Forest Tent Caterpillar and Large Aspen Tortrix

Similarly, no incidence of forest tent caterpillar or large aspen tortrix damage was reported in 2010. However; these damage agents may have been classified as unknown defoliators.

Bruce Spanworm

In the Northern Interior Forest Region, a surprising 637,347 hectares of bruce spanworm damage was reported in 2009, versus no incidences in 2008. Overview flights in 2009 did not report any bruce spanworm defoliation in the Fort Nelson District, however; 546,642 hectares were detected during 2010 surveys, a considerable increase. The infestation began in the Peace District and has spread north and south to the Fort Nelson and Prince George Districts. Smaller, more scattered infestations were found in the Fort Nelson District (as compared to the Peace District). The majority of damage in the Fort Nelson District was concentrated along major river drainages, extending as far north as the Northwest Territories/BC border. Figure 2 illustrates the extent of the current bruce spanworm infestation. Ground surveys will be completed in 2011 to confirm a sample of these reported cases.

Figure 2. Bruce spanworm defoliation observed in 2010.



Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Unknown Defoliators

Unknown defoliators accounted for a total of 17, 181 hectares of damage in the 2010 overview flights. This is a considerable increase over 2009 levels. Defoliators can be difficult to identify aerially, and ground surveys should be completed in 2011 to identify unknown agents and assess risk. The priority ranking for unknown defoliators has been

increased from low to medium due to the rise in affected area and the uncertainty of the agent(s) involved.

Willow Leaf Miner

Willow leaf miner is a defoliator that was noticed in the Fort Nelson TSA for the first time in 2008. It was again present in 2009. In its second year of attack, the leaf miner spread considerably, affecting virtually every willow in the District. Willow leaf miner is not identified in the Forest Health Overview Survey because Willow is not considered to be a merchantable species. As is the case with most defoliators, mortality results only after consecutive years of heavy defoliation. A notable decline in the number of affected willow was observed in 2010. Willow leaf miner has been ranked as a Medium priority and will continue to be monitored in 2011.

Bark Beetles

Bark beetle damage in the Fort Nelson Forest District as observed during 2010 aerial overview surveys increased considerably from 2009 levels, but was mainly low in severity. Table 3 displays the hectares affected by bark beetle and severity class.

Table 3. Hectares of bark beetle damage by damage agent and severity class

Bark Beetles	Severity (ha)					
	Trace	Light	Moderate	Severe	Very Severe	Total
Mountain Pine Beetle	789	659	391	56	0	1,894*
Spruce Beetle	0	0	0	0	0	0
Western Balsam Bark Beetle	3506	5322	0	6	0	8,835
Engraver Beetle (Ips species)	0	0	0	0	0	0
Lodgepole Pine Beetle	0	0	0	0	0	0
Total Bark Beetles	4295	5981	391	56	0	10,728

Source: Ministry of Forests and Range 2011

Mountain Pine Beetle

Mountain pine beetle was identified in the Fort Nelson District for the first time in 2010. Twenty-four hectares of mountain pine beetle damage was reported under the Fort Nelson District in 2009, however this area was actually located within the Peace District. Forest Health Overview Survey boundaries do not necessarily match up with District or TSA boundaries. The Fort Nelson District surveys have habitually included a portion of the Peace District. The reported numbers for 2010 are approximately equivalent to actual District numbers.

The size of attack ranged from a group of 5 trees, to an area of 542 hectares. The majority of occurrences were less than 1 hectare in size. It is worth mentioning that 9 attacks were reported to be in young pine stands. In recent years, mountain pine beetle has increasingly been found to attack young stands, threatening pine plantations across the province.

Mountain pine beetle damage was identified along the southern boundary of the District, as far east as the Sikanni Chief River and west into the Northern Rockies Provincial Park. A few occurrences were also noted along the Kechika River Corridor in the southwest corner of the District. Mountain pine beetle has been assigned a priority ranking of medium, as pine is not a key commercial species, nor is it a dominant, leading species within the District.

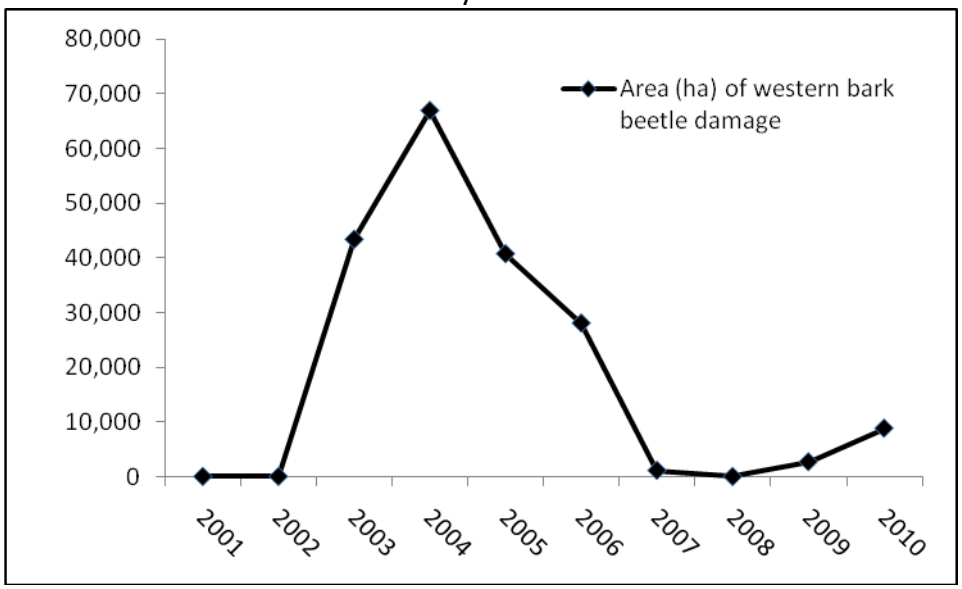
Spruce Beetle

Spruce beetle damage levels were high in 2003 – 2004, after which they dropped off sharply and have remained low since. In 2009, damage occurrence climbed to 413 hectares, but no occurrences were found in 2010. It has been given a priority ranking of low and will be continue to be monitored in 2011.

Western Balsam Bark Beetle

Historic levels of western balsam bark beetle peaked in 2004 and are currently on the rise again. Figure 3 illustrates the 10-year trend of observed western bark beetle damage. Surveys completed in 2008 reported only six hectares of affected forest area, while 2009 surveyors observed 2,698 hectares, which more than doubled in 2010. Damage tends to occur mainly where white spruce and subalpine fir is present. In 2007 it was detected in the Northern Rocky Mountains, Mackenzie Mountains, and the foothills to the east of each mountain range. In 2008 it was detected throughout the Fort Nelson TSA along the major drainages that were surveyed. The 2009 surveys detected a large (>1000 ha) area of beetle attack southeast of the mouth of the Toad River, with scattered smaller patches concentrated along the centre of the district stretching as far north as Maxhamish Lake and as far south as Prophet River. The same general areas were affected again in 2010, including over 5000 hectares at the mouth of the Toad River. The same stands are often affected in low levels of scattered attack for consecutive years, which, over time, can result in mortality (MFLNRO 2011). While western balsam bark beetle damage is increasing, it has been assigned a priority ranking of low as balsam fir is not a key commercial species and most attacks are occurring in remote areas that have little potential for harvest opportunity.

Figure 3. Hectares of reported western balsam bark beetle damage from 2001 to 2010 aerial overview surveys in the Fort Nelson TSA.



Engraver Beetle

Virtually no incidences of engraver beetle (Ips) have been detected since 2008 when one hectare was identified. Engraver beetle will remain a low priority in 2011.

Lodgepole Pine Beetle

Lodgepole pine beetle has historically been assigned a low priority ranking in the Fort Nelson Forest District. Virtually no instances of lodgepole pine beetle have been reported since 2003, including 2010. Lodgepole pine beetle will remain a low priority in 2011.

White Pine Weevil

Weevil damage is generally undetectable during aerial overview surveys. Aerial surveys are not an effective means of monitoring weevil populations as this type of damage is not readily observable from the height at which the surveys are flown. Weevil damage will continue to be monitored to look for signs that the population is increasing.

