

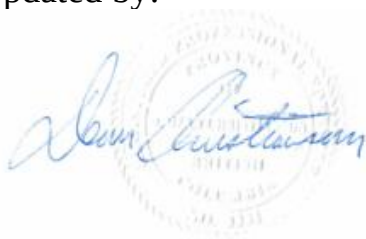
MINISTRY OF FORESTS, LANDS, NATURAL RESOURCE OPERATIONS
AND RURAL DEVELOPMENT

Selkirk Natural Resource District

**Golden TSA
Forest Health Strategy 2019-20**



Updated by:

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July 14, 2020

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Date: 30 July 2020



Downie Wood River IBS Harvest – Photo by Nadine Overwater



Spruce Beetle



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Tent Caterpillars - Photo by Scott King



Spruce Weevil – Photo by Scott King

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 Golden Timber Supply Area (TSA) lies in the East Kootenay area of the Kootenay Boundary Natural Resource Region and is administered by Selkirk Natural Resource District, Revelstoke office. The Golden TSA lies within the traditional lands of the Okanagan, Secwepemc and Ktunaxa Nations though there are no current First Nations communities within the TSA boundary.

The TSA covers 902,000 hectares; it is bounded by the Selkirk and the Purcell Mountains to the west and the Rocky Mountains to the east. It straddles the Rocky Mountain Trench and the Columbia River Valley, which runs through the town of Golden and northward to the Big Bend area near the Mica Dam. The TSA is bordered by three National Parks; Kootenay, Yoho, and Glacier, as well as Hamber and Cummins Lake Provincial Parks.

The following Beetle Management Units (BMUs) are included in the Golden TSA. All BMUs follow landscape unit boundaries. This strategy excludes National Parks.

Table 1: BMUs covered by the forest health strategy

BMU#	BMU Name	BMU#	BMU Name	BMU#	
G01	Upper Wood	G11	Goosegrass	G21	Blacberry
G02	Molson/Dainard	G12	Windy/Austerity	G22	Quartz
G03	Lower Wood	G13	Bachelor	G23	West Bench
G04	Tsar	G14	Ventego	G24	Canyon
G06	Kinbasket	G15	Esplanade	G25	Mount Seven
G07	Sullivan	G16	Blackwater Ridge	G26	Kicking Horse/Beaverfoot
G08	Foster/Garrett	G17	Hope/Goodfellow	G27	Ice/Moose
G09	Chatter/Prattle	G18	Valenciennes	G28	Kootenay
G10	Bush River	G19	Bluewater/Waitabit	G29	Swan
		G20	Moberly		

Most of the Golden TSA lies in the interior wet belt of the province. The major biogeoclimatic zones include the Interior Cedar Hemlock, Engelmann Spruce-Subalpine Fir, Montaine Spruce, Interior Douglas-fir and Alpine Tundra zones.

The species distribution within the Golden TSA THLB is available in Table 2 with Sx, Fdi and Pl making up over 78% of the volume.

Table 2: Golden TSA THLB Species volumes for > 60 year old stands. (2020)

Species	Leading Species Volume	Species 2 Volume	Species 3 Volume	Species 4 Volume	Total Volume	%
SE/Sx	6,278,007	2,017,597	656,007	127,086	9,078,697	35.4%
FDI	5,369,158	1,060,954	380,294	147,360	6,957,766	27.2%
PLI	2,491,435	869,649	494,900	127,248	3,983,232	15.5%
BL	530,546	933,872	258,516	166,638	1,889,572	7.4%
Hw/Hm	996,819	505,604	169,704	65,582	1,737,709	6.8%
CW	779,084	313,947	125,591	43,209	1,261,831	4.9%
AT	26,699	155,206	118,007	77,502	377,414	1.5%
PW	34,583	68,240	42,667	35,740	181,230	0.7%
PA	16,886	15,396	20,503	9,948	62,733	0.2%
Act	739	11,562	23,367	11,500	47,168	0.2%
Ep	148	7,699	11,886	8,655	28,388	0.1%
W	-	6,079	3,796	5,378	15,253	0.1%
LA	-	97	76	-	173	0.0%
Totals	16,524,104	5,965,902	2,305,314	825,846	25,621,166	

Approximately 36.5% of the total area of the Golden TSA is considered productive forest land. The remaining 63.5% is considered non-productive (i.e. rock, ice alpine, roads, etc.). Within the productive land base, 32.7% is considered available for timber harvesting.

The Golden TSA is characterized by steep mountainous terrain in the north, with gentler and wider valleys in the south. The mountainous environment creates varied climates and growing conditions, resulting in diverse forests. In the more predominant, wetter parts of the TSA, valley bottoms are covered with cedar and hemlock, and stands of spruce and subalpine fir occupy the higher elevations slopes. The southern portion of the TSA experiences a significantly drier climate and the drier valley bottoms are occupied by Douglas-fir forests, while lodgepole pine is often found at higher elevations.

