

MINISTRY OF FORESTS, LANDS, NATURAL RESOURCE OPERATIONS
AND RURAL DEVELOPMENT

Selkirk Natural Resource District

**Revelstoke & Cascadia TSAs (Revelstoke Portion)
Forest Health Strategy 2019-20**



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IBD Attack



Cover: Courtesy of Nadine Overwater

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1 GOAL

The goal of this Forest Health Strategy is to serve as a resource for directing forest health management and for communicating hazards or other relevant information on major pests in the Golden Timber Supply Area (TSA) and other area-based tenures with Golden TSA - Woodlots. It provides some of the tools necessary to improve sustainability and resiliency of forested ecosystems by identifying strategies and tactics to minimize losses from damaging insects, diseases and abiotic disturbances. The Provincial Forest Health Strategy guides government's forest health program to achieve the goals of:

- maintaining and improving the productivity of British Columbia's forests
- extending the supply of the remaining timber resource
- protecting other forest resource values

2 OBJECTIVES

The overall objective is to minimize timber losses and the hazard and risk from forest health factors by:

- Maintaining a detection program for forest health agents over the land base;
- Assessing the potential risks and impact of the identified forest health agents on resource values and timber supply;
- Identifying prevention and suppression strategies and tactics for major pests;
- Implementing ecologically sound, economically feasible and socially acceptable mitigating strategies and tactics to address forest health agents while considering constraints and limitation placed on the land base;
- Encouraging and fostering knowledge sharing on forest health agents amongst the Golden TSA forest stakeholders, primarily forest tenure Licensees;
- Evaluating management practices for the purposes of adaptive management; and
- Provide strategic direction for management activities.

2.1 Provincial Forest Health Mandate

The goal of the Provincial Forest Health Program is to manage pests to meet forest management objectives. The provincial government's three key strategic forest health objectives are to:

1. Pest impacts are monitored and assessed

The evaluation of pest impacts on forest resource values is supported by forest health monitoring and assessments.

2. Practices are adapted to accommodate known forest health risks

Forest practices are modified to minimize the impacts of forest health factors based on the best available information.

3. Resources are protected

Forest resources are protected from pest damage through appropriately applied direct management actions.

Additional information on the Provincial Forest Health Program can be found at:

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health>

3. TSA DESCRIPTION

The Revelstoke and Cascadia Timber Supply Areas are situated in the north western portion of the Kootenay Boundary Natural Resource Region and are administered by the Selkirk Resource District, Revelstoke office. The Revelstoke and Cascadia TSAs lie within the traditional lands of Okanagan,

Secwepemc and Ktunaxa Nations though there are no current First Nation communities within the TSAs boundaries.

The Revelstoke TSA covers 549,420 hectares of rugged and mountainous terrain. Approximately 222,822 hectares or 41 percent of the total TSA area is forest land managed by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. The area defined as the timber harvesting land base, 52,358 hectares, represents about 23 percent of the productive forest land base following area exclusions for factors such as poor operability, environmental sensitivity and unmerchantable forest types. The Cascadia TSA covers 77,548 hectares.

The species distribution within the Revelstoke TSA THLB is available in Table 1 with Hw, Sx, Cw and Fdi making up over 88% of the volume.

Table 1: Revelstoke TSA THLB Species volumes for > 60 year old stands. (2020)

Species	Leading Volume	Species 2 Volume	Species 3 Volume	Species 4 Volume	Total Volume	Species %
H/Hw/Hm	1,974,203	624,934	139,066	14,517	2,752,720	29.3%
S/Se/Sx	1,415,461	567,755	365,400	49,129	2,397,745	25.5%
CW	1,188,233	455,481	108,741	22,901	1,775,356	18.9%
FDI	1,094,409	174,327	104,917	24,407	1,398,060	14.9%
BL	251,382	255,126	78,299	33,450	618,257	6.6%
PW	23,341	78,139	81,632	49,657	232,769	2.5%
EP	3,030	41,132	20,551	22,200	86,913	0.9%
AT	1,436	28,230	21,585	9,530	60,781	0.6%
PLI	9,022	21,330	5,977	3,123	39,452	0.4%
ACT	608	11,765	11,555	1,487	25,415	0.3%
LW/Lt	3,474	10,987	3,680	164	18,305	0.2%
PA	-	-	1,066	1,425	2,491	0.0%
Totals	5,964,599	2,269,206	942,469	231,990	9,408,264	

A large portion of the timber harvesting land base (THLB) exists in younger age classes (0-50 years), and older age classes (141+), while relatively little area exists in stands between the ages of 41 and 140 years. Stands dominated by western red cedar, western hemlock, Engelmann spruce and Sub-alpine fir tend to make up a large component of the older age classes.

The forests of these areas provide a variety of habitat for wildlife, including large animals such as black bear, grizzly bear, moose, elk, mule deer, mountain goat, and mountain caribou. The TSAs provide important habitat for the Revelstoke/Shuswap caribou herd.

Recreational values and uses of forests in these areas are high due to proximity of national and provincial parks, exceptional natural scenery, and the presence of highway and rail transportation. Consequently, tourism is becoming an increasingly important economic sector in the area's economy.

Bark beetles have posed a threat to management objectives for many of these resources. Western hemlock looper is considered the highest priority forest health agent, with spruce beetle and Douglas-fir beetle to a lesser extent in each TSA. Catastrophic infestations result in millions of dollars in reduced revenue due to timber losses, degraded lumber values, reduced stumpage values, degradation of non-timber resources, increases in unsalvaged losses, and disruptions in forest planning and long-term impacts on resource sustainability. Large scale tree mortality within the two

TSAs could also have negative impacts on recreation, fire hazard, visual objectives, fish and wildlife resources, water management and other resource values.

Beetle Management Units (BMUs) follow the same boundary lines as Landscape Units and are listed and displayed in Table 2 and Figure 1.

Table 2: The following BMUs are included in this TSA Forest Health Strategy.

BMU#	BMU Name	BMU#	BMU Name
R01	Pingston	R10	Laforme
R02	Cranberry	R11	Big Eddy
R03	Akolkoalex	R14	Liberty
R04	Mulvehill	R15	Horne
R06	Redrock	R16	Soards
R07	Jordan	R18	Bigmouth
R08	Frisby Ridge	R20	Illecillewaet

The following BMUs contain TFL55 & 56 area and are not covered by this strategy.

TFL BMU #	TFL BMU Name	TFL BMU #	TFL BMU Name
R05	French	R17	Mica
R12	Downie	R19	Goldstream

Comprehensive descriptions of the Revelstoke & Cascadia TSA are included in the following documents:

Revelstoke TSA Website:

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/revelstoke-tsa>

Cascadia TSA website:

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/cascadia-tsa>

- Data Package
- Analysis Report
- Rational for Allowable Annual Cut Determination

Kootenay-Boundary Land Use Plan

<https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/kootenay-boundary/kootenay-boundary-rlup>