Weevil damage in the Fort Nelson District is most commonly attributed to the white pine weevil, also known as the spruce weevil (*Pissodes strobi)*. The white pine weevil attacks the leader of young spruce trees. It is common in the Fort Nelson District, often attacking young spruce plantations. Historically it has been assigned a priority ranking of Medium. It is now considered to be low, as no recent outbreaks have been observed.

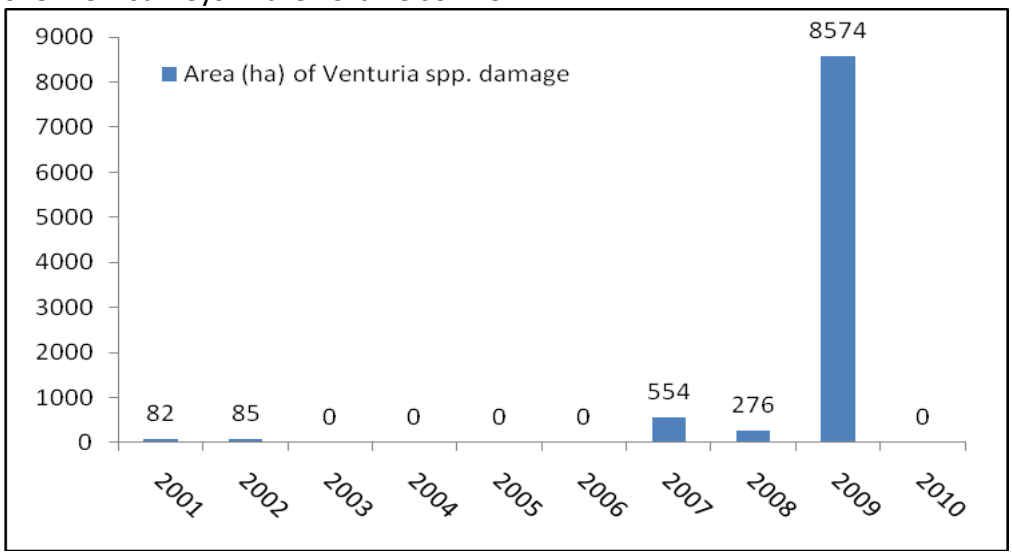
Disease

In the Fort Nelson TSA, the only source of disease-caused forest health agent identified during aerial overview surveys has been *Venturia* spp. No other incidences of disease or dieback were noted. However, several notable diseases not captured in aerial overview surveys have habitually been found in the Fort Nelson TSA at low levels. These include tomentosus root rot, pine stem rusts of lodgepole pine and pine foliage diseases.

Venturia spp.

Venturia spp. is a type of leaf and shoot blight. It is characterized by the blackening and curling of shoots and leaves and is commonly referred to as "Sheppard's crook". In 2008, 276 hectares of *Venturia* spp. related dieback was detected during overview surveys. In 2009, a total of 8574 hectares was identified, 96% of which was assigned a severity class of Light or Moderate. No incidences of *Venturia* spp. were detected during 2010 overview flights. The drastic drop in *Venturia* spp. observations could be attributed to changes in the aerial survey crew; however no significant occurrences were noted by ground personnel (MFLNRO 2011) . It is possible that some of the bruce spanworm and unknown defoliator damage reported in 2010 may have been attributable to *Venturia* spp. Ground monitoring in 2011 should refine 2010 survey levels. There appears to be no trend in *Venturia* spp. overview flight data, as can be seen in Figure 2, which displays the area affected by *Venturia* spp. over the last ten years.

Figure 4. Hectares of reported *Venturia* spp. damage from 2001 to 2010 aerial overview surveys in the Fort Nelson TSA.



Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Venturia spp.is most apparent in young openings being managed for deciduous regeneration. Conventional harvesting and silviculture methods create favourable conditions for sprouting aspen and cottonwood. Blight infection, combined with a wet spring can cause widespread mortality in stands that have regenerated through sprouting.

The priority ranking for this forest health agent will remain high until ground checks can verify that levels have in fact dropped.

Tomentosus Root Rot

Tomentosus root rot, caused by the saprophytic parasite fungus *Inonotus tomentosus*, is relatively widespread in boreal spruce pine forests, but typically occurs at very low levels in the Fort Nelson TSA. It thrives on mesic to xeric sites and primarily infects interior spruce, but may also infect lodgepole pine. It is believed that its low frequency in the FNTSA may be a function of the generally widespread high soil moisture which is not conducive for root to root contact spread. Tomentosus may be confused with high water table related mortality in spruce. The distinguishing factor is blowdown exhibiting small root wads with broken main roots contining honeycomb pitted decay. Large pancake style intact root systems are characteristic of high water related mortality and blowdown.

Pine stem rusts of lodgepole pine

Pine stem rusts caused by western gall rust, stalactiform blister rust and comandra blister rust are generally not common in the FN TSA. It is believed that the climate is not as conducive for infection and spread, as in the sub boreal spruce forests. Western gall rust spreads pine to pine. A general lack of western gall rust may be indicative of climate that is not very suitable for infection. Western gall rust infects in the mid to late May through to the end of June. The blister rusts also infect at this time of year, but they infect their alternate hosts. Comandra blister rust requires the alternate host plant *Geocaulon lividum* (bastard toad flax) in close proximity to lodgepole pine for infection to occur. Stalactiform blister rust requires an alternate host from the figwort family. Look for stalactiform blister rust on sites with common paintbrush (*Castilleja* spp.), cow wheat (*Melanpyrum lineare*), or yellow rattlebox (*Rhinanthus minor*). Lack of infection by these two blister rusts may be due to the lack of the alternate host, or poor infection climate. Sweet fern blister rust, the 4th pine stem rust present in the FN TSA, is caused by the fungus *Cronartium comptoniae*, and has Sweet gale (*Myrica gale*) as its alternate host. This nitrogen fixing plant is found on the waters edge of water bodies, but is rare. All three blister rusts infect the foliage of their pine hosts in mid summer; potentially from mid-July to mid-August. Infection likely requires free water, close to 100% RH, and warm nights (>10^{o}C) for an extended duration. Climate change may increase the likelihood of these events and therefore the risk of infection.

Pine Foliage Diseases

Lodgepole pine is susceptible to numerous foliar diseases. *Dothistroma pini* is commonly found near rivers due to higher humidity. It infects all ages of foliage, but is more commonly found on the lower crown working its way up. It produces narrow red bands of discoloured red foliage. In time the entire needle dies and is cast. *Lophodermella concolor* and *L. monitvega* infect current years foliage, which then turns red the following spring. Look for a central band of straw coloured foliage on needles, but the attack may cover the entire crown. Elytroderma needle cast caused by *Elytrodrema deformans* causes needle cast and stem cankers which may girdle and kill the tree. Elytroderma infects the current

years foliage, which turns red the following spring, and produces distinctive long black fruiting bodies by June/July that summer. This needle cast is more prevalent in moist ecosystems near water bodies.

Abiotic Damage

Abiotic damages are not assigned a priority ranking. The historical and current presences of abiotic damages are shown in Table 4 for comparison. Fire, birch decline, wind-throw, flooding, and redbelt were detected during 2010 surveys. Drought, frost and snow/ice damage have historically been found in the District, but were not detected in 2010. Slides/slumps along rivers are a common occurrence largely to soil conditions and the scouring action of the rivers; however, no new slides were detected in 2010.

Table 4. Historical and current presence of abiotic forest health damage

Abiotic Damage Agent	Historical Presence	Current Presence
Fire	Yes	Yes
Aspen decline	Unknown	No
Birch decline	Unknown	Yes
Windthrow	Yes	Yes
Drought	Yes	No
Flooding	Yes	Yes
Shoot/Bud Frost Kill	Yes	No
Hail	Unknown	No
Slide	Yes	No
Redbelt	Yes	Yes
Snow/Ice	Yes	No

Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Table 5 displays the hectares identified in each severity class. A total of 7,459 hectares of abiotic damage was detected. Fire and Flooding were the most prevalent on the landscape each over 3000 hectares.

