

100 Mile House Natural Resource District Forest Health Strategy

March 13, 2023



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Executive Summary

The purpose of the 2023 100 Mile House Natural Resource District Forest Health Strategy is to provide operational planners, reviewing agencies, and approval authorities with an update of current forest health conditions and risks. It also will provide best management practices recommended by overarching legislation, regulation, and higher-level plans, as well as incorporating strategies and tactics developed in conjunction with local licensees and First Nations.

Please note that this document does not provide identification or life history information on the various forest health factors found in the 100 Mile Timber Supply Area (TSA). The intended audience is expected to either have some expertise in the field of forest health or to have staff or contractors who do. Additionally, this strategy may not account for every forest health factor present in the 100 Mile House TSA but focuses on the factors of most concern and those that have practicable, reasonable measures to manage the hazard they pose to our forests. If a practitioner notices a forest health agent of note that is not addressed in this document, they are encouraged to contact the 100 Mile House Natural Resource District Stewardship staff and guidance will be sought out and provided. **This is intended to be a “living document”, and as changes arise or input is provided from any source, it will be updated as required.**

Updates of Note 2023:

- A new Forest Health portal is being created by regional GIS staff with input from local stewardship staff. This portal is intended for interested parties to be able to see, at a glance, the current state of forest health throughout the Natural Resource District. It is also intended to be the method of disseminating important updates such as aerial overview survey mapping and planning beetle management units. More to come on this as the portal is developed.
- A new Provincial bark beetle strategy is being created. More information is forthcoming.
- Priority and ranking of Forest Health factors in the 100 Mile House Natural Resource District (Table 1).
- Updated Beetle Management Unit Strategies – new strategies and definitions
- The adoption of deciduous species (trembling aspen) into regional stocking standards as non-deleterious
- Addition of pests/pathogens of concern booklet for silviculture surveyors the 100 Mile House TSA in the document appendices

Forest Health Factors to Note for the Coming Field Season:

- Wildfires have continued to have a large impact on the 100 Mile House TSA. In addition to the 2017/2018 wildfire seasons, we have experienced yet another devastating year in 2021.
- Douglas-fir beetle – despite what appears to have been a stable or even declining population in 2022, there remains potential for population growth in susceptible stands, and that climatic conditions in 2022 may have masked the potential for further growth.
- Western spruce budworm – extensive tracts of moderate defoliation and some areas of severe defoliation have been noted in aerial overview surveys, especially in the Meadow Lake and Dog Creek areas. An aerial spray program of 40,000 hectares will be conducted in the Williams Lake and 100 Mile House TSAs in 2023.

Useful Links and Information:

- Provincial Forest Health Website (includes links to the various aerial overview surveys, guidebooks, legislation, strategies):
<https://alpha.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health>
- Bark Beetle Management Guidebook:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/forest-health/bark-beetles/bark_beetle_management_guidebook.pdf
- Forest Practices Code Bark Beetle Management Guidebook:
<https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FPC%20archive/old%20web%20site%20contents/fpc/fpcguide/beetle/betletoc.htm>
- Cariboo-Chilcotin Land Use Plan (CCLUP):
<https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/cariboo/cariboochilcotin-rlup>
- Cariboo-Chilcotin Land Use Plan Biodiversity Conservation Strategy and Updates:
<https://www.for.gov.bc.ca/hfd/library/RBCS.htm>
- Ungulate Winter Range and associated objectives and General Wildlife Measures:
https://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html
- Approved Wildlife Habitat Areas:
https://www.env.gov.bc.ca/cgi-bin/apps/faw/wharesult.cgi?search=show_approved

- Windthrow Management Handbook:
<https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=11211>
- Dwarf Mistletoe Management Guidebook:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/forest-health/dwarf_mistletoe_management_guidebook.pdf
- Root Disease Guidebook:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/forest-health/forest-health-docs/root-disease-docs/rootdiseaseguidebookjune2018_4.pdf
- Root Disease Website:
<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/forest-pests/root-diseases>
- Silviculture Surveys Procedures Manual:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/silviculture-surveys/silv_survey_procedures_manual-april_2_2022-final.pdf
- Frost-Prone Site Identification and Guidance:
<https://www.for.gov.bc.ca/hfd/pubs/Docs/Frr/FRR157.pdf>
<https://www.for.gov.bc.ca/rsi/research/cextnotes/extnot05.pdf>
- Reforesting Dry and Drought-Prone Sites:
https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/reforesting_dry_sites_in_the_thompson_okanagan_natural_resource_region_brochure_final.pdf

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Table of Contents

Executive Summary	2
Updates of Note 2023:	2
Forest Health Factors to Note for the Coming Field Season:	3
Useful Links and Information:	3
Useful Contacts:	4
Table of Contents	5
List of Tables	6
1.0 Introduction	7
1.1 Natural Resource District Responsibilities and Activities	7
2.0 Major Forest Health Agents	10
3.0 Ranking of Forest Health Factors by Priority	11
4.0 Status of Priority Forest Health Agents	12
4.1 Bark Beetles	12
4.1.1 IBD: Douglas-fir Beetle (<i>Dendroctonus pseudostugae</i>) – high priority	12
4.1.2 IBS: Spruce Beetle (<i>Dendroctonus rufipennis</i>) – medium priority	13
4.1.3 IBB: Western Balsam Bark Beetle (<i>Dryocoetes confusus</i>) – medium priority	13
4.2 Defoliators	14
4.2.1 IDW: Western spruce budworm (<i>Choristoneura freemani</i>)	14
4.2.2 IDM: Spongy (Formerly Gypsy) Moth (<i>Lymantria dispar</i>)	14
4.2.3 Other Defoliators	14
4.3 Foliar Diseases	15
4.4 Animal Damage	15
4.5 Abiotic and Other Damage	16
5.0 Management Objectives	16
6.0 Specific Strategies	17
6.1 Bark Beetles	17
6.1.1 Beetle Management Units	17
6.1.2 Prioritizing Beetle Management Units	17
6.1.3 Beetle Management Unit Establishment	17
6.1.4 Beetle Management Unit Strategies	18
6.1.5 Beetle Attack Analysis/Susceptibility Maps	19
6.1.6 Aerial Surveys	19
6.1.7 Probing	19
6.1.8 Harvesting	20
6.1.9 Minimizing Windthrow:	20
6.1.10 Post-Harvest Mop-Up	22
6.1.11 Conventional Trap Trees and Semiochemical Baits	22
6.1.12 Funnel Trapping	23
6.1.13 Access	23
6.1.14 Delivery and Milling Restrictions	23
6.1.15 Douglas-fir Beetle-Specific Control Tactics	24
6.1.16 Spruce Bark Beetle-Specific Control Tactics	25
6.2 Weevils	26

6.3 Defoliators.....	26
6.4 Root Disease Control Tactics.....	27
6.5 Foliar Disease Control Tactics.....	28
6.6 DMP: Lodgepole Pine Dwarf Mistletoe Control Tactics	29
6.7 Stem Rusts of Pine.....	29
6.8 DSA: Atropellis Canker (<i>Atropellis piniphila</i>).....	29
6.9 Abiotic Damage	30
7.0 Reporting to the Chief Forester:	32
Appendix 1: 100 Mile House Natural Resource District Beetle Management Units.....	33

List of Tables

Table 1: Ranking of Pest Species by Priority for Forest Management Activities.....	11
Table 2: Guide to interpreting aerial overview survey data.....	12
Table 3: Timber area (ha) affected by Douglas-fir beetle	13
Table 4: Timber area (ha) affected by spruce beetle	13
Table 5: Timber area (ha) affected by western balsam bark beetle	13
Table 6: Timber area (ha) affected by western spruce budworm	14
Table 7: Timber area (ha) affected by select defoliators	14
Table 8: Timber area (ha) affected by select foliar diseases.....	15
Table 9: Timber area (ha) affected by animal damage	15
Table 10: Timber area (ha) affected by abiotic and other damage	16
Table 11: Beetle-infested timber hauling windows	23

100 Mile House Natural Resource District Forest Health Strategy 2023

1.0 Introduction

This District Forest Health Strategy is prepared and compiled under the guidance of the Provincial and Cariboo Regional Forest Health Strategies.

