Selkirk Natural Resource District

2018 Forest Health Strategy
for the
Golden Timber Supply Area

Updated by:

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Spruce Beetle
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Mount 7 June 14, 2018 Fresh IBD attack in blowdown and signs of blowdown/ breakage
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). 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.

2 OBJECTIVES

The overall objective is to minimize timber losses and the hazard and risk form 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://www.for.gov.bc.ca/hfp/health/index.htm#first

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 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 Trans-Canada highway passes through the south-central part of the area providing relatively easy access to an area of outstanding mountain scenery.
The following Beetle Management Units (BMUs) are included in the Golden TSA. All BMUs follow landscape unit boundaries. This strategy excludes National Parks.

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

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 forests of the Golden TSA are dominated by Engelmann spruce and subalpine fir (40%), Douglas-fir / western larch (25%), Lodgepole pine (19%), and western hemlock / western red cedar (13%). Other tree species that occur less commonly in the TSA are cottonwood, birch and aspen (3% in total), and mountain hemlock and whitebark pine. 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.

Throughout the timber supply area, mountain peaks are covered by vast expanses of alpine tundra, rock and ice. Because of the rugged landscape and generally cold, wet climate, only a small portion of the timber supply area is productive forest land.

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. The 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.

Catastrophic infestations result in millions of dollars of reduced revenue due to timber losses, degraded lumber values, and 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 Golden TSA could also have negative impacts on recreation, fire hazard, visual quality objectives, fish and wildlife resources, water management and other resource values.

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 1).

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:

- Very High: a forest health factor that could result in damage equivalent to the loss of >400 ha per year
- High: loss of 200 – 400 ha per year
- Moderate: loss of 100 – 200 ha per year
- Low: loss of 50 – 100 ha per year
- Very Low: very little or no known damage (<50 ha per year)

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>
<thead>
<tr>
<th>Table 2: Ranking of Forest Health agents by potential impact on forest management activities in the Golden TSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very High</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td><strong>Defoliators</strong></td>
</tr>
<tr>
<td><strong>Diseases</strong></td>
</tr>
<tr>
<td><strong>Insects</strong></td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
</tr>
<tr>
<td><strong>Abiotic Factors</strong></td>
</tr>
</tbody>
</table>

Table 3 provides an overview of the activity status of some of the priority forest health agents which were reported during the 2015 to 2017 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 and IBD are Priority 1’s 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 Mountain pine beetle are significant priority 2’s.

<table>
<thead>
<tr>
<th>FH Agent</th>
<th>Common Name</th>
<th>2017 (ha)</th>
<th>2016 (ha)</th>
<th>2015 (ha)</th>
<th>Trend</th>
<th>Current Impact on Timber Supply</th>
<th>TSA Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBS</td>
<td>Spruce beetle</td>
<td>3,201</td>
<td>2,106</td>
<td>1,070</td>
<td>Significant Increase</td>
<td>Very High</td>
<td>1</td>
</tr>
<tr>
<td>IBD</td>
<td>Douglas-fir beetle</td>
<td>245</td>
<td>274</td>
<td>103</td>
<td>Increasing</td>
<td>High</td>
<td>1</td>
</tr>
<tr>
<td>NB</td>
<td>Fire</td>
<td>9,670</td>
<td>32</td>
<td>180</td>
<td>Significant Increase</td>
<td>Very High</td>
<td>2</td>
</tr>
<tr>
<td>IBM</td>
<td>Mountain pine beetle</td>
<td>922</td>
<td>2,733</td>
<td>1,848</td>
<td>Significant Decrease</td>
<td>Very High</td>
<td>2</td>
</tr>
<tr>
<td>IBB</td>
<td>Western balsam bark beetle</td>
<td>6,465</td>
<td>12,494</td>
<td>6,232</td>
<td>Significant Decrease</td>
<td>Very High</td>
<td>2</td>
</tr>
<tr>
<td>AB</td>
<td>Bear</td>
<td>0</td>
<td>0</td>
<td>38</td>
<td>Decreasing</td>
<td>Very Low</td>
<td>3</td>
</tr>
<tr>
<td>ID</td>
<td>Defoliators</td>
<td>0</td>
<td>0</td>
<td>71</td>
<td>Slight Decrease</td>
<td>Nil</td>
<td>n/a</td>
</tr>
<tr>
<td>ID6</td>
<td>Aspen serpentine leafminer</td>
<td>426</td>
<td>8,591</td>
<td>2,431</td>
<td>Significant Decrease</td>
<td>Low</td>
<td>n/a</td>
</tr>
<tr>
<td>NF</td>
<td>Flooding</td>
<td>10</td>
<td>0</td>
<td>107</td>
<td>Static</td>
<td>Very Low</td>
<td>n/a</td>
</tr>
<tr>
<td>NS</td>
<td>Slide</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Static</td>
<td>Nil</td>
<td>n/a</td>
</tr>
<tr>
<td>ND</td>
<td>Drought</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>Slight Increase</td>
<td>Very Low</td>
<td>3</td>
</tr>
<tr>
<td>NW</td>
<td>Windthrow</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>Slight Increase</td>
<td>Very Low</td>
<td>2</td>
</tr>
</tbody>
</table>