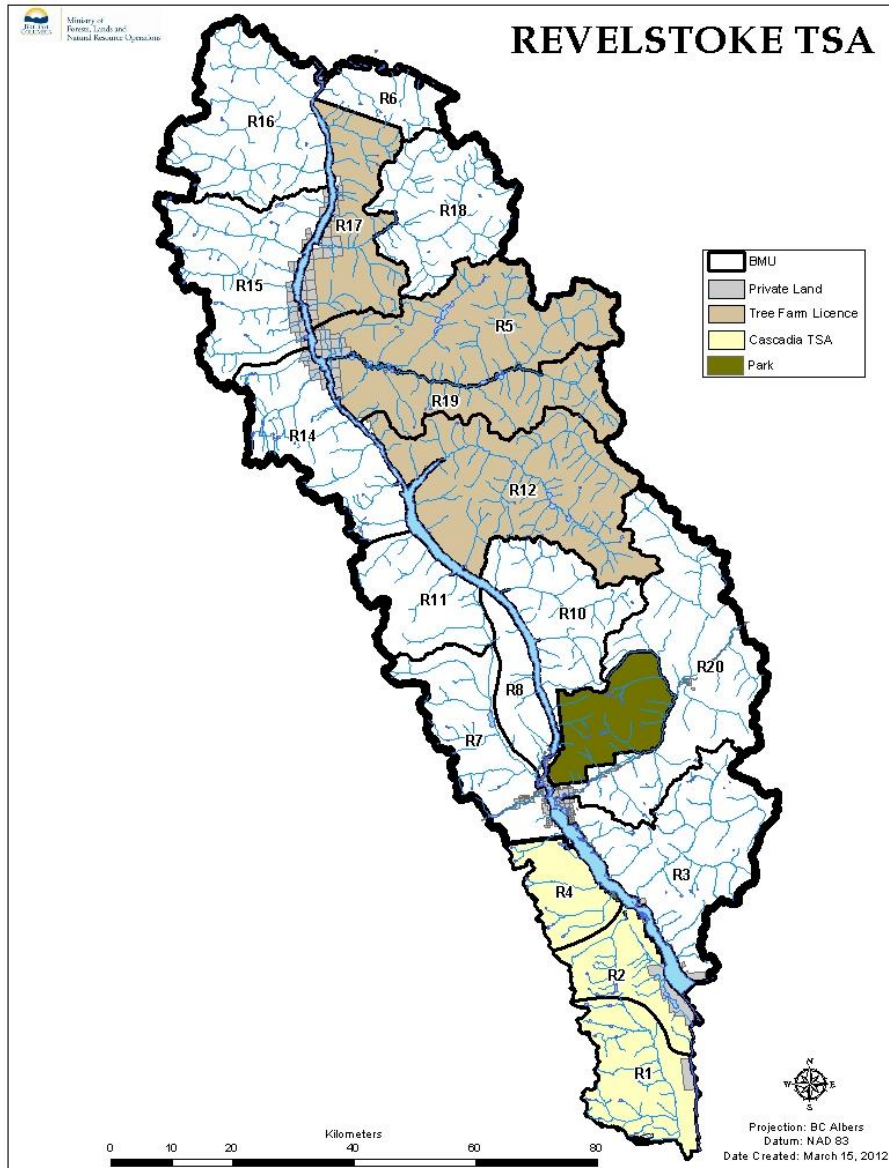


Figure 1: Map of Revelstoke and Cascadia (Revelstoke Area) TSAs, identifying Revelstoke National Park, private land and TFL area not included in this Forest Health strategy.

4 TSA Priority Ranking of Forest Health Agents

The priority forest health agents have been ranked following the Provincial Forest Health Strategy (Table 3).

Rankings were based on the following factors:

- The collective knowledge of the regional and district forest health specialists, forest managers, licensees and contractors
- Historic recorded occurrence patterns
- Known or suspected impacts to forest resource values, based on the knowledge of local forest professional and regional forest health specialists
- Availability of operational detection and treatment methods
- Costs and benefits of applying detailed detection and treatment activities

- Overall level of knowledge about the hazard and risk zones
- Distribution of pest and current incidence levels

The rankings are somewhat subjective, so an additional approach is to consider what the impact of the forest health factor would be equivalent to in terms of area. This approach provides a useful perspective to the rankings and generally applies as follows:

<i>Ranking</i>	<i>Predicted potential damage loss per year (ha)</i>
Very High	>400
High	200-400
Moderate	100-200
Low	50-100
Very Low	<50

Note: some abiotic injuries (i.e. flooding) are not ranked, as the severity can change with each event. Also note that not all forest health factors are ranked, only the more significant pests within the two TSAs.

Table 3: Ranking of Forest Health agents by potential impact on forest management activities in the Revelstoke and Cascadia TSAs

	Very High	High	Moderate	Low
Defoliators	Western hemlock looper			Black army cutworm, Birch leaf miner, Aspen serpentine leaf miner
Diseases		Armillaria root disease	Tomentosus root disease White pine blister rust	Dothistroma, Lophodermella, Hard pine rusts (Western gall rust, Stalactiform blister rust, Comandra blister rust)
Insects	Spruce beetle, Douglas-fir beetle, Western balsam bark beetle		Spruce weevil	Mountain pine beetle
Mammals			Bear	Deer, Moose
Abiotic Factors	Fire	Windthrow	Drought	

An overview of the activity status of some of the priority forest health agents which were reported during the 2018 and 2019 provincial aerial overview surveys (AOS) are provided in Table 4. Note that spot tree counts have been incorporated into the severe category of damage based on a fraction of a hectare per spot. Priority ranking is based on risk of current and future non-recoverable losses. IBD and Fire Killed stands are Priority 1's represents the largest current losses of higher value timber species and area and all the bark beetles have the potential to cause further losses if not managed/harvested.

Table 4: Selected summary of 2018 & 2019 forest health agents recorded during the aerial overview survey on forested lands in the Revelstoke and Cascadia TSAs and TFLs 55 & 56 (hectares).

FH Agent	Common Name	2019 Affected Area (ha)	2018 Affected Area (ha)	Trend	Current Impact on Timber Supply	TSA Priority
IBD	Douglas-fir beetle	265	537	Significant Decrease	High	1
NB/ NBP	Fire/ Post Fire	40	2180	Significant Decrease	High	1
IBB	Western balsam bark beetle	5,359	4,330	Significant Increase	High	2
IBS	Spruce beetle	179	196	Slight Decrease	Moderate	2
IBM	Mountain pine beetle	269	204	Slight Increase	Low	3
IDL	Hemlock Looper	220	0	Significant Increase	Low	3
NE	Cedar Flagging	6228	ND	NEW-- Significant Increase	Low	n/a
ID6	Aspen serpentine leafminer	2,849	3,414	Significant Decrease	Low	n/a
IDN	Birch leaf miner (Birch decline)	23	90	Slight Decrease	Very Low	n/a
NF	Flooding	33	78	Static	Low	n/a
NS	Slide	20	21	Static	Very Low	n/a
AB	Bear	0	37	Decrease	Very Low	3
ND	Drought	0	29	Decrease	Very Low	3
NW	Windthrow	0	58	Decrease	Very Low	3

5 FOREST HEALTH AGENTS - STRATEGIES AND TACTICS

5.1 DEFOLIATORS

Western hemlock looper IDL (*Lambdina fuscicollis lugubrosa*)

IDL was observed for the first time in many years in 2019 with 220 ha mapped. Locations include 1 polygon in each of La Forme Ck (Moderate Severity), Tangier Ck (Light Severity) and Courier Ck (Light Severity & National Park). The last outbreak of western hemlock looper occurred in 2002-2003, defoliating approximately 16,000 hectares of forest land north of Revelstoke. The preferred host of the looper is western hemlock followed by interior spruce, Douglas-fir and western red cedar and found primarily in mature and overmature hemlock and hemlock-cedar stands. Looper outbreaks tend to run on a 10-year cycle, the last outbreak began in 2012. Aerial spraying occurred in 2012, approximately 7,500 hectares was sprayed within the ICH and Caribou GAR Order areas north of Revelstoke. Areas for sprayed were prioritized by the best habitat for caribou. The population had since collapsed but may be restarting.

Aspen serpentine leaf miner ID6 (*Phyllocnistis populiella*)

Aspen serpentine leaf miner attacks trembling aspen and black cottonwood. Larval mining reduces tree photosynthesis and water vapour conductance. Heavy attacks can reduce tree growth, cause branch dieback and even cause tree mortality. Foliage discoloration and associated premature leaf fall may reduce the aesthetic value of trees on recreation sites. It has been identified on the annual aerial overview survey (AOS) for the last six years peaking with 5,541 hectares of infestation in 2016 then decreasing to 1,885 hectares in 2017. The area observed in 2019 is down at 2,849 ha compared

to 3,414 ha in 2018. This defoliator is not being managed though the presence of foliar diseases and climate change could impose constraints on future management. Aspen serpentine leafminer is widespread and there is no prescribed treatment or management for this defoliator.

Birch leaf miner IDN (*Fenusa pusilla*) (Birch Decline)

Birch leaf miner has been observed at 23 and 90 ha in 2019 and 2018 respectively. The trend has been sporadic over the last 5 plus years. This defoliator is not being managed though the presence of foliar diseases and climate change could impose constraints on future management. Birch leaf miner is widespread and there is no prescribed treatment or management for this defoliator.

Black army cutworm IDA (*Actebia fennica*)

The black army cutworm hazard is highest when a site is burnt in the spring and no herbaceous food source is available. Most mortality occurs among those seedlings that are more than 60% defoliated. Hosts are spruce, lodgepole pine, western larch, Douglas-fir and trembling aspen with Douglas-fir and spruce being highly susceptible and lodgepole pine being relatively resistant to damage. The number of blocks broadcast burnt in recent years has been relatively low. Due to the higher occurrence of wildfire in 2017 any replanting of burned areas or salvage of and planting these areas could be at risk.