The Provincial government's key strategic forest health objectives can be viewed at [Forest health - Province of British Columbia \(gov.bc.ca\)](https://www2.gov.bc.ca/gov/content/spe/spe_agriculture/forest/forest_health/forest_health_strategy/forest_health_strategy.htm)

The purpose of this strategy is to outline the vision for forest health stewardship in the District. It also establishes bark beetle management objectives, specific strategies and procedures, and the current status and extent of priority forest health agents in the 100 Mile House District. Its main focus is twofold: managing the priority forest health agents of the District, with some comments on locally important forest health agents, and emphasizing the importance of proactive management to improve forest resilience.

On November 7, 2018 the AAC for the 100 Mile House TSA was reduced from 1.948 million m³ to 967,805 m³. Approximately half of the cut will continue to be from dead timber, but as mountain pine beetle salvage and fire salvage slow down, there will be an increased focus on harvesting species such as Douglas-fir and spruce heightening the need to mitigate the impact of forest health factors when and where appropriate. Douglas-fir beetle, spruce beetle, and western spruce budworm are classed as the priority forest health agents. Catastrophic infestations could potentially result in millions of dollars in reduced revenue due to timber losses, degraded lumber values, reduced stumpage values, increased fire hazard, degradation of non-timber resources (e.g. visuals quality, wildlife, recreation), disruptions in forest planning, and long-term impacts on resource sustainability.

A new Timber Supply Review is currently underway, which will consider the effects of the end of the mountain pine beetle salvage and the fire events over the last several years.

1.1 Natural Resource District Responsibilities and Activities

The 100 Mile House Natural Resource District Stewardship staff are the point of contact for forest health concerns and planning. Staff conduct forest health monitoring and treatments both independently and in collaboration with First Nations and stakeholders. Responsibilities of District staff include:

- Acting as a point of contact and facilitator for First Nations, licensees and other stakeholders when coordinating forest health treatments
- Determining and establishing Beetle Management Units (BMUs) in coordination with First Nations, licensees and other stakeholders

- Disseminating regional information to licensees, First Nations and other stakeholders including, but not limited to, aerial overview surveys, beetle and other forest health agent hazard mapping, spray programs, etc.
- Acting as subject matter experts for forest health and as conduits to access information from other subject matter experts when required

District Stewardship staff work with regional staff to plan detailed overview flights and spray programs. Stewardship staff should contact First Nations, licensees and other stakeholders when performing these actions to deploy the limited resources we have to best effect. Stewardship staff also coordinate ground-truthing using the results of overview and detailed flights in the form of probing to determine the extent of the insect/pathogen population and plan follow-up treatments. This can take the form of information sharing with First Nations, licensees, small scale salvagers and other stakeholders to encourage targeted harvest of areas of concern.

The primary focus of District Stewardship forest health staff is currently Douglas-fir beetle. Staff are involved in post-harvest mop-up of various treatments including wildfire risk reduction (WRR) treatments, small scale salvage of beetle-infested timber, and larger licensee cutting permits in areas of concern for potential beetle infestation. Leftover logging slash and stumps attract Douglas-fir beetle, which can lead to infestation of retained or adjacent timber. Some post-harvest mop-up tactics include deploying 3-methylcyclohex-2-en-1-one (MCH) antiaggregant semiochemicals to discourage Douglas-fir beetles from infesting retained stems, funnel trapping, and trap trees.

A funnel trapping program is also active in the District. Stewardship staff liaise with log yard owners to trap beetles emerging from or being attracted to freshly cut timber stockpiles. Additionally, there are traps established to monitor beetle populations within recently burned areas, and to suppress populations in burned or windthrown stands that will not be subjected to harvest treatments due to inoperable ground or poor economics.

Juvenile spacing of Douglas-fir stands is another District activity. Stewardship staff identify overstocked Douglas-fir stands with little merchantable volume and no overlapping obligation for spacing as both a timber supply mitigation measure and a forest health measure. Spaced stands can realize increased growth and vigour of individual stems once inter-tree competition is reduced. This can lead to better lumber quality of those stems once they reach merchantable sizes as well as increased resilience since they have more resources at their disposal to counter pest and pathogen infestation. Another benefit is reduced fuel loading in the event of a future wildfire. These projects are undertaken with cooperation of the Canoe Creek First Nations community. There is an opportunity being explored regarding a potential research project that will determine whether spaced stands are more resilient to western spruce budworm infestation. Budworm larvae descend through the canopy onto lower layers of primarily Douglas-fir stands as they feed and grow. If there is less understorey to fall onto, hypothetically there is less for the larvae to feed on, leading to reduced development or even mortality of larvae, which then leads to fewer adults to lay egg masses for continued infestation.

Stewardship staff also lead reforestation efforts in wildfire-damaged areas. Staff employ planting strategies that account for future stand condition, which includes forest health principles. Some such principles include the decision on whether reforestation is appropriate for a specific site (or not) at a landscape level, and a species mix and density that will lead to the most resilient future stand. This may not be a species mix that is the easiest to establish. The inclusion of increased percentages of Douglas-fir seedlings in IDFdk3 zones (the majority of recent wildfire area falls in the IDFdk3 zone) poses difficulty in establishment of plantations but will hopefully lead to future stands that are more resistant to drought and other insects and pathogens than the other preferred species, lodgepole pine. Additionally, the use of Climate-Based Seed Transfer stock to better prepare for future conditions as well as the adoption of other species such as ponderosa pine and western larch in some circumstances are intended to increase diversity and resilience to future climate effects. Regional stocking standards have been updated to include deciduous species as non-deleterious to stocking of plantations in the Interior Douglas-fir biogeoclimatic (BEC) zone. The Elephant Hill wildfire area also has specific stocking standards which lists deciduous species as non-deleterious. Again, the intent is to increase stand diversity as well as acting as a more fire-resistant component on the landscape. The inclusion of deciduous species has the added benefit of being faster to establish post-fire, acting as a nurse crop to other seedlings (namely Douglas-fir), and increasing insect and animal biodiversity in conifer-dominated environments. Additionally, deciduous species tend to be preferred for many cavity-nesting birds and animals; many of which prey on insects, including bark beetles and defoliating caterpillars and loopers.

Refer to the the [Silviculture Survey Procedures Manual](#) for survey protocols that allow for the retention of deciduous species in IDFdk3 and other defined BEC units.

Stewardship staff at the 100 Mile Natural Resource District Office are always open to the inclusion of interested parties in these activities, as well as partnering on proposals that are intended to improve forest health and growth. Anyone interested in the above can contact David Majcher, RPF, Stewardship Officer at David.Majcher@gov.bc.ca or via phone at 250 706 6227.

2.0 Major Forest Health Agents

Bark Beetles

- Douglas-fir beetle (*Dendroctonus pseudotsugae*)
- Spruce beetle (*Dendroctonus rufipennis*)
- Western balsam bark beetle (*Dryocoetes confusus*)

Defoliators

- Western spruce budworm (*Choristoneura freemani*)
- Two-year cycle budworm (*Choristoneura biennis*)
- Aspen serpentine leafminer (*Phyllocnistis populiella*)
- Douglas-fir tussock moth (*Orgyia pseudotsugata*)

Root Disease

- Armillaria root disease (*Armillaria oystoyae*)
- Tomentosus root disease (*Inonotus tomentosus*)
- Laminated root disease (*Phellinus weirii*)

Stem and Branch Diseases

- Lodgepole pine dwarf mistletoe (*Arceuthobium americanum*)
- Western gall rust (*Endocronartium harknessii*)
- Stalactiform blister rust (*Cronartium coleosporioides*)
- Atropellis canker (*Atropellis piniphila*)
- Commandra blister rust (*Cronartium comandrae*)

Weevils

- White pine weevil (*Pissodes strobi*)
- Lodgepole pine terminal weevil (*Pissodes terminalis*)
- Warren's root collar weevil (*Hylobius warreni*)

Foliar Diseases

- Dothistroma needle blight (*Dothistroma septosporum*)
- Elytroderma needle cast (*Elytroderma deformans*)
- Lophodermella needle cast (*Lophodermella concolor*)
- Aspen Poplar leaf and twig blight (*Venturia macularis*)

Abiotic Damage

- Wildfire
- Aspen decline
- Drought
- Frost
- Animal damage
- Windthrow

- Flooding

3.0 Ranking of Forest Health Factors by Priority

Forest health factors are ranked according to:

- The collective knowledge of the Regional/District forest health specialists.
- Known or suspected impacts to forest resource values.
- Availability of operational detection and treatment methods.
- Costs and benefits of applying detailed detection and treatment activities.
- Distribution of pests and current incidence levels.
- Resources and funding required to implement the necessary management for the pests.