Additional maps and data are available on the Branch FTP site at [https://www.for.gov.bc.ca/ftp/HFP/external/publish/Aerial_Overview/](https://www.for.gov.bc.ca/ftp/HFP/external/publish/Aerial_Overview/)

5 FOREST HEALTH AGENTS - STRATEGIES AND TACTICS

This section summarizes the strategies and tactics to be used for the forest health factors identified in the Forest Health Strategy, and is organized as follows:

Current Status: Provides a one-word description of the current state of the Forest Health Factor (FHF) in the Selkirk Natural Resource District.

- **Endemic:** The FHF is at its natural (generally low) level of influence on forest health.
- **Building:** The influence on forest health by the FHF is increasing.
- **Outbreak:** The FHF has grown in influence and is (or is at significant risk of) causing a high level of damage.
- **Declining:** The FHF was at a high level and is now diminishing in importance.

Management Strategy: Provides a two-word description of the strategy.

- **Do nothing:** No strategy as the FHF is of minimal concern.
- **Passive Monitoring:** The FHF does not necessitate or lend itself to direct monitoring, so use overview flights, anecdotal information gathered in
silviculture surveys, etc. Passive monitoring generally is not focused on a specific FHF.
Active Monitoring: Specifically monitor the FHF.
Indirect Action: Actions that treat the results of the FHF (e.g. salvage of trees killed by a FHF)
Direct Action: Treatments that focus on the FHF itself (e.g. stump removal to eliminate a root disease), or aerial spraying with biological insecticides to decrease damage from insect defoliators

*Tactics:* Describes the planned tactic in just a few words.
*TSR Implication:* Application to short term, mid-term or long term timber forecasting.
A discussion of the Forest Health Factor then provides more information.

### 5.1 DEFOLIATORS

**Western hemlock looper (Lambdina fiscellaria lugubrosa)**
*Current Status:* Endemic
*Management Strategy:* Active Monitoring
*Tactics:* Overview flights, 3 Tree beatings, moth traps
*TSR Implication:* Short term timber supply

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 and north of Revelstoke. 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. Looper outbreaks run on a 10 year cycle, the 2011 overview survey and yearly ground sampling by our regional entomologist showed the looper defoliation started to build. The 2013 annual overview survey identified that the looper population has collapsed.

**Aspen serpentine leafminer (phylocnistis populiella)**
*Current Status:* Building
*Management Strategy:* Do Nothing
*Tactics:* N/A
*TSR Implication:* N/A

Aspen serpentine leafminer 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. It has been identified on the annual aerial overview survey (AOS) for the last six years covering in excess of 2,000 hectares per year, the AOS identified significantly less in 2017 with only 426 hectares identified.