For blocks burned in the spring (May-June) of the previous year, one should try to delay planting until most cutworms have pupated. If cutworm damage is expected when seedlings are planted, the simplest and fastest approach is to plant on moist sites as early as possible in the spring; on sites where significant moisture stress is expected, delay planting for 1 year.

5.2 DISEASES

Armillaria root disease DRA (*Armillaria ostoyae*)

Management of Armillaria and other root diseases in the TSA is recommended to follow the “[Managing Root Disease in BC](#)” guide published by FLNRORD (2018). Stocking Standards for Free Growing Stands are contained in each licensee’s Forest Stewardship Plan and have been developed to address this disease. Harvested ICH stands of a suitable nature should be considered for stump removal treatments post-harvest to reduce DRA levels. Treatment of stands other than the ICH should be assessed for DRA levels or only after discussions with FLNRORD Regional Pathologist. Because deciduous brush thinning can promote spread of Armillaria, such action should be applied carefully. Options might include earlier treatment to maintain conifer crop tree growth vigour when competing deciduous broadleaves have a less extensive root network.

Stocking Standards for Free Growing Stands are contained in each licensee’s Forest Stewardship Plan and have been developed to address this disease. Harvested ICH stands of a suitable nature should be considered for stump removal treatments post-harvest to reduce DRA levels. Treatment of stands other than the ICH should be assessed for DRA levels or only after discussions with FLNRORD Regional Pathologist. Because deciduous brush thinning can promote spread of Armillaria, such action should be applied carefully. Options might include earlier treatment to maintain conifer crop tree growth vigor when competing deciduous broadleaves have a less extensive root network.

Young plantations with DRA tend to suffer a distinct early wave of mortality due to young roots contacting infected stump systems. Mortality usually peaks between 9 and 16 years after planting. Thus, applying free-growing surveys after this time period would provide the most useful

information on plantation success. A later FG survey than typical is recommended for areas with known *Armillaria*, such as ICH sites.

RESULTS data indicates that 18.8 ha of stump removal was completed in 2019 by a single Licencee in the TSA and only 313.4 hectares of stump removal has been completed in the last 12 years. All the stump removal treatments within the TSA were completed by a single Forest Licencee. This number seems somewhat low given the high % of ICH stands in Revelstoke TSA and potential susceptibility of these areas to DRA. Limiting factors are likely large stump size and steep slopes but where these are not limiting factors it is **recommended that all Licencees should be considering stump removal treatments in high risk areas where feasible.**

Tomentosus root disease DRT (*Inonotus tomentosus*)

Tomentosus root disease often causes small gaps in stand canopies that can coalesce into larger opening, within which lay randomly oriented, downed trees with decayed roots. Crown symptoms are not very common but include chlorotic thinning foliage, reduced shoot growth, and distress cones. Juvenile trees die quickly; older trees suffer extensive butt rot leading to increased susceptibility to windthrow and insect attack. Tomentosus spreads primarily through root contact and can survive in infected large stumps for decades.

White pine blister rust DSB (*Cronartium ribicola*)

White Pine blister rust is an introduced pathogen which has caused extensive mortality of western white pine, limber pine and whitebark pine. The availability of disease-resistant white pine makes it possible to ensure this valuable timber species is restored. Disease resistant white pine should be promoted as a reforestation species on appropriate sites. Based on successfully yielding approximately 65% survivorship of white pine, a similar rust-resistance effort should continue to be supported for whitebark pine, which is occasionally harvested, federally endangered, and especially valuable for wildlife. Forest Licencees are encouraged to consider planting rust resistant Pw seedlots.

Whitebark Pine Decline

Whitebark pine (*P. albicaulis*) often occurs within harvest units at elevations above 1600 meters. The causes are primarily white pine blister rust and mountain pine beetle. To a lesser extent, the exclusion of fire has favoured its less fire-hardy competitors. As a result, this tree species was placed on the federal endangered species list in 2012. Whitebark pine is valuable to grizzly bears and many other wildlife species for its very large seeds.

The cutting or damaging of whitebark pine should be strictly avoided. Whitebark pine stands, especially those with many cone-bearing trees and in good health, are good candidates for wildlife tree reserves, Old Growth Management Areas, and Wildlife Habitat Areas for grizzly bears. In harvest areas, the thinning of competing trees can promote whitebark pine survivorship by reducing competition and providing seed regeneration habitat.

Hard pine rusts- Commandra blister rust DSC (*Cronartium comandrae*), Stalactiform blister rust DSS (*Cronartium coleosporioides*), Western gall rust DSG (*Endocronartium harknessii*)

Hard pine rusts are a very minor concern as pine is not normally planted in harvested blocks in either TSA. Based on RESULTS records no Pli has been planted in the last eleven years.

5.3 INSECTS

Western balsam bark beetle IBB (*Dryocoetes confusus*)

There are significant areas of subalpine fir leading forest stands in the TSAs that are susceptible to western balsam bark beetle. Western balsam bark beetle has been chronically causing mortality over the years. 2019 saw another increase in attack to 5,359 ha from 4,330 ha in 2018 were observed primarily in Trace and Light severity class in 2019 and Trace in 2018. Harvesting areas of more severe attack is recommended if possible, to reduce Non-Recoverable Losses. Direct control action on that insect is very difficult due to its attack dynamics and the scattered distribution of the stands.

Douglas-fir beetle IBD (*Dendroctonus pseudotsugae*)

The 2019 aerial overview survey had a decrease in incidence of Douglas-fir beetle from 537 to 265 ha compared to 2018. **The 2019 detailed flight covering area just north, east and west of Revelstoke and south to the ferry found 107 IBD spots (76 in 2018) with a total of 464 red trees (584 in 2018).** Area of Coverage was approximately the same for IBD and only spots of 3 trees or more were mapped.

Large outbreaks of Douglas-fir beetle have not been recorded likely due to the widespread occurrence of mixed species stands. Areas of recent IBD attack are primarily from Beaton Arm/ Shelter Bay north to Revelstoke on east and west side of the Columbia River then west along Highway 1.

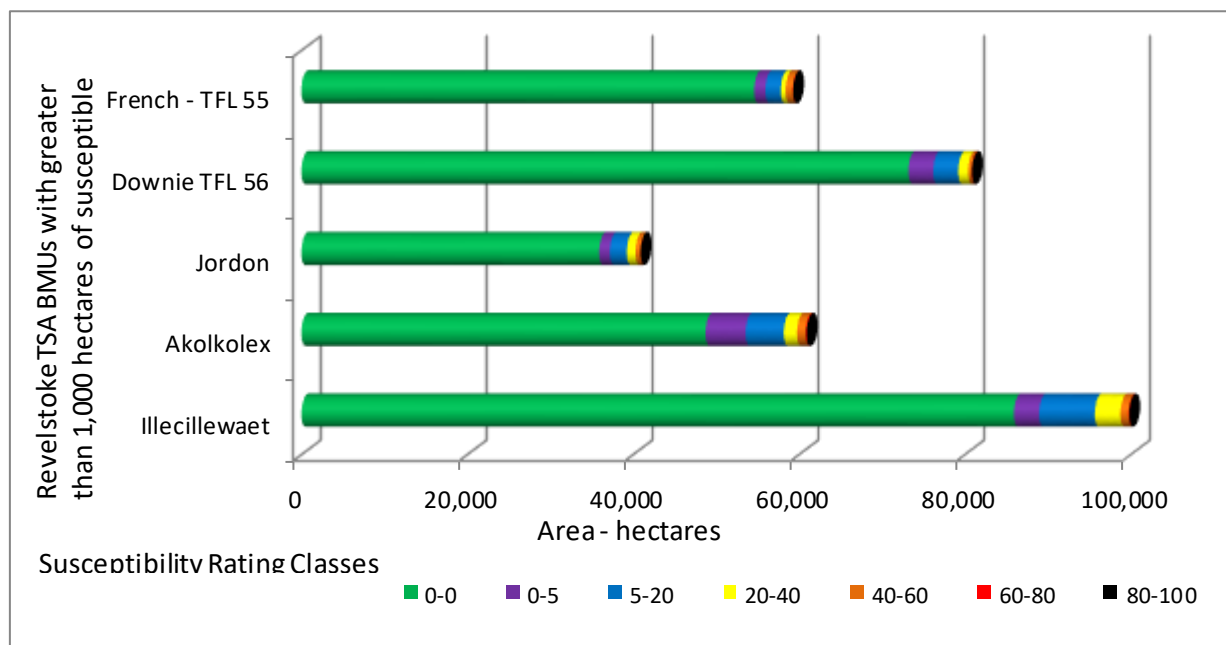


Figure 2: Douglas-fir beetle susceptibility rating for Revelstoke TSA BMUs with > 1,000 ha of moderate or greater area as of 2015 ranked from lowest to highest area top to bottom.

