Kalum Forest Health Strategy 2007

For the Kalum Forest District

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1.0 INTRODUCTION

This document is an update of the Forest Health Strategy (FHS) developed in 2004 for the Kalum Forest District. This document is intended to identify forest health conditions, issues and strategies unique to the Kalum and Nass Timber Supply Areas (TSA) as well as Tree Farm Licence (TFL) 1 and TFL 41. It will further serve to guide supporting documentation for Forest Stewardship Plans, operational plans, and forest health investments by licencees, BC Timber Sales, and the Kalum Forest District through FIA funded activities.

The responsibility for the development of a District Forest Health Strategy was transferred from the Defined Forest Area Management group to the Ministry of Forest and Range (MOFR). This document fulfils the MOFR requirement to prepare a FHS for the Kalum and Nass TSAs.

The *Provincial Forest Health Implementation strategy* (Draft dated March, 2007) provides guidance for implementing a forest health program. The implementation strategy bridges higher level provincial forest health strategies and the Provincial Forest Health Program with the regional strategies for TSAs. This document provides a template for the content of the Kalum General Forest Health Strategy and describes the roles and responsibilities of the MOFR and licencees.

The mandate of the Ministry of Forests and Range regarding forest health is described in Section 4 of the Ministry of Forest Act:

(a) encourage maximum productivity of the forest and range resources;

(b) manage , protect and conserve the forest and range resources of the government , having regard to the immediate and long term economic and social benefits they

The Kalum District Forest Health Strategy follows the guiding principles that forests should be managed on an ecological basis. This principle is of great importance in the Kalum Forest District as the area contains a diversity of Biogeoclimatic zones, with exceptional species diversity as a result. The dominant zones include the Coastal Western Hemlock (CWH) and the Interior Cedar Hemlock (ICH), and there are smaller amounts of the ESSF and SBS. Thus, in the Kalum District, managing forests on an ecological basis requires the inherent species diversity of those forests to be maintained. The timber supply impacts of most forest health concerns in the Kalum can be greatly reduced, if not eliminated, by maintaining tree species diversity in managed stands.

The Kalum District Forest Health strategy is structured as follows:

1. Describe the objectives of the District *Forest Health Strategy* and specific actions necessary to meet the objectives*;*
2. Identify the known forest health factors in both the Kalum and Nass TSAs, and TFLs 1 and 41, and rank their relative importance;
3. Describe links to specific strategies and tactics that apply to those factors, and identify and justify any deviations from currently available best management practices.

Implementing a forest health strategy can augment and stabilize the timber supply of a management unit by increasing the success of regeneration practices, increasing the productivity of immature stands, and decreasing losses of mature timber. These benefits imply a reduced risk to silviculture investment and a more stable planning environment, both of which are important to the MOFR and the timber industry. In addition, ecologically appropriate forest health practices will reduce the risk of wildfire associated with widespread timber mortality, improve

public safety in multiple use areas, and lower the risk to non-timber resource values. Establishment of a proactive framework emphasizing the early detection of forest health problems and the prompt implementation of scientifically sound solutions will allow licencees and the MOFR to take full advantage of potential benefits. It will do this by ensuring that expenditures of resources are necessary, efficacious, and cost effective.

This strategy provides a framework to co-ordinate and guide forest health activities within the Kalum Forest District. The current focus of forest health activities is divided between control of pests and of abiotic factors (e.g. windthrow), and accounts for only a portion of potential activities.

A comprehensive Forest Health Strategy should incorporate the principles of "Integrated Forest Health Management" (IFHM) to effectively manage the interactions between forest practices and forest health agents impacting on resource objectives, and apply ecologically sound techniques for the protection and enhancement of resource values.

Integrated Forest Health Management is a variant of the internationally recognized approach to pest management known as Integrated Pest Management (IPM)[1]. The principles of IPM have been slightly modified within a forestry context to produce the principles of IFHM. These principles can be summed up briefly as:

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

2.0 OBJECTIVES OF THE *KALUM DISTRICT FOREST HEALTH STRATEGY* AND ACTIONS REQUIRED AT THE DISTRICT LEVEL

The objectives of the Kalum District Forest Health Strategy are inspired and taken from a March 2003 draft Provincial Forest Health Strategy. This document has not been adopted or updated; however the objectives described are entirely appropriate for the Kalum Forest District (*personal communication, A. Woods*), and will therefore continue to apply in this District FHS.