**Birch leafminer (Fenusa pusilla) (Birch Decline)**
*Current Status:* Endemic
*Management Strategy:* Do Nothing
*Tactics:* N/A
*TSR Implication:* N/A

Birch leafminer has been noted in many areas within the Golden TSA. It was identified on the annual aerial overview survey sporadically over the TSA the previous 5 years, however none was detected in 2017. 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*)

**Current Status:** Endemic  
**Management Strategy:** Passive Monitoring  
**Tactics:** Silviculture surveys  
**TSR Implication:** Long term timber supply

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, one should try to delay planting 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 (*Armillaria ostoyae*)**

**Current Status:** Endemic  
**Management Strategy:** Passive Monitoring  
**Tactics:** Silviculture surveys, stocking standards, Stump removal, Species regeneration selection  
**TSR Implication:** Long term timber supply

Armillaria (DRA) root disease has been identified as a significant issue throughout the TSA. No areas were noted in the AOS the last 3 years but it is often not picked up during this survey. Management of Armillaria in the TSA is recommended to follow the BC Root Disease Management Guide, recently published, and a copy has been placed on the FTP site at the following link:

https://www.for.gov.bc.ca/ftp/DAB/external/?publish/Forest%20Health/

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 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. 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 (Cronartium ribicola)**

*Current Status:* Endemic  
*Management Strategy:* Passive Monitoring  
*Tactics:* Overview flights and/or specific detailed surveys coupled with ground checks to verify WPBR, Silviculture surveys, planting of resistant stock  
*TSR Implication:* Long term timber supply

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 - Cronartium comandrae** (Commandra blister rust), *Cronartium coleosporioides* (Stalactiform blister rust), *Endocronartium harknessii* (Western gall rust)

*Current Status:* Endemic  
*Management Strategy:* Do Nothing  
*Tactics:* N/A  
*TSR Implication:* Mid to Long term timber supply

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.

### 5.3 INSECTS

**Western balsam bark beetle (Dryocoetes confusus)**

*Current Status:* Building  
*Management Strategy:* Active Monitoring  
*Tactics:* Overview flights, harvest where feasible/ economical  
*TSR Implication:* Short term timber supply

There are significant areas of subalpine fir leading forest stands in the TSA that are susceptible to western balsam bark beetle. Western balsam bark beetle has been chronically causing mortality over the years. In 2017, 6,465 ha had some level of mortality due to the western balsam bark beetle, a significant decrease in the area from 2016 which was 12,494 ha. Attack levels for 2015 to 2017 were primarily in the trace and light severity attack categories. Direct control action on that insect is very difficult due to its attack dynamics and the scattered distribution of the stands.

**Douglas-fir beetle (Dendroctonus pseudotsugae)**

*Current Status:* Building  
*Management Strategy:* Indirect and Direct Action  
*Tactics:* Overview flights, detailed flights, ground truthing, trap trees, harvesting, and funnel trapping  
*TSR Implication:* Short term timber supply
Over the previous years, the provincial aerial overview survey has identified a low incidence of Douglas-fir beetle throughout the TSA but the incidence is building. Areas of recent IBD attack include: Kicking Horse River, Mt 7, Little Chief Ridge area at north end of TSA, south of Cummings Arm and north of Golden along Hwy 1/ Columbia River corridor. The 2017 detailed aerial survey noted 54 spots with a total of 285 red trees in an area long Hwy 1 from east of Golden to Donald area. 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.](image)

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 fire-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 2015 to 2017 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 0 to 4.3% over the three years. 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: 2015-17 IBD Aerial Overview Survey polygon area and completed/ planned harvest to date

<table>
<thead>
<tr>
<th>Year</th>
<th>Total AOS Polygon Area (ha)</th>
<th>Parks</th>
<th>Operable AOS Polygon Area (ha)</th>
<th>Harvested Area as of Winter 2017-18</th>
<th>Planned Harvest Area as of Winter 2017-18</th>
<th>Harvested % of Operable as of Winter 2017-18</th>
<th>Planned Harvest % of Operable as of Winter 2017-18</th>
<th>Total Current &amp; Future Harvest %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>96.8</td>
<td>54.9</td>
<td>32.1</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2016</td>
<td>264</td>
<td>12.5</td>
<td>110.3</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2017</td>
<td>236.2</td>
<td>31.6</td>
<td>139</td>
<td>6</td>
<td>0</td>
<td>4.3%</td>
<td>0.0%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Spruce beetle (*Dendroctonus rufipennis*)

Current Status: Building
Management Strategy: **Indirect Action & Direct Action**
Tactics: Overview flights, detailed detection, Priority harvesting of attacked stands in THLB areas
TSR Implication: Short term timber supply

Spruce beetle has increased significantly from 2098 hectares in 2016 to 3199 ha in 2017 while in the attack area in the THLB has gone down slightly from 330 to 295 hectares. The 2016 and 2017 attack is primarily in Light, Moderate and Severe classes. Areas with significant IBS outbreak areas outside the National Parks include: Upper Wood Arm and Gorman Ck.