There are 15,344 ha of susceptible (>20 rating) forest types to Douglas-fir beetle in the Revelstoke TSA based on a 2014 BMU analysis. BMUs with greater than 1,000 hectares of susceptible stands are shown in Figure 2. Most of the susceptible area is in the 2 lower classes of 20-40 and 40-60. The Douglas-fir beetle has the potential to significantly impact the Revelstoke TSA timber supply as much of the concentration of Fdi susceptible stands are in areas of high constrain for other values such as Visuals, Ungulate range and Recreation. Therefore, the management of Douglas-fir beetle and Douglas-fir leading stands remain a high priority. **Trap tree and/ or funnel trap programs**

and monitoring post-harvest slash and monitoring blowdown in recently harvested blocks and removing or burning any slash are recommended beneficial practices to minimize future losses. Additional good practice includes harvesting fired damaged trees and adjacent stressed trees to reduce IBD population increases.

The 2017 to 2019 harvest of IBD polygons has not been significant to date as seen in Table 4. The planned and actual harvest amounts of AOS IBD polygons ranges from 5.9 to 6.6% over the three years. Most of this area is still planned and therefore not mitigating any IBD spread. **Licencee response in suppression BMUs should be targeting harvest of at least 70% of the previous year's attack within 1 to 2 years.**

Table 4: 2017-19 IBD Aerial Overview Survey polygon area and completed/ planned harvest to date

2017-19 IBD AOS Polygon % Harvest Area							
Year	Total AOS Polygon Area (ha)	Operable AOS Polygon Area (ha)	Harvested Area (ha) as of Spring 2020	Planned Harvest Area as of Spring 2020	Harvested % of Operable as of Spring 2020	Planned Harvest % of Operable as of Spring 2020	Total Current & Future Harvest %
2017	872.8	762.8	7.4	39.3	1.0%	5.2%	6.2%
2018	537	442.3	0	26.0	0%	5.9%	5.9%
2019	258.2	221.8	0	14.6	0%	6.6%	6.6%

Spruce beetle IBS (*Dendroctonus rufipennis*)

Spruce beetle has remained static in 2019 with 179 ha noted compared to 196 ha in 2018. Most of the attack severity has been Trace the last 2 years with a minor amount in Low and Moderate, no Severe or Very Severe. The detailed Aerial Survey only flew a small area in the upper Tangier River basin and only 2 spots with 6 trees were tallied.

There are 98,221 ha of susceptible (>20 rating) forest types to Spruce beetle in the Revelstoke TSA based on a 2014 BMU analysis. The 13 BMUs with greater than 4,000 ha of susceptible Sx area are noted in Figure 3 below in ascending order top to bottom of susceptible area. The TSA is very susceptible to IBS with the high amount of spruce covered area in moderate or higher susceptibility. Most of the susceptible areas is within the 20-40 and 40-60 susceptibility classes.

Spruce blowdown when identified is a high priority for treatment / harvest. The Bark Beetle Guidebook will guide treatments. Link is as follows:

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/beetle/betletoc.htm>

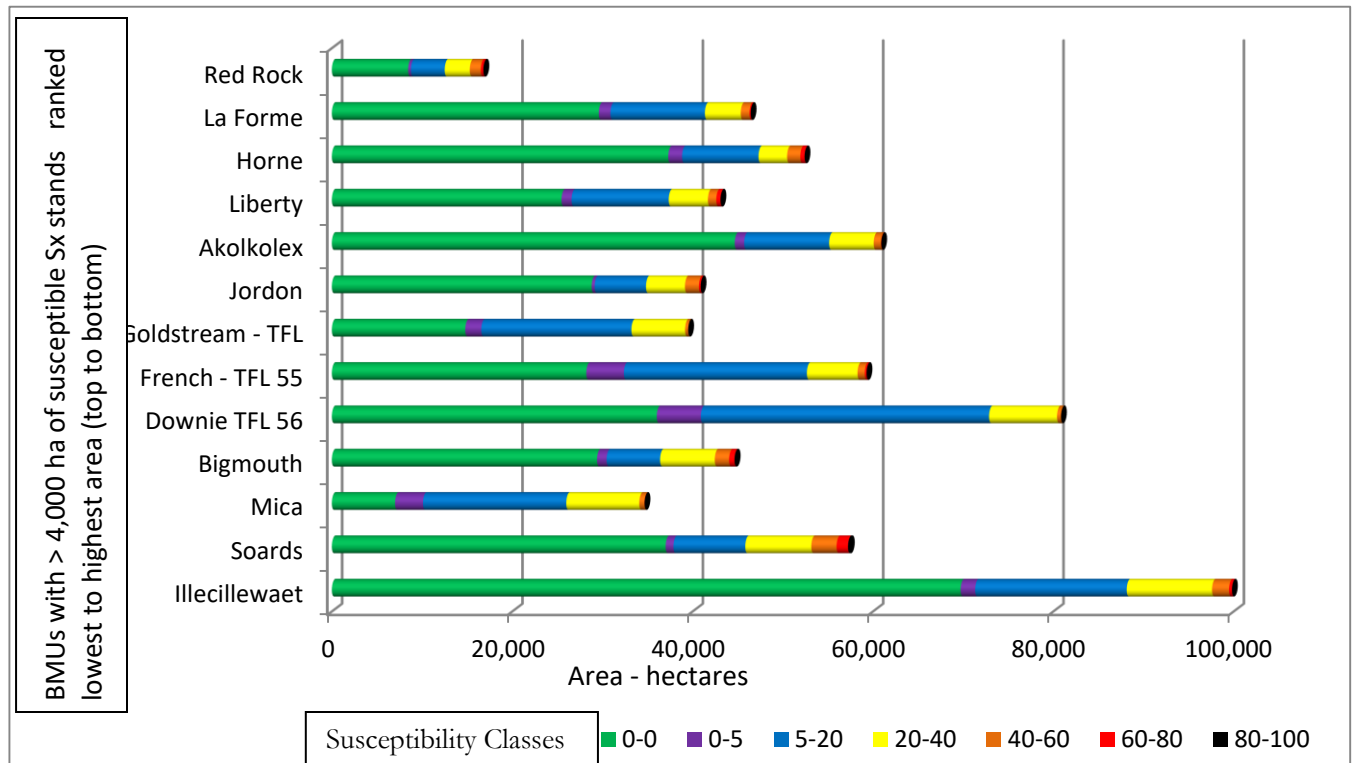


Figure 3: Spruce beetle susceptibility rating for Revelstoke TSA BMUs with > 4,000 ha of moderate or greater area as of 2015 ranked from lowest to highest area top to bottom.

Forest Licence plans, and harvest of IBS attacked areas from 2017-2019 is shown in Table 5. The area has been relatively small in the THLB and is decreasing over the last 2 years and to date none of the area has been harvested or planned to harvest. Rapid harvest response to any IBS outbreaks on operable THLB area is critical to reduce losses and IBS populations. **Given the current low amount of attack in operable areas, harvesting and keeping IBS populations low should be targeted through immediate harvesting, in less than 1 to 2 years.**

Areas of note with IBS outbreak areas include: Upper LaForme Ck, upper Carnes Ck, and upper Tangiers River.

Table 5: 2017–2019 IBS AOS Polygon area and completed/ planned harvest to date

2017-19 IBS AOS Polygon % Harvest Area							
Year	Total AOS Polygon Area (ha)	Operable AOS Polygon Area (ha)	Harvested Area as of Spring 2020	Planned Harvest Area as of Spring 2020	Harvested % of Operable as of Spring 2020	Planned Harvest % of Operable as of Spring 2020	Total Current & Future Harvest %
2017	620	258.8	0	0	0%	0.0%	0%
2018	196.0	148.2	0	0	0%	0%	0%
2019	177.0	91.0	0	0	0%	0%	0%

Mountain pine beetle IBM (*Dendroctonus ponderosae*)

Mountain pine beetle has been noted on white pine as spot infestations on the aerial overview surveys over the last number of years. 2019 saw a slight increase to 196 ha compared to 204 ha in 2018. 2019 attack was primarily in the Moderate and Light severity classes. Due to the minor

lodgepole pine component, the majority of the area is considered low hazard to mountain pine beetle, with most of the hazard found in the southern part of the TSA. 2017-19 THLB area of IBM attack is very low and actual and planned harvest of it is negligible at this time (Table 6). Any larger polygons of moderate or worse severity should be targeted for harvest if feasible. There are only 868 hectares of susceptible area within Revelstoke TSA with over half in 1 BMU - Akolkolex and therefore is not considered a significant threat to timber supply.