Objective 1: Maintain a detection program for damaging agents over the landbase

Kalum District Actions

a) Apply the results of the annual provincial overview survey to prioritize the location and need for detailed aerial and ground surveys within the District. As required, quantify the incidence and intensity of damaging agents to the standard in the appropriate guidebooks.
   - The most damaging forest health agent currently in the Nass TSA is Dothistroma needle blight. Low-level aerial surveys and ground-truthing have been ongoing since 2003. The aerial surveys are now proposed to be carried out every two years with the next survey scheduled for 2008.
   - The most damaging forest health agent currently in the Kalum TSA and TFL 1 is windthrow. Identification usually occurs through over view flights in the spring. Once

[1] The definitions of IPM are posted on the WLAP web site at http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/IPMdefn.htm

identified, windthrown timber is recovered when it is physically and economically accessible.

b) Maintain a record of all survey information for the landbase.
c) Standardize data collection among MOFR and licencees when and where required to facilitate strategic objectives.
d) Improve and refine detection methods in consultation with Regional Forest Health specialists.
e) Ensure forest workers, consultants and industry staff, are competent at identifying specific forest health agents. Training, both formal and informal may be obtained from Regional Forest Health specialists.

Objective 2: Assess current and future stand and landscape level hazard and risk from detected damaging agents, including the impact of forest management practices on resource values

Kalum District Actions

a) Use the best current information to determine hazard and risk and probable impacts for all detected and potential forest health agents on the land-base.
    - In the case of Dothistroma needle blight, there is a real risk of stand failure if Pl dominates the stand; however, this risk has been limited in the ICH by limiting Pl to an acceptable species (as opposed to preferred) with stocking composition limits. Refer to local stocking standards.
b) Update existing hazard and risk rating systems as new information becomes available.
c) Develop, support and implement modelling of pest dynamics and impact assessments for Timber Supply Reviews.
d) Evaluate and prescribe approaches to deal with introductions of non-native, potentially harmful organisms.

Objective 3: Identify significant pest risks to resource values and identify appropriate management strategies and tactics, while considering constraints and limitations imposed by other resource management imperatives

Kalum District Actions

a) Consider all scientifically sound, forest health management strategies and tactics. New strategies and tactics are always being developed but they **must** be reviewed by regional forest health specialists, for scientific validity before being adopted as operational practice.
b) Identify knowledge gaps that limit the ranking and assignment of priorities and hinder identifying appropriate management strategies and tactics. Notify forest managers. Licencees and contractors of emerging forest health issues as they are identified.

Objective 4: Implement mitigating strategies and tactics based on scientifically sound, forest health management practices

Kalum District Actions

a) Assign mitigating strategies where deemed appropriate (include prevention, suppression, exclusion, and eradication through either direct or indirect control tactics). Forest tenure holders to incorporate the district strategies into operational plans and actively co-operate to work towards meeting the forest health goals and objectives. Wherever economically feasible, direct harvesting efforts to meet those strategic forest health objectives.

b) Quantify the outcome of selected strategies and tactics, including doing nothing (e.g., change in quantified yields or diminished future management options). A series of permanent sample plots have been established in the Kalum and Nass TSAs to monitor forest health factors in managed stands.
   - Management efforts will primarily focus on young forests and plantations. Actions taken on over-mature forests within the District have a poor return on investment (i.e. stands over 250 years old often have poor timber quality). Therefore, without significant damage from a forest health agent (or a real risk of such damage), direct action will be limited in these over-mature forests.

c) Accelerate implementation of mitigating strategies and tactics to deal with unforeseen outbreaks of damaging agents in a timely manner.
   - The handling of the Dothistroma needle blight issue has been a good example of a mitigating strategy. The magnitude of the forest health concern was first identified in 1999, and a series of specific actions were subsequently undertaken including the development of a reforestation program for failed plantations and a revision of stocking standards, placing lodgepole pine in an acceptable rather than preferred category. Decision making management matrixes were developed in 2005 for ground and aerial survey processes. Research trials starting in 2007 are planned to assess the benefits of planting larger stock or the placement of seedling protectors in reducing the damage to seedlings caused by hares. Hare damage to underplanted seedlings in stands that have been severely impacted by Dothistroma is compromising the viability of those underplanting treatments. More information regarding Dothistroma is in section 4.0 and in the appendices.