Table 5. Hectares of abiotic damage by agent and severity class

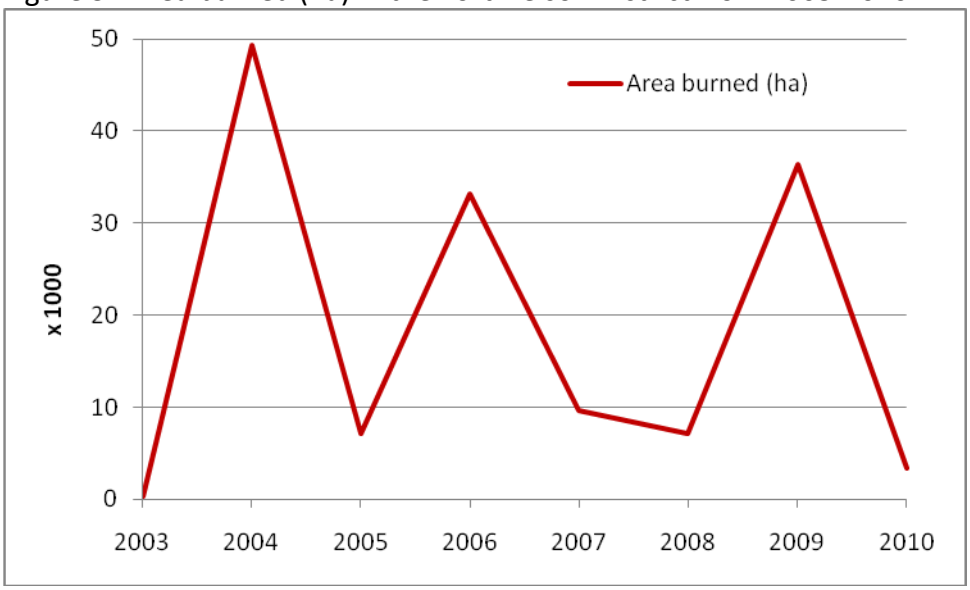
Abiotic Damage Agent	Severity (ha)					
	Trace	Light	Moderate	Severe	Very Severe	Total
Fire				3,393		3,393
Aspen decline						0
Birch decline				128		128
Wind-throw				43		43
Drought						0
Flooding	2,814		48	153		3,015
Shoot/Bud Frost Kill						0
Hail						0
Slide						0
Redbelt				880		880
Snow/Ice						0
	2,814	0	48	4,598	0	7,459

Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Fire

Fire is typically the leading abiotic damage within the District. Area burned varies considerably from year to year, from as low as 384 hectares in 2003 to 49,258 hectares in 2004. Figure 5 illustrates the area burned each year, beginning in 2003. 2010 was a relatively quiet fire season in the District, with only 3,393 hectares burned.

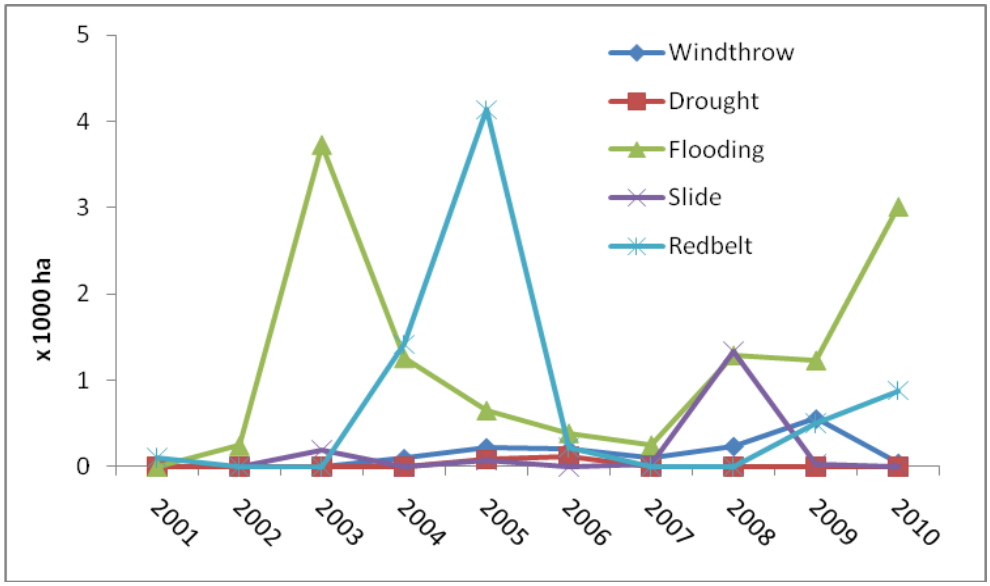
Figure 5. Area burned (ha) in the Fort Nelson District from 2003-2010



Source: Ministry of Forests, Lands and Natural Resource Operations 2011

Figure 6 is a chart illustrating the trend in abiotic damage in the Fort Nelson District, from 2001-2010. All abiotic damage agents are shown, except for fire which is shown in Figure 4, above. Flooding and redbelt are the two most prominent abiotic agents after fire.

Figure 6. A comparison of area (hectares) damaged by abiotic damage agent from 2001 to 2010 in the Fort Nelson District



Flooding

Flooding is common to the area, as much of the District lies in and around muskeg. Flood levels have been increasing since 2007 after a steady drop since 2003. Provincially, Fort Nelson District sustained the most flooding in 2010, which occurred primarily in two areas, recorded near Klua Lakes and Little Beaver Creek.

Redbelt

Redbelt occurrence has also risen in recent years; however, it is typically sporadic in occurrence, driven mainly by weather patterns. All the 2010 damage was confined to the Muskwa River area east of Horseshoe Mountain in the Fort Nelson Forest District. This damage was just south of the 506 hectares recorded in the district last year.

Slides

As slides often directly impact river systems, even a relatively small slide can have a significant impact. Slides reported in 2008 peaked at 1337 hectares. No new slides were reported in 2010.

Drought & Windthrow

Drought and windthrow typically affect much less area than the previous agents.

Objectives and Required Actions

1: Maintain a detection program for damaging agents over the land base.

a. Conduct detailed aerial and ground surveys in identified areas, as required, to quantify the incidence and intensity of damaging agents to the standard in the appropriate guidebooks.
b. Maintain a record of all survey information for the land base.
c. Standardize data collection when required to facilitate strategic objectives.
d. Improve detection methods through consultation with Regional Forest Health specialists.
e. Encourage forest workers, consultants and industry staff to identify specific forest health concerns within the TSA through training. Formal and informal training may be obtained from Regional Forest Health specialists.

2: Assess current and future stand and landscape level hazards and risks from detected damaging agents, including the impact of forest management practices on resource values.

a. Use the best current information to determine hazards, risks, and probable impacts for all detected and potential forest health agents on the land base.
b. Update existing hazard and risk rating systems as new information becomes available.
c. Develop and implement modelling of pest dynamics and impact assessments for Timber Supply Reviews.
d. Evaluate and prescribe approaches to deal with introductions of non-native, potentially harmful organisms.

3: Identify significant pest risks to resource values and identify appropriate management strategies and tactics, while considering the constraints and limitations imposed by other resource management imperatives

a. Consider all scientifically sound, forest health management strategies and tactics. New strategies and tactics are always being developed, but they must be reviewed by Regional forest health specialists for scientific validity before being adopted as operational practice.
b. Identify and address knowledge gaps that limit the ranking and assignment of priorities and hinder identifying appropriate management strategies and tactics.

4: Implement mitigating strategies and tactics based on scientifically sound, forest health management practices.

a. Assign mitigation strategies where deemed appropriate (including prevention, suppression and salvage through either direct or indirect tactics). Direct sanitation

or salvage harvesting efforts must meet the strategic forest health objectives identified in the FNFHS.

b. Quantify the outcome (e.g., change in quantified yields or diminished future management options) of selected strategies and tactics, including a monitor-only approach.
c. Accelerate implementation of mitigation strategies and tactics to deal with unforeseen outbreaks of damaging agents in a timely manner.