Note: abiotic injuries (i.e. drought, windthrow and animal damage) 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 forest health factors within the 100 Mile House Natural Resource District.

Table 1: Ranking of Pest Species by Priority for Forest Management Activities

Very High	High	Medium	Low	Very Low
Douglas-fir beetle	Western spruce budworm	Western balsam bark beetle	Two-Year cycle budworm	Atropellis canker
		Spruce beetle	Forest tent caterpillar	
		Lodgepole Pine Dwarf mistletoe	Elytroderma needle cast	
		Tomentosus root disease	Lophodermella needle cast	
		Armillaria root disease	Commandra blister rust	
		Laminated root disease	Stalactiform blister rust	
		Lodgepole pine terminal weevil	Western gall rust	
		White pine weevil	Warren's root collar weevil	

Forest health treatment planning should target highest priority stands first.

4.0 Status of Priority Forest Health Agents

All data presented below is from the Provincial Aerial Overview Survey Reports available [here](#). Important to note is that areas presented include the **total** of trace, light, moderate, and severe polygons. For better information on the severity of infestation or natural disturbance, refer to the site above.

Table 2: Guide to interpreting aerial overview survey data

Severity:	Percentage of Trees in Polygon Impacted:
Trace	<1%
Low	1-10%
Moderate	11-29%
Severe	30-49%
Very Severe	>50%

4.1 Bark Beetles

4.1.1 IBD: Douglas-fir Beetle (*Dendroctonus pseudostugae*) – high priority

Douglas-fir beetle throughout the District has been identified as *proactive* for all BMU's. (refer to pages 18-19 for definitions of BMU strategies)

There was another catastrophic wildfire season in 2021 within the 100 Mile House Natural Resource District. A significant amount of the areas burned were mature Douglas-fir-leading stands. Post-wildfire mortality is expected to increase in the coming years in areas with damaged Fdi stands, largely due to the expected buildup of Douglas-fir beetle populations and the weakening of host trees from scorch and drought. In addition, Douglas-fir forests comprise a large proportion of the 100 Mile House TSA, making that forest type ecologically and economically significant. Most of the population is established in and around Douglas-fir forests, making potential infestations unsightly and hazardous. Complicating matters further is that many ecologically important Old Growth Management Areas (OGMAs) and Mule Deer Winter Ranges (MDWR) are comprised of Douglas-fir forests. This adds a layer of complexity to operations within those areas; therefore, the priority for managing this pest is high to reflect the importance of keeping population levels low.

Results from the District's funnel trapping and probing program have shown a down year for Douglas-fir beetle despite fears of a population surge due to the fires and drought of 2021 stressing and killing host trees. However, the trapping program did not experience large volumes, nor did the probing program locate much current attack. The possible reasons for such a down year are many, including a cool, wet spring not being conducive to larval development and conditions that increase host tree vigour. Additionally, the Douglas-fir beetle flight in 2021 was large, but it also occurred during the "heat dome" event, which may have led to mortality outside of the traps. It is also possible that the elevated beetle population over the last 7-8 years has allowed for a growth in the populations of the beetle's natural pests and predators, leading to a collapse. Most likely, it is a combination of some or all of these factors.

Conversely, aerial overviews cannot detect attack within burned areas, since trees infested by beetle appear the same as trees recently killed by wildfire, so it is possible that populations are “hiding” within large, burned areas.

Table 3: Timber area (ha) affected by Douglas-fir beetle

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Area (ha)	184	291	2,587	5,390	14,350	8,733	6,417	12,272	8,944	39,769	6,593

(Provincial Overview Report): These areas, in hectares, are all estimates of recorded trace, low, moderate and high infestations collected during the provincial aerial overview survey. The survey records all red trees, but not new infestations. So, as the reds turn into greys the infestation area decreases.)

4.1.2 IBS: Spruce Beetle (*Dendroctonus rufipennis*) – medium priority

Spruce beetle throughout the district has been identified as *proactive* for all BMU’s. (refer to pages 18-19 for definitions of BMU strategies)

Spruce beetle activity has continued to remain at low levels in the 100 Mile TSA. The affected area remains at 0 ha, which it has been since 2018. Despite this, spruce beetle remains a medium priority due to the aggressive nature of after disturbance events such as wind or drought, and since spruce, along with Douglas-fir, now comprises the majority of live timber in the TSA, making it important both commercially and ecologically.

Table 4: Timber area (ha) affected by spruce beetle

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Area (ha)	10,899	416	652	205	130	275	0	0	0	0	0

(Provincial Overview Report): These areas, in hectares, are all estimates of recorded trace, low, moderate and high infestations collected during the provincial aerial overview survey. The survey records all red trees, but not new infestations. So, as the reds turn into greys the infestation area decreases.)

4.1.3 IBB: Western Balsam Bark Beetle (*Dryocoetes confusus*) – medium priority

Western balsam bark beetle throughout the District has been identified as *no action* for all BMU’s. (refer to pages 18-19 for definitions of BMU strategies)

Infestations from Western Balsam Bark Beetle have been trending downwards, to a low of 440 ha in 2021.

The majority of the balsam bark beetle infestations are located in high elevation spruce/balsam mixed stands with marginal or no access and, due to the rapid degradation of timber quality of subalpine fir upon mortality, the economics of balsam bark beetle sanitation and salvage are marginal at best. For this reason, balsam bark beetle will not be treated unless in conjunction with spruce beetle treatment. These stands are very susceptible to blowdown if single tree extraction is conducted. Trap trees can be utilized to contain/concentrate balsam bark beetle.

Table 5: Timber area (ha) affected by western balsam bark beetle

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Area (ha)	1,567	1,915	4,936	3,695	8,530	5,665	5,506	3,993	717	440	213

(Provincial Overview Report): These areas, in hectares, are all estimates of recorded trace, low, moderate and high infestations collected during the provincial aerial overview survey. The survey records all red trees, but not new infestations. So, as the reds turn into greys the infestation area decreases.)

4.2 Defoliators

4.2.1 IDW: Western spruce budworm (*Choristoneura freemani*)

Despite its namesake, the western spruce budworm is a defoliator that primarily feeds on Douglas-fir foliage; in some instances it has been known to feed on spruce, true fir, and larch foliage. The incidence of western spruce budworm is increasing; especially in the areas of Meadow Lake and Dog Creek. Western spruce budworm defoliation stunts growth and repeated infestations can cause mortality; however, perhaps its most damaging effect is that it stresses trees and makes them susceptible to other pests and pathogens, specifically Douglas-fir beetle. Furthermore, a wild Douglas-fir cone collection program was impacted by western spruce budworm feeding in cones in 2022. A spray program utilizing *Bacillus thuringiensis* va. Kurtaski (B.t.k) of 40,000 ha is planned for the 100 Mile House and Williams Lake TSAs in 2023.

