2013/2014
Merritt TSA Forest Health Strategy

Cascades District

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Cover Photo: Landscape level MPB management in the Pennask Plateau area, taken by Martin Ponsioen.

Document Prepared by:

Martin Ponsioen, RFT
Cascades District
Ministry of Forests, Lands and Natural Resource Operations
Merritt, BC

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Forest Health Strategy

Introduction

Forest health factors such as insects and diseases are natural components of our forested ecosystems. When present below certain thresholds, native forest health factors are integral to healthy ecosystems, contributing to the food chain and biodiversity. What is considered an acceptable level for a certain forest health factor depends in part on the management goals and objectives for the area. At unacceptable levels (such as the present Mountain Pine Beetle outbreak in many parts of British Columbia) damage by pests can lead to economic instability, unsalvaged losses, degraded lumber values, reduced stumpage values, disruption of long-term forest management planning, and negative impacts on recreation and aesthetic values, range, fish and wildlife resources, and watershed management.

Responsible stewardship directed at protecting forests in British Columbia (BC) from unacceptable damage is guided in principle by the BC Ministry of Forests, Lands and Natural Resource Operations' (MFLNRO) *Provincial Forest Health Strategy* (2008/09-20010/11). The provincial government's three key strategic forest health objectives are to:

1. Protect forest resources from pest damage by direct actions when operationally possible 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.

In response to the Mountain Pine Beetle epidemic in the BC interior, in April 2005 the BC government released the Mountain Pine Beetle Action Plan for 2005 – 2010 (updated Plan for 2006-2011 released September 2006) in effort to mitigate the impacts of the beetle on the forest values, communities and the economy in the short term, and to implement measures to ensure their sustainability in the long term. The five year plan presents seven (7) broad objectives which outline a government-wide effort of cooperation between multiple ministries, the forest industry and other impacted stakeholders, including

- Recovering the maximum value from the infested, dying and beetle-killed timber before it decays or is destroyed by wildfire,
- Prevent or minimize the damage to susceptible forest that is not yet significantly infested,
- Reforest areas of beetle-infested and killed timber that have been salvage/sanitation harvested, and
- Conserve the longer-term forest values identified in higher-level land use plans.

The following 2013/14 Forest Health Strategy is an update of the 2012/13 strategy document, and is specific to the Merritt TSA. Specifically for the Mountain Pine Beetle, the strategy will also be guided by the key objectives within the provincial 2006 – 2011 Mountain Pine Beetle Action Plan.

Goals and Objectives

The goal of the Merritt TSA Forest Health Strategy is to protect the forest resources from damaging agents that threaten the resources immediate and long-term sustainability. In the case of Mountain Pine Beetle the strategy will be to maximize the removal of green attack, dead and susceptible in a manner consistent with the strategy and tactics

developed jointly with government and licencees.

To successfully attain this goal, a number of objectives must also be identified and achieved. These objectives mirror those identified at the provincial level and are as follows:

- Maintain a detection program for damaging agents. This program includes standardized incidence surveys, reports, records and continuous improvement or evolution of methods.
- Assess current and future stand and landscape level hazard and risk from priority pests including the impacts of forest management practices on resource values.
- Identify significant pest risks to resource values and identify appropriate management strategies and tactics, while considering constraints imposed by other resource management agencies.
- Implement strategies and tactics according to scientifically sound practices. This includes implementing strategies and tactics in a timely manner for unforeseen occurrences or outbreaks.
- Evaluate results of practices over the short and long-term and modify accordingly. This includes monitoring practices, identifying information gaps and applying research to revise and improve practices as required.

Forest Health Responsibilities

As of April 1, 2005 the responsibility for managing the forest health program in the province returned to the BC Ministry of Forest, Lands and Natural Resource Operations. Table 1a and 1b describe the basic functions required by the Government of BC and the forest licensees within the Merritt TSA as of April 1, 2005.

Table 1a. Forest health obligations for the Merritt TSA: BC Government

District Responsibilities	Region / Branch Responsibilities
• Prepare an annual Forest Health Strategy consistent with the provincial Forest Health Strategy • Strategic planning for uplift volume. • TSA Forest Health committee meetings.	• Define performance measures for specific strategies and tactics
• Conduct detailed aerial and ground surveys for the TSA, within the existing identified Suppression Beetle Management Units (BMU) of the Merritt TSA	• Conduct annual aerial overview survey on all provincial forests • Provide the annual province-wide forest health overview
District Responsibilities	**Region / Branch Responsibilities**
• Within the Suppression BMU's of the TSA, conduct bark beetle detection and deliver measures for single tree treatment of Bark Beetles. • Provide maps showing the results of detailed aerial surveys. The district forest health program will be the 'keeper of the data' for aerial overview (supplied by Region) and detailed overview and	• Conduct aerial treatment of defoliator epidemics. • Monitor and evaluate activities.

ground survey information.

- Produce an annual report describing bark beetle performance measures for the single tree treatment operations.
- Mortality estimates of Bark Beetles

The individual forest licensees within the Merritt TSA are still obligated to record and evaluate the occurrence of detected forest health factors for Forest Stewardship Plans and operational plans, as well as conduct ground surveys and timber reconnaissance in efforts to develop salvage/sanitation harvest plans and treatments

Table 1b. Forest health obligations for the Merritt TSA: BC Government and Licensees.

Activity	Government	Forest Licensees
Conduct annual aerial overview forest health survey on all provincial forests and report on results	X	
Conduct detailed aerial surveys of suppression beetle management units	X	
Conduct ground surveys as required to quantify incidence and intensity of damaging agents.	X	X
Maintain a record of collected survey information	X	
Conduct bark beetle treatments when required by the Forest Health Strategy	X	X*
Provide annual reporting of bark beetle activities to the Province	X	
Conduct treatment of defoliator outbreaks when appropriate	X	
Monitor and treat, if necessary, introductions of non-native potentially harmful organisms	X	
Identify knowledge gaps	X	
Utilize the best current information to detect and manage forest health factors	X	X
Monitor and evaluate forest health activities to attain adaptive management	X	

* Includes pheromone baiting, trap tree felling, and salvage/sanitation harvesting.

Where management activities are recommended in this strategy, procedures would follow the standards set by the Ministry of Forest, Lands and Natural Resource Operations, and/or those detailed in the *Forest Practices Code* guidebooks, if appropriate. Reforestation with species that are suitable for each biogeoclimatic zone is addressed by following the stocking standards in the appropriate licensee stewardship plan. To the best of present knowledge, these guidelines take into consideration potential forest health hazards in species selection.

TSA Description

The Merritt TSA encompasses a total of 1,130,064 hectares, of which 811,398 hectares (71.8%) is productive forest land and 686,565 hectares (60.4%) is within the operable land base available for timber harvest. Of this land base, various designations apply and forest health management objectives, responsibilities and potential control activities differ depending on the land designation (Table 2).

Table 2. Merritt TSA Landbase Profile

Landbase Designation	Area (ha)	% of Total Area
Merritt TSA Total	1,130,064	
Private, IR, TFL	209,456	18.5%
Parks and Protected Areas	11,017	1.0%
Woodlots	16,500	1.5%
Total Forested Area (MoF)	811,398	71.8%
Timber Harvesting Land Base	683,565	60.4%

The hectares quoted in the above table do no match the TSR 4 Analysis Report as they are based on TSR 3.

The landscape across BC is classified according to biogeoclimatic zones using vegetation, soils and climate. Dominant climatic climax vegetation is utilized to name each zone. These zones are used frequently in forestry management to help determine hazard ratings for forest health factors. Eight of the total sixteen zones found in BC are represented (Table 3a, Figure 1a).

Table 3a. Biogeoclimatic zones in the Merritt TSA.

Biogeoclimatic zones	Area (ha)	% of Total Area
Interior Douglas-fir (IDF)	538,730	47.6
Montane Spruce (MS)	312,990	27.7
Engelmann Spruce Subalpine Fir (ESSF)	200,515	17.7
Bunchgrass (BG)	46,282	4.1
Ponderosa Pine (PP)	28,323	2.5
Coastal Western Hemlock (CWH)	2,934	0.3
Interior Mountain-heather Alpine(IMA)	1,198	0.1
Mountain Hemlock (MH)	174	<0.1

Mountainous terrain and steep river valleys of the Cascade Mountains dominate the western portion of the TSA, while the dry, flat Thompson Plateau dominates the eastern portion. Over 5% of the TSA is very dry grasslands with sagebrush and open-growing Ponderosa Pine.

Five natural disturbance types (NDTs) are recognized as occurring in BC, which characterize areas with different natural disturbance regimes. Stand-initiating disturbances (e.g. wildfires and insect outbreaks) are those processes that largely terminate the existing forest stand and initiate secondary succession in order to produce a new stand. Disturbances such as the understorey ground fires that occur in the IDF and PP biogeoclimatic zones are vital to keeping the successional processes stable in these zones. The frequent ground fires also prevent large, dense thickets of immature Douglas-fir from forming in the understory which encourages the build-up of Western spruce budworm populations. As shown in Table 3b and Figure 1b, a significant portion of the Merritt TSA (52.6%) is in the NDT4 and is susceptible to frequent wildfires.

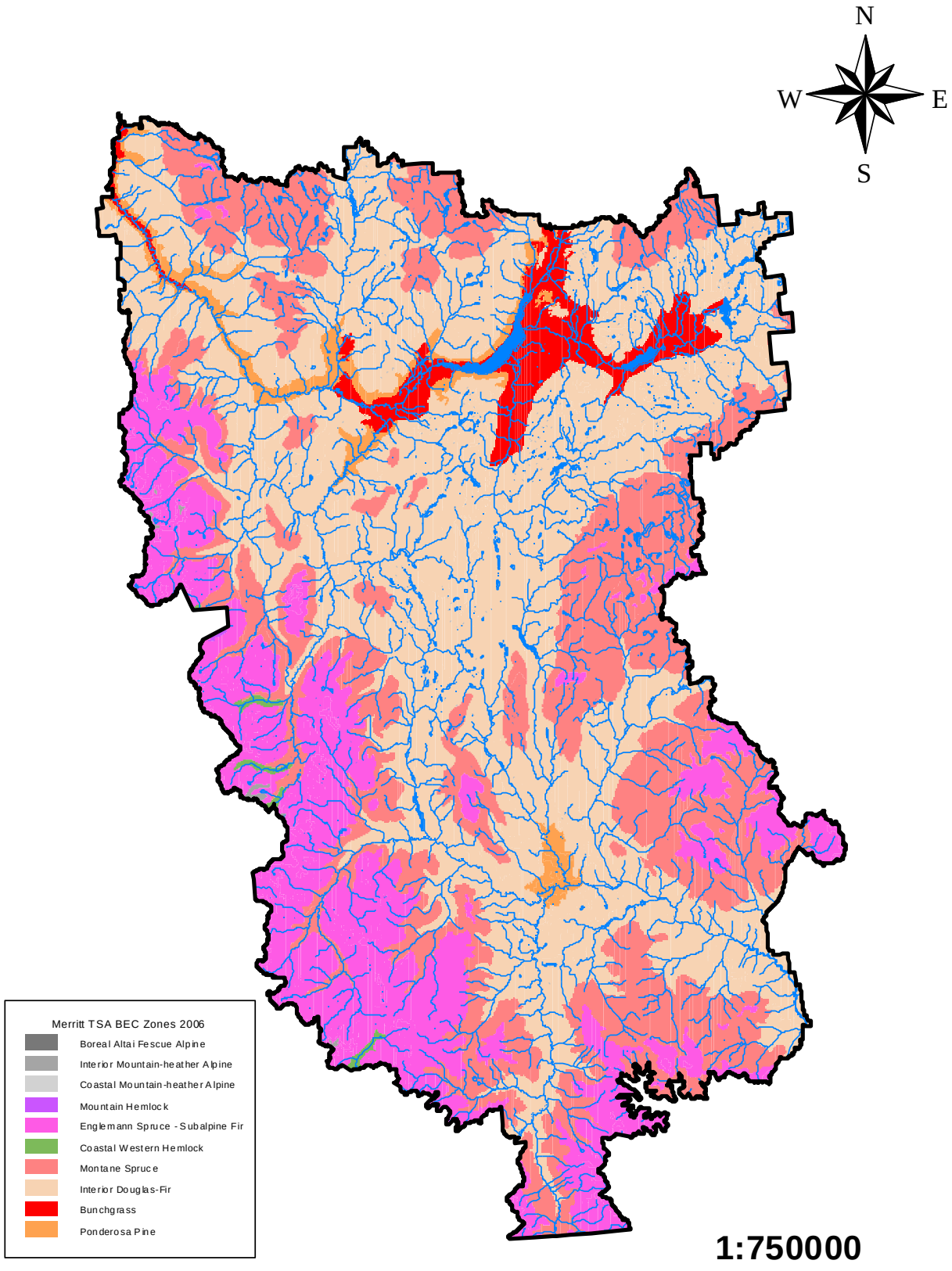

Figure 1a. Biogeoclimatic zones in the Merritt TSA (January 2006).