Table 6: 2017-19 IBM Aerial Overview Survey polygon area and completed/ planned harvest to date

2017-19 IBM AOS Polygon % Harvest Area							
Year	Total AOS Polygon Area (ha)	Operable AOS Polygon Area (ha)	Harvested Area as of Spring 2020	Planned Harvest Area as of Spring 2020	Harvested % of Operable as of Spring 2020	Planned Harvest % of Operable as of Spring 2020	Total Current & Future Harvest %
2017	468.1	44.3	0	0.4	0%	0.9%	0.9%
2018	203.6	0	0	0	0%	0%	0%
2019	262.1	32.2	0	0	0%	0%	0%

Spruce weevil (*Pissodes strobe*)

Spruce weevil is an insect that will repeatedly attack and damage the leader of spruce trees, causing poor form and reduced growth. It is not typically noted by the AOS. Spruce weevil is currently a medium to low priority issue overall, but in plantations that contain a large proportion of spruce seedlings; it is a medium to high priority. The best method of dealing with this insect is to ensure that there is a good species mix on the site, consider Sx seedlot selection carefully and maintain a relatively high planting density.

5.4 MAMMALS

Bear AB

Bear damage was decrease again in 2019 to 0 ha observed from 37 ha in 2018. Mortality often appears to be on younger (saplings and poles) single trees rather than widespread areas. Bear damage is not easily identified by the overview survey as only red attack trees are identified; ground checks are required to positively identify the cause of death. Bear damage has been identified at the free growing survey stage and in a number of blocks where Stand Development Monitoring (SDM) plots have been established in the Revelstoke TSA. To be detected on the AOS it would be significant damage within an opening or strata. Potential solutions to manage animal damage and in particular bear damage might include species diversity at time of planting and perhaps higher planting density as well. Rapidly growing, vigorous trees in moderately to lightly stocked stands are preferred. Stands that have been juvenile spaced and or pruned appear to have a greater incidence of bear damage than stands that have not been spaced and or pruned.

5.5 ABIOTIC FOREST HEALTH FACTORS

Windthrow NW

Overall, damage as a result of wind can cause significant forest loss. No windthrow was observed for 2019 compared to 58 ha in 2018. The geography of the area consists of many narrow valleys that drain cold air from higher elevations and flow into the Columbia River drainage: this concentrates air flows and creates turbulence pockets both of which can result in increased wind speeds. Strategies for managing windthrow risk include considering dominant wind patterns when establishing the

boundaries for harvest areas, and, in rare cases where there are high values at risk and forested areas that are not overly decadent, feathering the edges of harvest blocks by selectively removing trees and retaining the more wind-firm stems. Since management strategies cannot account for unpredictable storm winds, aerial overview survey data will identify new patches of windthrow and can be evaluated for salvage potential. Licensees have been monitoring areas of known wind events e.g. Boulder Mountain has had several wind events over the last many years resulting in patches of Douglas-fir being blown down.

Fire NB

In recent history, fire has not been a major concern in Revelstoke TSA although in 2018 2,180 ha burned and in 2019 only 40 ha were recorded as burned, significantly lower. Fire damaged area is detected based on previous year's fire season and post fire damage is additional noted mortality in subsequent years. Fire damaged stands should be considered for immediate salvage to reduce future damaging agents such as Douglas-fir bark beetle and to reduce non-recoverable losses. Harvest within a year of damage is recommended for wood quality and reduction of other pests.

Hot Droughts ND

The frequency and intensity of drought combined with higher summer temperatures appears to be increasing in the southern interior of BC. As a result, trees become stressed, especially young regeneration and overstocked (high density) mature stands. In 2019 no Drought areas were observed compared to 29 ha in 2018. Although the observed high amount of Cedar flagging is likely due to the 2017 & 2018 summer droughts. Drought mortality may not become evident until the year following as well. Impacted trees often don't die until a year or two post hot drought. The hot droughts of 2003 and 2007 are implicated in the timing of deaths of Armillaria infected regeneration on the Knappen Creek Stump Removal Trial. In a report to the Chief Forester, Axelson and Ebata (2015) predict the following impacts:

- Bark beetles of various species populations will increase.
- Plantation pests such as spruce weevil or lodgepole pine terminal weevil will increase.
- Defoliator activity could increase. Decline syndromes already being experienced in aspen and birch, they will continue or will become accelerated.
- Root diseases impacts will accelerate.

Flooding NF & Slides NS

Flooding and slide affected areas were similar to previous years with 33 and 20 ha affected respectively. Slide damaged areas can be a source for IBD and IBS population build up and should be managed by harvest, adjacent trap trees and/ or IBD funnel trapping if feasible.

6 Management Objectives for Priority Forest Health Agents

6.1 Integrated Forest Health Management objectives

The following principle for management objective commonly known as "Integrated Forest Health Management" will be followed for all the priority forest health agents in the Revelstoke TSA:

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

The Integrated Forest Health Management is a system that, in the context of specific resource management objectives and knowledge of the associated environment and the biology of the forest health agent and host species, applies all suitable techniques and methods to maintain forest health agent populations at levels below those causing unacceptable damage or mitigates such damage.

6.2 Management objectives for bark beetles (IBD, IBS and IBM)

The following are the management objectives to be implemented for the three main bark beetles in the Revelstoke and Cascadia TSAs: spruce bark beetle, Douglas-fir beetle and mountain pine beetle. Any reference to “bark beetles” in the following management objective refers to the three bark beetles listed above.

1. **Sanitation and salvage harvesting of beetle killed areas where economically feasible, especially moderate or higher severity IBD, IBS and IBM attacked polygons and larger Light attack polygons identified by the Aerial Overview Survey or other surveys. Limit the amount of unsalvageable losses due to bark beetles. Target harvesting a minimum of 80% of the area to maintain BMU suppression strategy within 24 months of the AOS flight.**
2. Prioritize the forest management to higher hazard forest stands by harvesting or reducing the susceptibility of stands to bark beetles.
3. Limit the amount of non-recoverable losses due to bark beetles;

Definitions:

Sanitation harvesting: harvesting operations specifically designed to maximize the extraction of currently infested or infected stands in order to reduce the damage caused by forest pests and to prevent their spread, e.g. bark beetles.

Salvage Harvesting: harvesting operations primarily designed to recover timber damaged or degraded by fire, an old insect attack, wind, or disease before the potential wood products become un-merchantable. Control of forest health factors such as bark beetles is incidental and is not the primary objective of salvage logging.

6.3 Harvesting Treatments

Harvesting is to be considered the preferred treatment for all infestations where it is operationally feasible. Treatment may include a single harvest regime or combination of harvest regimes ranging from large cut blocks, to single tree selection or small patch where appropriate.

The treatment goal is to remove as much, if not all of the current attack prior to the next beetle flight period. Within the Suppression Zone action plans must contemplate harvest before the next flight period. If this is not achievable, or the likelihood of pre-flight harvest is low, then these areas should be tabled as opportunities for other Licencees by at least April 1st of the following year.

Direct single tree treatments are not to be considered an alternative for harvest where the recovery of otherwise lost timber values and sanitation of beetles, i.e. removal of trees with brood can be attained. Where resources are insufficient to address the removal of all infestations prior to the next beetle flight, consideration must be given to minimizing block sizes and/or harvesting only those portions of the block that are infested this should be considered a short-term strategy until resources permit the removal of logical openings.

It is imperative the operational planning requirements are scheduled accordingly and where necessary to meet tight time frames. If necessary, expedited approvals should be requested and are appropriate

where infestations are identified post-flight and where harvest is planned to take place prior to the next beetle flight.

Licencees should consider a small-scale sanitation program as required to meet overall objectives. Sanitation is defined as the removal of infested material prior to beetle flight. Sanitation is to be used, where necessary, to balance resource allocations to optimize the effectiveness of harvesting and single tree treatment strategies and maximize the recovery of otherwise lost timber values.