Forest Licencee plans and harvest of IBS attacked areas from 2015-2017 is shown in Table 5. The infested THLB area has been relatively small but increasing over the last 3 years and only a small amount of that area has been harvested or planned to harvest to date. Approximately ninety percent of the 2015 to 2017 polygon area is located in National parks, or inoperable/ OGMA areas.

**The 2017 detailed aerial survey in the small area flown found 8 polygons in the Upper Wood Arm Area with 40-80% severity totalling 1104.2 hectares. The upper Wood Arm area also had 45 spots with 257 red trees and the south Wood Arm area had 45 spots with 250 red trees. Note that single tree spots were not tallied. The AOS found similar results for these areas. Figure 3 shows the mapped distribution of these areas.**

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:

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 5**: Spruce Beetle attacked area 2015 – 2017 compared to area harvested and planned to be harvested.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total AOS Polygon Area (ha)</th>
<th>Parks</th>
<th>Operable AOS Polygon Area (ha)</th>
<th>Harvested Area as of Winter 2017-18</th>
<th>Planned Harvest Area as of Winter 2017-18</th>
<th>Harvested % of Operable as of Winter 2017-18</th>
<th>Planned Harvest % of Operable as of Winter 2017-18</th>
<th>Total Current and Future Harvest %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1070.1</td>
<td>868</td>
<td>102.3</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
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<tr>
<td>2016</td>
<td>2098</td>
<td>1340.7</td>
<td>330</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2017</td>
<td>3199.3</td>
<td>2219.3</td>
<td>295.2</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Figure 3:** 2017 Detailed aerial surveyed IBS polygons & spots in northern Golden TSA
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 (*Dendroctonus ponderosae*)

*Current Status:* Declining  
*Management Strategy:* Active Monitoring  
*Tactics:* Overview flights and Priority harvesting of attacked stands in THLB areas  
*TSR Implication:* Short term timber supply

Mountain pine beetle over the last 3 years has been noted primarily in the Trace, Light and Moderate severity classes and the trend is declining especially in the operable area attacked in 2017. Area of more noted attack over the last 3 years include: Valenciennes River/Bush Arm, Caribou Creek, Willowbank Ck, Schlichting Ck, Bachelor Ck. Table 6 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 6: 2015-17 IBM Aerial Overview Survey polygon area and completed/planned harvest to date

<table>
<thead>
<tr>
<th>Year</th>
<th>Total AOS Polygon Area (ha)</th>
<th>Parks AOS Area</th>
<th>Operable AOS Polygon Area (ha)</th>
<th>Harvested Area as of Winter 2017-18</th>
<th>Planned Harvest Area as of Winter 2017-18</th>
<th>Harvested % of Operable as of Winter 2017-18</th>
<th>Planned Harvest % of Operable as of Winter 2017-18</th>
<th>Total Current &amp; Future Harvest %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1829.5</td>
<td>405.3</td>
<td>647.4</td>
<td>33.6</td>
<td>1.4</td>
<td>5.2%</td>
<td>0.2%</td>
<td>5.4%</td>
</tr>
<tr>
<td>2016</td>
<td>2724.1</td>
<td>836.6</td>
<td>714.3</td>
<td>0</td>
<td>7.4</td>
<td>0.0%</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>2017</td>
<td>914.1</td>
<td>410.2</td>
<td>159.5</td>
<td>0</td>
<td>3</td>
<td>0.0%</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

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.