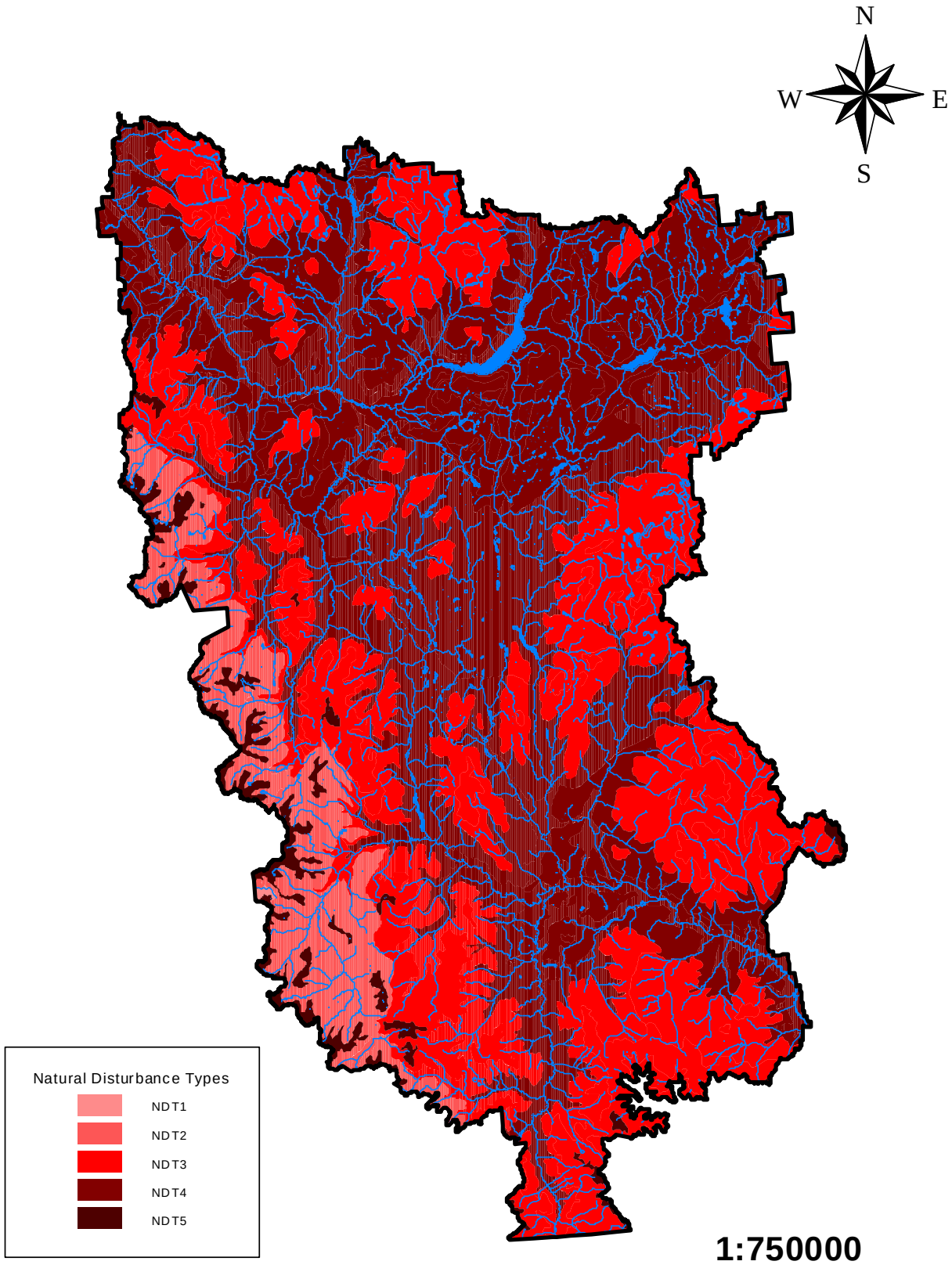

Figure 1b. Natural Disturbance Types (NDT) in the Merritt TSA.

Table 3b. Natural Disturbance Type (NDT) zones in the Merritt TSA.

NDT zone	Disturbance Interval	Area (ha)	% of Total Area
NDT1	Rare, 250-350yrs	369	<0.1
NDT2	Infrequent, 200yrs	87,482	7.7
NDT3	Frequent, 100yrs	420,501	37.2
NDT4	Frequent, 4-50yrs	594,595	52.6
NDT5	Rare, Alpine	28,201	2.5

Also, the vast majority of pine forest types susceptible to Mountain pine beetle are found within the NDT3 and NDT4, when combined total nearly 90% of the TSA landbase.

Forest Health Agents of Concern

Stands damaged by forest health agents are recorded annually by two levels of aerial survey by the BC Ministry of Forest, Lands and Natural Resource Operations. This information is recorded as spots or polygons of affected trees, with associated severities and hectares involved. The more general aerial overview survey is conducted over the entire Merritt TSA, and it is the quantitative data gathered from the aerial overview that is quoted in the Forest Health strategy to allow consistent comparison with other TSA's. Only forest health factors that are readily distinguishable from the air are recordable with the overview survey. The general forest health agents (excluding bark beetles) identified during the 2012 overview survey are shown in Figure 2a (primary agents only) and Figure 2b (all agents). All forest health agents identified each year since 2001 are listed in Table 5. Identified bark beetle infestations are presented in the Bark Beetle Strategy in Figure 6. The detailed aerial GPS forest health survey is more operational in nature, and tends to drive the on-the-ground beetle management activities within the *suppression* beetle management units where ground surveys and single-tree treatments may be implemented.

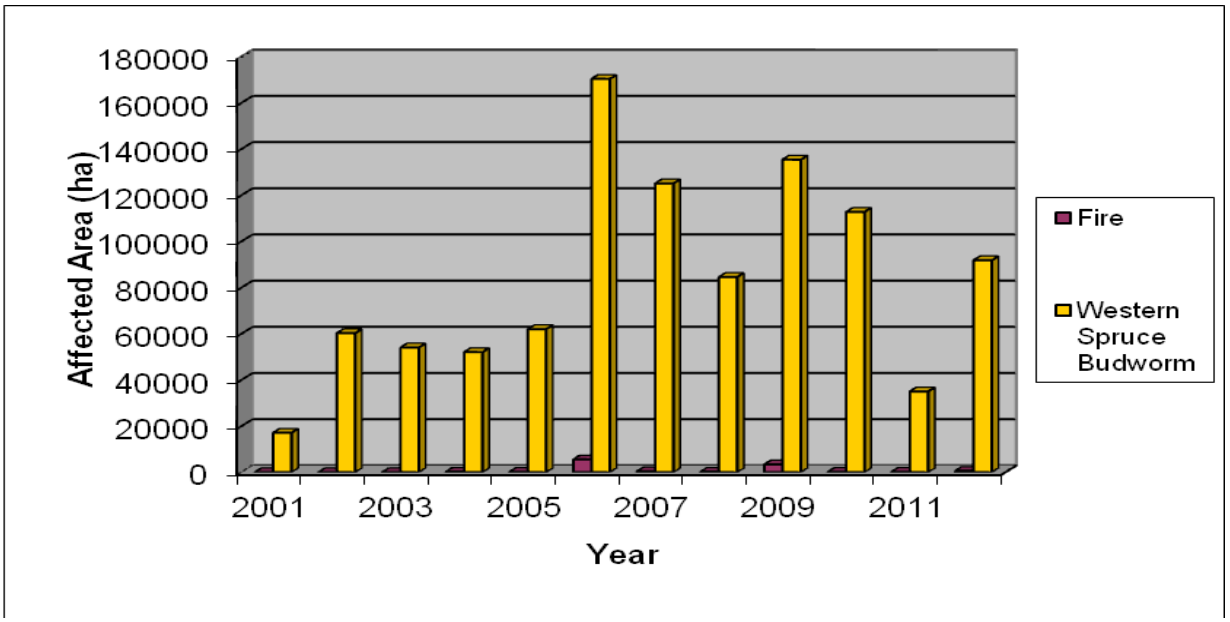

Figure 2a. Primary forest health agents (excluding beetles) in the Merritt TSA 2001 – 2012.

The priority forest health pests have been ranked following the Provincial Forest Health Strategy (Table 4). Rankings were based on the following factors: known impacts to forest resource values, availability of operational detection and treatment methods, costs and benefits of applying detailed detection and treatment activities, overall level of knowledge of the hazards and risks and distribution and incidence levels of the pests.

Table 4. Merritt TSA Priority Ranking of Forest Health Pests

Very High	High	Medium	Low	Very Low
Mountain Pine Beetle	Western Spruce Budworm	Cattle	Western Balsam Bark Beetle	
Spruce Bark Beetle	Lodgepole pine Dwarf Mistletoe	Tomentosus Root Rot	Vole	
Armillaria Root Disease	Hard pine stem rusts		White pine blister rust	
	Douglas-fir Beetle			
Phellinus Root Disease				

Stand Establishment Decision Aids

Stand Establishment Decision Aids (SEDAs) exist for forest health factors that affect this TSA. These SEDAs are available for download at http://www.forrex.org/tools/sedas/. The FH SEDAs that reference ecosystems from this TSA (and therefore may be of interest) are:

1. Southern Interior Forest Region Forest Health SEDAs (Blackstain Root Disease, Comandra Blister Rust, Western Gall Rust, Western Spruce Budworm, and White Pine Blister Rust)
2. Spruce Weevil coastal forests
3. White Pine Blister Rust
4. Armillaria Root disease
5. Laminated Root Rot coastal forests
6. Hemlock Dwarf Mistletoe coastal forests
7. Cariboo Forest Region SEDAs (Pine Dwarf Mistletoe, Lodgepole Pine Terminal Weevil, Western Gall Rust, and Spruce Terminal Weevil).

Although our ecosystems are not mentioned in the Southern Interior Forest Region Forest Health SEDA for Spruce Terminal Weevil; this pest has been noted in the TSA. Consideration should be given to this FH agent, especially as we favor planting increased quantities of genetically improved spruce in our TSA.

Several of these SEDAs are from the Coast and Cariboo in name, but due to the transitional ecosystems in our TSA, some of them apply. It is recommended that you monitor the Forrex webpage as new SEDAs are published from time to time and may be applicable to this TSA.

Where a SEDA identifies that there is a high hazard from a specified forest health factor in a given ecosystem, and the ranking of that forest health factor is high or very high, it may be more appropriate to follow the management recommendations given in the SEDA. For your convenience and to help inform delegated decision makers (when reviewing proposed FSP stocking standards) those high hazard, high rank intersections are presented below.