Objective 5: Evaluate results of forest health management practices over the short and long-term and modify practices accordingly

Kalum District Actions

a) Inspect field practices to ensure forest management objectives are met.
b) Target applied research activities to support scientifically based standards of forest practice on Crown lands.
c) Bring issues of particular concern, where more research could be directed, to the attention of Regional forest health specialists.
d) Apply the results of inspections and monitoring to the development and refinement of future actions. Consider providing a tabular report summarising the status of the actions identified in the Forest Health Strategy.

For example:

ACTION	STATUS

3.0 RANKING OF IMPORTANCE OF FOREST HEALTH FACTORS

Pest species and abiotic factors are ranked according to:

1. The collective knowledge of the Regional forest health specialists, forest managers, licencees and contractors.
2. Distribution of pest and current incidence levels.
3. Known or suspected impacts to forest resource values, based on the knowledge of local forest professionals and regional forest health specialists.
4. Availability of operational detection and treatment methods.
5. Costs and benefits of applying detailed detection and treatments activities.
6. Overall level of knowledge about the hazard and risk zones.
7. Resources required to obtain missing information necessary for management of the pest.

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
- Medium: 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)

Allocation of funding and resources will be based on these rankings (Tables 1 and 2).

Table 1 – Ranking of Forest Health Factors by Potential Impact on Forest Management Activities in the Kalum TSA, TFL 1, and TFL 41

Very High	High	Medium	Low	Very Low
Diseases				
	Dothistroma needle blight	Annosus root disease Comandra blister rust Hemlock dwarf mistletoe	Rhizina root disease Stalactiform blister rust Tomentosus root disease Western gall rust Other conifer foliar diseases	Atropellis canker Fir broom rust Pine dwarf mistletoe Spruce broom rust
Insects				
	White Pine/ Spruce weevil	Mountain Pine beetle	Conifer seedling weevil Spruce bark beetle Spruce budworm Warren's root collar weevil Western blackheaded budworm Northern pitch twig moth **Western Hemlock Looper	Black army cutworm
Mammals				
		Porcupine Voles Snowshoe hares		Moose
Abiotic Factors				
	Wind	Fire Sunscald (pruned stands)	Frost Ice/ Snow/ Hail	

** approximately 535 hectares of Western Hemlock Looper infestation was identified around Kalum Lake during the 2006 aerial overview survey. This has not been confirmed by a ground survey. The impact ranking may be adjusted to medium if this forest health factor infestation is confirmed and increases in subsequent surveys.

Table 2 – Ranking of Forest Health Factors by Potential Impact on Forest Management Activities in the Nass TSA

Very High	High	Medium	Low	Very Low
Diseases				
Dothistroma needle blight	Tomentosus root disease	Hemlock dwarf mistletoe Wood decay fungi Hard pine rusts	Hardwood foliar diseases Pine dwarf mistletoe Rhizina root disease Other conifer foliar diseases	
Insects				
	Spruce beetle Western balsam bark beetle	Other insect defoliators Mountain pine beetle Western Hemlock Looper	Northern pitch twig moth Spruce weevil Warren's root collar weevil	Eriophyid mites
Mammals				
		Snowshoe hares	Voles Other grazing mammals	
Abiotic Factors				
		Fire Wind	Frost Ice/ Snow/ Hail	Sunscald

4.0 STRATEGIES AND TACTICS

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

Current Status: Provides a one-word description of the current state of the Forest Health Factor (FHF) in the Kalum Forest 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 focussed 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)

Tactics: Describes the planned tactic in just a few words.

A discussion of the Forest Health Factor then provides more information.

4.1 DISEASES

Dothistroma Needle Blight (*Mycosphaerella pini*)

Current Status: Outbreak
Management Strategy: Indirect Action
Tactics: Underplanting of resistant species

Dothistroma is currently the most important forest health issue in the Interior Cedar-Hemlock (ICH) biogeoclimatic zone. The Dothistroma needle blight outbreak in northwest BC began in 1999 and continues today, and is the largest and most severe outbreak to date in this province. The Dothistroma needle blight epidemic has developed rapidly and the severity and extent of the damage was not predicted. The outbreak is predominantly in the Kispiox TSA, but there are significant areas within the Nass TSA as well as well as pine-leading stands in the Kalum TSA and TFL 1. Dothistroma needle blight has also been found in pine-leading stands in the Coastal Western Hemlock biogeoclimatic zone in the Kispiox, Kalum, and Nass TSAs.