Spruce weevil (*Pissodes strobe*):  
*Current Status*: Endemic  
*Management Strategy*: Passive Monitoring  
*Tactics*: Stocking Standards  
*TSR Implication*: Regen delay, wood quality

Spruce weevil is an insect that will repeatedly attack and will the leader of spruce trees, causing poor form and reduced growth. 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, maintain a relatively high density of stems per hectare and avoid planting in higher hazard BEC subzones, e.g. warmer ICH.
5.4  MAMMALS

Voles

*Current Status:* Endemic  
*Management Strategy:* Passive Monitoring  
*Tactics:* Silviculture surveys  
*TSR Implication:* Long term timber supply

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:

- 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

*Current Status:* Endemic  
*Management Strategy:* Passive Monitoring  
*Tactics:* Silviculture surveys, Regeneration species selection and density  
*TSR Implication:* Long term timber supply

Bear damage is not easily identified by the overview survey and has not been noted in the last 2 annual surveys. 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 other TSA 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. 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.

Deer, Moose

*Current Status:* Endemic  
*Management Strategy:* Passive Monitoring  
*Tactics:* Silviculture surveys, Regeneration species selection and density  
*TSR Implication:* Long term timber supply

Deer and moose populations and the potential damage their feeding can cause are cyclical: natural predation will generally control the population before management strategies can be implemented. Ungulate damage is not typically noted by the AOS. In the future, as moose populations increase, and
second growth forests become harvestable, moose browse on plantations may become an issue. Currently these pests are of low concern.

5.5 ABIOTIC FOREST HEALTH FACTORS

Windthrow

*Current Status:* Endemic  
*Management Strategy:* Active Monitoring; Indirect Action  
*Tactics:* Overview flights; Block design; Salvage  
*TSR Implication:* Short to Mid-term timber supply

Overall, damage as a result of wind can cause significant forest loss in the Golden TSA. Small areas are often not noted by the AOS and only 13 hectares was found in 2017. 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. Whenever reasonable, windthrown timber is salvaged within a short time from discovery so that bark beetle infestation levels are minimized.

Fire

*Current Status:* Endemic  
*Management Strategy:* Indirect Action; Direct Action when it occurs  
*Tactics:* Fire Management Plans; Firefighting, Residual harvest debris management  
*TSR Implication:* Short, Mid and Long term

In previous years fire has not been a major concern in the Golden TSA, however 2017 had 9670 hectares of area burned although most of this area was in the Parks and only about 500 hectares was outside the parks. 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.

Hot Droughts

*Current Status:* Endemic  
*Management Strategy:* Indirect Action; Direct Action when it occurs  
*Tactics:* Re-plant damaged areas, plant higher densities, species selection for regeneration, salvage merchantable areas  
*TSR Implication:* Mid and Long term

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. A total of 21 hectares were mapped as drought in 2017. 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/hauled 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 licencee. The responsibility to carry out these actions or measures is the responsibility of the licencee.

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 Licencee must carry out activities within the operating area of another Forest Licencee, 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.

<table>
<thead>
<tr>
<th>DSE Forest Health Responsibility Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRICT RESPONSIBILITIES</td>
</tr>
<tr>
<td>Prepare an annual TSA Forest Health Strategy</td>
</tr>
<tr>
<td>Info sharing at TSA Steering Committee meetings and directly to Forest Licencees and other clients</td>
</tr>
<tr>
<td>Conduct detailed aerial and ground surveys within the TSA where deemed appropriate</td>
</tr>
<tr>
<td>Produce maps from the aerial surveys and provide ground survey information and maps to Licensees and clients</td>
</tr>
</tbody>
</table>

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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.