The current area estimated to be economically and environmentally suitable for harvesting – the ‘timber harvesting land base (THLB) – covers 141,530 hectares. A significant portion of the crown forest land base is unavailable for timber harvesting due to its inoperability, environmentally sensitive areas, unstable soils, steep slopes sites with low timber productivity and problem forest types. Other resource constraints on the land base include but not limited to Ungulate Winter Range, Caribou Habitat, Old Growth Management Areas and Connectivity Corridors.

Bark beetles have posed a significant threat to the management objectives of many of these resources. Mountain pine beetle (IBM), Douglas-fir beetle (IBD) and spruce beetle (IBS) are classed as priority forest health agents. Over the entire land-base, the susceptible host area for IBM is 163,022 hectares primarily in the southern portion of the TSA, for IBD 171,110 hectares again primarily in the southern portion of the TSA and for IBS 336,883 hectares.

Comprehensive descriptions of the Golden TSA are included in the following documents:

Golden 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/golden-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>

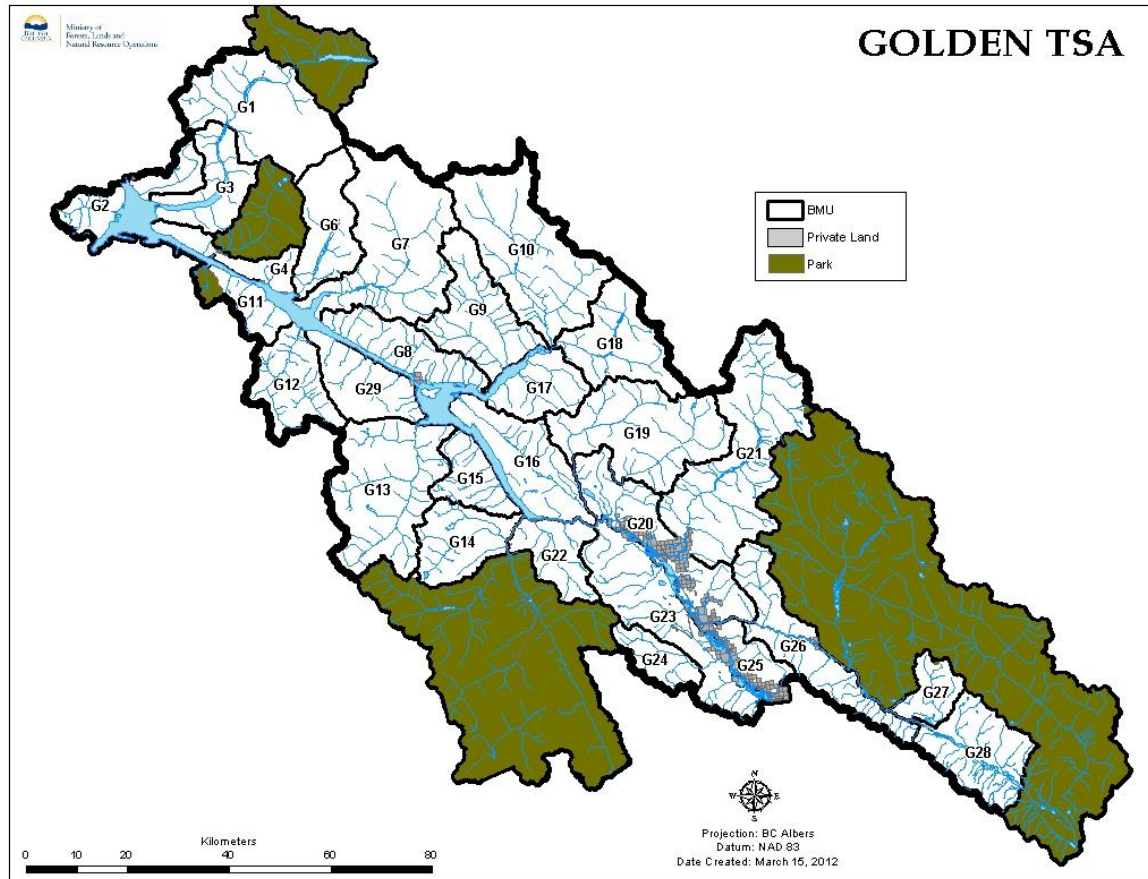


Figure 1: Map of Golden TSA, identifying BMUs, National and Provincial parks and private land.

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 Golden TSA.

Table 3: Ranking of Forest Health agents by potential impact on forest management activities in the Golden TSA

	Very High	High	Moderate	Low
Defoliators			Western hemlock looper	Black army cutworm, Birch leafminer, Aspen serpentine leafminer
Diseases		Armillaria 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, Mountain pine beetle Western balsam bark beetle		Spruce weevil	
Mammals			Bear, Voles	Deer, Moose
Abiotic Factors	Fire	Drought, Windthrow		

Table 4 provides an overview of the activity status of some of the priority forest health agents which were reported during the 2018 & 2019 provincial aerial overview surveys (AOS). 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. IBS, IBB and IBD are Priority 1's and represent the largest current losses of higher value timber species and area and the bark beetles have the potential to cause further losses if not managed/ harvested. Fire damaged stands and IBM remain significant priority 2's.