Table 6: Timber area (ha) affected by western spruce budworm

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Area (ha)	48,105	50,205	9,810	1,330	1,470	0	4,358	1,059	7	13,025	44,737

(2022 Overview of Forest Health Conditions in Southern British Columbia): Areas include the total of trace, low, moderate and severe polygons)

4.2.2 IDM: Spongy (Formerly Gypsy) Moth (*Lymantria dispar*)

Spongy moth is an invasive pest that defoliates primarily deciduous trees. It has not been detected in the 100 Mile House TSA, but through a partnership with the Canadian Food Inspection Agency, a trapping program is in place at recreation sites throughout the TSA. Spongy moths are known to lay their egg masses on recreation vehicles and trailers, so it is anticipated that any incipient infestation would occur at these sites.

4.2.3 Other Defoliators

Other defoliators have been of a lesser concern; however, aspen serpentine leaf miner (*Phyllocnistis populiella*) continues to be a major pest of trembling aspen and has been responsible for considerable defoliation of that species throughout the 100 Mile House TSA. A large collapse in affected area was noted in 2022: down to 1,622 ha from 86,920 ha in 2021. Future overview flights need to be performed before a collapse is confirmed. Leaf miner itself does not usually cause enough damage to result in tree mortality, but it can reduce photosynthetic capacity by up to 75%, therefore weakening the tree and making it more susceptible to other forest health agents. There is no planned treatment to address aspen serpentine leaf miner at this time.

Table 7: Timber area (ha) affected by select defoliators

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Two Year Cycle Budworm	0	770	7,700	0	0	2,700	3,713	250	1,360	4,626	9,762

Douglas-fir Tussock Moth	0	0	0	0	0	0	0	0	29	0	0
Pine Needle Sheathminer	0	0	510	1,340	2,270	300	18	0	0	0	4
Aspen Serpentine Leafminer	6,290	8,905	67,245	48,625	46,490	222	63,815	80,999	28,406	86,920	1,622
Birch Leaf Miner	0	0	0	0	69	0	47	0	0	0	0

*All units are hectares

(2022 Overview of Forest Health Conditions in Southern British Columbia): Areas include the total of trace, low, moderate and severe polygons)

4.3 Foliar Diseases

Dothistroma needle blight has historically been the most damaging foliar disease in the 100 Mile House Natural Resource District TSA. No treatments for *Dothistroma* is planned at this time; see section 6.5.3 for more information on *Dothistroma* needle blight.

Elytroderma needle cast, though not currently a major pathogen of concern in the 100 Mile Natural Resource District, has left a legacy of deformed stems in our dry pine stands, resulting in lower growth rates and wood quality. See section 6.5.1 for more information on *Elytroderma* needle cast.

Table 8: Timber area (ha) affected by select foliar diseases

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Venturia Blight	0	26	0	0	6,909	0	6	0	0	0	0
Dothistroma Needle Blight	0	0	0	0	616	8,460	105	0	3,760	180	0
Lophodermella Needle Cast	0	0	0	0	0	1,275	0	0	934	0	0

*All units are hectares

(2022 Overview of Forest Health Conditions in Southern British Columbia): Areas include the total of trace, low, moderate and severe polygons)

4.4 Animal Damage

Animal damage is often expressed as the removal of bark and cambium or tramping of seedlings. Bear damage is the most common issue seen in the AOS, but it is quite small in scope. Bear damage is most commonly the peeling of bark at or near the root collar of a tree, with strips of peeled bark extending up the trunk. This can either be seen in separate strips or the complete girdling of a stem. Bears will often do this in spring to eat the cambium as an early season food source. Porcupine damage is similar, though it is usually higher up the stem and the teeth marks are smaller.

Table 9: Timber area (ha) affected by animal damage

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Porcupine	57	0	0	0	0	0	0	0	0	0	0
Bear	0	239	200	384	1,291	661	893	0	42	61	90

*All units are hectares

(2022 Overview of Forest Health Conditions in Southern British Columbia): Areas include the total of trace, low, moderate and severe polygons)

4.5 Abiotic and Other Damage

The past 6 years have seen multiple catastrophic wildfire seasons. Forest activities should be conducted in ways that both minimize ignitions and account for longer-term and landscape-level effects. See section 6.9.3 for more information on wildfire. When considering for potential abiotic damage, selecting species for planting should not only consider ease of establishment, but how that species is likely to fare throughout its lifespan. This should include the expected impacts of climate change. Cutblock design can be an important tool in mitigating abiotic damage by providing shelter for regenerating seedlings and accounting for windthrow and wildfire hazard. Stand tending practices such as spacing/thinning and fertilization can increase the vigour of retained stems and reduce fuel loading.

Table 10: Timber area (ha) affected by abiotic and other damage

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Wildfire	26	48	23	26	37	136,371	12,814	23	7	107,875	0
Post-Wildfire	0	477	1,560	0	65	0	0	13,200	7,807	7	659
Drought	0	0	0	0	21	57	326	177	0	719	3
Cedar Flagging	0	0	0	0	0	215	0	2,971	138		0
Aspen Decline	5	70	218	5	3,435	0	695	21	31	65	219
Flooding	30	15	23	30	89	8	51	16	30	341	0
Hail	0	0	111	0		0	0	0	0		0
Shoot/Bud Frost Kill	0	0	0	0	0	0	0	0	0	4,628	0
Windthrow	984	0	29	984	0	804	53	0	0	0	0

*All units are hectares

(2022 Overview of Forest Health Conditions in Southern British Columbia): Areas include the total of trace, low, moderate and severe polygons)

5.0 Management Objectives

Bark beetles, defoliating insects, parasites and fungal pathogens are natural components of forest ecosystems in British Columbia, and at most times are present at low or endemic levels. Presently there are no populations of any damaging forest health agent that have expanded into what would be considered epidemic levels in the 100 Mile House Natural Resource District, with the possible exception of western spruce budworm. With adequate resources, endemic levels of forest health agents can be managed to meet objectives. This strategic plan provides direction to deploy resources to where it is most appropriate to mitigate the rate of spread.

Impediments to achieving bark beetle management objectives include overlapping landscape values issues (i.e. OGMA/OGDA and MDWR) and stumpage rates. It will also depend on licensee willingness to focus harvesting in identified areas.

Since the collapse of mountain pine beetle populations and in the wake of several catastrophic wildfire seasons, focus is shifting from reactive management to a more proactive approach. Many of the strategies proposed in this document emphasize the need to manage

our forests for ecosystem health and resiliency. Healthy trees are better able to resist the stresses placed upon them by forest health agents and the impacts of climate change; furthermore, managing forests at a landscape scale can mitigate the spread of not only pests and pathogens, but wildfire and climate change effects.

6.0 Specific Strategies

For priority forest health agents, the 100 Mile House Forest Health Strategy will follow the specific strategies and tactics outlined in the Forest Practices Code Guidebooks, Provincial Bark Beetle Strategy, Regional Bark Beetle Plans, and focus on areas identified by the 100 Mile House Natural Resource District Detailed Aerial Survey Maps.

6.1 Bark Beetles

6.1.1 Beetle Management Units

A Beetle Management Unit (BMU) is a planning and reporting unit for operational beetle management. Its purpose is to identify an area of concern, establish the appropriate beetle management objectives, and to facilitate the implementation of those beetle management activities. Resource management objectives will be consistent throughout each BMU. Additionally, strategies will be evaluated for compatibility with adjacent BMUs. BMUs have been created within the District for prioritising each bark beetle species.

Note that the Forest Planning and Practices Regulation (FPPR) section 41 states:

“An agreement holder or a timber sales manager who uses trap trees or pheromones to concentrate insect populations must ensure that the insect brood is destroyed before the insects emerge.”

Whenever trap trees or semiochemical lures are mentioned in this document, this regulation must be considered and adhered to.

6.1.2 Prioritizing Beetle Management Units

A priority rating will be given to all beetle management units based on timber types, resource values, adjacent infestations, and past investments. This priority rating then needs to be further evaluated to consider shelf life, species composition and amount of infestation to better inform the management strategy to be used.