5: Evaluate results of forest health management practices over the short and long term and modify practices accordingly.

a. Inspect field practices to ensure forest management objectives are met.
b. Target applied research activities to support scientifically based standards of forest practice on Crown lands. It is important to bring issues of particular concern to the attention of Regional forest health specialists to facilitate proper direction of research.

Management Strategy

Defoliators

- Eastern spruce budworm, *Choristoneura fumiferana* Clem.
- Forest tent caterpillar, *Malacosoma disstria* Hubner
- Large aspen tortrix, *Choristoneura conflictana* Walker
- Aspen leaf miner, *Phyllocnistis populiella* Chambers
- Willow leaf miner, *Micrurapteryx salicifoliella* Chambers, previously *Lithocolletis salicifoliella*

Historically, forest health problems in spruce have been attributed to the "spruce decline syndrome complex" - a progressive tree weakening and eventual mortality caused by eastern spruce budworm defoliation and other secondary forest pests. As there are large stands of mature and spruce and aspen throughout the TSA, these areas should be dealt with as outlined in the Defoliator Management Guidebook. Currently the defoliator populations appear to be endemic, and therefore do not pose a significant forest health threat.

Bark Beetles

- Spruce beetle, *Dendroctonus rufipennis* Kirby
- Western Balsam bark beetle, *Dryocoetes confuses* Swaine
- Mountain pine beetle, *Dendroctonus ponderosae* Hopkins
- Lodgepole pine beetle, *Dendroctonus murryanae* Hopkins

As already mentioned, the forests in the Fort Nelson TSA are dominated by large stands of mature aspen and spruce. As a result there may be areas that are susceptible to attack by beetles (especially spruce beetle). These areas should be dealt with as outlined in the Bark Beetle Management Guidebook.

Mountain Pine Beetle was first detected in the Fort Nelson Forest District during the 2010 overview surveys. The beetle has made its way north from the Peace Forest District and is also moving in from the Mackenzie District along Williston Lake.

During the summer of 2008, Canadian Forest Products Ltd. (Canfor) began transporting timber that was potentially infested with mountain pine beetle into the Fort Nelson forest District which has increased the risk of infestation. Canfor developed and implemented a hauling and milling strategy in order to ensure that mountain pine beetle was not spread into District as a result. The hauling of this high-risk timber ceased shortly after its commencement with the closure of the Tackama plywood mill. An area behind Canfor's mill

along the Muskwa River was identified as having trace levels of mountain pine beetle in 2010. Ground checks in December of 2010 could not confirm or deny its presence. A helicopter flight over the area in snow-free conditions is needed to pinpoint the exact location of red trees so that they may be checked on the ground.

In preparation for the beetle's arrival, a "Mountain Pine Beetle Area of Interest" has been defined in the southern portion of the FNFD. This was done in order to concentrate efforts closest to current MPB infestations in adjacent Forest Districts. A total of 542,305 hectares of susceptible pine stands were indentified within the Area of Interest. Figures 1 and 2 illustrate the age class distribution and area of pine stands within the Fort Nelson Forest District as a whole as compared to the Area of Interest alone. Figure 7 specifically illustrates stands with 50% or more pine and Figure 8 illustrates stands with 25-49%.

Figure 7. Age class distribution and area of stands containing 50% or more pine in the Fort Nelson Forest District and the Area of Interest.

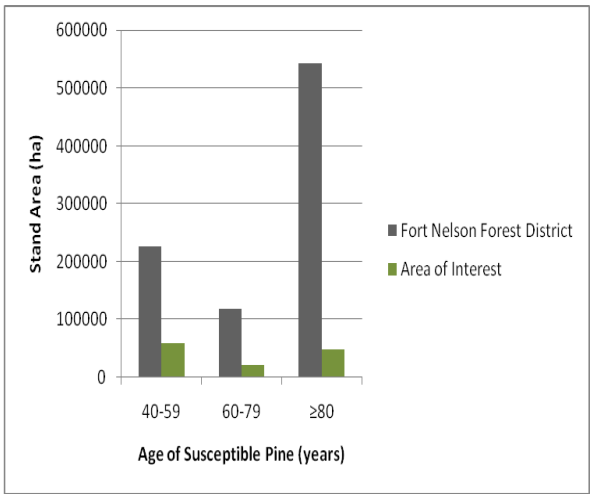
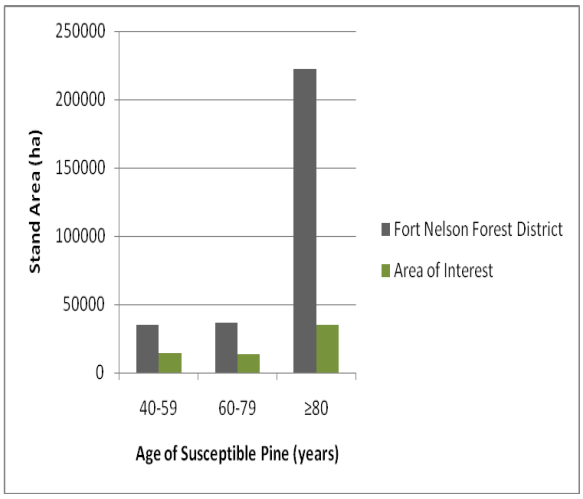


Figure 8. Age class distribution and area of stands containing 25-49% pine in the Fort Nelson Forest District and the Area of Interest.



As is evident in the figures above, the majority of pine in the Fort Nelson Forest District are 80 years of age or older. This age class is the preferred host for mountain pine beetle. In the Area of Interest alone, stands with a greater pine component (≥50%) are generally in the younger (40-59yrs) and older (≥80yrs) age classes, with relatively few stands in the mid (60-79yrs) class. In stands with a smaller pine component, the pine tend to fall into the older class.

Much of the pine stands are accessible with the current road network, yet salvage operations in some pine stands would be impractical. Substantial areas of pine stands within the DFN are located in sensitive areas, such as the Muskwa Kechika Management Area or adjacent to the Alaska Highway (Hwy 97) west of Fort Nelson which is a tourist attraction due to the pristine landscape within the Highway Corridor.

An identified action of the 2009 Forest Health Strategy for the Fort Nelson TSA was to organize a Mountain Pine Beetle Working Group. The Working Group held its first meeting on January 27th 2010. In attendance were representatives from licensees, the Northern Rockies Regional Municipality and the Ministry of Forests and Range. The purpose of the working group is to inform stakeholders and interested parties of the potential impacts that mountain pine beetle could have on the District, track the beetle's progress as it enters the District and explore management options to control the spread. The group's mandate is to to:

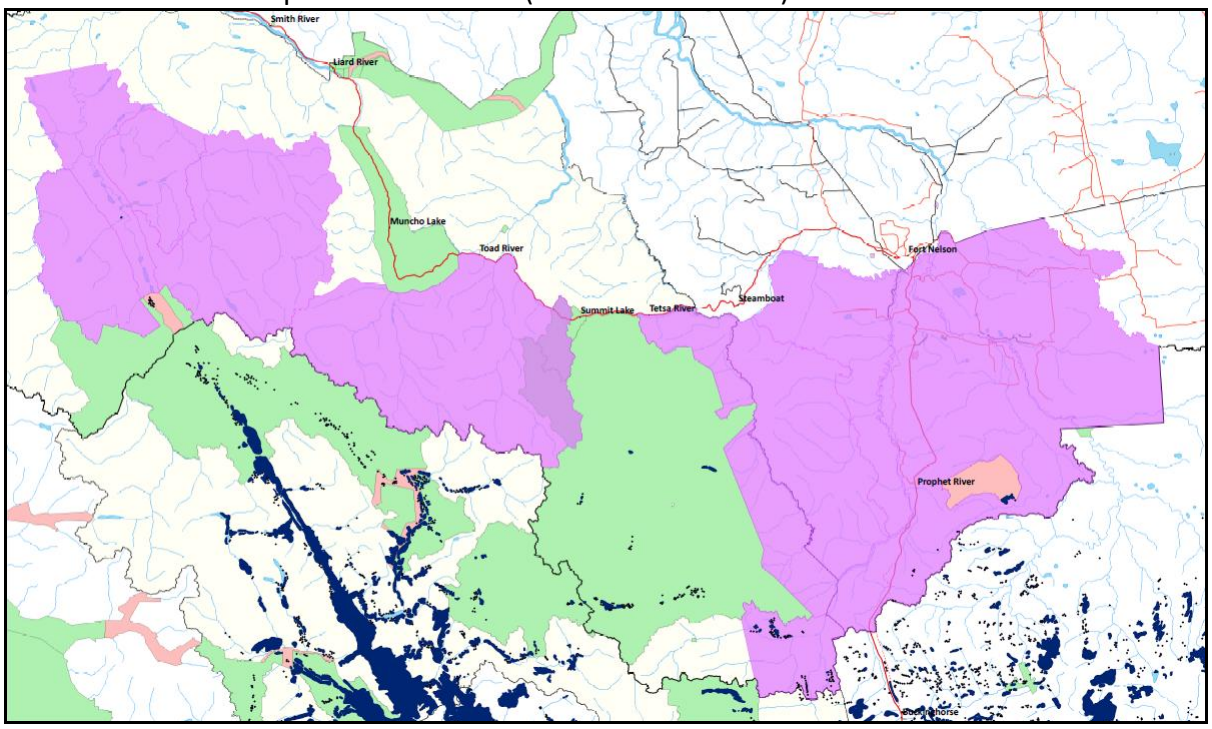
1. Raise the level of awareness and education among members of the public, First Nations and industry.
2. Through consultation with the MPB Planning Group members, we will determine probable benefits and risks associated with different management strategies (or absence of) that could be implemented to reduce infestation risk, or infestation severity.
3. To identify (a) areas of high importance to stakeholders, First Nations and (b) accessible areas that contain high volumes of merchantable pine that are at risk of infestation.
4. To determine if/where proactive management strategies need to be employed. and;
5. Plan operational strategies that would be employed if MPB infested stands warrant salvage logging operations.

A webpage has been set up as part of the Fort Nelson Forest District website that provides some background on the mountain pine beetle and describes the Mountain Pine Beetle Working Group. The webpage will act as a resource for the public and group members, as presentations, documents and maps from meetings will be available for download. The address for the webpage is http://www.for.gov.bc.ca/dfn/MPB/index.htm. At this time, the Working Group does not have an operating budget. As a result no meetings have been held since April of 2010.

An Emergency Bark Beetle Management Area (EBBMA) was established in the Fort Nelson District in 2010. Currently all Emergency Bark Beetle Management Units (EBBMUs) within the EBBMA are considered "suppression". The EBBMA/EBBMUs are reviewed annually. More suppression EBBMUs are expected to be established in the south west corner of the District, where the mountain pine beetle is making its way into the District via the Kechika River corridor. These are in addition to the existing units which have not changed since their establishment in 2010. Figure 9 is a map showing the location of the proposed suppression EBBMUs (pink) in relation to the current location of mountain pine beetle attack (dark blue). EBBMUs are established to aid in the allocation of forest health resources.

The most current approved Provincial Suppression Beetle Management Units, including maps for these areas can be found at the following website:
http://www.for.gov.bc.ca/hfp/health/fhdata/bmu.htm

Figure 9. 2011 proposed suppression EBBMUs (shown in pink) in relation to the current location of mountain pine beetle attack (shown in dark blue).



White Pine Weevil

- White pine weevil, *Pissodes strobi* Peck

White Pine Weevil (also known as spruce weevil), although designated as a low priority for 2011, will continue to be monitored where it has been identified, and new occurrences will be noted. Damage that affects form and vigor has the potential to affect whether trees will achieve or maintain their free-growing status. Monitoring is critical to identify reductions in forest health and/or resource value. A Stand Establishment Decision Aid is available online through FORREX at the following link: http://jem.forrex.org/index.php/jem/article/view/16

Disease

- Aspen and poplar leaf and shoot blight, *Venturia macularis* Fr.:Fr. and *Venturia populina* Vuill. L. Fabricus
- Pine foliar disease, *Dothistroma pini*, *Lophodermella concolor*, *L. monitvega* and *Elytrodrema deformans*

The crowns of mature aspen and cottonwood stands will become stunted and deformed if infection continues for consecutive years; therefore the monitoring of aspen stands is critical in order to identify any long-term reductions in forest health and/or resource value.

The high susceptibility of mortality in young aspen and cottonwood sprouts (asexual reproduction), combined with the high infection rate observed in 2008 and 2009 calls for close monitoring of openings being managed for deciduous regeneration.

Samples of pine foliage disease should be sent to the regional forest pathologist for identification. Increased awareness of pine foliar diseases will assist in identifying outbreaks before they threaten forest management objectives in young pine stands.

Abiotic Damage

Abiotic damage is difficult to manage for, since occurrences are often outside of our control. However; incidences are important to monitor as long-term effects on forest health must be accounted for to ensure the sustainability of our forest resource and to ensure that remedial action is taken where necessary.

Tactical Strategy

Forest health activities to be carried out in the Fort Nelson Forest District have been summarized with a timeline in the Project Plan and Tracking Form. A snapshot of the current Project Plan and Tracking Form can be seen in Appendix V.

Forest health agents will continue to be monitored through the provincial forest health overview surveys which are conducted annually. In 2009, the overview surveys were completed by Fort Nelson Forest District Staff, however; in 2010, due to staffing restraints, this work was contracted. As staffing restrictions continue, 2011 flights are expected to be contracted as well. The south and western boundaries of the TSA should continue to be flown to monitor the spread of mountain pine and other bark beetles. Because drainages can act as corridors which increases insect access to host species, major drainages should also be flown to monitor tree health in these areas and to detect early signs of infestation.

The following is a summary of the procedure taken to conduct the aerial overview Flights, for further information see Appendix III. Flights will be conducted from early-July through August to coincide with the optimum damage symptom expression of major forest pests. Aircraft selection is largely determined by what is available locally; but it should be of high-wing configuration for ease of viewing, and have seating capacity for at least four. Weather is very important in the planning of flights. Good visibility and a minimum ceiling of 3000 feet are required. Flights can only be conducted during mid-morning to mid-afternoon, when the sun is high, and does not create shadows over features. A minimum of two observers should be present to conduct surveys; one on either side of the plane to plot infested areas on a map as detected. A composite map is then created through sketching, and this map is then digitized.

1. Estimate pest incidence, severity, type and location.
2. Assess and predict pest damage.
3. Ground truth pest incidence through surveys to collect site specific data to better assess any hazard and risk associated with the pest.
4. Monitor pest behaviour and populations.

Monitoring of mature and regenerating deciduous and coniferous stands will continue in 2010. This is carried out in collaboration with licensees. This monitoring effort will:

1. Identify any long-term reductions in forest productivity and/or resource values,
2. Assess level of mortality caused in 2010, and
3. Determine the future risk to stands

With all forest health issues, areas where salvage operations would be feasible will be identified and information will be transferred to the Fort Nelson Forest District Small Scale Salvage Strategy (Appendix II).

References

Alfaro, R., A. Shand, D. Leckie, S. Magnussen, E. Cloney, P. Boudewyn, N. Walsworth, T. Heeley and D. Hill. 2004. Spruce Budworm Disturbance of the boreal forest of British Columbia: damage, risk and ecosystem changes. Forest Innovation Investment Forest Research Program Project: R04-010. Canadian Forest Service, Victoria, BC. Pg. 39.

Duthie-Holt, M. 2004. DFAM Forest Health Strategy Fort Nelson TSA. Fort Nelson DFAM Forest Health Committee. Unpublished.

Ministry of Forests and Range. 2006. TSA Forest Health Strategies and Tactical Plans. http://www.for.gov.bc.ca/hfp/health/fhdata/template.htm.

Ministry of Forests and Range. 2007. Provincial Forest Health Strategy (2008-2011). http://www.for.gov.bc.ca/hfp/health/Strategy/FH%20Strategy.pdf

Ministry of Forests and Range. 2010. Forest Health Conditions in 2009. Forest Practices Branch, Ministry of Forests and Range. Retrieved March 11, 2010. http://www.for.gov.bc.ca/hfp/health/overview/2009.htm.