Table 4: Selected summary of 2018 & 2019 Golden TSA significant Forest Health damaging agents

FH Agent	Common Name	2019 Affected Area (ha)	2018 Affected Area (ha)	Trend	Current Impact on Timber Supply	TSA Priority
IBS	Spruce beetle	1,824	1,814	Static	Very High	1
IBD	Douglas-fir beetle	181	78	Increasing	Moderate	1
IBB	Western balsam bark beetle	11,059	9,775	Significant Increase	Very High	1
NB/ NBP	Fire/ Post Fire Mortality	766	5,204	Significant Decrease	Very High	2
IBM	Mountain pine beetle	809	1,141	Slight Decrease	Moderate	2
AB	Bear	38	26	Static	Very Low	3

ID6	Aspen serpentine leafminer	1,503	ND	Significant Increase	Very Low	n/a
IDN	Birch Leaf Miner	90	ND	New - Increase	Very Low	n/a
ND	Drought	22	99	Slight Decrease	Very Low	3
NE	Cedar Flagging	4,701	ND	New - Significant Increase	Low	n/a
DFH	Larch Needle Blight	24	ND	NEW - Increase	Nil	n/a
NF	Flooding	0	11	Static	Very Low	n/a
NW	Windthrow	0	0	Static	Nil	2

5 FOREST HEALTH AGENTS - STRATEGIES AND TACTICS

5.1 DEFOLIATORS

Western hemlock looper IDL (*Lambdina fuscicollis lugubrosa*)

No IDL has been noted for the last several years. The current management strategy is to monitor and if necessary, consider spraying with Btk. Monitoring is through the aerial overview survey and ground sampling carried out at the Regional level. The last outbreak of western hemlock looper occurred in 2002-2003, defoliating approximately 16,000 hectares of forest land in the northern portion of the Golden TSA. The preferred host of the looper is western hemlock followed by sub-alpine fir, western red cedar and white spruce and found primarily in mature and overmature hemlock and hemlock-cedar stands.

Aspen serpentine leaf miner ID6 (*Phyllocnistis populiella*)

2019 saw a significant rise in ID6 from no area in 2018 to 1,503 ha in 2019. ID6 attacks trembling aspen and occasionally 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. The impact of these pests and diseases on the TSA is not significant. No management is planned. As per Chief Forester direction, deciduous species should not be included in stocking standards.

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

Birch leaf miner was observed over 90 ha for 2019 within the Golden TSA. It has been identified on the annual aerial overview survey sporadically over the TSA the last many years.. This insect is not being managed though the presence of this insect and climate change could impose constraints on future management.

Black army cutworm (*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 in the Golden TSA. Any Wildfire areas to be salvaged and planted or existing openings to be replanted should consider this issue.

For blocks burned in the spring (May-June) of the previous year, planting should be delayed until most cutworms have pupated. This allows seedlings 1 year to establish before being subjected to attack; sites also gain an additional summer to “green-up” and provide cutworms with alternative food sources. 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*)

Armillaria has been identified as a significant issue throughout the TSA. DRA is not typically observed in the AOS.

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 FLNRO 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 Armillaria 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 only 16.2 hectares (3 openings) of stump removal has been completed in the last 10 years of which 13.2 ha is within the TSA and the balance within a woodlot. No Stump removal has been recorded for 2019. This number seems somewhat low given the high % of ICH stands in Golden 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.**

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.

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

Hard pine rusts are a moderate concern in the pine plantations south of the Bush Arm. The loss impact on the TSA is unclear but will impact the future rotation to some degree with timber mortality and

quality losses. Free Growing surveys and declarations should be modified to ensure stands are not declared free growing without the stand being old enough or tall enough to more fully express the potential problem with these diseases, especially in ICH sites where Pl is planted or regenerated. Where possible, a mix of species is highly recommended to be planted or regenerated naturally.

Whitebark and Limber 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. Limber pine (*P. flexilis*) is rare in the TSA and occurs only in southeast BC. As a five-needled pine, it's impacted by the same forest health agents as whitebark pine. It occurs at lower elevations, such as along Hwy in Kicking Horse Canyon.

The cutting or damaging of these pines should be strictly avoided. 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 light thinning of competing trees can promote pine survivorship by reducing competition and providing seed regeneration habitat.

5.3 INSECTS

Western balsam bark beetle IBB (*Dryocoetes confusus*)

Western balsam bark beetle has been chronically causing mortality over many years. In 2019, 11,059 ha had some level of mortality due to the western balsam bark beetle, a significant increase for second year in a row from 2018 which was 9,775 ha. Attack levels for 2018 & 2019 were primarily in the Trace and Light severity attack categories with some in Moderate. NRLs were down slightly presumably as more of the 2019 attack was not in the THLB. There are significant areas of subalpine fir leading forest stands in the TSA that are susceptible to western balsam bark beetle. 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*)

IBD incidence has been building for the last few years and has more than doubled from 78 ha in 2018 to 181 ha in 2019. The AOS areas of noted 2019 IBD attack include: Kicking Horse Pass, Cummins Ck, south of Encampment Ck and South of Horse Ck to North of Parsons both sides of valley. The 2018 detailed aerial survey noted 63 (94 in 2018) spots with a total 283 (529 in 2018) red trees in areas near Golden/ Mt 7, south of Encampment Ck and near mouth of Cummins Ck. Management of blowdown and other significant debris is a key component of IBD management.