- Western spruce budworm is noted as high hazard in the Southern Interior Region (SIR) Forest Health SEDA. When operating in the IDF xh1, xh2, and dk1 the following regeneration and establishment considerations are suggested: promote species mixtures and consider converting stands to non-host species (ie lodgepole pine and ponderosa pine). Further harvest and plantation maintenance considerations are made in the SEDA.
- Armillaria root disease is noted as high hazard, in the Armillaria Root Disease SEDA, when operating in any of our ecosystems except the PP. If Armillaria is detected within a block strong consideration should be given to the recommendations contained within the SEDA.
- Lodgepole pine dwarf mistletoe is noted as high hazard in the Cariboo Forest Region Part 1 Forest Health SEDA. When operating in the IDF dk1 and ESSF dc2 consideration should be given to the recommendations contained within the SEDA, including removal of residual lodgepole pine over 50cm tall.
- Commandra Blister Rust is speculated (limited or conflicting data) at moderate to high hazard in the SIR Forest Health SEDA. When operating in the ESSF dc2, IDF dk1, dk2, and MS dm2 consideration should be given to the recommendations contained within the SEDA, including increased stocking density to offset rust caused mortality. This may be of lesser or greater importance based on whether or not plantations and stands in the geographic area have had a history of or exhibit signs of current rust infections or if large amounts of the alternate hosts are noted.

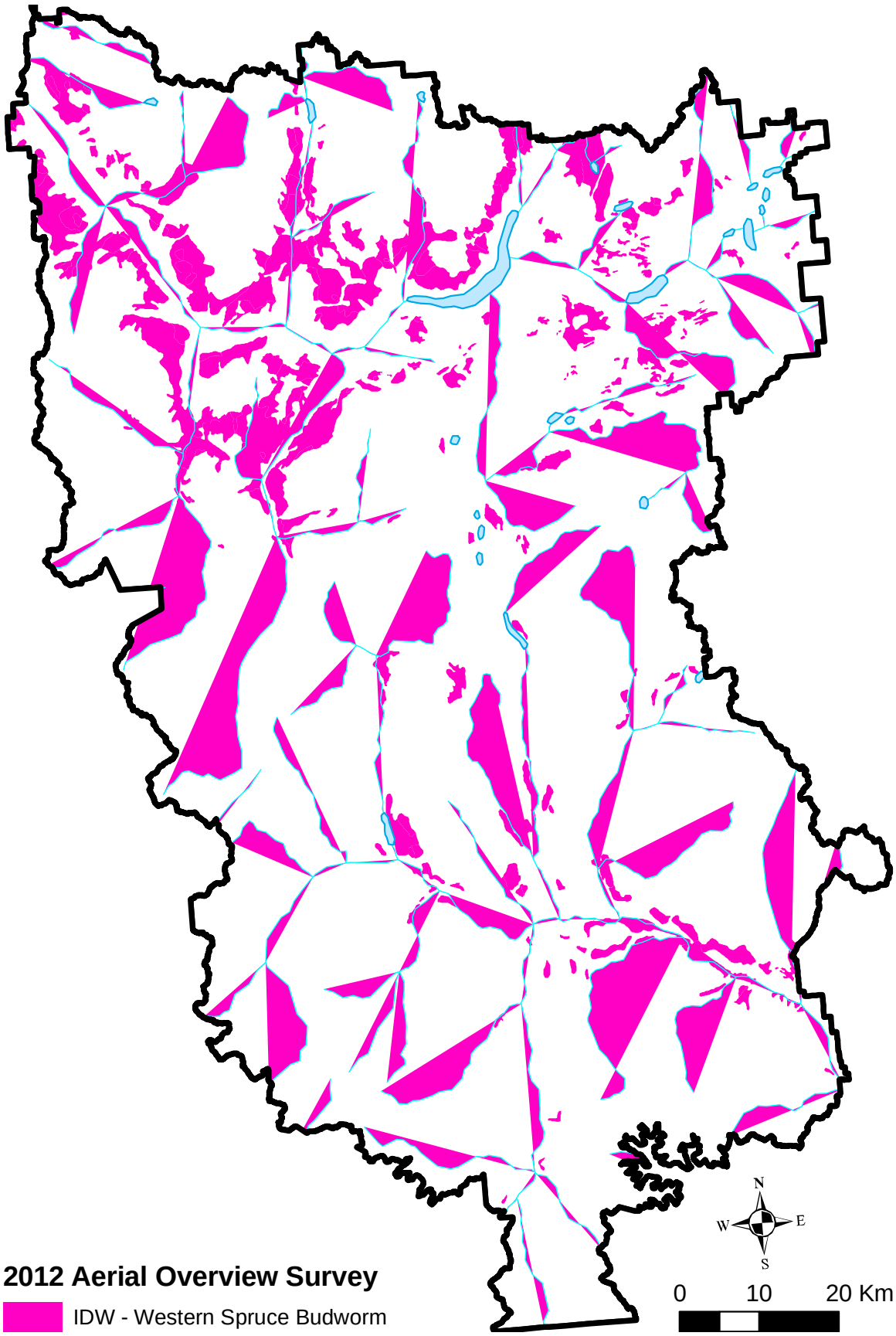

Figure 2b. 2012 Aerial Overview Survey of the Merritt TSA, Excluding Bark beetles.

Defoliators

Western spruce budworm (*Choristoneura occidentalis)* is the primary defoliator of concern for interior Douglas-fir in the Merritt TSA. Outbreaks of this budworm cause significant damage through larval feeding on the foliage, resulting in reduced seed production due to damaged cones, growth loss, topkill, formation of stem deformities and even mortality, particularly in the understory. The IDF biogeoclimatic zone, which covers almost half of the TSA (Figure 1), is a high hazard zone for western spruce budworm in Douglas-fir stands. Observed defoliation incidence levels in 2012 have significantly increased in area. In 2012 portions of the outbreak were treated; which is mitigates some of the impacts.

The **gypsy moth** *(Lymantria dispar)* is a serious defoliator that causes reduced growth and mortality on a wide range of deciduous trees and shrubs, as well as some coniferous trees. It is an insect that has been periodically intercepted in BC since 1978 but aggressive monitoring and eradication programs have thus far prevented its establishment. Government agencies continue to conduct province-wide monitoring, using pheromone traps to detect and treat incursions of gypsy moth in BC. Gypsy moth pupae may be transported on recreational vehicles traveling along major routes from the Lower Mainland. Therefore, there exists great potential for its introduction into the Merritt TSA from along Hwy 3 (Crowsnest Hwy), Hwy 5 (Coquihalla), Hwy 97C (Coquihalla Connector), and to a lesser extent along Hwy 8 from Spences Bridge and the TransCanada Hwy. Pheromone traps are placed at permanent monitoring locations at recreational sites and rest stops along the major travel corridors.

The **Douglas-fir tussock moth** *(Orgyia pseudotsugata)* is a destructive defoliator of Douglas-fir of all ages. Since the larvae consume both old and new foliage, one year's defoliation can result in top kill and mortality. Outbreaks tend to be cyclical, and of short duration. If mature trees survive the defoliation, the resulting stress can put them at high risk of attack by the Douglas-fir beetle. The potential exists for a DFTM outbreak, particularly in the IDFxh2 subzone. The Ministry of Forests, Lands and Natural Resource Operations monitors adult moth populations with the use of pheromone traps at permanent monitoring sites. The observed area has decreased to 0 hectares in 2012.

Miscellaneous defoliators such as the satin moth have been recorded in small amounts during past overview surveys (Table 5). Deciduous trees can sustain severe defoliation without mortality, and since the infested hectares have been low in the Merritt TSA this defoliator is therefore presently of little concern.

Climatic Injuries

Over the past few years, **drought** has significantly impacted seedling establishment. All species have been affected and there was widespread drought damage to young stands in the Merritt TSA. All young stands should be monitored for health factors that could arise from drought stress and mortality. No drought-affected plantations were observed during the 2012 aerial overview survey.

The risk of **wildfires** is always present in the Merritt TSA. In 2009 a significant fire occurred south of Brookmere. Licencees are salvaging fire damaged timber, which should reduce insect buildup problems. No major fires occurred in 2012.

Table 5. Primary forest health agents recorded during aerial overview surveys 2004 – 2012 for the Merritt TSA, excluding major bark beetles.

Year	Forest Health Agents	Light Disturbance (ha)	Moderate Disturbance (ha)	Severe Disturbance (ha)	Total Hectares
2004	Western spruce budworm	44,792	7,061	161	**52,014**
	Satin Moth	10	14		**24**
	Drought	257	59	20	**336**
	Fire			200	**200**
2005	Western spruce budworm	48,574	13,256	104	**61,934**
	Satin Moth	96		21	**117**
	Fire			150	**150**
2006	Western spruce budworm	78,413	90,260	1,666	**170,339**
	Satin Moth	6			**6**
	Fire			5,516	**5,516**
2007	Western Spruce budworm	102,005	22,067	971	**125,043**
	Fire	7	45	300	**352**
2008	Western Spruce budworm	83,690	814		**84,504**
	Fire	95	98		**193**
2009	Western Spruce budworm	77,959	56,457	979	**135,395**
	Fire			3,353	**3,353**
	Douglas fir tussock moth	414	365	106	**885**
2010	Western Spruce budworm	101,594	11,109		**112,703**
	Fire	32	115		**147**
	Douglas fir tussock moth			7	**7**
2011	Western Spruce budworm	25,922	9,060		**34,982**
	Fire	30	150		**180**
	Douglas fir tussock moth		99		**99**
2012	Western Spruce budworm	58,012	33,259	524	**91,795**
	Fire		8	583	**591**
	Satin Moth		60		**60**

Areas of damaged timber associated with wildfires, specifically Douglas-fir and spruce, will be monitored for infestation by bark beetles through aerial survey, ground

reconnaissance and pheromone monitoring traps (if warranted), with subsequent treatment of beetle-infested trees through targeted trap tree and salvage/sanitation harvesting programs, where operationally feasible. Monitoring of fire damaged timber conducted in 2012 showed no significant outbreaks of Douglas fir beetle.

Root Diseases

Armillaria root disease (*Armillaria ostoyae*) occurs throughout the Merritt TSA, with the highest hazard biogeoclimatic zones being the IDF and MS, which cover more than two-thirds of the TSA. A comprehensive list of host susceptibility is included in the *FPC of BC Root Disease Management Guidebook.* Armillaria root disease can cause growth loss and minor butt rot in diseased trees; however mortality and reforestation issues are the greatest cause of loss. **Laminated root rot** (*Phellinus weirii*) is also a forest health factor of concern primarily for Douglas-fir in the IDF biogeoclimatic zone. Infections can result in extensive butt rot and mortality can occur at all ages.

Tenure obligations in regards to root disease include an assessment of root disease incidence that may be required by the District Manager to ensure potential impacts are accommodated for in relevant operational plans. Results of these assessments and surveys are used to determine management options based on recommended practices in the FPC *Root Disease Management Guidebook*.

Pine Diseases

Lodgepole pine has a preponderance of diseases that influence growth, tree form and cause mortality. **Lodgepole pine dwarf mistletoe** (*Arceuthobium americanum*) is prevalent throughout the majority of mature lodgepole pine stands in the Merritt TSA (67% of the timber harvesting landbase). The IDF and MS biogeoclimatic zones, which cover 75% of the TSA, are high hazard areas for lodgepole pine dwarf mistletoe (DMP), though this disease is present throughout the range of lodgepole pine. Incidence and intensity of DMP has increased with fire exclusion practices. Heavily infected trees suffer reduced height and diameter growth, structural weakness leading to breakage, and occasional mortality. This disease can have significant impact in regenerating stands. Management objectives are to reduce and minimize the spread of the parasite into regenerated stands of lodgepole pine. The eradication of infected stems following harvesting minimizes the potential of re-invasion of the parasitic plant back into regenerated areas.

White pine blister rust (*Cronartium ribicola*) on white pine, **western gall rust** (*Endocronartium harknessii*), **stalactiform blister rust** (*Cronartium coleosporioides*), and **comandra blister rust** (*Cronartium comandrae*) on lodgepole and ponderosa pine infect the host species throughout its range. Although these rusts can be found on trees of all ages, young trees are the most susceptible to serious damage including reduced tree growth, defects and mortality. Management strategies include the identification of the rust in regenerating stands, and based on the intensity levels present, developing treatments to ensure stands achieve freegrowing status. Targeting stocking densities that account for projected incidence levels or mortality and applying treatments such as pruning and removal of the infected stems, and the planting of blister rust-resistant stock are planned tactics for managing these rusts.

Atropellis canker (*Atropellis piniphila*) is a stem disease that infects lodgepole pine and occasionally ponderosa pine. The resulting cankers lower wood quality and can induce stem breakage. This disease does not usually become apparent in a stand until after freegrowing has been achieved.