Sanitation should also be considered where landscape level disturbances and impacts dictate a light footprint approach and where a minimum of one truck load (40 m³) of operable timber can be recovered, within reasonable skid distance (400 metres) of established logging truck access; the objective is to remove all infested trees prior to the next beetle flight. Only under exceptional circumstances where the methods cannot be applied should these sites be baited and held over flight.

If it is determined that harvesting prior to the next beetle flight is impossible, then consideration should be given to expanding the harvest area to include the area baited, as well as sufficient susceptible host.

6.4 Hauling and Milling Guidelines

The following guidelines should be considered when areas surrounding the mill site are in or near urban areas, or in areas not yet affected by bark beetles.

In recognition of the potential for bark beetles to fly from milling facilities into adjacent areas the following guidelines apply typically from April 1 to August 15 for IBD, May 1 to June 30 for IBS and July 1 to August 31 for IBM.

- Manage -spring break up inventories of infested timber for priority processing prior to the above-noted period;
- Keep mill inventories and deliveries of bark beetle infested wood at a minimal operational level to meet business needs;
- Mill profile requirements permitting, prioritize processing beetle- infested sources over uninfested sources.
- Establish funnel traps (especially for IBD) in and around log yards, log decks and log booms to assist in monitoring bark beetle flight and to serve as a control measure. Traps should be monitored at least weekly and contents destroyed.

In recognition of the potential for bark beetles to fly from infested cut blocks (standing trees or decks) to adjacent timber, the following guidelines apply:

- In Salvage BMU's, no special considerations
- In Suppression and Holding BMU's:
 - For infested cut blocks that are not harvested/hailed prior to beetle flight, consider baiting in an attempt to minimize spread. Licensees should, where practical, plan operations that avoid leaving decks of infested timber on site.
 - Communication of business needs/expectation for awareness between licensee and DSE prior to spring break-up/next beetle flight is required.

In recognition of the potential for bark beetles to fly from trucks during transport the following guidelines apply:

- Inform truck drivers when they are hauling green attack loads and that the beetle flight period typically extends from April 1 to August 15 for IBD, May 1 to June 30 for IBS and July 1 to August 31 for IBM.
- Inform truck drivers that extended delays along the way can result in bark beetles flying from the load into the adjacent forest land base.
- When practical, hauling of beetle infested logs should be as direct as possible from the cutting area to the mill.

6.5 Pheromone Placement

Pheromone placement is to occur in **infested stands only**, where beetle control activities cannot be implemented until after the next flight and in mop up operations around harvested and treated infestations. In the case of larger blocks with isolated concentrations of attack, only the infested portions of the block should be baited.

The use of pheromone baits must always be followed by actions to remove or eradicate the concentrated beetle populations. All pheromone placement plans should be shared at operational beetle planning meetings, including scheduling follow-up treatments and responsibilities.

Pheromone placement can be implemented throughout the spectrum of treatment strategies including fall and burn. Pheromones should not be placed in operable areas where population levels are extremely high and increasing, or in inoperable areas where population levels are endemic and declining.

The responsibility to carry out follow-up treatments to remove or eradicate concentrated beetle populations resulting from baiting lies solely with the placement agency (Section 41 of the Forest Planning and Practices Regulation (FPPR)). Follow-up actions must be carried out prior to the subsequent beetle flight unless specifically exempted by the District Manager (Section 91 of the FPPR).

Licensees, excluding TSL holders not operating under a cutting permit authority, should consider pheromone bait placement in unharvested portions of beetle infested blocks prior to biological beetle flight times where due to unforeseen circumstance the Licensee will not be able to complete harvest prior to the beetle flight.

All pheromone placement activities must be carried out in a manner which allows for future identification and location of baited trees. Baited trees must be marked conspicuously in the field using flagging, and the placement agency must be identified at each bait site. Maps identifying all baited areas should be provided to the District by September 15th each year. Detailed guidance and protocols on the use of pheromones is provided in “Strategies and Tactics for Managing the Mountain Pine Beetle”, developed for the B.C. Forest Service by Lorraine MacLauchlan and J. E. Brooks (http://www.for.gov.bc.ca/ftp/HFP/external/!publish/MPB_booklet/).

7 ROLES AND RESPONSIBILITIES

Detailed bark beetle surveys are carried out to determine the nature and extent of bark beetle infestations within the area of the plan. Specific areas requiring surveys are identified from aerial overview maps and previously known infestations.

If significant risks to forest resources are identified from surveys, actions to reduce risks are identified and reported within bark beetle survey reports and shared with the appropriate licensee. The responsibility to carry out these actions or measures is the responsibility of the licensee.

1. Responsibilities are assigned in this matrix according to funding source. Although there are allowances for some activities under the appraisal system, the responsibilities assigned include the implementation and funding of these activities.
2. In the event that a Forest Licensee must carry out activities within the operating area of another Forest Licensee, the responsibility for bark beetle management activities post-harvest are to be negotiated in advance.
3. Where special management areas have been identified such as areas of interest for the Protected Areas Strategy, the responsibilities identified in this matrix may be amended to address specific management guidelines for these areas.

DSE Forest Health Responsibility Matrix

DISTRICT RESPONSIBILITIES	REGIONAL RESPONSIBILITIES
Prepare an annual TSA Forest Health Strategy	Conduct annual aerial overview surveys and provide digital data to Districts to produce overview maps and to distribute to DSE clients.
Info sharing at TSA Steering Committee meetings and directly to Forest Licensees and other clients	Produce and distribute the Provincial annual forest health overview surveys
Conduct detailed aerial and ground surveys within the TSA where deemed appropriate	Conduct defoliator monitoring & aerial treatments for defoliators (ex. spruce budworm Bt spraying)
Produce maps from the aerial surveys and provide ground survey information and maps to Licensees and clients	Provide overwinter mortality estimates of bark beetles

Within Selkirk Resource District (DSE), Forest Licensees have a responsibility to track, monitor and treat forest health factors. The following table covers the responsibilities for Licensees and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

ACTIVITY	FLNRORD	LICENSEES
Monitor and evaluate forest health activities (Utilize the best current information to detect and manage forest health factors)	X	
Conduct treatment of defoliator outbreaks (FLNRORD regional responsibility)	X	
Develop annual reports of bark beetle activities for the Province	X	
Conduct bark beetle treatments when required by the Forest Health Strategy	X	X
Maintain and share records of collected survey information	X	
Conduct ground surveys when required to verify incidence and severity of forest health pests	X	X
Conduct aerial overview forest health surveys and report on results (FLNRORD region)	X	
Conduct detailed aerial surveys focusing on suppression beetle management units	X	

8 BMU STRATEGY FOR IBS, IBD and IBM

Most of the BMUs are listed as still in suppression in Table 7 for all 3 bark beetles with BMUs listed as Monitor where susceptibility is extremely low. No changes have been made to the BMU strategies for the 3 bark beetles for many years.

Table 7: BMU Strategy by beetle: IBM, IBS, IBD for 2017/2018 for the Revelstoke TSA (unchanged)

BMU	BMU Name	Beetle		
		IBM	IBS	IBD
R01	Pingston	Monitor	Suppression	Suppression
R02	Cranberry	Monitor	Suppression	Suppression
R03	Akolkolex	Suppression	Suppression	Suppression
R04	Mulvehill	Monitor	Suppression	Suppression
R06	Redrock	Monitor	Suppression	Suppression
R07	Jordan	Monitor	Suppression	Suppression
R08	Frisby Ridge	Monitor	Suppression	Suppression
R10	LaForme	Suppression	Suppression	Suppression
R11	Big Eddy	Monitor	Suppression	Suppression
R14	Liberty	Monitor	Suppression	Suppression
R15	Horne	Monitor	Suppression	Monitor
R16	Soards	Monitor	Suppression	Suppression
R18	Bigmouth	Suppression	Suppression	Suppression
R20	Illecillewaet	Suppression	Suppression	Suppression

9 Recommended activities to manage IBS, IBD and IBM

9.1 Douglas-fir beetle

The overall strategy for Douglas-fir beetle (IBD) management is that of suppression/monitor through the use of one or a combination of the following:

1. Sanitation harvesting;
2. Clean harvesting practises;
3. Trap trees;
4. Anti-aggregation pheromones (MCH);
5. Funnel trapping.

9.1.1 Harvesting

Timber harvesting in infested (1st priority) and red/grey attack (2nd priority) and un-infested stands (3rd priority) with high hazard and stress factors such as nearby windthrow, fire damage for example and/ or infestation is critical to meeting suppression strategy objectives and reducing non-recoverable losses. A combination of sanitation and salvage harvesting for Douglas-fir beetle suppression should be carried out in areas of current-attack in order to reduce the existing population and inhibit the infestation expansion. Failure to address these losses continues to impact future timber supply determinations negatively.