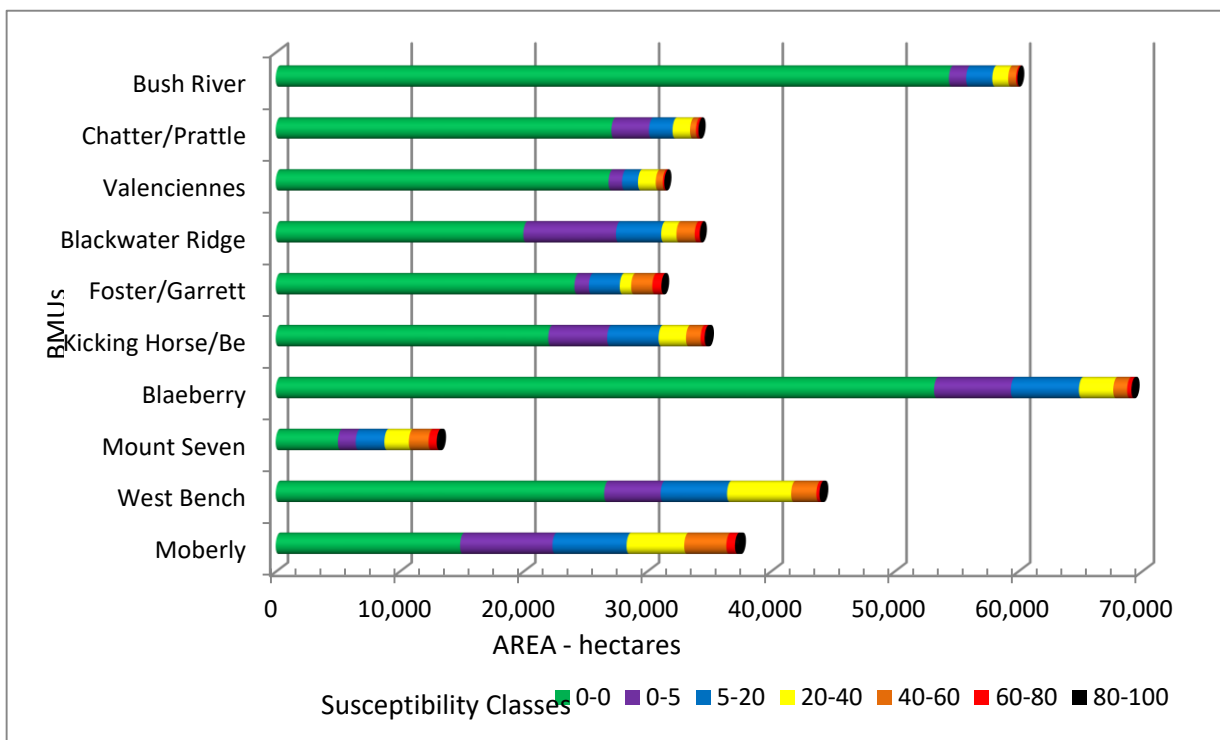


Figure 2: Douglas-fir beetle susceptibility rating for Golden TSA BMUs with > 2,000 ha of moderate or greater area as of 2015 ranked from lowest to highest area top to bottom.

There are 58,933 ha of susceptible (>20 rating) forest types to Douglas-fir beetle in the Golden TSA outside of the National Parks based on a 2015 BMU analysis. The ten BMUs with greater than 2,000 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 Golden TSA timber supply. 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. This may be even more important for small tenure holders such as Woodlots.

The 2017 to 2019 harvest of IBD polygons has not been significant to date as seen in Table 5. The planned and actual harvest amounts of AOS IBD polygons ranges from 0 to 5.1% over the three years. **Licencee response in suppression BMUs should be targeting harvest of at least 50% of the previous year's attack within 1 to 2 years.**

Table 5: 2017-19 IBD Aerial Overview Survey polygon area and completed/ planned harvest to date

2017-19 IBD AOS Polygon Area & % Harvest Area – Operable THLB				
Year	Operable AOS Polygon Area (ha)	Harvested Area as of Winter 2019-20	Planned Harvest Area as of Winter 2019-20	Total Current & Future Harvest %
2017	139	7.1	0	5.1%
2018	0.1	0	0	0%
2019	26	0	0.2	0.8%

Spruce beetle IBS (*Dendroctonus rufipennis*)

Spruce beetle has increased slightly from 1814 hectares in 2018 to 1824 ha in 2019 while in the THLB attack has decreased from 383 to 265.4 ha. The 2018 attack is primarily in Moderate severity class with some in each of Trace, Light and Severe. The main area with significant IBS outbreak areas outside the National Parks is in Upper Wood Arm in inoperable/ OGMA areas and a small amount in Lang Ck.