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

8.0 BMU STRATEGY FOR IBM, IBS AND IBD

<table>
<thead>
<tr>
<th>BMU</th>
<th>BMU Name</th>
<th>Bark Beetle</th>
<th>IBM</th>
<th>IBS</th>
<th>IBD</th>
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<tbody>
<tr>
<td>G01</td>
<td>Upper Wood</td>
<td>Monitor</td>
<td>Suppression</td>
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<tr>
<td>G02</td>
<td>Molson/Dainard</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
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<td>G03</td>
<td>Lower Wood</td>
<td>Monitor</td>
<td>Suppression</td>
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</tr>
<tr>
<td>G04</td>
<td>Tsar</td>
<td>Monitor</td>
<td>Suppression</td>
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<td>Kinbasket</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
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<td>Sullivan</td>
<td>Suppression</td>
<td>Suppression</td>
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<td>Suppression</td>
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<td>Bush River</td>
<td>Suppression</td>
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<td>G11</td>
<td>Goosegrass</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
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<tr>
<td>G12</td>
<td>Windy/Austerity</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
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<td>G13</td>
<td>Bachelor</td>
<td>Suppression</td>
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<td>Ventego</td>
<td>Monitor</td>
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<td>Suppression</td>
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<td>Esplanade</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
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<td>G16</td>
<td>Blackwater Ridge</td>
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<td>Hope/Goodfellow</td>
<td>Suppression</td>
<td>Suppression</td>
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<td>G18</td>
<td>Valenciennes</td>
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<td>Bluewater/Waitabit</td>
<td>Suppression</td>
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<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G20</td>
<td>Moberly</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G21</td>
<td>Blaeberry</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G22</td>
<td>Quartz</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G23</td>
<td>West Bench</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G24</td>
<td>Canyon</td>
<td>Monitor</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G25</td>
<td>Mount Seven</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
<tr>
<td>G26</td>
<td>Kickinghorse/Beaverfoot</td>
<td>Suppression</td>
<td>Suppression</td>
<td>Suppression</td>
<td></td>
</tr>
</tbody>
</table>
9   Recommended activities to manage IBS, IBD and IBM

9.1 Douglas-fir beetle

9.1.1 Harvesting
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. Trap trees;
2. Anti-aggregation pheromones (MCH);
3. Traps trees and (MCH); and
4. Clean harvesting practices.

Timber harvesting in infested (1\textsuperscript{st} priority) and red/grey attack (2\textsuperscript{nd} priority) and un-infested stands (3\textsuperscript{rd} 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.

No Planned funnel trapping by FLNRORD in Golden for 2018-19.


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 2018-19 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 2017.

9.2 Spruce beetle

9.2.1 Harvesting
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. Trap trees;
2. Clean harvesting practices.

Timber harvesting in infested (1\textsuperscript{st} priority) and red/grey attack (2\textsuperscript{nd} priority) and un-infested stands (3\textsuperscript{rd} 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 2018-19 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 2017. 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.
- Ongoing discussions with Licencees regarding active IBS, IBD and IBM populations and infestations in their operating areas and targeting these areas for immediate harvest.

11 2018-19 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.
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 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 2017 (See Table 8 and Figures 6 & 7). Over the 19 years reported in this table the volume lost by the significant FH factors represents about 8.1% of the AAC for that time period. The 19 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 2017 has had very low harvest recovery rates of only 2-3%. 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 3 years show a low harvest response to date. Given the rise of IBD and IBS (both at highest losses in last 19 years) especially Forest Licencees are encouraged to target the damaged stands for immediate harvest (maximum completion in 2 years).
Table 8: 1999-2017 THLB volume killed and not harvested and total killed volume harvested by selected Forest Health factors.