Trap trees are highly recommended as an effective tool to reduce overall beetle population levels in any IBD areas or Douglas-fir stands and complete a post-harvest mop-up where necessary. Baited funnel traps and MCH anti-aggregant may be used where conditions are appropriate.

9.1.2 Pheromone Use

Pheromone use is planned for use with IBD funnel trapping projects only at this time under Land Based Investment Funding works through Selkirk Resource District and is covered by the Southern Interior Region Pest Management Plan. The 2019 funnel trapping program funded by Land Based Investment and managed by District contract collected 550,238 (398,000 in 2018) Douglas-fir beetles over 24 sites. A similar program is planned for 2020. TFL56 (RCHC) also captured 17,200 beetles and additional untallied beetles were captured by a few other Licencees. Funnel trapping is also planned by some Forest Licencees for 2020.

http://www.for.gov.bc.ca/rsi/ForestHealth/PDF/PMP_2013-2017_FH_Southern_Interior_Feb_19_2013.pdf.

9.1.3 Single tree treatment and other treatments

No planned single tree treatments at this time.

9.1.4 Detailed Flight and Ground Surveys

The current plan for 2020 is to consider a heli detail survey of an area likely smaller than 2019, budget allowing, of selected higher incident and risk areas in Revelstoke TSA (excludes TFL areas). A limited number of ground surveys may also be completed. Detailed mapping flights were completed for Douglas-fir bark beetle in portions of the TSA in 2019.

9.2 Spruce beetle

The overall strategy for Spruce beetle (IBS) management is that of suppression/monitor through the use of one or a combination of the following:

1. Clean harvesting practices;
2. Trap trees.

9.2.1 Harvesting

Timber harvesting in infested (1st priority) and red/grey attack (2nd priority) and un-infested stands (3rd priority) with high hazard and/ or infestation is critical to meeting suppression strategy objectives and reducing non-recoverable losses. A combination of sanitation and salvage harvesting for Spruce beetle suppression should be carried out in areas of current attack in order to reduce the existing population and inhibit the infestation expansion. Failure to address these losses continues to impact future timber supply determinations negatively.

Trap trees are highly recommended as an effective tool to reduce overall beetle population levels in any IBS areas or Spruce stands and complete a post-harvest mop-up where necessary.

Trap trees are highly recommended as an effective tool to reduce overall beetle population levels in any IBS areas or Spruce stands and complete a post-harvest mop-up where necessary.

9.2.2 Pheromone Use

No planned use of pheromones is planned at this time for IBS management.

9.2.3 Single tree treatment and other treatments

No planned single tree treatments at this time.

9.2.4 Detailed Flight and Ground Surveys

The current plan for 2020 is to consider a heli detail survey of known higher priority incident areas, budget allowing, in Revelstoke TSA (excludes TFL and CFA areas). No Ground surveys currently planned. A small amount of area was detailed mapped in 2019.

9.3 Mountain pine beetle

9.3.1 Harvesting

Harvesting is the most efficient short-term method of managing IBM populations with the intent to prevent timber loss. Timber harvesting in infested (1st priority) and red/grey attack (2nd priority) and un-infested stands (3rd priority) with high hazard and/ or infestation is critical to reducing non-recoverable losses. Failure to address these losses will impact future timber supply determinations negatively. In order to reduce mid-term timber supply impacts harvesting should be targeted at infested stands with significant hazard where feasible.

9.3.2 Pheromone Use

None planned at this time.

9.3.3 Single tree treatment and other treatments

No planned single tree treatments at this time.

9.3.4 Detailed Flight and Ground Surveys

None planned at this time as susceptible area too small to manage at this time

10 Priority Activities in BMUs

The following projects are planned:

- Ongoing detailed monitoring (primarily detailed flights) in higher priority areas, with adequate funding.
- Ongoing discussions with Licencees regarding active IBS, IBD and IBM populations and infestations in their operating areas and targeting these areas and any fire damaged or windthrow areas for immediate harvest.
- Funnel Trapping for IBD in selected areas and encouraging Forest Licencees to consider their own funnel trap and trap tree programs.

11 2020-21 Fiscal Year Tactical Plan

The tactical plan will be to continue to monitor forest health agents through the overview survey and possibly a small amount of IBD / IBS detailed survey in selected areas of suppression units. Selkirk District is currently implementing a small funnel trap program for IBD near the city of Revelstoke and south to the ferry. Additional opportunities for funnel trapping will be considered on an annual basis based on current attack levels, funding and site feasibility.

Forest Licencees have been encouraged to consider their own funnel trapping programs and trap tree programs for IBD. The focus will continue on TSA Licencees meetings to address primarily IBD & IBS impacted areas through harvesting to reduce non-recoverable losses and attempt to limit the spread of the various bark beetles. No planned single tree treatments at this time.

12 Stocking Standards

Forest health concerns can be a factor in species selection and other aspects of stocking standards. There is some concern of drought risk for some species currently listed in DCO stocking standards such as Sub-alpine fir at lower elevations where it was not previously listed by Chief Forester Standards.

Licencees and prescribing foresters need to be cognizant of climate change and how this can impact future timber supply through stocking recommendations and forest health issues that may have greater, lesser or different impacts in the future as a result of climate change. With the effects of

climate change and the unforeseen impacts that this will have on forest health, it will be important to recognize changing environmental conditions and predict the effect that this will have on the management of forest ecosystems. Forest managers will need to assess the suitability of other non-native species as well as how current species will respond to changing climatic conditions.

An additional consideration to professionals completing Free Growing (FG) declarations is the age at which plantations are allowed to undergo FG evaluation. The average FG declaration age is 9 years in the South Area. However, Armillaria root disease, the primary agent of mortality in a substantial number of plantations, does not typically spread until 12-16 years. Thus, FG evaluations prior to 16 years of age risk underestimating stand mortality.

13 Non-Recoverable Losses

Non-recoverable losses (NRLs), or unsalvaged losses, are the amount of volume lost annually to damaging agents that is not harvested. This represents losses above and beyond those already accounted for in existing growth and yield models, often as a result of unpredictable events. These losses can be both incremental losses (e.g. defoliation, defect) and mortality. NRLs are generally subtracted from yield projections.

The estimated annual forest volume killed by selected Forest Health Factor and not harvested in the Timber Harvesting Land Base (TSA only), as well as the amount of that killed volume that has been harvested for 1999 to 2019 is presented in Table 8. The losses are relatively low when compared to other TSAs within Selkirk District. Over the 21 years reported in this table the volume lost by the significant FH factors represents about **0.3%** of the AAC for that time period. The 21-year average annual of Volume Killed and harvested is 19% which is up by 3% from last year and 2013 was the last year that the TSA met or exceeded this value. Harvesting of NRLs in the last 6 years has been minimal with 3 years at 0%, 2 at 1% and 1 at 6%. Ideally Licencees should target more of the beetle attacked AOS polygons for harvest and within a faster timeframe to reduce losses and beetle population growth which contribute to more future losses. While there is often a lag between losses and harvesting and some damaged timber is easier to harvest than others the last 3 years show a low harvest response to date and given rise of IBD and IBS especially Forest Licencees are encouraged to target the damaged stands for immediate harvest (maximum completion in 2 years).

Table 8: 1999-2019 THLB volume killed and not harvested and total killed volume harvested by selected Forest Health factors.