Aerial overview surveys in 2006 indicated over a two-fold increase in areas infected from the 2005 surveys. This is attributed to above normal precipitation levels in the summer of 2005.

The majority of the recent infections were of severe intensity (82%) and the remaining light intensity (18%). Subsequent detailed aerial surveys using helicopters at lower elevations were

conducted targeting primarily managed stands. Aerial surveys are planned to be conducted every two years. These surveys indicate a more widespread affected area than the aerial overview survey at approximately 4700 hectares. Of this area one-third were severely damaged.

Underplanting of severely infected stands occurred in 2002 and 2003. High mortality of the seedlings due to snowshoe hares curtailed further operational planting. Trials have been set up to study the hare damage to underplanted seedlings. In 2007 18,000 trees will be planted with larger stock to assess resistance to hare damage. This trial will also investigate the application of seedling protectors to 1+0 stock.

Due to its unforeseen nature there were previously no strategies or tactics in place to deal with Dothistroma needle blight. However, management strategies have now been developed: for example, lodgepole pine is no longer considered a preferred species for management in the Interior Cedar Hemlock and Coastal Western Hemlock zone. Action plans through the Dothistroma steering committee have been developed and are being implemented within the Kispiox, Nass and Kalum TSAs. The primary strategies include continued monitoring of infestations, trials to develop strategies on reducing hare damage to underplanted shade tolerant seedlings, replanting of sites that are NSR with other species.

Provincial funding of the Dothistroma Reforestation Project for 2007/2008 totals $318, 000. The project covers the sowing of seedlings, planting, and both aerial and ground surveys. Funding for this project has been applied for under the FIA Dothistroma Program.

Decision making matrixes for both ground and aerial survey processes have been developed and are attached in appendix A

Tomentosus Root Disease (*Inonotus tomentosus*)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Overview flights, Silviculture surveys

Tomentosus root disease is one of the most damaging diseases of spruce in the northwest. The annual volume loss due to Tomentosus in mature spruce-leading stands can be significant. Although the BC MOFR inventory appears to account for the mature volume loss in its yield model VDYP, this volume loss estimate illustrates the potential for increased stand productivity if Tomentosus root disease is proactively managed.

Ten stem-mapped plots have been established in 25-30 year old plantations within the Kispiox TSA, to monitor the development of Tomentosus root disease and to provide opportunities to model the behaviour of the disease. This applied research, which has been targeted at a specific disease concern for a different TSA, may have application in portions of the Kalum District. The plots were re-measured in 2006 with analysis of this data to occur over the next year.

The impact of Tomentosus root disease on the productivity of second growth stands is being investigated by Alex Woods, BC Ministry of Forests Regional Forest Pathologist and Fred Peet of the Pacific Forestry Centre. It is hoped that through this collaboration more accurate Operational Adjustment Factors (OAFs) for root disease may be developed.

Where treatments to manage Tomentosus are called for, the strategies and tactics for this root disease differ sufficiently from the FPC Root Disease Management Guidebook to justify their description in Appendix 3 to this Forest Health Strategy.

Annosus Root Disease (Heterobasidion annosum)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Silviculture Surveys

Considering that the major crop tree species in the Kalum Forest District are also the most susceptible to Annosus root disease, this is potentially an important forest health factor. To date, the extent of Annosus infections in the Kalum Forest District has been limited, but there is a real potential for increased presence, particularly when commercial thinning in second growth becomes more common. Losses from this forest health factor are considered minor at this time (*personal communication A. Woods Regional Pathologist NIFR April 2007)*

Five stem mapped 50 x 50m permanent sample plots (PSPs) have been established to monitor the spread and intensification of Annosus root disease in the Kitimat Valley. Four of the plots were randomly located while the 5th plot was located in an area previously known to contain Annosus infested trees. The PSPs were re-measured in 2004 and the data will be analysed in the upcoming year. These plots will, over time, provide more accurate assessments of the risks associated with Annosus root disease in managed stands of the Kalum.