Forest Licence plans and harvest of IBS attacked areas from 2017-2019 is shown in Table 6. The infested THLB area has been relatively small in area in the THLB and only a very small amount of that area has been harvested or planned to harvest to date.

The 2019 detailed aerial survey in the small area flown found 1 polygon (4 in 2018) in the Upper Wood Arm Area with 10% severity totalling 115 hectares. 68 spots (40 in 2018) were also found with 269 trees (166 in 2018), a slight increase from the IBS amount detected in 2018. Note that one or 2 tree spots were not tallied.

Rapid harvest response to any IBS outbreaks on operable THLB area is critical to reduce losses and IBS populations. Current harvest response levels are inadequate for suppression designation and in fact are well below holding designation as well. **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.**

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>

There are 123,514 ha of susceptible (>20 rating) forest types to Spruce beetle in the Golden TSA outside of the National Parks based on a 2015 BMU analysis. The 24 BMUs with greater than 2,500 ha of susceptible Sx area are noted in Figure 4 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 area is within the 20-40 and 40-60 susceptibility classes.

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

2017-19 IBS AOS Polygon & % Harvest Area - Operable THLB				
Year	Operable AOS Polygon Area (ha)	Harvested Area as of Winter 2019-20	Planned Harvest Area as of Winter 2019-20	Total Current and Future Harvest %
2017	295	0	0	0%
2018	383	0	0	0%
2019	265	0	19.2	7.2%

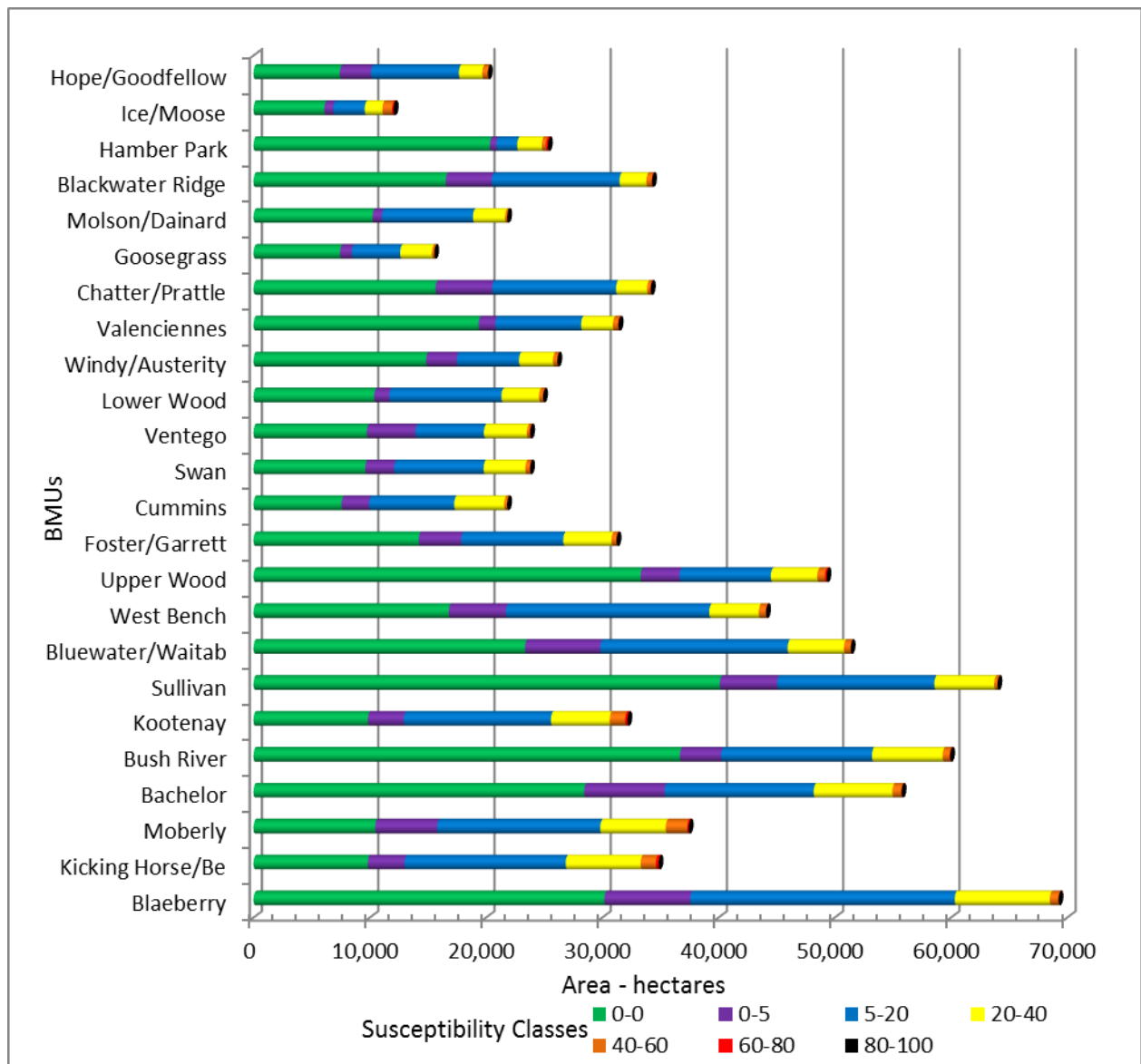


Figure 4: Spruce beetle susceptibility rating for Golden TSA BMUs with > 2,500 ha of moderate or greater area as of 2015 ranked from lowest to highest area top to bottom.