Ministry of Forests, Mines and Lands. 2011. 2010 Summary of Forest Health Conditions in British Columbia. Accessed online, March 22 2011 at: http://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/2010/FH%20Conditions%202010.pdf

Ministry of Forests, Lands and Natural Resource Operations. 2011. Forest Health Conditions in 2010. Forest Practices Branch, Ministry of Forests and Range. Retrieved February 24, 2011. http://www.for.gov.bc.ca/hfp/health/overview/2009.htm.

Glossary of Terms

DFN – Fort Nelson District

District – Fort Nelson District

EBBMA – Emergency Bark Beetle Management Area

EBBMU – Emergency Bark Beetle Management Unit

FNFHS – Fort Nelson Forest Health Strategy

MFLNRO – Ministry of Forests, Lands and Natural Resource Operations

MPB - Mountain Pine Beetle

PFHS – Provincial Forest Health Strategy

TSA – Timber Supply Area

APPENDICES

Appendix I: Common Tree Species in the Fort Nelson TSA

The dominant tree species in the Fort Nelson TSA are:

- white spruce (*Picea glauca*),
- black spruce (*Picea mariana*) and
- trembling aspen (*Populus tremuloides*).

In addition, tree species of secondary importance are

- lodgepole pine (*Pinus contorta*),
- jack pine (*Pinus banksiana*),
- a pine hybrid (*Pinus* x *murraybanksiana*),
- tamarack (*Larix laricina*),

Other tree and shrub species

- sub-alpine fir (*Abies lasiocarpa*),
- black cottonwood (*Populus balsamifera* ssp. *trichocarpa*),
- balsam poplar (*Populus balsamifera ssp. balsamifera*),
- poplar (*Populus balsamifera*),
- paper birch (*Betula papyrifera*),
- Alaska paper birch (*Betula neoalaskana*),
- water birch (*Betula occidentalis*),
- Alaska x paper birch hybrid (*Betula* x *winteri*),
- peachleaf willow (*Salix amygdaloides*),
- Bebb's willow (*Salix bebbiana*),
- Pacific willow (*Salix lucida*),
- pussy willow (*Salix discolor*),
- Scouler's willow (*Salix scouleriana*),
- choke cherry (*Prunus virginiana*),
- pin cherry (*Prunus pensylvanica*) and
- balsam fir (*Abies balsamea*). [Balsam fir is thought to occur in the TSA, but very little documentation, if any, is available as to how far west it ranges.]

Appendix II: Fort Nelson Forest District Strategic Salvage Plan

Purpose

The Ministry of Forests objective for the small scale salvage program are:

1. Harvest and utilize small volumes of timber that are dead and/or in danger of being significantly reduced in value, lost or destroyed and would otherwise not be harvested;
2. Reduce the spread of insects and disease and contribute to forest health management;
3. Provide employment and business opportunities for small independent operators and communities;
4. Ensure a cost-effective program that contributes to government revenues;
5. Recognize and meet the government's objectives with respect to coarse woody debris; and
6. Reduce forest fire hazard by reducing the dead and down fuel load.

In Fort Nelson Forest District, to date there has been no incidence of Mountain Pine Beetle attack, so there is no link to the *British Columbia Mountain Pine Beetle Action Plan*.

The role of the salvage program within the district is to accommodate requests, mainly from small independent operators, to provide volume for firewood, building logs and timbers to construct bridges for both the oil and gas and forest industries.

Application and Scope

This district salvage plan will be reviewed and revised annually (in conjunction with the district service plan) and as circumstances require.

The majority of the licences will be direct award Forestry Licences to Cut with a maximum volume of 2,000 m3 (Small Scale Salvage).

One non-replaceable forest licence (A78356) was awarded to Tsa Cho Timber Ltd. October 1, 2005. This licence has a term of 5 years and a maximum of 90,000 m3 of fire killed trees can be harvested. If there are more catastrophic events, such as a project fire, then another non-replaceable forest licence may be an option.

The attached map shows areas that are targeted for salvage, as they are along major access routes and the volume is in danger of decreasing as a result of a wind, event, fire, or over mature age class of the stand. In most instances, road construction will not be approved for the purposes of salvage, as the road building costs would exceed any profit that may be made from harvesting the affected trees.

The district program will be managed to meet local demand for volume, currently there is a non-replaceable forest licence with an annual allowable cut of 18,000 m3

per year and an estimate of direct award volume of 2,000 m3 (Forestry Licence to Cut)
The stands that will be targeted are:

- NRFL A36978 trees killed by the Coal River Fire of 2004
- Coniferous and deciduous wind throw
- Trees attacked by budworm, and/or bark beetle
- Coniferous and deciduous over mature with tops broken
- Coniferous and deciduous jackknifed due to slope stability issues (if safe operations can be conducted on site – Work Safe BC regulations would prevail).

All licences would be awarded on stands that are on unencumbered Crown land, the district accepts both professional and conventional applications. For the conventional applications, district staff will do the electronic submission. All licences will have spatial information captured along with a post harvest report. The activities will be monitored to ensure that the harvest does not result in clear cuts greater than one hectare.

General Forest Conditions

The Fort Nelson Timber Supply Area (TSA), which covers the same area as the Fort Nelson Forest District, is 9.8 million hectares bordering Alberta to the east, the North West Territories and Yukon to the north, Fort St. John TSA to the south, Mackenzie and Skeena-Stikine TSAs to the west. There is limited access, with mainly winter only roads, which require the creation of ice bridges every year. The access issues can result in stands with forest health issues not being harvested.

Forests in Fort Nelson TSA are part of Canada's legendary boreal forest which is the largest intact forest ecosystem in the world and amounting to more than half the total area of Canada. The boreal forest in Fort Nelson TSA consist of three biogeoclimatic zones including: boreal white and black spruce (the majority of the area), spruce-willow-birch and alpine tundra. The forests in the first two zones listed are susceptible to the majority of forest pests and disease that exist in the north.

The following is an outline of the forest conditions that exist in the Fort Nelson TSA which contribute to merchantable volume loss; thereby making stands eligible for the salvage program:

1. Natural- and human-caused wildfire – fires do sometimes burn through merchantable stands, resulting in potential volume loss. Recently the wildfires of 2003 and 2004 have occurred in areas that could have been salvaged. The non-replaceable forest licence issued to Tsa Cho Logging Ltd in August of 2005 was to salvage volume from area burnt by the Coal River Fire in 2004. A major fire occurred in 2009 in the Smith River area. Potential exists for salvage in this area; however limited markets exist for the sale of salvaged timber.

2. Spruce decline – located primarily in the Liard River, LaBiche River, Nelson Forks, Kiwigana River, Kotcho Lake and west of Coal River area. It is not confined to these areas and can be found in pockets throughout the TSA. It is characterized by old spruce forests that have been gradually declining, due mainly to their age. These older trees are easily stressed by biotic and abiotic factors. The decline in some of these stands had been accelerated by repeated defoliation by eastern spruce budworm.
3. Eastern spruce budworm (*Christoneura fumiferana*) – the budworm had been defoliating white spruce and sub-alpine fir for the past decade. The eastern spruce budworm outbreak was at its worst from 1982 to 2001. From 2001 to 2004 the population decreased substantially; and in 2005 it became very apparent that the population had crashed. In its wake the eastern spruce budworm has weakend many stands, primarily those consisting of white spruce and sub-alpine fir.
4. Bark beetles: Western balsam bark beetle (*Dryocoetes confusus*) (WBBB) and spruce beetle (Dendroctonus rufipennis).
5. Forest Tent Caterpillar (*Malacosoma disstria*) – there was incidence of this pest in 1999 and 2000. The tent caterpillar population is endemic in the district, with infestations levels that are low to moderate.

Strategic Goals

The focus of the salvage program in the Fort Nelson district is to utilize volume damaged by pests, disease and a weather events before significant values are lost. The salvage activities will be directed to the areas where they fulfill the greatest forest management need, and where the stands are accessible by the existing road network.

This plan will be made available to salvage operators, First Nations groups, and the public for comment.