6.1.3 Beetle Management Unit Establishment

Currently, the BMU boundaries for the District follow the boundaries of Landscape Units. However, pending the discovery of an active infestation, BMU boundaries can be modified to reflect the management strategy best suited for the area. Modification of existing or the creation of new BMU boundaries is authorized by the District Manager with the input from District Stewardship staff and any proponent licensee(s), First Nation(s) or other stakeholder(s). Information used to inform the creation/modification of BMUs include, but is not limited to,

District staff monitoring programs, overview flight data, beetle probe findings, and stand susceptibility (i.e.: bark beetle susceptibility mapping).

6.1.4 Beetle Management Unit Strategies

The following five strategies for each or portion of the 100 Mile House BMU's will be implemented. These strategies are selected based on the level of outbreak in an area and the estimated effectiveness of selected treatments in achieving stated objectives. The BMU's will be re-evaluated, usually yearly, as new aerial survey information is received. Revised strategies for each of the BMU's will be adjusted at that time.

1. Proactive

The use of proactive management tactics and is applied where beetle populations are in the endemic population phase. The key goal of the Proactive strategy is to prevent beetle populations from expanding to unmanageable levels.

2. Targeted

The use of aggressive pest reduction tactics on beetle populations that are in the incipient population phase and is applied where pest populations are building but can still be effectively reduced before more widespread infestation occurs.

3. Reactive

The use of tactics in response to pest populations that are in the epidemic population phase. The goal of the Reactive strategy is to reduce and mitigate widespread bark beetle-caused host tree mortality.

4. Salvage

Focus on the harvesting of mostly dead or dying trees and stands to minimize timber value losses in widespread infestations and is applied where management efforts would be ineffective in reducing beetle populations and subsequent levels of damage. The Salvage strategy is most suited for beetle populations that are nearing the end of the epidemic phase or in the post-epidemic phase. The goal is to recover timber value, to regenerate impacted areas and to reduce fire risk to promote future more resilient forests.

5. No Action

The No Action strategy is applied to designated areas where:

- Natural disturbances are left unmanaged

- Management efforts would be ineffective in substantially reducing beetle populations and impacts
- There is no short-term possibility of salvaging dead timber
- Access cannot be put in place before substantial merchantable degradation of the dead material (economically constrained areas)
- Non-timber values or other management constraints such as wilderness areas, Parks or ecological reserves, culturally significant areas, supersedes that of timber or wood products

Areas designated as no action should be large enough to allow for the full range of ecosystem processes through time.

6.1.5 Beetle Attack Analysis/Susceptibility Maps

Beetle susceptibility mapping reflects the susceptibility of stands to beetle infestation based on factors such as tree age, elevation, species composition, landscape constraints, current infestation levels etc. and is calculated from information in the Ministry of Forests' (MoF) digital inventory ("FIP") files. These maps are updated periodically by the MoF to reflect the changing landbase as stands grow and age into higher susceptibility classes as well as the removal of stands due to harvesting and other disturbances i.e. wildfire.

*see appendices for 100 Mile House Natural Resource District beetle susceptibility mapping

6.1.6 Aerial Surveys

The provincial aerial overview survey is carried out via fixed-wing aircraft each year to determine the spread of bark beetles and other forest health agents within the District. These results are shared to interested parties by District Stewardship staff or by request. The aerial overview survey can be used to inform a more detailed overview survey using rotary-winged aircraft at lower altitudes to further refine the impacted areas.

It should be noted that aerial surveys can only detect trees that have already been attacked by bark beetles (IBM can turn foliage red in the autumn after spring infestation; IBD and IBS can take over a year to exhibit symptoms). Therefore, aerial overview surveys are typically useful to determine where the beetles have been, and it must be inferred that the current year's infestation may be in the green trees surrounding the attacked areas. Ground truthing through probes is currently the only way to determine the presence/absence of current infestation.

6.1.7 Probing

Beetle probing is the ground-truthing method used to further refine the infested area provided from flight data. Probing can also identify current (green) attack while aerial surveys cannot. The extent of active infestation is important for determining the appropriate course of action, especially in constrained areas (i.e. OGMAs) as per the Biodiversity Guidelines. There are several methods of beetle probing; more detailed information, see the [Forest Practices Code Bark Beetle Management Guidebook](#).

6.1.8 Harvesting

Harvesting is a viable control to physically remove and destroy beetle populations. A distinction should be made between sanitation and salvage harvesting. Sanitation harvesting is the removal of currently infested trees and requires timely identification of infested stems via ground-truthing. Salvage harvesting is the removal of already killed timber to recover economic value and to hasten regeneration of the infested stand. These definitions are especially important when operating in constrained areas. Review [Biodiversity Update 7b](#) for more information regarding this.

Timing of harvest should be planned to occur prior to the next beetle flight, or once the strategy being used to concentrate beetle populations has been completed. Infested timber should be prioritized for processing in log yards to avoid the spread of beetles to adjacent stands. As noted above, any strategies employing trap trees, semiochemical lures and other insect concentration tactics must result in insect brood being destroyed prior to emergence as per the FPPR sec. 41

Small Patch or Selective:

Small patch harvesting is a viable control option for small, scattered patch infestations of Douglas-fir and Spruce bark beetle. All harvesting should be followed by a mop-up procedure (see below). Small patch harvesting utilizing Small Scale Salvage is not considered an effective tool for large-scale outbreaks.

Selective harvesting (single tree mark-to-cut, shelterwood etc.) should consider windfirmness of retained stems (see windthrow management guidance below) as well as the susceptibility of those retained stems to infestation due to age, tree health, size etc. Careful harvesting should minimize the amount of damage to residual stems from equipment impacts or rub trees. Those trees damaged during harvest should be removed or left as trap trees if a follow-up treatment is prescribed since stressed or damaged trees can act as an attractant to bark beetles. Residual slash and slash piles can attract beetles and lead to the retained stems becoming infested. Management options include clean harvesting and slash removal concurrent with harvesting or by deploying MCH on the retained stems for 2-3 years post-harvest once the attractant slash has decomposed or has been disposed of.

Clearcutting:

Clearcutting of large polygons is the main control for severe and very severe large-scale infestations of bark beetles, and wherever possible should be used in conjunction with a strategy to concentrate beetle populations into the planned harvest areas. Strategies include trap tree falling, road right-of-way falling (trap trees), or semiochemical baiting.

6.1.9 Minimizing Windthrow:

Both Douglas-fir and spruce beetles are highly attracted to large, windthrown stems. Beetle infestations often begin after windthrow events where suitable host trees are killed by windthrow and act as nurseries for beetle broods. A windthrown tree can host up to four (4) times the number of beetle brood than a live tree being attacked by beetles. Adult beetles then

emerge from the windthrown trees in populations large enough to mass attack adjacent healthy trees.

Cutblock design should consider windthrow risk based on a host of factors (soils, stand characteristics, topography, known prevailing winds and meteorological conditions etc.). If a proposed cutblock is assessed as being susceptible to windthrow, the following strategies should be employed to mitigate possible damage:

Clearcutting:

- Wind-facing boundaries should be located on sites that are least risk (deep, well-drained soils with tree species known for deep rooting and good crown form)
- Use natural landscape boundaries to create windfirm edges (rock bluffs, previously disturbed edges, bogs etc.)
- Boundaries should be relatively uniform and smooth – avoid sharp corners or indentations that are exposed to wind
- Boundaries may require “feathering” on sites that are at higher risk. This involves removing more vulnerable stems along the boundary edge and retaining the more windfirm stems to protect the downwind adjacent stand. No more than 15-20% should be removed.