Mountain pine beetle IBM (*Dendroctonus ponderosae*)

Mountain pine beetle for 2019 decreased from 1141 ha in 2018 to 809 ha in 2019 and was observed across all 5 severity classes relatively evenly. It is declining in the operable area as well. Table 7 shows that very little of the attacked area over the last 3 years has been harvested or planned to be harvested and any of these areas within suppression BMUs would not be achieving anywhere the targeted 80% harvest within 2 years. It is recommended that Licencees harvest IBM attacked polygons within 2 years or less of discovery especially if Moderate, Severe or Very Severe attack noted to reduce non-recoverable losses.

Table 7: 2017-19 IBM Aerial Overview Survey polygon area and completed/ planned harvest to date

2017-19 IBM AOS Polygon & % Harvest Area - Operable THLB				
Year	Operable AOS Polygon Area (ha)	Harvested Area as of Winter 2019-20	Planned Harvest Area as of Winter 2019-20	Total Current & Future Harvest %
2017	160	0	3	1.9%
2018	138	0	2.6	1.9%
2019	58	0.2	0.3	0.9%

There are only 4077 hectares of susceptible area within Golden TSA outside of the National Parks and 2564 of these hectares are within just the 4 BMUs highlighted in Figure 5.

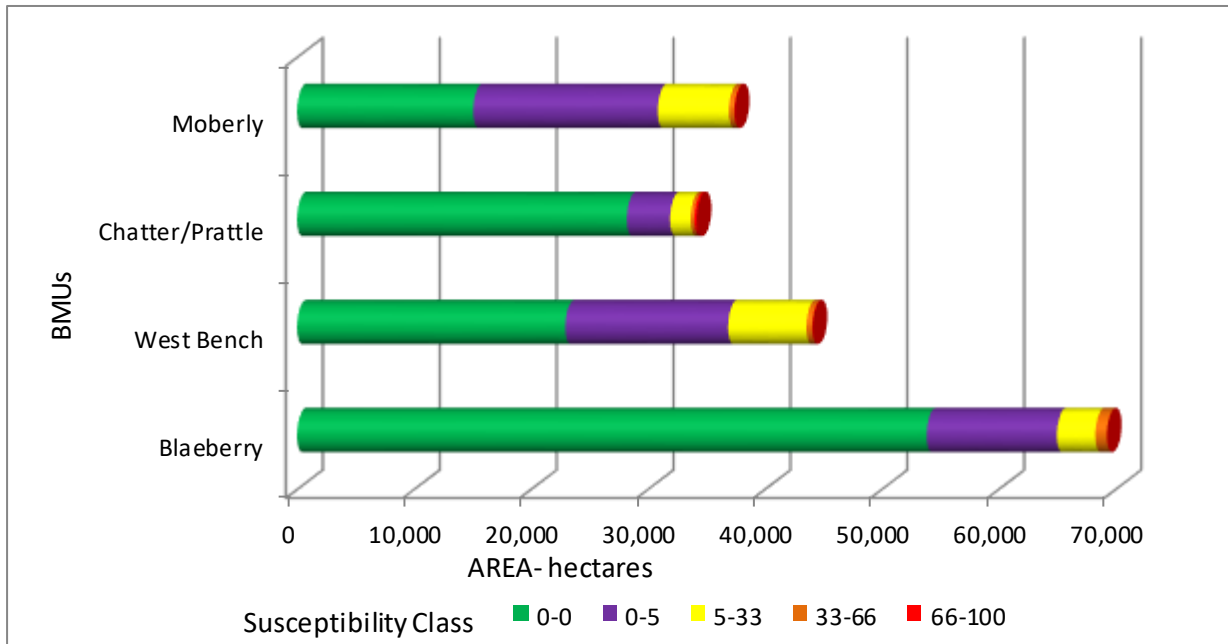


Figure 5: Golden TSA BMUs with > 500 hectares of susceptible (33+) Lodgepole Pine in ascending order of area from top to bottom.

5.4 MAMMALS

Voles

Voles are a reoccurring issue in the Golden TSA. Some areas have experienced extensive damage eg. Glenogle, Beaverfoot, and Blaeberry areas have experienced annual damage whereas other areas appear to be on a four-year cycle. Vole research treatments have included various types of repellents, guards and feeding station establishment consisting of a sunflower mix in areas where annual populations reside eg. Glenogle and Redburn Valley.