There are two **pine needle casts** that are present within the Merritt TSA; Elytroderma

needle disease (*Elytroderma deformans*) and pine needle cast (*Lophodermella concolor*). Elytroderma needle disease is most common on ponderosa pine, and pine needle cast on lodgepole pine. Infection can cause severe defoliation, resulting in growth reductions and occasionally mortality. No significant areas of needle cast have been identified in the TSA since 2002 (Table 5).

Animal Damage

Various animals cause damage to certain tree species in the Merritt TSA on a localized or cyclical basis. Damage to seedlings and saplings by **voles** (*Microtus* spp.) during winter feeding is cyclical and localized, but can be extensive and significant in a given plantation. **Cattle** damage due to feeding, trampling and rubbing is common in heavy grazing areas.
Animal damage is addressed only when damage is sufficient that it interferes with the obligation to produce freegrowing stands. The potential for this problem must be considered in relevant operational plans.

Aspen Decline

Approximately 2845 hectares was observed in the 2012 survey. 719 hectares of this was in the moderate severity class. This is a significant increase over 2011. This has also been observed in the western United States. The exact causes of this decline have not been determined.

Forest Health Strategy and Adaptive Management

Adaptive management as defined by the Ministry of Forests, Lands and Natural Resource Operations is a formal process for continually improving management by learning from the outcomes of operational plans. The ability to improve forest management outcomes through the implementation of alternative policies or practices resulting from the adaptive management process is a tremendous asset.

Important steps in the process include:

- acknowledging uncertainty about what policy or practice is "best" for the particular management issue,
- thoughtfully selecting the policies or practices to be applied,
- carefully implementing the plan of action,
- monitoring key response indicators,
- analyzing the outcome in light of the original objectives, and
- incorporating the results into future decisions.

This same process can be applied to the Forest Health Strategy, where the policies and practices implemented under the plan to meet the guiding strategic goals and objectives are closely monitored over time through key indicators (e.g. green:red ratio within managed areas), with the results of such actions evaluated against the stated objectives as a measure of success. Recommendations are then made to modify the existing forest health management goal and/or objective, policy and/or practice to be considered for incorporation in the Forest Health Strategy in efforts to meet or exceed current performance levels (i.e. continual improvement). In order for the adaptive management process to succeed, there must be active support by all parties involved in forest health the Merritt TSA.

Bark Beetle Strategy and Tactical Plan

Bark Beetle Strategy Background

At a provincial level, broad mountain pine beetle management zones have been enacted. This allows for judicial allocation of limited resources to areas where aggressive management will most likely have the greatest impact and includes provisions for streamlining extraction of infested trees in a timely manner. These zones (Units) are defined within the overall management area known as the Emergency Bark Beetle Management Area (EBBMA). Designations have not changed over the last few years and the 2010 EBBMA designations will remain in effect. The Merritt TSA is still within an EBBMA *Salvage* unit for mountain pine beetle. The focus within a *Salvage* unit is on timber salvage operations rather than direct control treatments such as fall-and-burn and small-scale sanitation harvesting. The Merritt TSA continues to be designated as an EBBMA suppression unit for spruce bark beetle. Aggressive harvest of beetles will be the priority tactic, supported by small-scale harvesting where appropriate.

As of April 1, 2005, the MFLNRO Cascades District is the lead agency responsible for managing bark beetles in the TSA. This includes reviewing and delineating beetle management units (BMUs), developing strategies and a tactical plan for each BMU, conducting detailed aerial surveys, conducting applicable ground surveys, applying treatments where needed, auditing activities, tracking actions taken and reporting on the program annually. All activities will be done in a cooperative approach with forest licensees, who will be responsible for conducting ground surveys for assigned sites within their operating area, implementing trap tree and pheromone baiting programs and developing bark beetle salvage/sanitation management plans.

The Merritt TSA strategy is guided by the *Provincial Bark Beetle Management Technical Implementation Guidelines*. The four possible strategies are Suppression, Holding action, Salvage and Monitor. These strategies will be selected on an annual basis for each bark beetle of concern for each BMU based on a combination of stand susceptibility, levels of attack (including spot to polygon ratio, total hectares, attack intensity, current to previous year attack ratios and adjacent population pressures), and consideration of whether the strategy objectives can realistically be achieved.

Susceptible Forest Types

An important part of designating strategies is to determine how much of the forest is at risk from a particular beetle. Area of susceptible forest types was determined for the Merritt TSA for the mountain pine beetle, Douglas-fir beetle and spruce beetle (Table 6). The range of the susceptible forest types are shown for mountain pine beetle, Douglas-fir beetle and spruce beetle in Figures 3, 4, and 5, respectively.

The most current susceptibility data available based on the updated Shore and Safranyik model (Safranyik *et al* 1992, 2000, 2005) was provided by the MoFR – Southern Interior Region (spatial data – January 2007). This system considers age, susceptible pine basal area, stand density and location. The model represents overall stand susceptibility, but does not necessarily represent individual tree susceptibility. Observations have shown that often the most susceptible trees where infestations tend to start are located in lower elevation Douglas-fir/lodgepole pine stands. As this system produces a continuum of numbers from 0 – 100, the following categories were used:

0: none, 1-5: very low, 6-30: low, 31-60: moderate, 61-80: high 81+: very high

The Merritt TSA has a significant component of forest area containing susceptible pine (668,713 hectares or 59% of the TSA) which is currently supporting the extended Mountain pine beetle outbreak. Of this susceptible forest, 284,275 hectares or 25% of the TSA is of moderate to very high susceptibility.

Table 6. Susceptibility ratings for mountain pine beetle, spruce beetle, and Douglas-fir beetle in the Merritt TSA.

Beetle	Susceptibility	Hectares	Percent of TSA
Mountain pine beetle	none	462,434	40.9
	very low	229,628	20.3
	low	154,810	13.7
	mod	119,430	10.6
	high	124,271	11.0
	very high	40,573	3.6
Total moderate to high susceptible Pl		**284,275**	**25.1**
Douglas-fir beetle	none	696,069	61.5
	very low	128,992	11.4
	low	204,615	18.1
	mod	80,420	7.1
	high	21,051	1.9
	very high	0	0.0
Total moderate to high susceptible Fd		**101,471**	**9.0**
Spruce beetle	none	815,575	72.1
	very low	55,465	4.9
	low	177,401	15.7
	mod	77,122	6.8
	high	5,132	0.5
	very high	452	0.0
Total moderate to high susceptible Sx		**82,706**	**7.3**

It is very important to note that with spruce beetle and particularly Douglas-fir beetle, stress factors such as fire, drought, root disease and windthrow play a pivotal role in infestation development, so susceptibility ratings can only be viewed as a rough estimate.

Larger versions of the following susceptibility mapping are available at the Cascades District Forest Health FTP site located at:
http://www.for.gov.bc.ca/ftp/DCS/external/!publish/Forest%20Health/

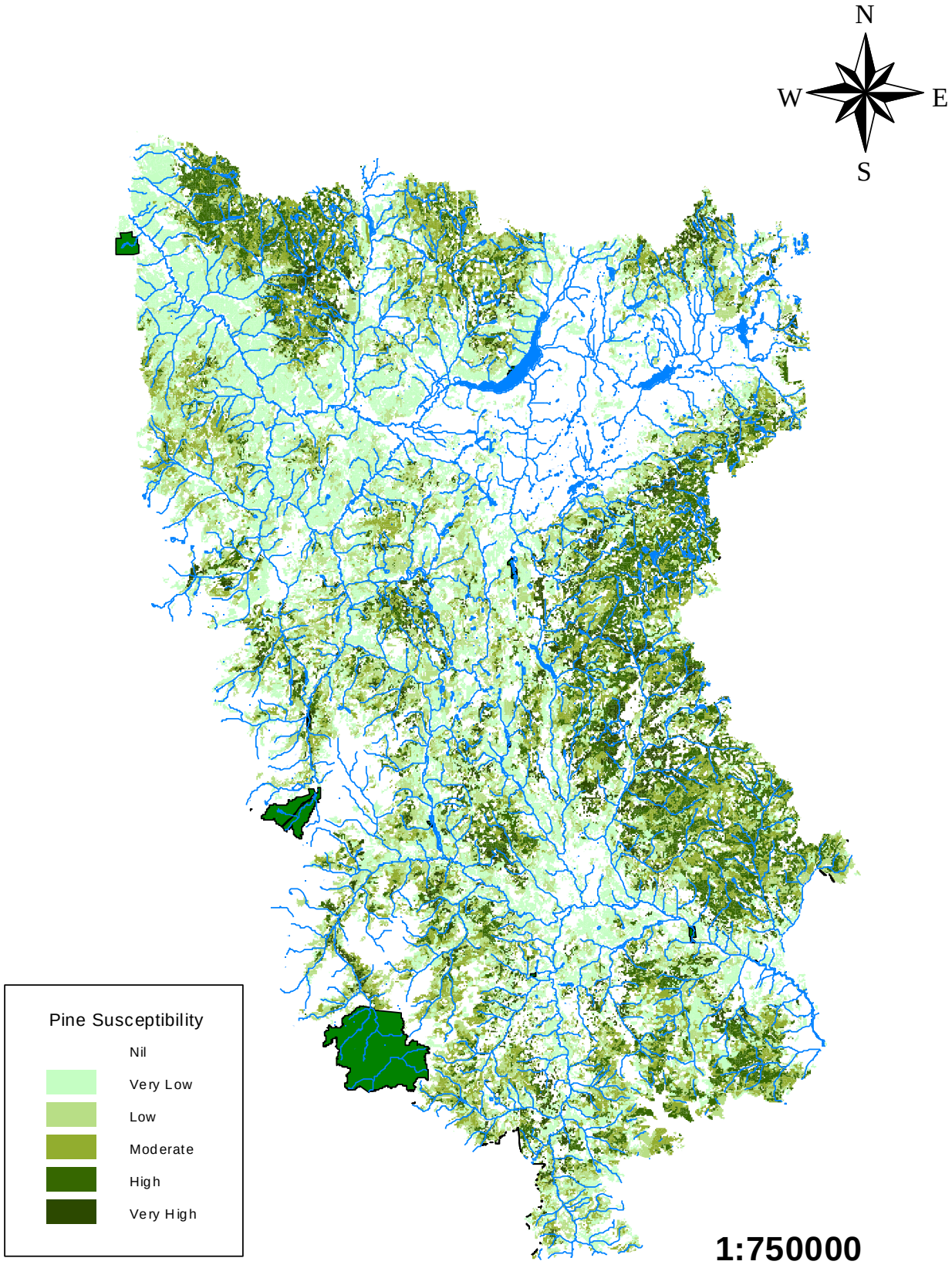

Figure 3. Pine stand susceptibility in the Merritt TSA.