Annual Volume Killed (m3) on the THLB and Not Harvested as of 2019 – Revelstoke TSA									Volume Killed and Harvested	
Year	Fire	IBM	IBD	Flood	NW	IBS	IBB	Grand Total*	M ³	% of Total Killed
1999	-	-	-	-	-	-	-	-	-	0%
2000	-	67	102	-	-	-	139	308	484	61%
2001	-	55	397	-	-	-	-	452	191	30%
2002	-	44	127	-	-	-	-	171	32	16%
2003	-	38	870	-	-	86	-	994	667	40%
2004	1,551	137	-	-	-	-	418	2,106	1,728	45%
2005	7,127	304	2	-	335	-	68	7,501	6,179	45%
2006	8,269	501	-	-	-	608	59	9,437	255	3%
2007	2,683	638	55	-	-	-	-	3,376	7	0%

2008	-	2,500	151	-	-	-	-	2,651	866	25%
2009	387	1,862	60	-	-	-	94	2,403	695	22%
2010	1,969	1,412	340	-	4,780	-	-	3,721	2,181	37%
2011	-	3,162	183	970	-	-	-	4,315	150	3%
2012	-	249	-	-	-	-	5	254	736	74%
2013	-	239	866	1,458	-	-	-	2,563	1,395	35%
2014	873	805	140	-	-	-	-	1,818	18	1%
2015	-	6	69	702	-	-	-	777	-	0%
2016	-	16	600	2,992	-	583	-	4,191	264	6%
2017	-	83	6,431	576	399	295	57	9,610	456	5%
2018	9,480	-	790	-	54	14	32	10,316	-	0%
2019	-	11	1,615	-	-	-	-	1,626	-	0%
Grand Total	32,339	12,129	12,798	6,698	5,568	1,649	872	68,590	16,304	19%
Change from previous year	-4,333	-591	+2,105	0		-63	-175	-3,057	+2,491	+3%

*Includes Drought

The 21-year average reduction in losses from the 2018 data is presumably due to harvesting of previously damaged areas, changes in TSA THLB boundaries and/ or refinements in data analysis.

The historical Revelstoke TSA AAC (excludes Area based tenures – CFAs and WLs and Cascadia (TFL23 Area) from 1999 to present is listed in the table below.

Revelstoke TSA Historical AAC	
	Volume m3
1999-2010	230,000
2011- Present	225,000
21 Year Total	4,785,000

14 Conclusion

This Forest Health Strategy provides strategic direction for the licensees, and FLNRORD in the Selkirk Natural Resource District – Revelstoke and Cascadia TSAs. Some concerns regarding Spruce beetle, Balsam Bark Beetle and Douglas-fir beetle but to date attack levels and losses remain low. Prompt action can mitigate any future losses. Hemlock Looper may be on the rise and is worth being cognizant about. To date NRLs in Revelstoke remain minimal and Much of the attack and corresponding losses are in the National Parks. Specific practices conducted by each licensee should fall within the strategic direction provided within this document.

Periodic review of the Forest Health Strategy will allow adaptive management principles to be used. The plan is to review it on an annual basis will ensure forest managers regularly turn their minds to other potential sources of damage or risk to the forest.

The active co-operation of licensees and FLNRORD staff working together to promote and manage healthy forests through diversity, early detection of forest health issues, and direct action as required, will ensure a sound and sustainable industry

15 Information Links and Reference Material

Report: 2019 Overview of Forest Health Conditions in Southern British Columbia

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/forest-health/forest-health-docs/2019_south_area_forest_health_conditions_report.pdf

Provincial Forest Health Strategy 2013-2017

<https://www.for.gov.bc.ca/hfp/health/Strategy/Forest%20Health%20Strategy.pdf>

Provincial Bark Beetle Management Technical Implementation Guidelines (formerly Bark Beetle strategy)

<https://www.for.gov.bc.ca/hfp/health/fhdata/bbstrategy.htm>

Spatial Data:

Bark Beetle Hazard Ratings

https://www.for.gov.bc.ca/rsi/foresthealth/hazard_rating.htm

2019 and earlier Annual Overview Surveys. (fixed wing based aerial mapping of all visible forest pests).

http://www.for.gov.bc.ca/ftp/HFP/external/lpublish/Aerial_Overview/

2019 and earlier Detailed Mapping (Helicopter based aerial mapping of Beetle Management Units with a Douglas-fir beetle strategy of suppression.)

Available upon request from District Forest Health Staff or at following FTP location:

<https://www.for.gov.bc.ca/ftp/DAB/external/lpublish/Forest%20Health/Detailed%20and%20Aerial%20Overview%20flight%20data/>

2017-19 Maps of IBD, IBS and IBM for the area are available on the FTP site at

<https://www.for.gov.bc.ca/ftp/DAB/external/lpublish/Forest%20Health/Detailed%20and%20Aerial%20Overview%20flight%20data/2018%20data/AerialOverviewSurvey%202016-2018%20IBM%20IBD%20NW%20NF%20GEOrefPDF%20maps/>

APPENDIX A: BARK BEETLE STRATEGY & TACTICS

Background

Due to the diversity of forest types, all major tree-killing bark beetle species pose a threat to the forests of the Revelstoke and Cascadia TSAs. The main threat comes from spruce beetle, Douglas-fir beetle and to a lesser degree western balsam bark beetle and mountain pine beetle.

Priority and strategy assignment occurs on two levels: broad provincial zonations and landscape level beetle management units (BMUs). Information that is used to determine the status of forest health agents is provided by FLNRORD via the annual aerial overview survey and by reports from licensees, regional, district and branch forest health specialists and district staff.

Beetle Management Unit Strategies

BMUs are planning and reporting units for operational beetle management. These BMUs usually coincide with landscape unit boundaries. This strategy includes the fourteen (14) BMUs in the Revelstoke and Cascadia TSAs. For each bark beetle, the BMUs have been assigned one of four specific strategies. These strategies are:

1. **Suppression** – (includes Prevention), this is the most aggressive strategy. It is selected when the infestation status is such that aggressive direct control actions are expected to keep an area at a low level of infestation. Areas are lightly infested, and resources for direct control or harvesting and milling capacities equal or exceed the amount of infestation. The intent of the strategy is to reduce or keep the outbreak to a size and distribution that can be managed within “normal resource capability”.
2. **Holding Action** – The intent of this strategy is to maintain an existing outbreak at a static level. It is a delaying strategy until adequate resources are available, or access is created that allow for a more aggressive approach, or to reduce overall loss while waiting for a killing climatic event. This is appropriate in areas with chronic beetle infestations that are too large to deal with using single tree treatments or where access is poorly developed for directed harvesting.
3. **Salvage** – Applied to areas where management efforts would be ineffective in substantially reducing the beetle populations and subsequent levels of damage. Such areas have extensive outbreaks covering a large proportion of susceptible stands. The objective in this case is to salvage affected stands and minimize value loss.
4. **Monitor** – This strategy is applied to areas where management efforts would be ineffective in substantially reducing the beetle population and subsequent levels of damage, or where there is no short term (less than 5 years) possibility of salvaging dead timber. This may be due to management constraints such as wilderness area, Park or ecological reserve, or because access cannot be put in place before substantial merchantable degradation of the dead material occurs.

Table 8: Provincial control strategies and associated objectives for beetle population removal.

Strategy	% of current infestation to treat	Comments
Suppression/ Prevention	>80%	Address all current attack within two years or less. The intent is to “control” the outbreak in the area and stop the spread.
Holding	50-79%	Address the largest population of the new infested material, at least close to the rate of expansion. The intent is to maintain beetle populations at a level that can be dealt with annually without a huge expansion.

Salvage	<50%	The priority is to salvage timber previously attacked to minimize value loss. Relevant in areas where suppression or holding actions are no longer appropriate or feasible.
Monitor	0	No action is required beyond monitoring and recording. This is most appropriate in Parks and Ecological Reserves and in inoperable areas where the outbreak has peaked, salvage is not possible, and there is no chance for any mitigation of further loss.

The implementation of a particular strategy in a BMU represents a commitment on the part of forest licensees and forest districts to work towards a measurable goal or performance measure prior to the next beetle flight.

Blanket salvage permits are still available with approval based on the TSA Forest Health strategy. The guidance on the use of blanket salvage permits and comparative cruising will be available in the updated Interior Appraisal manual and the Cutting Permit and Road Tenures Administration manual.

Table 9: Bark Beetle Management Tactics as they apply to specific BMU strategies.

Activity	Prevention	Suppression	Holding	Salvage	Monitor
Aerial Overview Survey	Yes	Yes	Yes	Yes	Yes
Detailed Aerial Survey	Yes	Yes	No – detail not required to direct harvest	No – detail not required to direct harvest	No – no action will be taken
Harvesting	High hazard host removal	Sanitation and high hazard host removal	Sanitation and high hazard host removal	Focus no longer on beetle removal but salvage of merchantable timber	Other resource objectives take precedence over harvest
Single tree treatments	Where conventional harvest not possible and treatment success is expected	Where conventional harvest not possible and treatment success is expected	Very minimal use when combined with harvest in adjacent areas	No – infestation too widespread to expect success	Other resource objectives take precedence
Access Development	Yes, into high hazard stands	Yes, into high hazard stands	Yes, into high hazard stands	Yes, into high hazard stands	Other resource objectives take precedence