Other things to consider when harvesting in known vole areas are:

- using alternative silvicultural systems – green-tree retention (Douglas-fir, spruce) wherever possible, avoid contiguous clearcut units,
- enhance habitat for predators and predation – increase the number of debris piles will increase small carnivores, increase the amount of snags and shrub trees will increase birds of prey,
- avoid the use of seeding of pasture grasses – use alternative shrub species (alder, willow) for erosion control,
- tree species selection/planting regime – plant spruce, subalpine fir, or larch where possible – all are relatively unpalatable to voles compared with lodgepole pine and Douglas-fir, plant more

- trees per ha to accommodate expected damage, use larger stock where possible, nursery seedlings with reduced fertilization regime and tree guards,
- provide a diversionary food source.

Bear

Bear damage is not easily identified by the overview survey and was surveyed at only 38 ha in 2019 compared to 26 ha in 2018. Mortality often appears to be on younger (saplings and poles) single trees rather than widespread areas. 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 other TSAs in Selkirk District. 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 by bears. 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 in the Golden TSA. No windthrow was noted in 2018 or 2019 compared. 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 can create 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. Whenever reasonable, windthrown timber is salvaged within a short time from discovery so that bark beetle infestation levels are minimized.

Fire/ Post Fire Mortality NB/ NBP

In years prior to 2017, fire had not been a major concern in the Golden TSA. Fire damage was down significantly in 2019 to only 766 hectares, however in 2018 5,204 hectares were affected and in 2017 had 9,670 hectares of area burned. 2018 had more than 7 times more volume lost than 2017 in the THLB as 2018 fires were located in THLB vs a lot of Park area in 2017. **Volume loss due to fire was nil for 2019 as fires were located outside of the THLB.** Nonetheless fire has the greatest potential to damage the most forest area in the shortest time. Due to this fact, fire management plans have been prepared and updated yearly for each TSA. Fire damaged areas should be considered for immediate salvage where economically feasible to capture volume before non-recoverable losses are incurred and assist with regeneration through reforestation activities post-harvest.

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 stands on thin soils / rocky knobs/ ridges and overstocked (high density) mature stands. 2019 weather was not as hot and dry and only 22 ha were noted for drought compared to 99 hectares in

2018. 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.

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 Golden 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 Golden TSA: 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 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. If 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	LICENCEES
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	
Submission of survey and treatment data to FLNRORD		X

8.0 BMU STRATEGY - IBM, IBS AND IBD

No changes have been made to the BMU strategies for the 3 bark beetles for many years. All BMUs for IBD and IBS are currently listed as Suppression. IBM strategies are a mix of Monitor or Suppression. Given the low response of harvesting identified beetle attacked polygons some of these BMUs likely should be downgraded.

Table 8: BMU Strategy by beetle: IBD, IBS, IBM for 2019/2020 for Golden TSA

BMU	BMU Name	Bark Beetle		
		IBM	IBS	IBD
G01	Upper Wood	Monitor	Suppression	Suppression
G02	Molson/Dainard	Monitor	Suppression	Suppression
G03	Lower Wood	Monitor	Suppression	Suppression
G04	Tsar	Monitor	Suppression	Suppression
G06	Kinbasket	Monitor	Suppression	Suppression
G07	Sullivan	Suppression	Suppression	Suppression
G08	Foster/Garrett	Suppression	Suppression	Suppression
G09	Chatter/Prattle	Suppression	Suppression	Suppression
G10	Bush River	Suppression	Suppression	Suppression
G11	Goosegrass	Monitor	Suppression	Suppression
G12	Windy/Austerity	Monitor	Suppression	Suppression
G13	Bachelor	Suppression	Suppression	Suppression
G14	Ventego	Monitor	Suppression	Suppression
G15	Esplanade	Monitor	Suppression	Suppression
G16	Blackwater Ridge	Suppression	Suppression	Suppression
G17	Hope/Goodfellow	Suppression	Suppression	Suppression
G18	Valenciennes	Suppression	Suppression	Suppression
G19	Bluewater/Waitabit	Suppression	Suppression	Suppression
G20	Moberly	Suppression	Suppression	Suppression
G21	Blaeberry	Suppression	Suppression	Suppression
G22	Quartz	Suppression	Suppression	Suppression
G23	West Bench	Suppression	Suppression	Suppression
G24	Canyon	Monitor	Suppression	Suppression
G25	Mount Seven	Suppression	Suppression	Suppression
G26	Kickinghorse/Beaverfoot	Suppression	Suppression	Suppression
G27	Ice/Moose	Monitor	Suppression	Suppression
G28	Kootenay	Suppression	Suppression	Suppression

G29	Swan	Monitor	Suppression	Suppression
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9 Recommended activities to manage IBS, IBD and IBM

9.1 Douglas-fir beetle

The overall strategy for IBD management is that of suppression/monitor using 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 is covered by the Southern Interior Region Pest Management Plan. No Planned funnel trapping by FLNRORD in Golden for 2018-19. 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 2019-20 is to complete a heli detail survey, budget allowing, of selected higher incident and risk areas in Golden TSA. 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 2018.