The current strategy is to monitor the established stem mapped PSPs and several plantations in the Kitimat valley, and take a "wait and see" approach to determine if this root disease will stay at an endemic level. For plantations that are known to have Annosus infections, roadside buffers can be established when spacing, as woody debris in the road bed is a potential infection center.

Wood Decay Fungi

Echinodontium tinctorium (Indian paint fungus), ***Phellinus pini*** (Red ring rot)***, Phaeolus schweinitzii*** (Schweinitzii butt rot), ***Stereum sanguinolentum*** (Red heart fungus)

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

Wood decay fungi are an important forest health factor in the Kalum Forest District due primarily to the abundance of over-mature western hemlock and true firs. A thorough review of the decay waste and breakage factors for the District could have significant implications for timber supply forecasts. When mature forests are harvested, the resulting plantations and second growth forests are more vigorous and generally not susceptible to wood decay fungi unless stressed or damaged by some other agent.

Pruning provides an opportunity for wound invasion by *Stereum sanguinolentum* - a wound invading sap and heart rot. This opportunity may be enhanced by the effect of sunscald on a recently pruned stand. Maintaining untreated buffers along openings and roads, particularly on south and west aspects, may reduce the incidence of infection by reducing sunscald.

Hardwood Foliar Diseases

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

Poplar and Willow (*Cryptorhynchus lapathi)* borer caused heavy damage to willow along the highway 16 corridor between Terrace and Smithers. Mortality caused by this introduced pests has been high, particularly in stems below 12 cm dbh. Homeowners have lost decorative trees and there is a concern that the loss of willow will affect wildlife cover.

Black cottonwood and aspen trees are being repeatedly attacked by *Venturia populina* (Aspen and poplar shoot blight) throughout the valley bottoms of the southern portions of the Kispiox TSA with peak damage occurring in 2002. The 2005 & 2006 aerial overview for both the Kalum and Kispiox Districts did not detect any damage as it is assumed that levels were endemic or too low. There were previously identified areas of infestation of *V. poplin* within TFL 41 (near the mouth of Wahoo Creek, and on the east side of Hawkesbury Island), and one area in the Kitlope Nature Conservancy near the back end of the Tsaytis River. While this disease has also been noted in the Nass TSA over the years, no evidence of it was found in the 2006 survey. Although this and other hardwood foliar disease species are not currently being managed, the presence of foliar diseases and possible climate change could impose a constraint on any future management.

Rhizina Root Disease (*Rhizina undulata*)

Current Status: Declining
Management Strategy: Passive Monitoring
Tactics: Silviculture surveys

Rhizina root disease was a concern for forest managers in the mid-1980's. The risk of plantation failures due to Rhizina root disease have all but disappeared due to broadcast burning no longer being prescribed for site preparation.

Other Conifer Foliar Diseases

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Overview flights

The example of Dothistroma needle blight in lodgepole pine should be seen as a warning of the potential risk that foliar diseases may pose, particularly when species diversity is not maintained. This risk may well intensify given current predictions of climate change. Other conifer foliar diseases of note in the Kalum Forest District are *Lirula macrospora* (Spruce needle cast) and *Rhizosphaera kaukhoffii* (no common name) on spruce, and *Delfinella abietis* (no common name) and *Pucciniastrum epilobii* (fir fireweed rust) on true firs. These foliar diseases have been found throughout the Nass and Kalum TSAs, as well as in TFL 1 and TFL 41, and should continue to be monitored.

Western Hemlock Dwarf Mistletoe (*Arceuthobium tsugense*)

Current Status: Endemic
Management Strategy: Indirect Action
Tactics: Planting prescriptions; Silviculture treatment

Western hemlock dwarf mistletoe is found throughout the Kalum Forest District. This parasitic organism requires a live host, and therefore does not normally cause mortality. Damage from

windthrow due to reduced vigour and weakening of the bole is a more common issue with mistletoe.

Reductions in growth rate due to mistletoe can lead to significant volume losses on the landscape. Although the BC MOFR inventory appears to account for the mature volume loss in its yield model VDYP, this volume loss estimate illustrates the potential for increased stand productivity if mistletoe is proactively managed.