Selective Cutting and Thinning:

- Select high windthrow hazard areas and trees as the removal portion of the harvest plan, especially in group selection or strip-cut methods
- Avoid locating selective cuts adjacent to existing clearcuts or vice-versa. It will take some time for retained stems to become completely windfirm once adjacent stems have been harvested, so exposing them to full-force wind immediately post-harvest is poor practice
- Residual trees should be selected as the retention cohort (sound, well-rooted veterans, good taper and relatively small, open crowns)
- Inter-tree spacing of residuals should not exceed ½ tree length
- Early spacing on high windthrow hazard sites will encourage strong rooting while trees are flexible and before they are tall enough to be susceptible
- Several light-mid intensity treatments rather than one heavy treatment are preferred
- Allow several years between treatments to allow the residual stand to adapt to the new wind condition
- Avoid damaging root systems of retained stems during harvesting and skidding activities

In all instances, it is good practice to apply MCH along cutblock boundaries and on residual stems post-harvest prior to beetle flight in anticipation of possible windthrow. This will prevent infestation of windthrown stems that can result in populations able to mass-attack adjacent timber. MCH is effective on both Douglas-fir and Spruce Beetle.

Where Douglas-fir and Spruce are reserved singly or as wildlife tree patches, consider the above recommendations to maximize wind firmness. Retained stems and reserve areas should have post-harvest inspections conducted to ensure the wind firmness goals were met, and if there is blowdown these trees should be salvaged to prevent the concentration of bark beetles. For more information on managing windthrow, see the [*Windthrow Handbook for British Columbia Forests*](#).

6.1.10 Post-Harvest Mop-Up

For Douglas-fir and Spruce bark beetle control, slash and felled trees which may be present after harvesting should be minimized, piled and burned or cut into lengths less than 1m, to prevent population build-up or survival in that material. If the original harvest was to treat a bark beetle infestation, leaving trap trees in easily accessible areas post-harvest is a good cleanup tool to capture any beetles emerging from logging slash and stumps and to capture beetles from adjacent stands attracted to the smell of logging slash. See the “Conventional Trap Trees” section for more information on trap trees. If harvesting in Douglas-fir or spruce stands, MCH is an excellent tool to deter beetles attracted to logging slash, stems damaged by harvest, and any potential windthrow of reserve or edge trees.

6.1.11 Conventional Trap Trees and Semiochemical Baits

This tactic is used to concentrate Douglas-fir and spruce beetle and takes advantage of the fact that these pests prefer weakened, damaged, and downed material over standing, healthy trees. Trees are felled in easily accessible locations for removal after the next beetle flight. Trap trees should be felled at a ratio of one trap tree per every 4 known currently infested trees in the target stand. Trap trees should not be limbed nor felled into sunlit openings since this dries out the cambium and is less attractive to beetles. Trees must be removed between September and before beetle emergence (For Spruce beetle (IBS) this emergence date is just beyond May 15th and Douglas-fir beetle (IBD) Apr 15th).*

**These dates are guidelines only. Climactic and weather conditions may skew the timing of beetle emergence to both earlier and later in the season*

Trap trees can be useful for managing bark beetles in inoperable and constrained areas such as OGMA's and MDWR. Trees are felled outside of the inoperable/constrained area and left for a season to “pull” beetles out of the stand in question. Another good tactic is to pre-fell trap trees in a planned cutblock. These can be dispersed throughout the block (typically in clearcut treatments only; spillover of beetles from trap trees into standing timber makes this problematic in selective or partial cut systems) or be comprised of road rights-of-way. The pre-felled trap trees will attract beetles into the area to be cut, and then subsequent harvest and milling of timber will destroy any beetle brood.

Conversely, in place of trap trees, bark beetle baits can be applied to planned “sacrifice” cutblocks. Semiochemical baits mimic the pheromones exuded from beetles attacking trees that attract other beetles to increase the success rate of mass attack. The principles of trap trees apply: lures are applied to trees throughout the stand slated for harvest prior to beetle

flight. The beetles attack the stand, and it is harvested before the new brood flies the following year.

It should be noted that often trap trees will create a “spillover” effect where beetles are attracted to the trap trees but will also attack adjacent trees. Trap trees should be planned to account for possible spillover (harvest) or felled in areas with other tree species that are not susceptible to the beetle in question.

6.1.12 Funnel Trapping

Funnel trapping can help mitigate beetle populations if used in the correct circumstances. Semiochemical lures are attached to the traps along with a killing agent in the trap cup. Semiochemical lures are an even more powerful attractant than trap trees. One drawback to funnel traps is that they need to be monitored constantly; possibly even twice a week during peak beetle flight periods because even in spite of the killing agent, the cups may overfill with beetles, resulting in spillover of beetles into the adjacent stand. This makes them very labour intensive, especially in isolated areas. Since the semiochemical lures are so powerful, the spillover effect can be even greater than that of trap trees, so funnel traps should be placed in areas with no susceptible timber such as open clearcuts or deciduous types, with a buffer of 200 m from susceptible timber types. In burnt settings, that buffer can decrease to 100 m from susceptible timber.

Funnel traps are excellent tools around mill yards since beetles will already be attracted to log decks stored there and they will be easily accessible. Most of the mill yards in our area are surrounded by Douglas-fir forests, so the potential for spillover into the adjacent stands and private property are high. Funnel traps can be used to capture this spillover and kill any beetles that are either emerging from harvested timber or being attracted to log decks, especially if logs will be sitting unprocessed for a long.

Having some funnel traps with Ambrosia beetle lures around mill yards can increase timber and log quality. Ambrosia beetles burrow deeply into the core of felled timber and leave unsightly dark pinholes, thus deteriorating the log quality.

6.1.13 Access

Road deactivation should be delayed if future forest health activities are anticipated in an area.

6.1.14 Delivery and Milling Restrictions

All timber infested with bark beetles must be delivered to the mill and debarked between the following time periods:

Table 11: Beetle-infested timber hauling windows

Douglas-fir	Aug 15 th to April 15 th .
Spruce	Aug 15 th to May 15 th
Lodgepole Pine	no restrictions apply

DFE The mill must be advised of the beetle infested wood. Exemption may be given to these restrictions if it is determined that these beetles have entered the tree in the present year and will not emerge until the following spring.

6.1.15 Douglas-fir Beetle-Specific Control Tactics

The following control techniques will be deployed by the Ministry's District or regional forest health program when adequate resources are available and possibly in conjunction with major licensees, BC Timber Sales (BCTS), or Small Scale Salvage (SSS) licensees.

1. Using information from detailed aerial survey, locate red attack and perform detailed ground surveys collecting data on amount of current attack.
2. Prioritize control techniques by amount of current attack and ease of access.

General Guidelines:

- a. 1-10 current attack trees:
 - deploy MCH,
 - if access is good, harvesting may be considered.
- b. >10 current attack trees:
 - harvest current attack and access trees only,
 - or MCH deployment in remote locations
- c. >100 concentrated current attack (i.e. in 1-2 ha area)
 - develop cutblock encompassing current attack trees.
 - follow up with trap trees and/or MCH outside boundary.
3. Harvested bark beetle areas should have a follow-up treatment such as MCH or trap trees before the next beetle flight to control residual beetles in stumps and slash. Stumps should be cut no higher than 30 cm. If stumps are greater than 30 cm tall, the bark should be peeled and/or MCH should be deployed.
4. Control efforts in OGMAs must be done in accordance with the Regional Biodiversity Conservation Strategy (Update #7b) and Land Use Order. The level of beetle control activity may be limited by unsuitable BMU boundaries. In such instances, 100 Mile House Natural Resource District staff should be engaged to determine whether BMU boundaries can be altered to respond appropriately.
5. Control efforts, in MDWR, must be done in accordance with the Ministry of Environment General Wildlife Measures (GAR).
6. Cutting authorities being planned by major licensees and BCTS in Douglas-fir beetle infested areas should incorporate pre-felling trees on roads and landings prior to beetle flight to concentrate beetle populations into harvest area.

7. Additional post-harvest treatments are described in the post-harvest Mop-Up and Trap Trees sections.

6.1.16 Spruce Bark Beetle-Specific Control Tactics

The following control techniques will be deployed by the ministry's district or regional forest health program when adequate resources are available and possibility in conjunction with the major licensee, BCTS or SSS. Spruce beetle typically require 2 years to develop from eggs to larvae to mature adults, with first year larvae overwintering in infested trees. Subadults emerge in the spring of the second year and reattack the lower bole. Therefore, harvesting may result in the majority of the mature beetles being left behind in stumps. Additionally, trees may not turn red for 2 years after initial infestation, so it may not be immediately apparent that all infested trees have been treated/harvested. For these reasons, mop-up treatments (usually trap trees) are extremely important when treating spruce beetle infestations. If climatic conditions allow, spruce beetle can capitalize and transition to a single year life cycle, resulting in rapid population growth.