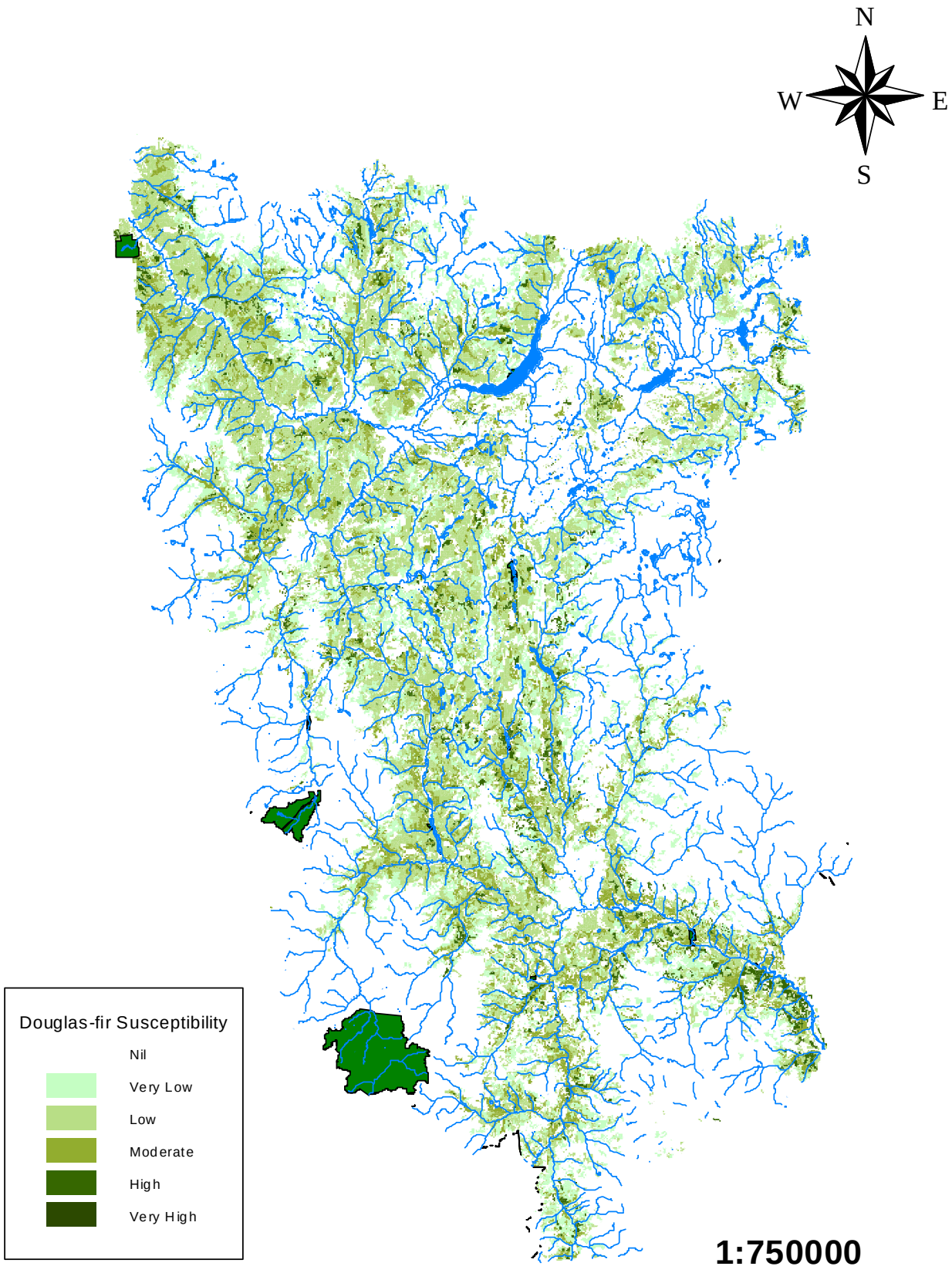

Figure 4. Douglas-fir stand susceptibility in the Merritt TSA.

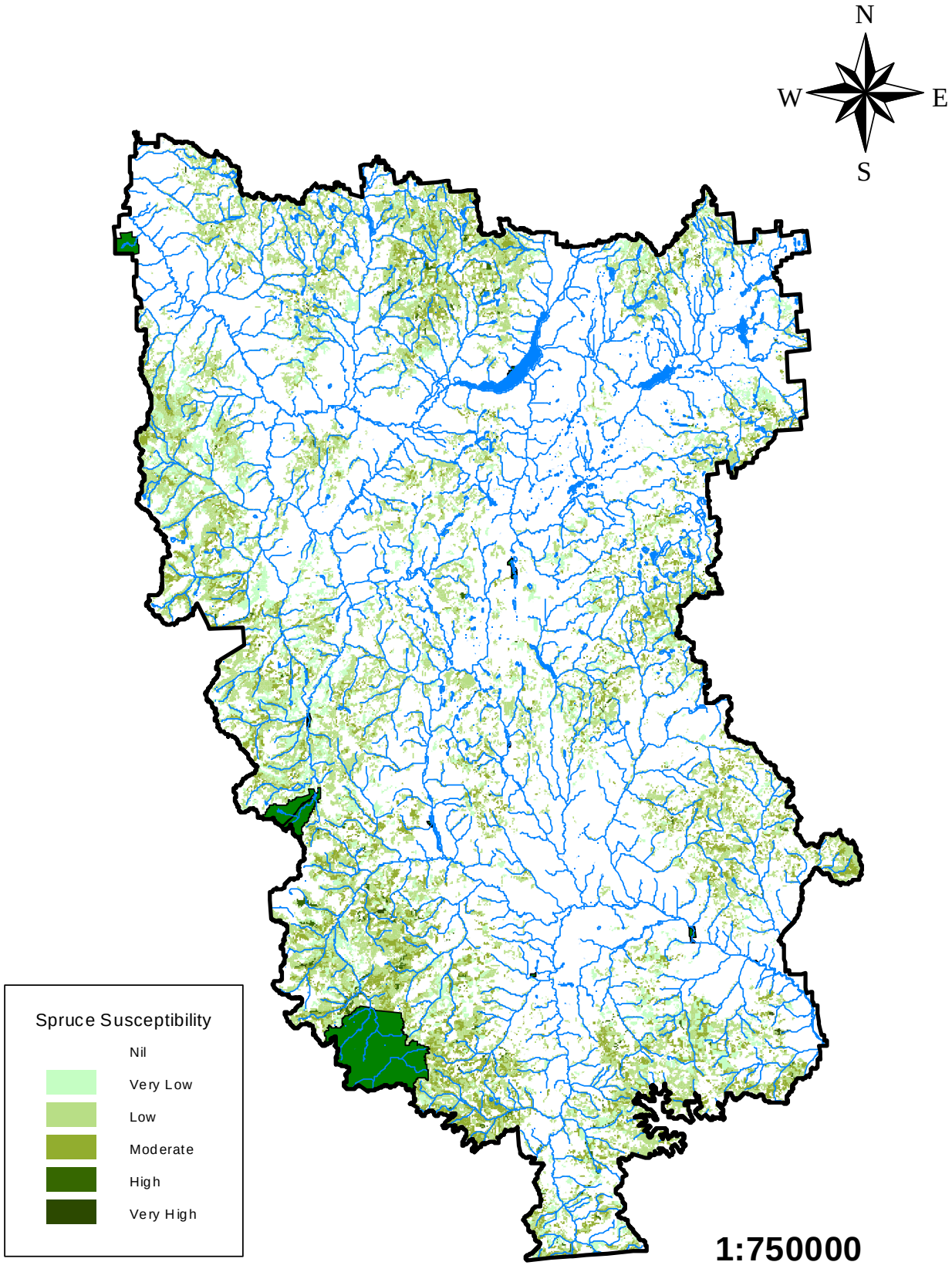

Figure 5. Spruce susceptibility in the Merritt TSA.

Bark Beetles in the Merritt TSA

The data quoted in this strategy stems from the Provincial aerial overview fixed wing survey. Although this data is not as accurate as the detailed aerial GPS survey data that drives the suppression activities, it has several advantages. The survey is cost efficient, covers all forested areas within the TSA (not just suppression BMUs), flags areas of interest that require detailed flights, includes all forest health factors visible from the air, and employs consistent methodology throughout the province year after year. As shown in Figures 6, 7, 8, and Table 7 four bark beetle species have been recorded as active in the Merritt TSA, the most significant of which is the Mountain pine beetle. In 2012, the hectares of mountain pine beetle infestation significantly decreased again, to 8,850 hectares. Western balsam bark beetle infested area increased significantly to 9,217 hectares, and Douglas-fir infested hectares remained low. Spruce beetle was mapped at 871 hectares.

Table 7. Total area of infestation for the primary bark beetles recorded during aerial overview surveys in 2002 – 2012 for the Merritt TSA.

Forest Health Factor	Total Area of Infestation (ha) by Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Douglas-fir beetle	187	147	35	0	11	0	.75	91	38	49	70
Spruce beetle	0	93	9	179	26	259	200	1,560	263	418	871
Balsam Bark beetle	4,112	3,073	2,835	8,564	9,957	13,902	6,931	5,574	2,901	3,614	9,217
Mountain Pine beetle	10,816	7,553	29,415	75,768	141,072	225,352	253,146	233,281	98,421	36,173	8,850

Mountain Pine Beetle

The mountain pine beetle (*Dendroctonus ponderosae*) is the most destructive pest of mature pine in British Columbia, and continues to be the largest threat to BC forests in terms of timber loss, environmental concerns and negative economic impacts. The most extensive mountain pine beetle (IBM) epidemic in recorded history is presently underway in British Columbia. Beetle populations have been on the decline for a few years in the province, due to unfavourable weather conditions and a declining abundance of host material.

At endemic population levels, trees are partially attacked or attacked singly. At the incipient stage, trees are attacked in small scattered groups. At the pre-epidemic phase, small spots grow in size and number, and start to coalesce into patches. At the epidemic phase, large patches extend over the landscape, and small spots are found at the leading edge of the infestation. Hence, the ratio of infested spots to infested patches can be used to infer the stage of an infestation.

The amount of Lodgepole pine in mature age classes, coupled with favorable climatic conditions over the previous five years have put all of the mature pine forest at risk in the TSA. Twenty-five percent (25%) of the land base of the TSA contains pine forest types of moderate to very high susceptibility. In addition to the identified biological issues are the challenges and constraints that are present involving economics; global markets, softwood lumber exports into the United States, and stumpage. Additional challenges occur with respect to the spread of the beetle into non-crown lands (municipalities, private lands, federal lands, and parks) with opposing or different management views on the issue.

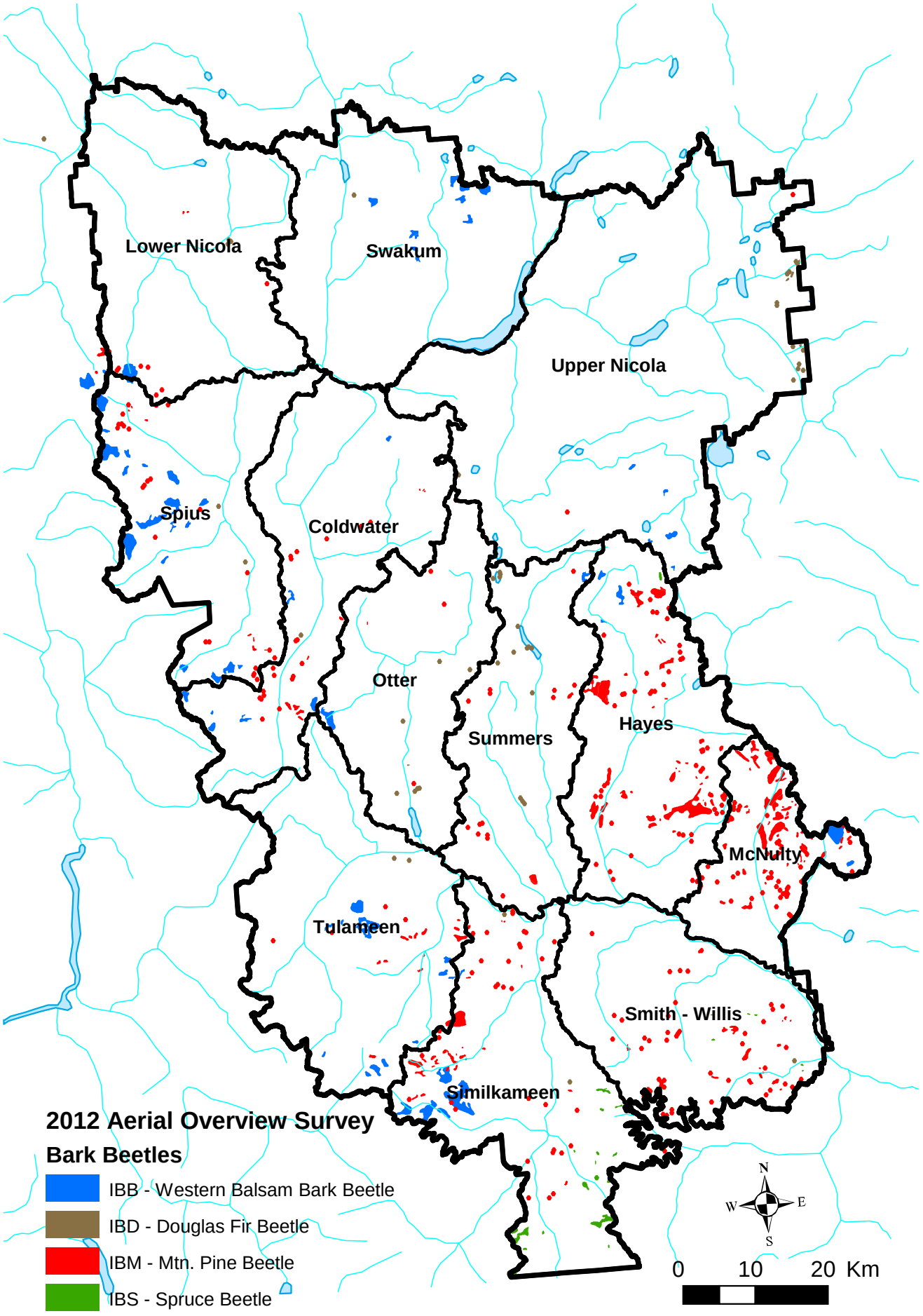

Figure 6. Beetle Management Units (BMUs) and 2012 bark beetle infestations.