Partial cutting of highly infested stands, whether it is commercial thinning or any variety of mature stand partial harvest, can increase the risk of losses due to mistletoe.

The primary strategies to deal with hemlock dwarf mistletoe are avoidance planting; alternate species selection near highly infested stands; and removal of potentially infected understory of western hemlock following harvesting (i.e. knock-down of infested advanced regeneration from stands where extensive mistletoe has been identified). In stands where high levels of hemlock dwarf mistletoe have been identified, partial cutting should not be prescribed unless it is required to meet other important management objectives.

Hard pine rusts

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

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

Hard pine rusts were of very minor concern prior to the discovery of Dothistroma needle blight. Now that Dothistroma needle blight has completely changed the way we manage lodgepole pine, rusts are of little concern. However, it is still worthwhile to note that these rusts may become opportunistic on stands already weakened by other forest health factors (e.g. Dothistroma). Comandra blister rust has been observed in the Lavender Creek area (Nass TSA, Kinskuch River area) and is more of a concern in the Nass TSA in stands where pine is the leading species.

4.2 INSECTS

Spruce beetle (Dendroctonus rufipennis)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Overview flights

There are some stands of spruce susceptible to attack by spruce beetle in the Nass TSA, and to a limited amount in the Kalum TSA, TFL 1, and TFL 41. The 2006 aerial overview did not identify any current areas of infestations. Due to the small areas at risk, any pockets of infestation that are noted in further overview flights will be dealt with on a site-specific basis.

Western balsam bark beetle (*Dryocoetes confusus*)

Current Status: Endemic
Management Strategy: Passive Monitoring

Tactics: Overview flights

There are large areas of subalpine fir leading forest stands, particularly in the Nass TSA, that are susceptible to the western balsam bark beetle (IBB). The 2006 aerial overview survey conducted by the MOFR identified relatively low levels of attack of 5% infestation on approximately 16,000 hectares. Given that most of the sites infested are inaccessible and very small and the attack dynamics of this insect do not lend themselves to direct control action, no direct strategies will be developed to deal with this forest health factor at this time.

Green-striped Forest Looper (*Melanolophia imitata)* and Western Hemlock Looper *(Lambdina fiscellaria lugubrosa)*

Current Status: Declining
Management Strategy: Passive Monitoring
Tactics: Overview flights

There are large areas of hemlock and subalpine fir forest stands in the Nass TSA that have been attacked by the green-striped forest looper. The western hemlock looper has been active on TFL 41 in the past. However, the attack dynamics of these insects do not lend themselves to direct action other than salvage of dying/ damaged stands, and logging of susceptible stands where they are reasonably accessible. Unfortunately, the economics of the infestation areas (high development and transportation costs coupled with very poor timber quality) has limited this action. The current strategy has been to allow the looper populations to run their course through the outbreak, and crash. The 2006 Aerial Overview survey identified a potential outbreak of western looper around Kalum Lake (553 ha). Ground confirmation was not possible due to inaccessibility. The aerial survey did not note any new outbreaks of green-striped looper.

Various Insect Defoliators
Spruce budworm (*Choristoneura* spp.); Western black-headed budworm (*Acleris gloverana*)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Overview flights

There are several defoliating insects that are considered low priority forest health factors. These insects tend to be cyclic, and populations can rise to damaging levels in some years. It is important to report any defoliation as early as possible, as these outbreaks are usually of short duration, and damaged timber may be priorized for harvest. No current defoliation was recorded in 2006.

Mountain pine beetle (*Dendroctonus ponderosae*)

Current Status: Endemic
Management Strategy: Active Monitoring
Tactics: Direct Action

Overview surveys have identified 58 hectares of trace intensity mortality around 112 km on highway 37 north. This area was previously identified in 2005 and was ground surveyed again in

March 2007 to determine the extent of the infestation spread. The infestation is being assessed to determine if any control action should be undertaken.

The infestation in the Copper River valley that was identified in 2004 and had control action taken in 2005 has been ground surveyed again in March 2007 to determine the success of the previous years' fall and burn program and to map any infestation spread. Approximately 50 current attack trees were identified. A fall and burn program is scheduled for April 2007.