<table>
<thead>
<tr>
<th>Year</th>
<th>IBM</th>
<th>IBB</th>
<th>Fire</th>
<th>IBD</th>
<th>Flooding</th>
<th>IBS</th>
<th>Drought</th>
<th>Totals</th>
<th>THLB NRL Volume Harvested</th>
<th>% Harvested as % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>42354</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>42354</td>
<td>25608</td>
<td>38%</td>
</tr>
<tr>
<td>2000</td>
<td>41063</td>
<td>4502</td>
<td>1248</td>
<td>1325</td>
<td>356</td>
<td>0</td>
<td>0</td>
<td>48494</td>
<td>20418</td>
<td>30%</td>
</tr>
<tr>
<td>2001</td>
<td>17208</td>
<td>321</td>
<td>0</td>
<td>932</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18461</td>
<td>6178</td>
<td>25%</td>
</tr>
<tr>
<td>2002</td>
<td>22789</td>
<td>389</td>
<td>0</td>
<td>798</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>23976</td>
<td>15308</td>
<td>39%</td>
</tr>
<tr>
<td>2003</td>
<td>27441</td>
<td>277</td>
<td>125</td>
<td>118</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27961</td>
<td>14391</td>
<td>34%</td>
</tr>
<tr>
<td>2004</td>
<td>27794</td>
<td>643</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>28437</td>
<td>12778</td>
<td>31%</td>
</tr>
<tr>
<td>2005</td>
<td>88574</td>
<td>6558</td>
<td>383</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>95515</td>
<td>34288</td>
<td>26%</td>
</tr>
<tr>
<td>2006</td>
<td>137731</td>
<td>1256</td>
<td>5613</td>
<td>903</td>
<td>318</td>
<td>468</td>
<td>0</td>
<td>146289</td>
<td>76826</td>
<td>34%</td>
</tr>
<tr>
<td>2007</td>
<td>53619</td>
<td>1249</td>
<td>1372</td>
<td>0</td>
<td>282</td>
<td>0</td>
<td>0</td>
<td>56522</td>
<td>28803</td>
<td>34%</td>
</tr>
<tr>
<td>2008</td>
<td>75944</td>
<td>1464</td>
<td>0</td>
<td>184</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>77592</td>
<td>35178</td>
<td>31%</td>
</tr>
<tr>
<td>2009</td>
<td>35282</td>
<td>1256</td>
<td>4192</td>
<td>165</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40895</td>
<td>8578</td>
<td>17%</td>
</tr>
<tr>
<td>2010</td>
<td>28382</td>
<td>409</td>
<td>5528</td>
<td>596</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>34915</td>
<td>5230</td>
<td>13%</td>
</tr>
<tr>
<td>2011</td>
<td>19985</td>
<td>137</td>
<td>188</td>
<td>104</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20414</td>
<td>3792</td>
<td>16%</td>
</tr>
<tr>
<td>2012</td>
<td>12537</td>
<td>604</td>
<td>77</td>
<td>0</td>
<td>2084</td>
<td>1332</td>
<td>0</td>
<td>16634</td>
<td>3218</td>
<td>16%</td>
</tr>
<tr>
<td>2013</td>
<td>8672</td>
<td>892</td>
<td>0</td>
<td>0</td>
<td>975</td>
<td>0</td>
<td>0</td>
<td>10539</td>
<td>2184</td>
<td>17%</td>
</tr>
<tr>
<td>2014</td>
<td>10870</td>
<td>4140</td>
<td>580</td>
<td>0</td>
<td>2139</td>
<td>0</td>
<td>0</td>
<td>17729</td>
<td>334</td>
<td>2%</td>
</tr>
<tr>
<td>2015</td>
<td>14442</td>
<td>3146</td>
<td>0</td>
<td>241</td>
<td>415</td>
<td>166</td>
<td>0</td>
<td>18410</td>
<td>524</td>
<td>3%</td>
</tr>
<tr>
<td>2016</td>
<td>9883</td>
<td>1165</td>
<td>0</td>
<td>1053</td>
<td>0</td>
<td>1029</td>
<td>0</td>
<td>13130</td>
<td>262</td>
<td>2%</td>
</tr>
<tr>
<td>2017</td>
<td>9833</td>
<td>1192</td>
<td>6040</td>
<td>3657</td>
<td>0</td>
<td>2153</td>
<td>1096</td>
<td>23971</td>
<td>615</td>
<td>3%</td>
</tr>
<tr>
<td>Totals</td>
<td>684,403</td>
<td>29,600</td>
<td>25,346</td>
<td>10,076</td>
<td>6,569</td>
<td>5,148</td>
<td>1,096</td>
<td>762,238</td>
<td>294,513</td>
<td>28%</td>
</tr>
</tbody>
</table>
Figure 6: 1999-2017 Annual volume killed and killed & harvested in Golden TSA THLB.

The historical Golden TSA AAC (excludes Area based tenures –Woodlots) from 1999 to present is listed in the table below.