In 2010, the Chief Forester set the Annual Allowable Cut (AAC) at 2,400,000 m^3 per year. This is a reduction from the previous AAC, which was roughly 2,800,000 m^3 per year. The disposition of the new AAC has not been determined at this point in time.

The new AAC is generating strategies specific to the management of both Mountain Pine Beetle and Spruce Bark Beetle and will also drive this strategy. Some of these strategies are described in the Partition Implementation and Stewardship Guiding Principles jointly developed by MFLNRO and forest licencee staff. The current strategy is to prioritize harvest based on the percent of dead timber within a block.
One of the past strategies has been to have various licencees harvesting different stages of the Mountain Pine Beetle attack as it progresses in a general North to South manner. This strategy of having licencees generally staying within their traditional operating areas has meant that some licencees are harvesting stands with mainly a red or grey attack component, while other licencees are harvesting stands along the leading edge of the infestation with mainly green attack trees. This strategy has ensured that unsalvaged losses are kept to a minimum and slowing of the infestation is still achieved.

Early in 2009 the District Manager received a request to be exempted from the newly implemented Secondary Stand Structure section of the *Forest Planning and Practices Regulation*. Based on sound rationale and a cooperative process involving the proponent licencee, District and Branch Forest Service staff, the district manager approved the exemption. This allowed the proponent licencee to follow the TSA group's management goals of harvesting active leading edge beetle infestations. This also allowed the licencee to save administrative and field costs and not be restricted by the 30% green attack at time of harvest rule.

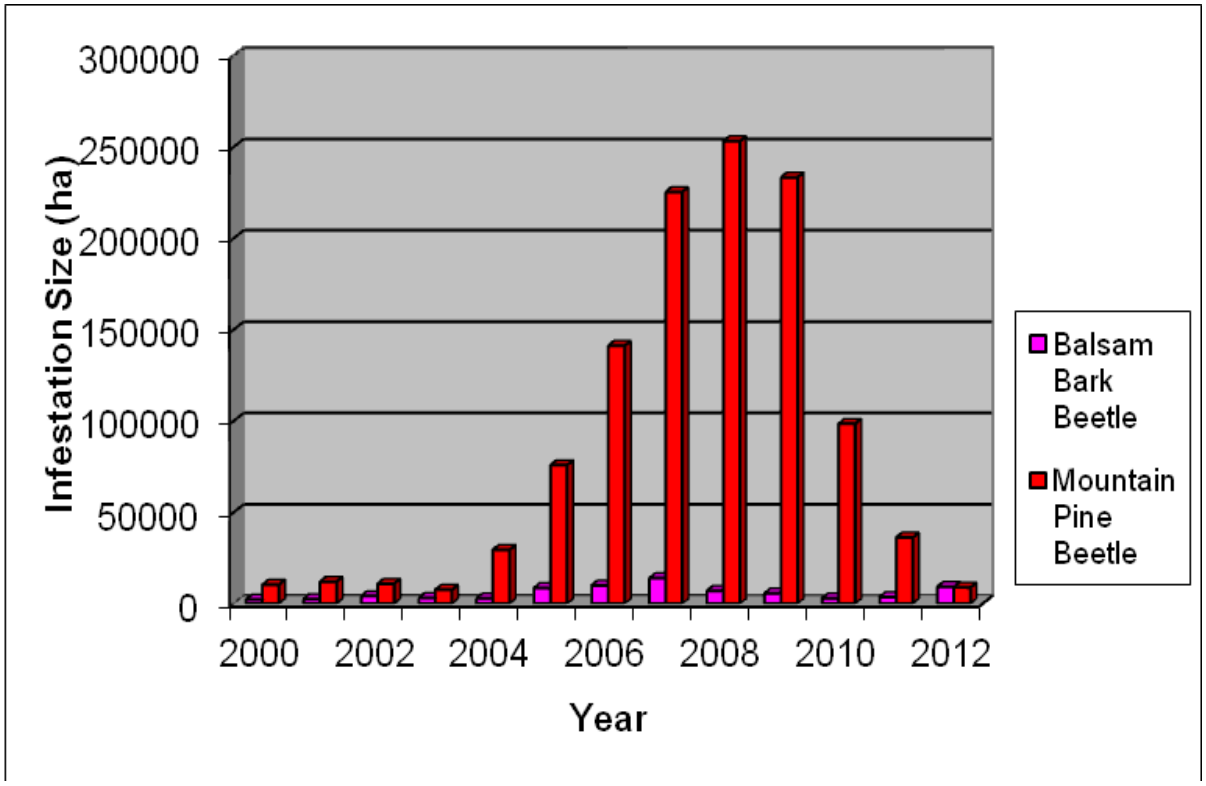

Figure 7. Mountain pine and Balsam bark beetle infestation levels in the Merritt TSA 2000 – 2012.

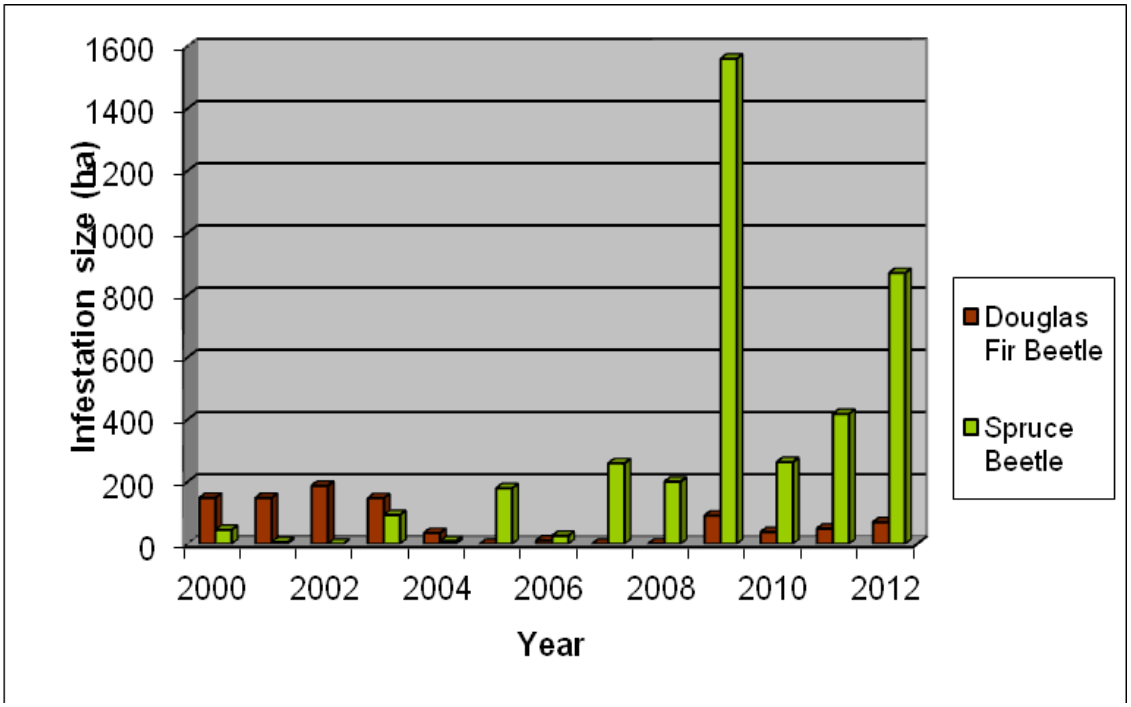

Figure 8. Douglas-fir and Spruce beetle infestation levels in the Merritt TSA 2000 – 2012.

Douglas-fir Beetle

Douglas-fir beetle (*Dendroctonus pseudotsugae*) is an important pest of mature Douglas-fir in BC. At low population levels, the beetle infests scattered, stressed trees and windthrow. However, Douglas-fir beetle (IBD) populations can quickly build under favourable conditions, at which time significant numbers of healthy trees can be killed. Drought, fire, root disease or significant windthrow/breakage from ice and snow are often the precipitators of outbreaks. Observed IBD remains low relative to susceptibility.

Spruce Beetle

The spruce beetle (*Dendroctonus rufipennis*) is the most destructive agent of mature spruce in BC. At low population levels, the spruce beetle (IBS) prefers to infest weakened trees and downed host material. If a significant amount of a preferred food source such as windfall or breakage from ice or snow is available, populations can build to the point of outbreak, where beetles then move into healthy trees.

The current outbreak was identified in early spring of 2009, in the areas to the south and east of the Similkameen River. There has also been an outbreak in the back end of Shinish Creek. The Chief Forester accounted for approximately 300,000 cubic meters of harvest per year for the next 8 years to address the outbreak.

Licencees cooperatively came up with an aggressive harvesting plan, to address the infestation in a timely manner. Licencees are developing and harvesting blocks in other licencees traditional operating areas. Licencees harvested some 400,000+ cubic meters over the 2009-2010 winter harvest season. They also harvested some 500,000+ cubic meters of infested stands during the winter of 2010-2011. Licencees conducted a reconnaissance program during and after the IBS flight of 2012. As in 2010 and 2011, the flight of 2012 seems to have not crossed the Similkameen River, it generally only infilled existing attacked areas. Continued cooperation between licencees and with the ministry and will be very important in our ability to address this landscape level infestation.

Western Balsam Bark Beetle

Western balsam bark beetle (*Dryocoetes confusus*) is the most significant damaging agent of its primary host, mature sub-alpine fir, in BC. This bark beetle and an associated pathogenic fungus can be responsible for significant tree mortality in high elevation ecosystems. More commonly however, less than 5% of a stand is killed in one year.

Beetle Management Units and Strategy Designations

A Beetle Management Unit (BMU) is a delineated area of the landscape for the purposes of planning, implementing and reporting on bark beetle management activities. A BMU is assigned and designated for an area based upon parameters including susceptible forest types, topographic features, bark beetle activity (incidence and risk) and management opportunities, challenges and constraints such as parks and protected areas.

As of April 1, 2007, there has been a transition from the previous BMU boundaries to those of the designated Landscape Units in the Merritt TSA. As a result, there are now twelve (12) BMUs designated within the Merritt TSA (Figure 6). A re-evaluation of the existing BMU strategies for Mountain Pine beetle, and consideration of strategies for Douglas-fir and spruce beetle has been completed. The assigned BMU strategies for 2013 are listed in Table 8. Eleven (11) of the twelve BMUs have been assigned the *salvage* strategy for Mountain Pine beetle, while the McNulty BMU has been assigned a *holding* strategy. All BMUs have been assigned the *suppression* strategy for Douglas-fir and Spruce beetle.

Table 8. BMU areas and strategy designations in the Merrit TSA as of April 1, 2013.

BMU	IBM Strategy	IBD Strategy	IBS Strategy	Hectares
Coldwater	Salvage	Suppression	Suppression	95,022
Hayes	Salvage	Suppression	Suppression	86,118
Lower Nicola	Salvage	Suppression	Suppression	99,207
McNulty	Holding	Suppression	Suppression	40,607
Otter	Salvage	Suppression	Suppression	70,200
Similkameen	Salvage	Suppression	Suppression	96,584
Smith-Willis	Salvage	Suppression	Suppression	80,262
Spius	Salvage	Suppression	Suppression	82,416
Summers	Salvage	Suppression	Suppression	72,990
Swakum	Salvage	Suppression	Suppression	104,222
Tulameen	Salvage	Suppression	Suppression	104,164
Upper Nicola	Salvage	Suppression	Suppression	199,355

The following set of tables present for each BMU the current bark beetle infestation status and the forest types susceptible to bark beetle attack (Tables 9-14).