1. Use information from detailed aerial survey to locate infestation centres and outer boundaries of infestations.
2. Control efforts in OGMAs must be done in accordance with the Regional Biodiversity Conservation Strategy (Update #7b) and Land Use Order. The level of beetle control activity may be limited by unsuitable BMU boundaries. In such instances, 100 Mile House Natural Resource District staff should be engaged to determine whether BMU boundaries can be altered to respond appropriately.
3. Where the BMU strategies are "targeted" and "reactive", the following control techniques can be utilized:

General Guidelines:

- a. Small infestation site, less than 1 hectare in size and isolated:

- The infested trees are to be removed by harvesting.
- If infested trees cannot be removed before the beetle flight the following year because of harvesting conditions, a trap tree program is to be utilized.

The above-mentioned control techniques will be deployed by the Ministry's District forest health program and possibility in conjunction with First Nations, major licensees, BCTS or SSS.

- b. Larger infestation areas, greater than 1 hectare in size:

- Harvested under a Forest Stewardship plan.
- Cutting authorities being planned by major licensees and BCTS in spruce bark beetle infestation areas require a multi-year plan and should incorporate the use of trap trees by pre-felling roads and landings along with a mop-up plan.
- Alternatively, bait with attractant semiochemicals in a grid pattern to concentrate beetle populations. Areas grid baited must be assured of harvest

within one year. Under the Forest and Range Practices Act (FRPA), FPPR Sec 41, it states that an agreement holder or a timber sales manager who uses trap trees or pheromones to concentrate insect populations must ensure that the insect brood is destroyed before the insects emerge.

- It is very important to follow up post-harvest with a trap tree program for one or two years to contain beetles coming out of stumps.

6.2 Weevils

IWW: Warren's Root Collar Weevil (*Hylobius warreni*) Pine and Spruce

IWP: Lodgepole Pine Terminal Weevil (*Pissodes terminalis*) Pine

IWS: White Pine Weevil (*Pissodes strobi*) Spruce

Weevils can cause considerable damage in young plantations, leading to degraded timber quality (terminal weevils, *Pissodes* sp.) and mortality (root collar weevil).

- increase stocking density to offset losses. *Pissodes* sp. Prefer open grown, vigorous trees, so increasing stocking may reduce stand susceptibility.
- Diversify species mix.
- Studies have shown that as duff depth increases, root collar weevil populations increase. Consider this when planting in areas of known root collar weevil presence.

6.3 Defoliators

6.3.1 IDW: Western Spruce Budworm (*Choristoneura freemani*)

As previously mentioned, this defoliator is on the increase in the 100 Mile House TSA. Western spruce budworm feeds primarily on Douglas-fir, but has been observed feeding on western larch, true firs, and occasionally spruce. The major control tactic for this pest is aerial spraying of *Bacillus thuringiensis* va. *kurstaki* (B.t.k), which is performed by the MoF. It is important that any licensees, First Nations or other stakeholders report infestations to District Stewardship Staff upon discovery in order to action the area quickly before population reproduction rates outpace control methods.

- Aerial spraying of *Bacillus thuringiensis* var. *kurstaki* (B.t.k) by the MoF
- Thinning of Douglas-fir stands can limit the food source and reproductive potential of western spruce budworm* and create an overall healthier and more resilient stand.
**Thinning in areas of active infestation can result in more harm than good. Speak with District forest health staff for more information.*
- landscape-level management of Interior Douglas-fir (IDF) stands is required to create a mosaic of different species, age classes, densities etc. that will “break up” the presence/absence of the pest’s food source, making its establishment as a damaging defoliation/mortality agent less likely.

6.3.2 IDB: Two-Year Cycle Budworm (*Choristoneura biennis*)

Two-Year Cycle Budworm remains an endemic pest of spruce forests in the 100 Mile House TSA. This insect feeds on spruce and subalpine fir, so it is present in the eastern and northeastern parts of the Natural Resource District in the SBS, ICH, and ESSF biogeoclimactic zones. There is currently no planned control or management for this pest; however, the principles for western spruce budworm generally apply – a mosaic landscape to prevent establishment. B.t.k. is an effective spot treatment as it is a bacterium that affects all lepidopterans.

6.3.3. IDT: Douglas-fir Tussock Moth (*Orgyia pseudotsugata*)

Douglas-fir tussock moth is not a common pest of the Cariboo area and is more common in the Thompson-Okanagan region; however, 2019 saw a minor outbreak of this pest up the Fraser River Valley in the Dog Creek area, and this is the furthest north this pest has ever been recorded. Regional forest health staff conduct annual monitoring programs for tussock moth in the 100 Mile House Natural Resource District; nevertheless, any instances of tussock moth found in the 100 Mile House TSA should be reported to District staff due to its irregularity. Similar to the aforementioned lepidopterans, it is susceptible to B.t.k. treatments.

Douglas-fir tussock moth larvae (caterpillars) have setae (hairlike structures) that can cause “tussockosis”, an allergic reaction that can be severe in some people. Since much of the human population is established in Douglas-fir forests, tussock moth could be considered a health risk if an epidemic were to occur in these areas, making monitoring for this pest all the more important.

6.4 Root Disease Control Tactics

DRA: Armillaria Root Disease (*Armillaria ostoyae*)

DRT: Tomentosus Root Disease (*Inonotus tomentosus*)

DRL: Laminated Root Rot (*Coniferiporia sulphurascens*)

Upon identification of root disease within areas of planned development, it is requested that interested parties contact District Stewardship staff to discuss management options.

Collaboration between proponents and District staff in planning the harvest and treatment of these stands is required to be authorized to claim appraisal allowances (stumping). Some tactics to manage for root disease include:

- Reforesting using species that are less susceptible to the root disease of concern and utilizing species mixes, including hardwoods.
- Avoiding planting adjacent to stumps. If the stump is infected, placing a new seedling directly beside it provides the fungus with fresh inoculum potential. This treatment is effective when dealing with *Tomentosus* root disease, but ineffective when dealing with *Armillaria* root disease.

- Post-harvest stumping. The ripped stumps should be replaced in the cavity they were removed from upside-down to allow the roots to dry. Any roots that break off while stumping should be dug out.
- Pushover harvesting. Additional protective armouring may be required on equipment.
- Delaying reforestation. Immediately planting post-harvest provides root disease with fresh inoculum potential.

These basic tactics have been drawn from the guidance document [Managing Root Disease in British Columbia](#). It replaces previous FPC Root Disease Guidebook (1996) and is intended to help forest professionals and practitioners navigate the challenges of operating in areas impacted by root disease by providing science-based survey and treatment options that are applied consistently across the province. Additionally, an updated and revised root disease [website](#) is also now available. Please consult these resources for further information, or contact the local District Stewardship staff for assistance.

6.5 Foliar Disease Control Tactics

6.5.1 DFE: Elytroderma Needle Cast (*Elytroderma deformans*)

Elytroderma infects lodgepole and ponderosa pine, especially near moist sites such as lowlands and near lakes. Some control tactics include:

- Clearcut harvest of all host species and subsequent slashing of understorey. This prevents the future planted stand from becoming infested.
- Avoid replanting host species near moist sites. Select non-host species for these sites.

6.5.2 DFL: Lophodermella Needle Cast (*Lophodermella concolor*)

Lophodermella is a needle cast that can infect large tracts of pine forests during wet springs and summers, with symptoms being displayed the following May/June. It can cause severe defoliation and even mortality in the event of repeated epidemics. The only strategies to manage for lophodermella is to avoid monocultures of lodgepole pine and to plant a diversity of species of preferably resistant stock wherever possible, and to promote airflow through stands by thinning or pruning (density management).