This plan and all salvage harvesting will be consistent with the applicable legislation, provincial, regional and district policies and procedures.

District Priorities

Stands available for salvage are prioritized by the following criteria:

1. Stands adjacent to all weather access (roads)
2. Dead, down and/or broken trees
3. Budworm damaged
4. Over mature stands both spruce and aspen leading
5. Site productivity at and over the site indices identified in the *Fort Nelson Timber Supply Area Timber Supply Review Data Package*
6. Areas that need to harvested to reduce fuel hazard with the objective of protection from wildfire
7. Stands that are adjacent to transmission line rights-of-way that may cause a safety concern or fire hazard.

Priority may be given to areas adjacent to private land, woodlots, highway and settlement corridors, scenic areas with fuel management concerns, and where other resource values may be at risk.

District Objectives for the Use of FLTC's, SNRFL's and CSL's

The tenure type that would be issued for the majority of the salvage operations in the TSA would be Small Scale Salvage Forestry Licence to Cut (maximum volume of 2,000m3). Most of the applications that come into the district office will be conventional applications (there are no local service providers, so it is not anticipated that any professional applications would be submitted). With the conventional applications, district staff will provide the electronic submission, spatial data and post harvest report.

Roads

No new roads will be authorized to be built for access to small scale salvage stands.

The salvage operator will need to enter into a road use agreement with the holder of a road permit, if use of the road is required to access the stand to be salvaged.

Implementation

Application forms for Forestry Licence to Cut can be obtained from the Fort Nelson Forest District Office, or can be accessed on the internet at http://www.for.gov.bc.ca/hth/timten/small-scale-salvage.htm.

For more information on the Fort Nelson forest District please visit our website at: http://www.for.gov.bc.ca/dfn/

Future Considerations

Currently, it is not anticipated that there would be much change in the program for the Fort Nelson TSA

Contact Information

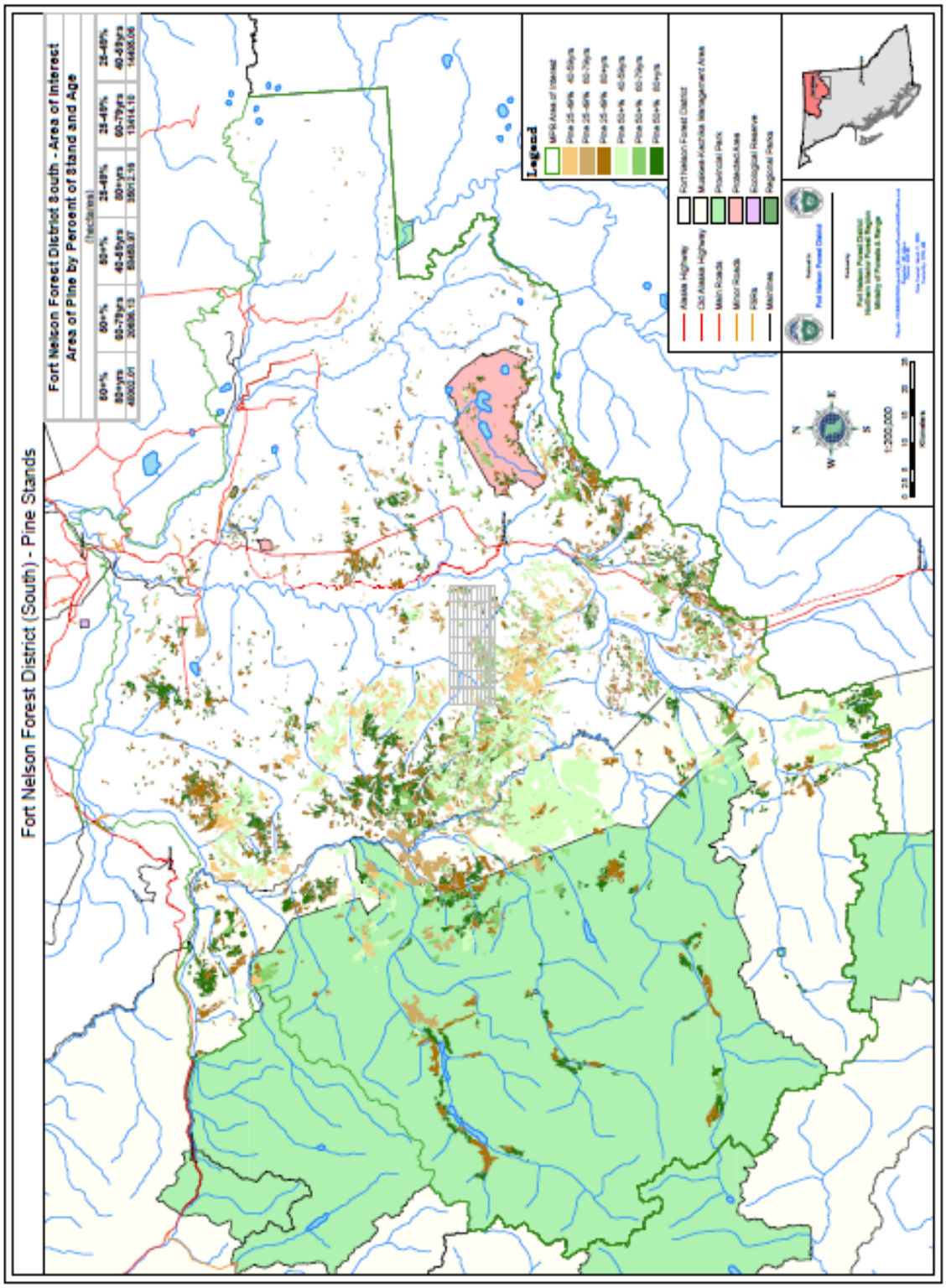
For more information regarding the salvage program in the Fort Nelson TSA contact: Jeanine Hudson, RFT, Tenures Technician at 250 774-5511.

Appendix III: Forest Health Aerial Overview Survey Standards for British Columbia

To view a copy of this document, visit the following website:

http://ilmbwww.gov.bc.ca/risc/pubs/teveg/foresthealth/assets/aerial.pdf

Appendix IV: Mountain Pine Beetle Area of Interest



Appendix V: Project Plan and Tracking Form

Fort Nelson Forest District

PROJECT PLAN AND TRACKING FORM

Project Name:	Forest Health
Project Priority:	3 of 3
Lead Program:	Forest Practices
Project Lead(s):	Mary
Team Members:	Stephanie Wilkie
Project Description & Project Goals: A clear description of what the project is and expected goals / outputs of the project	Quantification of Forest Health problems in the TSA; where necessary the prescription and implementation of protective or suppressive treatments to prevent insect, disease , abiotic and mammal damage to forest stands.

Project Scope (list of tasks required to complete the project)	**Resources Required**	**Staff Required**	**Timelines**	
			Start Date	**Complete Date**
Annual update of Forest Health Strategy for TSA – to be signed off by DM in April	Computer, Aerial Overview Survey Results	Stephanie	Mar 1	Mar 31
MPB Working Group – local group to develop short- and long-term management strategies to mitigate MPB impact on TSA AAC.	Meeting room, maps, GIS Analysis; beetle guidebooks,	Mary, Stephanie	Ongoing	Ongoing
Stand Specific Prescriptions; -where forest health incidence warrant, develop prescriptions and monitoring strategies on site by site basis	Helicopter, truck, maps, hatchets, field gear,	Mary Stephanie + other staff as available	May	October

External influences that may affect the project:

- Budget
- Workload/priorities of other programs – may not be able to provide assistance in field work.