Table 9. Pine susceptibility ratings for Beetle Management Units in the Merritt TSA.

BMU	Area of Forest (Hectares) by Susceptibility Rating						Total Area Mod-High	% of BMU Mod-High
	None	Very Low	Low	Mod	High	Very High		
Coldwater	40,422	25,890	17,234	6,463	2,927	2,086	**11,476**	**12.1**
Hayes	22,740	9,319	9,329	13,961	21,246	9,524	**44,730**	**51.9**
Lower Nicola	19,401	39,955	10,741	11,949	15,434	1,728	**29,110**	**29.3**
McNulty	10,394	5,364	4,336	7,400	12,496	616	**20,513**	**50.5**
Otter	24,448	17,027	16,159	5,698	3,863	3,005	**12,566**	**17.9**
Similkameen	35,408	20,021	16,776	13,842	7,681	2,855	**24,378**	**25.2**
Smith-Willis	27,746	17,501	10,489	10,577	11,974	1,975	**24,526**	**30.6**
Spius	35,755	21,825	12,920	7,066	3,128	1,723	**11,916**	**14.5**
Summers	25,233	17,462	9,305	7,615	8,741	4,633	**20,990**	**28.8**
Swakum	37,893	23,592	15,984	13,509	10,520	2,724	**26,753**	**25.7**
Tulameen	58,378	10,103	14,211	9,495	9,495	2,483	**21,473**	**20.6**
Upper Nicola	124,615	21,571	17,326	11,855	16,766	7,222	**35,843**	**18.0**
TSA Totals:	**462,434**	**229,628**	**154,810**	**119,430**	**124,271**	**40,573**	**284,275**	**25.1**

Table 10. Summary of Mountain Pine beetle dynamics in the Merritt TSA by BMU in 2012.

BMU	# Spots	#Spot Trees	Spot Area (ha)	# Polys	Poly Area (ha)	Spot to Poly	Total Area (ha)
Coldwater							
Hayes							
Lower Nicola							
McNulty							
Otter							
Similkameen							
Smith-Willis							
Spius							
Summers							
Swakum							
Tulameen							
Upper Nicola							
TSA Totals:							

This table has not been filled out for 2012, to facilitate an expedited update of the strategy.

Table 11. Douglas-fir susceptibility ratings for Beetle Management Units in the Merritt TSA.

BMU	Area of Forest (Hectares) by Susceptibility Rating						Total Area Mod-High	% of BMU Mod-High
	None	Very Low	Low	Mod	High	Very High		
Coldwater	47,277	12,822	26,208	7,216	1,498		**8,714**	**9.2**
Hayes	69,209	8,039	4,220	3,919	732		**4,651**	**5.4**
Lower Nicola	41,525	11,352	34,124	11,474	732		**12,206**	**12.3**
McNulty	33,757	1,689	2,148	2,505	507		**3,012**	**7.4**
Otter	23,468	12,229	24,109	8,877	1,518		**10,395**	**14.8**
Similkameen	57,145	12,656	14,543	10,368	1,872		**12,240**	**12.7**
Smith-Willis	52,157	6,753	10,355	6,313	4,685		**10,998**	**13.7**
Spius	52,132	9,619	13,108	6,375	1,181		**7,557**	**9.2**
Summers	33,556	12,382	14,356	9,388	3,309		**12,697**	**17.4**
Swakum	52,635	17,118	23,944	8,500	2,026		**10,526**	**10.1**
Tulameen	84,938	6,673	7,174	4,853	526		**5,379**	**5.2**
Upper Nicola	148,269	17,661	30,328	631	2,466		**3,097**	**1.6**
TSA Totals:	**696,069**	**128,992**	**204,615**	**80,420**	**21,051**		**101,471**	**9.0**

Table 12. Summary of Douglas-fir beetle dynamics in the Merritt TSA by BMU in 2012.

BMU	# Spots	#Spot Trees	Spot Area (ha)	# Polys	Poly Area (ha)	Spot to Poly	Total Area (ha)
Coldwater							
Hayes							
Lower Nicola							
McNulty							
Otter							
Similkameen							
Smith-Willis							
Spius							
Summers							
Swakum							
Tulameen							
Upper Nicola							
TSA Totals:							

This table has not been filled out for 2012, to facilitate an expedited update of the strategy.

Table 13. Spruce susceptibility ratings for Beetle Management Units in the Merritt TSA.

BMU	Area of Forest (Hectares) by Susceptibility Rating						Total Area Mod-High	% of BMU Mod-High
	None	Very Low	Low	Mod	High	Very High		
Coldwater	67,703	6,721	16,134	4,428	36		**4,465**	**4.7**
Hayes	68,332	2,359	9,925	5,255	209	37	**5,502**	**6.4**
Lower Nicola	76,438	3,304	16,301	3,085	47	32	**3,164**	**3.2**
McNulty	29,018	808	7,706	2,957	118		**3,075**	**7.6**
Otter	56,783	1,849	8,980	2,504	70	13	**2,588**	**3.7**
Similkameen	63,595	4,581	15,563	11,970	845	30	**12,845**	**13.3**
Smith-Willis	57,301	5,358	10,267	6,903	318	115	**7,336**	**9.1**
Spius	45,883	9,291	19,333	7,578	331		**7,908**	**9.6**
Summers	61,666	2,826	6,326	2,002	170		**2,172**	**3.0**
Swakum	67,783	4,206	23,652	7,666	844	70	**8,581**	**8.2**
Tulameen	50,569	8,220	26,450	17,151	1,638	136	**18,925**	**18.2**
Upper Nicola	170,505	5,941	16,763	5,622	505	19	**6,146**	**3.1**
TSA Totals:	**815,575**	**55,465**	**177,401**	**77,122**	**5,132**	**452**	**82,706**	**7.3**

Table 14. Summary of Spruce beetle dynamics in the Merritt TSA by BMU in 2012.

BMU	# Spots	#Spot Trees	Spot Area (ha)	# Polys	Poly Area (ha)	Spot to Poly	Total Area (ha)
Coldwater							
Hayes							
Lower Nicola							
McNulty							
Otter							
Similkameen							
Smith-Willis							
Spius							
Summers							
Swakum							
Tulameen							
Upper Nicola							
TSA Totals:							

This table has not been filled out for 2012, to facilitate an expedited update of the strategy.

For the Mountain Pine beetle, Table 15 presents the area of infestation recorded in the 2012 aerial overview survey for each BMU. All beetle management units saw a reduction in infestation by Mountain Pine beetle.

Table 15. Area of MPB infestation by BMU.

BMU	Susceptible Pine (ha)	MPB Infestation by BMU	
		Area (ha)	%
Coldwater	54,600	216	0.4%
Hayes	63,378	3,405	5.4%
Lower Nicola	79,806	53	0.1%
McNulty	30,213	2,980	9.9%
Otter	45,752	7	0.0%
Similkameen	61,176	957	1.6%
Smith-Willis	52,516	502	0.9%
Spius	46,661	97	0.2%
Summers	47,757	172	0.4%
Swakum	66,329	0	0.0%
Tulameen	45,786	454	1.0%
Upper Nicola	74,740	0	0.0%
TSA Totals:	**668,713**	**8,843**	**1.3%**

For all BMUs assigned *suppression* for a specific bark beetle species, the objective will be to observe a decline in the number (and size) of patches relative to the number of spots from one year to the next. The declining trend will be a result of single tree treatments and salvage/sanitation harvesting efforts in areas of significant bark beetle attack (patches and concentrated areas of spot infestations). Over time, the number and size of patches should decrease (therefore spot-to-patch ratio should increase), followed by a decrease in the number of spot infestations while the number of patch infestations remains few to none (decrease in the spot-to-patch ratio).

In order to ensure a consistent annual identification and measurement of bark beetle spot and polygon infestations to track beetle population dynamics over time as per the objective outlined in the previous paragraph, a consistent and appropriate detailed aerial survey method (e.g. fixed wing aerial photography and digitally enhanced mosaic imaging) should be followed each year.

Bark Beetle Non-Recoverable Losses and Merritt Timber Supply Reviews

When determining the allowable annual cut for the Merritt TSA, the chief forester must take into consideration the "abnormal infestations in and devastations of, and major salvage programs planned for, timber in the area" (Sec.8(8)(e) of the *Forest Act*). Standing timber volume that is destroyed by natural causes (such as bark beetles) and is not salvaged is referred to as a non-recoverable loss (NRL). An NRL estimate calculated for a timber supply review is presented as the average annual unsalvaged loss of timber volume projected throughout the planning period, occurring within the timber harvesting land base. The TSR analysis considers this value as how much timber volume was projected to be there, but will in fact *not* be there when that point in time is reached.

The NRL estimate calculated for the Merritt TSR4 in 2010 was 143,626m^3 per year, for the long term, which is 41+ years out. This number is the same as that calculated for TSR2 in 2000 and TSR3 in 2005. The TSR4 determination estimated non-recoverable losses to be 25,000 m^3 for spruce beetle, 18,565 m^3 for windthrow, 31,220 m^3 for fire. The near term Mountain Pine

Beetle losses were incorporated into stand yield reductions, it is not feasible to pull out an annual number.

Non recoverable losses for 2012 within the Merritt TSA area estimated at: 25,000 m^3 for spruce beetle, 18,000 m^3 for windthrow, 10,000 m^3 for fire, 1,500 $m^3$for Douglas fir bark beetle. Mountain Pine Beetle losses are outside the scope of this forest health strategy, they will be calculated in a future TSR process or when the current infestation is finished. Licencees indicate salvage is completed within the Brookmere fire. Unsalvaged losses for this area will be calculated into next year's numbers.
All other losses are considered to be accounted for by the Operational Adjustment Factors within the TSR process.

Over the course of the mountain pine beetle infestation, it has been projected (Provincial-Level Projection of the Current Mountain Pine Beetle Outbreak, BCMPB V9) that the Merritt TSA will experience 30% cumulative percent of the pine killed. This highlights the need for a significant contribution by forest licensees to manage bark beetles in the TSA through aggressive salvage/sanitation harvesting activities. In turn, the strong level of commitment by the forest licensees to harvest beetle infested-timber must be maintained and supported by the MoFR bark beetle management efforts, and other tenure holders.

Bark Beetle Management and the Timber Harvesting Land Base (THLB)

The mountainous terrain that covers a portion of the Merritt TSA presents a challenge to bark beetle management. Surveys and treatments outside of the THLB in inoperable areas tend to be very expensive, with little return on investment. Resources are limited, and need to be applied judiciously. The potential treatment prescribed for these areas is fall and burn, but safety of the crewpersons is a critical issue in conducting this treatment on steep unstable slopes. In addition, salvage/sanitation harvesting efforts by forest licensees are restricted to the operable areas within the TSA. The majority of Mountain Pine Beetle infestations mapped in 2012 were within the THLB (87.1% versus 92.9% in 2011), and are therefore generally accessible by forest licensees for treatment. Figure 9 and table 16 summarize the amount of Mountain Pine Beetle infestation (hectares) in the THLB, in each of the BMUs.

Table 16. Summary of THLB and Mountain Pine beetle (MPB) infestation in 2006 – 2012 by BMU.