6.5.3 DFS: Dothistroma Needle Blight (*Dothistroma septosporum*)

Dothistroma, or red band needle blight, infects pine species and is similar to lophodermella by requiring moist conditions to thrive. Like lophodermella, the only strategies to manage for dothistroma is to avoid monocultures of lodgepole pine and to plant a diversity of species of preferably resistant stock wherever possible, and to promote airflow through stands by thinning or pruning (density management).

6.6 DMP: Lodgepole Pine Dwarf Mistletoe Control Tactics

The most common dwarf mistletoe found in the 100 Mile House Natural Resource District is Lodgepole Pine Dwarf Mistletoe (*Arceuthobium americanum*). Though not detected through aerial overview surveys, it is local common knowledge that mistletoe is widespread in lodgepole pine plantations and mature stands throughout the TSA. Common tactics to manage dwarf mistletoe include:

- Developing cutblocks with “clean” edges i.e. along different timber type edges that do not contain host species infected with mistletoe or roadsides. This prevents re-infection of the stand to be planted.
- Clearcut harvest of all host species and subsequent slashing of understorey. This prevents the future planted stand from becoming infested.
- Selection harvesting can open the canopy and increase the light entering the stand. Mistletoe that was latent prior to the selective cut can be “activated” and increase. If using a selection harvest system, removal of all host species is recommended and retain stems of non-host species.

The [Dwarf Mistletoe Management Guidebook](#) is available online and contains additional information and strategies to manage not only for Lodgepole Pine Dwarf Mistletoe, but other varieties of dwarf mistletoe as well.

6.7 Stem Rusts of Pine

DSC: Comandra Blister Rust (*Cronartium comandrae*)

DSS: Stalactiform Blister Rust (*Cronartium coleosporoides*)

DSG: Western Gall Rust (*Endocronartium harknesii*)

Many rust fungi require an alternate host to complete their life cycles. Comandra blister rust’s alternate host is pale comandra (*Comandra umbellata*), and stalactiform blister rust’s alternate hosts are the painbrushes (*Castilleja* sp.) and cow wheat (*Melampyrum lineare*). Western gall rust does not have an alternate host. Some control tactics to consider:

- avoid harvest in areas of known instances of rusts with alternate hosts present (where applicable). There is hazard mapping available to determine if the stand in question is at-risk
- Increase stocking to offset growth losses
- Diversify species mix. Spore transmission from alternate hosts is very short-distance, so consider this when determining spacing between pine and other species when planting

6.8 DSA: Atropellis Canker (*Atropellis piniphila*)

Atropellis canker infects pine and can be more problematic on drier sites and on stems that survive wildfire. High density stands are also at greater risk.

- Diversify species mix

- Decrease pine component when planting to reduce density. If pine is the only acceptable species, reduce stocking density to avoid spread
- Cankers tend to form on north side of the stem. If spacing, space from north to south to more easily see infested stems and select them for cutting

6.9 Abiotic Damage

6.9.1 Frost Damage

The 100 Mile House Natural Resource District is prone to late spring and early summer frosts which can be damaging to the young buds and shoots of vegetation, and can be especially damaging to freshly planted stock and seedlings. Of greatest concern is the establishment of Douglas-fir since it is very susceptible to frost damage and over half of the TSA is located in the IDFdk3 with Douglas-fir being a preferred species in the Regional Stocking Standards. Much of the IDFdk3 was impacted by wildfire (C41602 Flat Lakes in particular), and is being subjected to salvage harvesting. Some of these sites will prove difficult to reforest due to frost potential. Additionally, there is interest in increasing the amount of Douglas-fir on the landscape (not just in the IDFdk3) since it is believed to be better-suited to projected future conditions in light of climate change. Some strategies to mitigate frost hazard include:

- Stratification of more frost-prone sites for a different treatment (no harvest, different species mix etc. These areas tend to be in the low spots in rolling terrain i.e. “bowls”)
- Site preparation
- Selective harvesting (shelterwood)
- If clearcutting, include strategic retention for shelter of seedlings including stubs, slash, shrubs etc. especially for the establishment of Douglas-fir seedlings. Utilize obstacle planting as much as possible
- Nurse crops to provide insulation and protect from the “clear sky” effect

Some useful guidance can be found in the [Identification and Management of Summer Frost-prone Sites in the Cariboo Forest Region](#) handbook, as well as the [bulletin](#) of the same title.

6.9.2 Drought

Similar to frost, the 100 Mile House Natural Resource District has considerable area that is drought-prone, and these tend to be in the IDFdk3 as well. Moreover, much of this area was impacted by wildfire (C41602 Flat Lakes in particular) and is being subjected to salvage harvesting. Many of these sites will prove difficult to reforest due to drought potential. Some common tactics include:

- Stratification of harvest areas and NAR to avoid areas that should reasonably be expected to be problematic to reforest due to drought
- Site preparation that focuses on providing shade, moisture pooling, and reducing vegetative competition for water (i.e., deep-ripping)

- Migration of more drought-tolerant species where acceptable i.e. Ponderosa pine
- Using the Climate-Based Seed Transfer tool to select for seed that may be more well-adapted to drought and heat stress as well as larger planting stock. Select species based on the future conditions they may be facing, not on ease of establishment
- Selective harvesting
- If clearcutting, include strategic retention for shelter of seedlings including stubs. Utilize obstacle planting as much as possible to provide shade for seedlings during the heat of the day
- Planting as soon as possible after snowmelt in the spring to give seedlings the most time to establish before the heat of summer arrives

The [*Reforestation Dry Sites in the Thompson Okanagan Natural Resource Region*](#) handbook has recently been developed to assist in reforestation these sites. Though developed for the Thompson Okanagan Region, many of the principles outlined in this handbook are applicable to our area.

6.9.3 Wildfire

Wildfire is a forest health issue and should be considered at all planning levels. When planning development, the future potential of wildfire throughout the rotation of the stand and where that stand sits within the landscape should be accounted for to better ensure a long-term stable timber supply. Some of these principles may include:

- Plan development over a landscape scale and establish a patchy matrix of age classes, species types, density classes etc. This patchiness can break up the fuel matrix in the event of a future wildfire which may ease in suppression efforts. This includes retention and road network development. Best practice in volume-based license areas is to coordinate with other tenure holders and government to manage for fire on this large scale
- Maintain permanent access structures (mainlines) for ease of access and brush rights-of-ways at regular intervals
- Reintroduction of broadcast burning and other prescribed fire post-harvest as a site preparation and fuel reduction tool
- Select species based on the future conditions they may be facing, not on ease of establishment. Select species that are fire-resistant as well as those that are resistant to other forest health concerns in that area to avoid large-scale mortality due to outbreaks which lead to considerable dead timber on the landbase acting as a ready fuel source
- Adopt deciduous species into stocking standards to act as fire-resistant species
- Selective harvesting that minimizes fuel loading of stands
- Density management i.e., juvenile spacing and pre-commercial thinning, thinning from below, and commercial thinning.

7.0 Reporting to the Chief Forester:

In the 100 Mile House TSA, Rationale for Allowable Annual Cut (AAC) determination (page 37), the Chief Forester states: "I encourage FLNR staff to monitor whether young stands are meeting minimum stocking standards given the impact of the various forest health issues."

To fulfil the requirements of this request, the District will continue to carry out Stand Development Monitoring surveys on young stands in the TSA to determine impacts of forest health agents and will consider additional monitoring protocols such as stand health and growth monitoring (SHAGM) to collect information where necessary. As well, the District will evaluate the results of the young stand monitoring (YSM) data being collected in the 100 Mile House Timber Supply Area.

Appendix 1: 100 Mile House Natural Resource District Beetle Management Units

**Douglas-fir Beetle
(IBD)**

BMU	STRATEGY
All	Proactive

**Spruce Beetle
(IBS)**

BMU	STRATEGY
All	Proactive

**Western Balsam Bark Beetle
(IBB)**

BMU	STRATEGY
All	No Action