<table>
<thead>
<tr>
<th>Golden TSA Historical AAC</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Volume m³</td>
</tr>
<tr>
<td>1999</td>
<td>540,000</td>
</tr>
<tr>
<td>2000-2003</td>
<td>530,000</td>
</tr>
<tr>
<td>2004-Present</td>
<td>485,000</td>
</tr>
<tr>
<td>Total</td>
<td>9,450,000</td>
</tr>
</tbody>
</table>
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 3 bark beetles – Spruce Beetle, Douglas-fir Beetle and Mountain Pine Beetle and the necessity to address these through harvest and other active management tools.

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: 2017 Overview of Forest Health in the Southern Interior Region
http://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/aerial-overview-surveys/summary-reports

The above report is based on spatial data found at the location below for 2016 Annual Overview Survey.

Provincial Forest Health Strategy 2013-2017

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

2017 and earlier Annual Overview Surveys. (fixed wing based aerial mapping of all visible forest pests).
http://www.for.gov.bc.ca/ftp/HFP/external/Ipublish/Aerial_Overview/

2017 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


Golden Timber Supply Area – TSRJ Analysis Report (2009), Ministry of Forests and Range, Victoria, BC.

Golden Timber Supply Area – TSRJ AAC Rationale (2009), Ministry of Forests and Range Victoria, BC.

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 9: 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. |
| | | The priority is to salvage timber previously attacked to minimize value |
Salvage  | <50%  | 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 10: Bark Beetle Management Tactics as they apply to specific BMU strategies.**

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

An important part of designating strategies is to determine how much of the forest is at risk from a particular beetle. The area of susceptible forest was determined for the both TSAs for mountain pine beetle, Douglas-fir beetle and spruce beetle, (Table 11). The distribution of the susceptible forest types are shown for mountain pine beetle, Douglas-fir beetle and spruce beetle in Figures 8, 9 and 10.

The most current susceptibility data available is based on the updated Shore and Safranyik model (Safranyik et al 1992, 2000, 2005 – Appendix 1) and was provided by FLNRORD – branch and regional staff (spatial data – January 2006). This system considers age, susceptible species basal area, stand density and location. The model represents overall stand susceptibility, but does not necessarily represent individual tree susceptibility. Observations have shown that often the most susceptible trees where infestations tend to start are located in lower elevation stands.

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

| Table 11 Susceptibility ratings for mountain pine beetle, spruce beetle and Douglas-fir beetle in the Golden TSA by hectares and percent on crown forest land base. |
|---|---|---|
| Beetle | Susceptibility | Hectares | Percent |
| mountain pine beetle (IBM) | Nil (0) | 1,054,926 | 80.5 |
| | VL (0-5) | 187,101 | 14.3 |
| | Low (5-33) | 61,544 | 4.7 |
| | Moderate (33-66) | 6,576 | 0.5 |
| | High (66-100) | 763 | 0.1 |
| | No Typing Available | 0 | 0.0 |
| | Total area susceptible pine (33 and greater) | 7,312 | 0.6 |
| spruce beetle (IBS) | Nil (0) | 704,483 | 53.7 |
| | VL (0-5) | 108,594 | 8.3 |
| | Low (5-20) | 317,608 | 24.2 |
| | LM (20-40) | 139,206 | 10.6 |
| | Moderate (40-60) | 35,829 | 2.7 |
| | High (60-80) | 4,758 | 0.4 |
| | VH (80-100) | 404 | 0.0 |
| | No Typing Available | 0 | 0.0 |
| | Total area susceptible spruce (20 and greater) | 180,197 | 13.7 |
| Douglas-fir beetle (IBD) | Nil (0) | 1,088,548 | 83.0 |
| | VL (0-5) | 74,877 | 5.7 |
| | Low (5-20) | 74,703 | 5.7 |
| | LM (20-40) | 41,174 | 3.1 |
| | Moderate (40-60) | 23,267 | 1.8 |
| | High (60-80) | 6,288 | 0.5 |
| | VH (80-100) | 2,025 | 0.2 |
| | No Typing Available | 0 | 0.0 |
| | Total area susceptible Douglas-fir (20 and greater) | 72,753 | 5.5 |
Figure 8 Mountain pine beetle (IBM) susceptibility

Figure 9 Spruce beetle (IBS) susceptibility
Figure 10 Douglas-fir beetle (IBD) susceptibility