	THLB in BMU		MPB infestation in THLB (ha)						
BMU	**THLB Ha**	**% of BMU**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Coldwater	51,670	54.4	4,004	17,563	16,919	19,747	7,950	3,036	113
Hayes	69,843	81.1	4,787	13,896	22,229	36,524	29,162	16,960	3,037
Lower Nicola	55,955	56.4	18,026	31,736	28,383	34,997	6,728	234	36
McNulty	31,159	76.7	307	1,516	1,192	4,729	5,233	3,594	2,710
Otter	46,087	65.7	5,802	13,289	15,195	9,711	1,459	310	7
Similkameen	75,508	78.2	12,747	16,041	12,608	13,817	6,313	1,461	837
Smith-Willis	58,733	73.2	5,631	13,798	15,799	15,753	6,538	2,547	442
Spius	50,763	61.6	3,745	16,667	15,177	17,910	6,881	985	79
Summers	53,143	72.8	8,420	13,469	15,841	14,434	7,971	2,204	56
Swakum	60,518	58.1	23,412	27,047	20,872	14,968	2,119	58	0
Tulameen	58,030	55.7	3,571	8,258	7,338	12,600	7,501	1,935	390
Upper Nicola	72,160	36.2	23,499	30,409	22,711	15,240	4,859	101	0
Total:	**683,569**	**60.4**	**113,951**	**203,689**	**194,264**	**210,429**	**92,714**	**33,425**	**7,706**

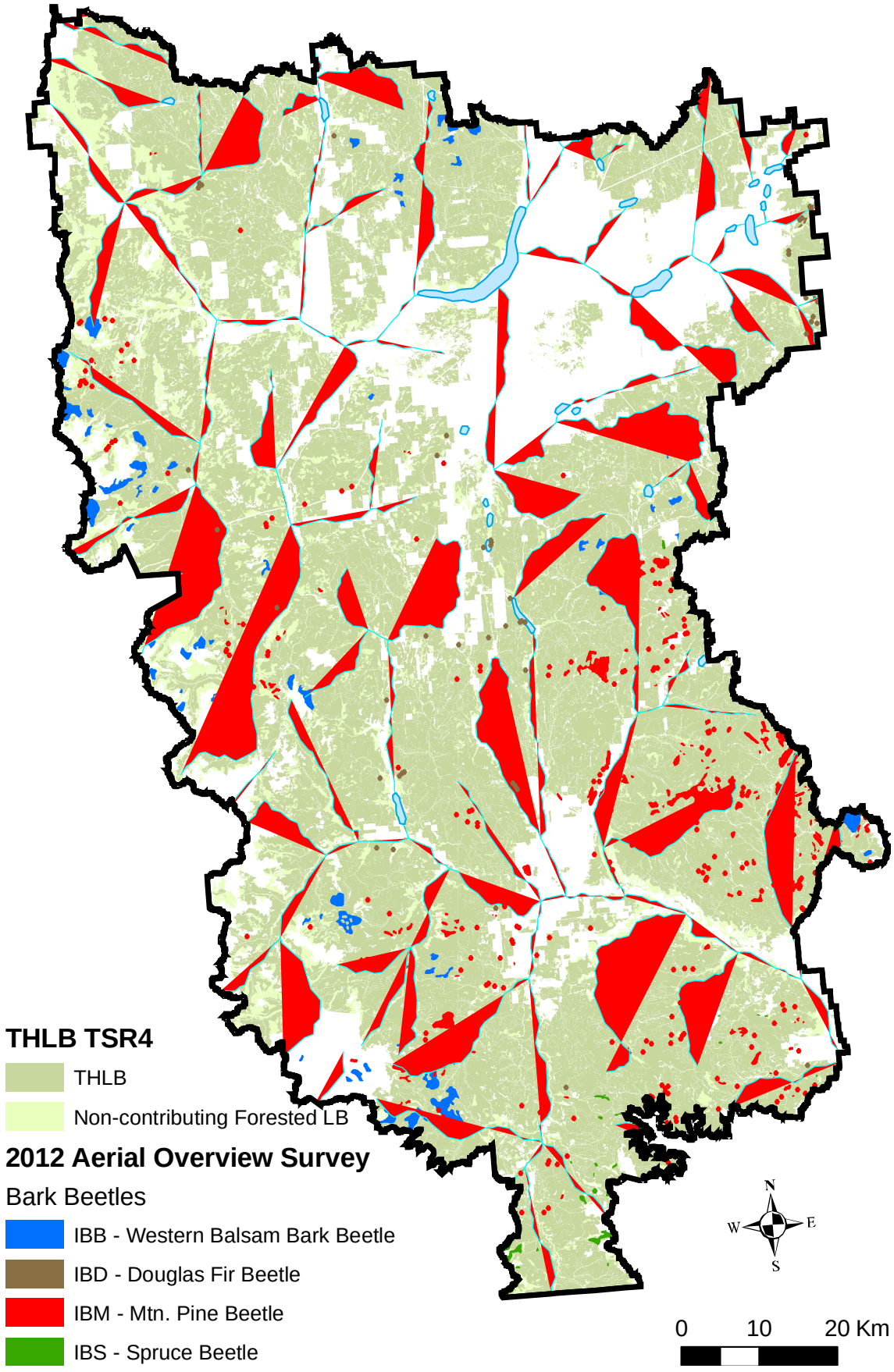

Figure 9. Timber Harvesting Land Base (THLB) and 2012 bark beetle infestations.

Bark Beetle Management and Reporting Activities

A variety of management activities will be considered and implemented to work towards meeting the management targets and expected performance measures in suppression BMUs. Communications and synchronization with forest licensees and other stakeholders representing forested lands in the Merritt TSA such as parks is integral to the success of the bark beetle management activities.

Detection

The detailed aerial surveys for bark beetle attack and windthrow will be conducted to the standards of the Cascades District. The aerial survey will begin the first week of August (weather and wildfires permitting), and complete by the last week of August. Aerial survey digital data will be made available as soon as possible to commence detailed management planning and prioritizing of identified beetle infestations for ground surveys and treatments. Information obtained from the detailed surveys will be provided to forest licensees, woodlots, small scale salvage loggers, and other interested stakeholders.

The ground surveys will be conducted as per the Cascades District schedules.

Single-tree Treatments

Single tree disposal by fall and burn will be conducted according to the Cascade Forest District schedules, and will be utilized to destroy small numbers of beetle-infested trees that cannot be addressed by harvesting, such as in riparian management areas, environmentally sensitive areas, wildlife tree patches, and other no-harvest zones. Fall-and-burn programs will also be targeted to support forest licensee beetle management efforts in suppression BMUs.

Salvage/Sanitation Harvesting and Harvesting Priorities

Harvesting currently-attacked trees before beetle flight is the most effective form of beetle management and will be utilized whenever possible. Beetle infestation ground reconnaissance and treatment (salvage/sanitation harvesting) targets will be established by individual licensees based on information from aerial and ground surveys. Virtually all harvesting within the Merritt TSA will be directed to harvesting of stands affected by various forest health factors.

Harvesting activities by stakeholders other than the major forest licensees (such as Salvage Non-renewable Forest Licences and Small Scale Salvage) will be directed, wherever possible, into priority areas that will assist with TSA beetle management efforts in suppression BMUs.

Now that the TSR4 determination has been made the harvest priority principles have been refined. The Nicola Similkameen Innovative Forestry Society (NSIFS) licensees have committed to follow the jointly developed Partition Implementation and Stewardship Guiding Principles, which was updated and agreed to in early 2013.
Licencees will prioritize their harvest based on bark beetle attack levels and stand characteristics, as described in the document. This matrix will be dynamic and is expected to be adjusted as the parameters surrounding beetle salvage and sanitation activities change (e.g. area and locations of current beetle infestation, BMU strategies, market conditions and AAC uplifts, etc.).

Hauling Restrictions

To ensure that beetles are not spread through log transportation, hauling and milling restrictions will be adhered to as per the Cascade Forest District standard operating procedures.

Yard Management

Activities to monitor beetles and reduce spread possibilities may include pheromone traps, watering of decks, and prompt manufacturing of logs delivered during beetle flight.

Harvesting Practices

Licencees will adhere to clean harvesting practices, including the burning of slash piles prior to beetle flight.

Reporting Activities

The Ministry of Forests, Lands and Natural Resource Operations will produce an annual report containing accomplishments, expenses, issues, recommendations and performance measures. This report and the annual update of the strategy will encourage the practice of adaptive management, and will be included in the following year's Forest Health Strategy.

Bark Beetle Management Targets

The current philosophy to bark beetle management in the Merritt TSA is an aggressive pro-active approach to identifying and managing the destructive forest pests within the TSA. Bark beetle management activities will be targeted at sites where infestations are in a building or outbreak phase, with the overall goal to minimize unsalvaged losses within the TSA, by aggressive harvest and utilization of all impacted stands.

To succeed in achieving the preceding beetle management goal, a cooperative and aggressive beetle management approach must be adopted and implemented by the MoFR, forest licensees, woodlots, and all other parties involved in beetle management activities in the TSA.

The forest licensee salvage harvest accomplishments and proposed salvage harvest targets are outlined in Tables 17. The proposed salvage harvest targets address beetle infestations in areas of the TSA where access is present or can be developed. Note that these targets are only estimates, and actual harvesting of the proposed blocks is dependent upon final approval and is subject to change.

The 2012 Nicola-Similkameen Innovative Forest Practices Society (NSIFS) annual report information is presented below.

The detailed MPB harvest strategy was developed by forest licensees through the Nicola-Similkameen Innovative Forest Practices Society (NSIFS) to address the AAC uplift conditions (July 13, 2005) in the Merritt TSA. This detailed strategy is presented in the NSIFS annual report in Appendix 1 of this document, dated March, 2013. For the NSIFS annual report, reporting is only done on NSIFS licences not other licence volume that is managed by major tenure holders. Also starting in 2009, reporting does not include a breakdown by BMU of heavily infested volume, volume at risk, or planned harvest volumes.

Table 17. Summary of forest licensee salvage harvest accomplishments in the Merritt TSA in 2006-10 [1].

Beetle Management Units[2]	Priority Infested Volume (m3)		Harvest Targets (m3)	
	Heavily-Infested	Volume at Risk	Proposed	Actual[3] (%)
2006	4,335,815	3,064,164	2,603,409	2,384,881 (92%)
2007	4,147,347	4,440,597	2,211,969	1,957,611 (89%)
2008	8,207,862	5,713,452	2,529,615	2,090,918 (83%)
2009	6,854,356	3,850,916	2,711,187	1,864,264 (97%)
2010			1,751,305	2,035,201 (116%)
2011			1,751,305	1,901,791 (109%)
2012			1,751,305	1,707,449 (97%)

[1] – From the Nicola-Similkameen Innovative Forestry Society 2006 - 2012 Annual Reports.

[2] – Beetle Management Units are equal to Merritt TSA Landscape Units as of April 1, 2007.

[3] – Actual harvest volumes by BMU are currently not reported by MoFR or NSIFS at this time.

For 2013 the NSIFS licencees are planning on harvesting 100% of the AAC off the NSIFS licences. The licencees are uncertain how the recent 14% cut reduction in the TSA will impact the IFPA licences. They anticipate that greater than 90% of the total harvest will be in heavily infested stands.

The heavily-infested volume includes those areas where the number of green-attack trees is greater than 10 stems per hectare, while the volume at risk includes those areas where the green attack is less than 10 stems per hectare. The forest licensee harvesting strategy includes harvesting the heavily-infested blocks first and where appropriate; placing pheromone baits in cutblocks where a portion is less-heavily infested to hold the beetle population until harvesting is possible.

Tactical Plan for Bark Beetle Activity in the Merritt TSA for 2013/14

Table 18 : Summary of MoFR forest health/bark beetle management activities and costs recommended for each BMU for 2013/14.[a]

BMU Name	Bark Beetle Species.	Strategy	Surveys				Treatments		Total BMU Cost ($)
			Detailed Air[b]		Ground[v]		Fall & Burn[d]		
			ha	$	ha	$	trees	$	
		$5,000 is requested for flying to support strategy development.							

[a] - Based upon historical data, infestation data, and population dynamics for the Merritt TSA.
[b] - $0.19/ha all-found cost includes helicopter/pilot, FH Technologist, and GPS-mapping technician and digital file production.
[c] - $60/ha all-found cost for a survey crew of 2 persons.
[d] - $65/pine tree & $110/dfir or spruce tree all-found cost for a fall-and-burn crew of 1 certified faller and 1-2 spotter/crewpersons.

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Appendix 1

Nicola-Similkameen Innovative Forestry Society
Mountain Pine Beetle Strategy – 2012 Annual Report
(March, 2013)