9.2 Spruce beetle

The overall strategy for IBS management is that of suppression/monitor using 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.

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 2019-20 is to complete a heli detail survey of known higher incident areas, budget allowing, in Golden TSA. No ground surveys currently planned. A small amount of area was detailed mapping occurred in 2018. District staff will discuss the IBS situation with Parks Canada due to the high amount of IBS detected in the National Parks area.

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.
- 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 IBD / IBS detailed survey in selected areas of suppression units.

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 except for possibly the Mount Seven research trial area for MCH application.

12 Stocking Standards

Forest health concerns can be a factor in species selection and other aspects of stocking standards. Significant concerns in Golden might relate more to drought 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 can 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 (Table 9). Over the 21 years reported in this table the volume lost by the significant FH factors represents about **7.4%** of the AAC for that time period. The 21-year average annual of Volume Killed and harvested is 28% and 2008 was the last year that the TSA met or exceeded this value. 2009 to 2012 saw a drop in killed volume harvested by close to half of previous year's levels then 2014 to 2019 has had very low harvest recovery rates of only 0-10%. 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 timber losses. While there is often a lag between losses and harvesting and some damaged timber is easier to harvest than others, the last 6 years show a low harvest response to date. Given the rise of IBD and IBS **Forest Licencees are encouraged to target the damaged stands for immediate harvest (maximum completion in 2 years)**. The lower NRLs in 2019 are due to no fires recorded causing significant volume losses.

Table 9: 1999-2019 THLB volume killed and not harvested and total killed volume harvested by selected Forest Health factors.

Annual Volume Killed on the THLB and Not Harvested as of 2019 -- Golden TSA								Volume Killed and Harvested	
Year	IBM	Fire	IBB	Wind Throw	IBS	IBD	Totals*	m ³	% of Total Killed
1999	39,419	0	0	0	0	0	39,419	24,798	39%
2000	37,021	1,248	4,516	1,945	0	1,148	44,289	21,111	32%
2001	15,089	0	321	0	0	932	16,342	6,478	28%
2002	20,823	0	389	54	0	798	22,010	14,892	40%
2003	26,182	125	277	156	0	118	26,702	13,806	34%
2004	25,857	0	643	0	0	0	26,500	12,320	32%
2005	82,006	383	6,254	0	0	0	88,643	34,930	28%
2006	132,054	6,153	1,275	0	468	923	141,191	76,932	35%
2007	51,081	1,372	1,239	257	0	0	53,974	28,837	35%
2008	71,341	0	1,161	0	0	184	72,686	34,676	32%
2009	32,463	3,661	1,243	219	0	157	37,524	9,690	21%
2010	26,128	1,914	357	6,386	0	535	28,934	7,007	19%
2011	18,405	253	137	877	0	104	18,899	3,990	17%
2012	11,338	77	587	6,486	1,332	0	15,418	3,360	18%
2013	7,993	0	885	250	0	0	9,853	2,226	18%
2014	10,392	776	4,071	0	0	0	17,378	563	3%
2015	13,536	0	3,026	0	166	241	17,387	705	4%
2016	8,396	0	1,000	0	1,029	1,053	11,478	424	4%
2017	9,578	6,040	1,287	624	2,266	3,692	23,959	825	3%
2018	1,888	32,491	6,839	0	161	0	41,594	4,658	10%
2019	608	0	4,705	0	8,772	1,002	15,087	-	0%
Totals	641,598	54,493	40,212	17,254	14,194	10,887	769,267	302,228	28%
Change from previous year	-44,638	-16,300	+3,887		+8,885	+1,180	-46,983	+8,160	+2%

*Includes Flooding & 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 Golden TSA AAC (excludes Area based tenures –Woodlots) from 1999 to present is listed in the table below.

Golden TSA Historical AAC	
Year	Volume m3
1999	540,000
2000-2003	530,000
2004-Present	485,000
21 Year Total	10,420,000

14 Conclusion

This Forest Health Strategy provides strategic direction for the licensees and FLNRORD in the Selkirk Natural Resource District – Golden TSA. Specific practices conducted by each licensee should fall within the strategic direction provided within this document. There are significant concerns on the spread and ongoing non-recoverable losses as a result of the 4 bark beetles – Spruce Beetle, Douglas-fir Beetle, Western Balsam Beetle and Mountain Pine Beetle and fire damaged stands and the necessity to address these through harvest and other active management tools to reduce NRLs in the present and future.

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/!publish/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/!publish/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/!publish/Forest%20Health/Detailed%20and%20Aerial%20Overview%20flight%20data/2018%20data/AerialOverviewSurvey%202016-2018%20IBM%20IBD%20NW%20NF%20GEOrefPDF%20maps/>

Additional maps and data are available on the Branch FTP site at

https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/

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 Golden TSA. The main threat comes from spruce beetle and to a lesser degree Douglas-fir beetle, western balsam bark beetle and mountain pine beetle as the susceptible area is either low or economic value is lower in case of Sub-alpine fir/ IBB.

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 twenty-eight (28) BMUs in the Golden TSA. 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 10: 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.

Table 11: 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