Appendix VI: Damage Codes (Form 747)

BRITISH COLUMBIA

DAMAGE AGENT AND CONDITION CODES

FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
A	**ANIMAL DAMAGE**		
AB	BEAR	AP	PORCUPINE
AC	CATTLE	AS	SQUIRREL
AD	DEER	AV	VOLE
AE	ELK	AX	BIRDS
AH	HARE OR RABBIT	AZ	BEAVER
AM	MOOSE		
N	**ABIOTIC INJURIES**		
NB	FIRE	NN	ROAD SALT
ND	DROUGHT	NR	REDBELT
NF	FLOODING	NS	SLIDE
NG	FROST	NW	WINDTHROW
NGC	frost crack	NWS	windthrow-soil failure
NGH	frost-heaved	NWT	windthrow-treatment
NGK	shoot / bud frost kill		or harvest related
NH	HAIL		
NK	FUMEKILL	NY	SNOW, ICE, SNOW PRESS
NL	LIGHTNING	NZ	SUNSCALD
D	**DISEASE**		
DB	BROOM RUST		
DBF	fir broom rust *Melampsorella caryophyllacearum*		
DBS	spruce broom rust *Chrysomyxa arctostaphyli*		
DD	STEM DECAYS		
DDA	white mottled rot *Ganoderma applanatum*		
DDB	white spongy trunk rot *Fomes fomentarius*		
DDD	sulfur fungus *Laetiporus sulphureus*		
DDE	rust-red stringy rot *Echinodontium tinctorium*		
DDF	brown crumbly rot *Fomitopsis pinicola*		
DDH	hardwood trunk rot *Phellinus ignarius*		
DDO	brown cubical butt & pocket rot of cedar *Postia sericeomollis*		
DDP	red ring rot *Phellinus pini*		
DDQ	brown trunk rot (quinine fungus) *Fomitopsis officinalis*		
DDS	Schweinitzii butt rot *Phaeolus schweinitzii*		
DDT	aspen trunk rot *Phellinus tremulae*		

FIELD CODES	DESCRIPTION
DF	FOLIAGE DISEASES
DFA	western pine aster rust *Coleosporium asterum*
DFB	delphinella tip blight *Delphinella* spp.
DFC	large-spored spruce-labrador tea rust *Chrysomyxa ledicola*
DFD	spruce needle cast *Lirula macrospora*
DFE	elytroderma disease *Elytroderma deformans*
DFF	marssonina leaf blights *Marssonina* spp
DFG	cottonwood leaf rust *Melampsora occidentalis*
DFH	larch needle blight *Hypodermella laricis*
DFL	pine needle cast *Lophodermella concolor*
DFM	larch needle cast *Meria laricis*
DFP	fir-fireweed rust *Pucciniastrum epilobii*
DFR	Douglas-fir needle cast *Rhabdocline pseudotsugae*
DFS	dothistroma (red band) needle blight *Mycosphaerella pini*
PSS	sirococcus tip blight *Sirococcus strobilinus*
PDT	cedar leaf blight *Didymascella thujina*
DL	LEADER OR BRANCH DIEBACKS
DLD	dermea canker *Dermea pseudotsugae*
DLF	red flag disease *Potebniamyces balsamicola*
DLK	conifer cytospora canker *Leucostoma kunzei*
DLP	diaporthe canker *Diaporthe lokoyae*
DLS	sydowia tip dieback *Sclerophoma pithyophila*
DLV	aspen & poplar leaf and shoot blights *Venturia spp.*
DM	DWARF MISTLETOES
DMF	Douglas-fir dwarf mistletoe *Arceuthobium douglasii*
DMH	hemlock dwarf mistletoe *Arceuthobium tsugense*
DML	larch dwarf mistletoe *Arceuthobium laricis*
DMP	lodgepole pine dwarf mistletoe *Arceuthobium americanum*
DR	ROOT DISEASES
DRA	armillaria root disease *Armillaria ostoyae*
DRB	blackstain root disease *Leptographium wageneri*
DRC	laminated root rot (cedar form) *Phellinus weirii*
DRL	laminated root rot (Fd form) *Phellinus weirii*
DRN	annosus root disease *Heterobasidion annosum*
DRR	rhizina root disease *Rhizina undulata*
DRS	schweinitzii butt rot *Phaeolus schweinitzii*
DRT	tomentosus root rot *Inonotus tomentosus*

FS 747 HSP 2005/02

FIELD CODES	DESCRIPTION
DS	STEM DISEASE (CANKER OR RUST)
DSA	atropellis canker *Atropellis piniphila*
DSB	white pine blister rust *Cronartium ribicola*
DSC	comandra blister rust *Cronartium comandrae*
DSE	sooty bark canker *Encoelia pruinosa*
DSG	western gall rust *Endocronartium harknessii*
DSH	hypoxylon canker *Entoleuca mammatum*
DSP	cryptosphaeria canker *Cryptosphaeria populina*
DSR	ceratocystis canker *Ceratocystis fimbriata*
DSS	stalactiform blister rust *Cronartium coleosporioides*
DSY	cytospora canker *Valsa sordida*
I	**INSECTS**
IA	APHIDS *OR ADELGIDS*
IAB	balsam woolly adelgid *Adelges piceae*
IAC	giant conifer aphid *Cinara spp*
IAG	Cooley spruce gall adelgid *Adelges cooleyi*
IAL	larch cone woolly aphid *Adelges lariciatus*
IAS	spruce aphid *Elatobium abietinum*
IB	BARK BEETLES
IBB	western balsam bark beetle *Dryocoetes confusus*
IBD	Douglas-fir beetle *Dendroctonus pseudotsugae*
IBI	engraver beetles *Ips*
IBM	mountain pine beetle *Dendroctonus ponderosae*
IBP	twig beetles *Pityogenes, Pityophthorus spp*
IBS	spruce beetle *Dendroctonus rufipennis*
IBT	red turpentine beetle *Dendroctonus valens*
IBW	western pine beetle *Dendroctonus brevicomis*
ID	DEFOLIATING INSECTS
IDA	black army cutworm *Actebia fennica*
IDB	two-year budworm *Choristoneura biennis*
IDC	larch casebearer *Coleophora laricella*
IDD	western winter moth *Erannis vancouverensis*
IDE	spruce budworm *Choristoneura fumiferana*
IDF	forest tent caterpillar *Malacosoma disstria*
IDG	green-striped forest looper *Melanolophila imatata*
IDH	western blackheaded budworm *Acleris gloverana*
IDI	pine needle sheath miner *Zelleria haimbachi*
IDL	western hemlock looper *Lambdina fiscellaria lugubrosa*
IDM	gypsy moth *Lymantria dispar*
IDN	birch leaf miner *Fenusa pusilla*

FIELD CODES	DESCRIPTION
IDP	larch sawfly *Pristiphora erichsonii*
IDR	alder sawfly *Eriocampa ovata*
IDS	conifer sawflies *Neodiprion spp.*
IDT	Douglas-fir tussock moth *Orgyia pseudotsugata*
IDU	satin moth *Leucoma salicis*
IDV	variegated cutworm *Peridroma saucia*
IDW	western spruce budworm *Choristoneura occidentalis*
IDX	large aspen tortrix *Choristoneura conflictana*
IDZ	western false hemlock looper *Nepytia freemani*
IS	SHOOT INSECTS
ISB	western cedar borer *Trachykele blondeli*
ISE	European pine shoot moth *Rhyaconia buoliana*
ISG	gouty pitch midge *Cecidomyia piniinopis*
ISP	pitch nodule moths *Petrova spp.*
ISS	western pine shoot borer *Eucosma sonomana*
ISQ	Sequoia pitch moth *Synanthedon sequoiae*
IW	WEEVILS
IWC	conifer seedling weevil *Steremnius carinatus*
IWM	Magdalis sp.
IWP	lodgepole pine terminal weevil *Pissodes terminalis*
IWS	white pine weevil (on spruce) *Pissodes strobi*
IWW	Warren's root collar weevil *Hylobius warreni*
IWY	cylindrocopturus weevil *Cylindrocopturus spp.*
IWZ	Yosemite bark weevil *Pissodes schwartzii*
M	**MITE DAMAGE (TRISETACUS SPECIES)**
T	**TREATMENT INJURIES**
TC	CHEMICAL
TH	HARVESTED
TL	LOGGING
TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
TP	PLANTING
TPM	planting — poor microsite
TR	PRUNING
TT	THINNING OR SPACING
V	**VEGETATION PROBLEMS**
VH	HERBACEOUS COMPETITION
VP	VEGETATION PRESS
VS	SHRUB COMPETITION
VT	TREE COMPETITION