An additional small MPB infestation has been identified in the Kemano area. This infestation is isolated and in very difficult terrain as well as the majority of the susceptible pine has been attacked and there is little chance the MPB population will continue to grow. Monitoring of this infestation will continue (*personal communication, S. Hicks, MOFR, March 2007*)

Due to the relatively small volume of susceptible lodgepole pine within both the Kalum and Nass TSAs and TFL 1, mountain pine beetle is not considered to be a major concern from a timber supply perspective, but is a concern in populated areas such as Jack Pine Flats and Rosswood. The direct control action being taken in the Copper is to prevent the spread of MPB into the Jack Pine Flats area. At this time no site-specific Beetle Management Unit strategies for the mountain pine beetle have been put in place: instead, small infestations that occur within susceptible timber types are being dealt with using the guidelines laid out in the Bark Beetle Management Guidebooks. It remains unclear what effect the Dothistroma needle blight will have on the resistance of pine stands to attack from the MPB.

Warren's root collar weevil (*Hylobius warreni*)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Silviculture surveys

This insect is considered a low priority forest health issue in plantations of pine and spruce. The incidence of this weevil in some plantations can be quite high, but overall mortality is usually less than 5%, and the impact from this pest declines with diameter growth of the crop trees. The use of mixed species in planting will reduce the damage from this insect.

Spruce weevil (*Pissodes strobi*)

Current Status: Endemic
Management Strategy: Indirect Action
Tactics: Stocking standards

Spruce weevil is an insect that will repeatedly attack and kill 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. While this insect is found throughout the Kalum Forest District, it is worth noting that there are isolated valleys within TFL 41 that have no evidence of spruce weevil. The best method of dealing with this insect is to ensure that there is a good species mix on the site, if possible. This is reflected in the stocking standards by restricting the spruce content for high hazard sites.

Northern pitch twig moth (*Petrova albicapitana*)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Overview flights

This insect can cause damage at some level in lodgepole pine plantations, but more work needs to be done on its impacts. Information on impacts from the re-measurement of damage assessment plots in the Kalum District indicates that the attacks occur primarily on the tips of branches and that the leader is not commonly attacked. It appears that the growth loss from the attack is minimal *(personal communication K White NIFR Entomologist April 2007*)

Eriophyid mites (Trisetacus campnodus)

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

These mites are considered a very low priority, but can cause fairly significant damage in some lodgepole pine plantations. There are currently no direct control measures available for this mite, but monitoring their incidence should be continued.

4.3 MAMMALS

Snowshoe Hare

Current Status: Building
Management Strategy: Indirect Action
Tactics: Assess various management techniques

Increasing snowshoe hare populations have impacted the success of the reforestation efforts on stands where dothistroma has caused significant mortality. Where underplanting has been carried out with alternative species to re-stock a stand devastated from dothistroma, the hare population have caused significant mortality to the newly planted seedlings. The habitat created by an increase in underbrush along with a dead and dying overstory of pine is an ideal situation for hares. In the Skeena Stikine Forest District, planting efforts have been put on hold until a method of protection can be afforded to the seedlings. Trials are planned for the 2007 and 2008 seasons to evaluate the resistance of larger stock to hare predation and the use of seedling protectors on smaller 1+0 stock. The timing of planting in the spring may also aid in the overall survival rate of planted seedlings *(personal communication, L. Tromp MoFR, March 2007).*

Vole (*Microtus spp*)

Current Status: Declining
Management Strategy: Active Monitoring
Tactics: Regeneration surveys

This small rodent can cause significant losses in young plantations as they eat the bark of seedlings, effectively girdling them. There have been numerous studies on the population dynamics, feeding preferences, and measures to control this pest; currently, effective controls are lacking. Control is carried out by population monitoring, planting of non-preferred species,

spraying predator odours near planted trees, and in extreme cases, providing alternate food sources. Additional strategies that could be reviewed are spring planting after leaf-out, and variations in stock types. Browse protectors have been tried, but a monitoring trial found them to be ineffective. There has been some noted vole activity in recent years in the Nass TSA, and little to none in the Kalum TSA. Populations will continue to be monitored through silvicultural surveys.

Porcupine (*Erithizon dorsatum*)

Current Status: Declining
Management Strategy: Passive Monitoring
Tactics: Silviculture surveys

Porcupines are similar to voles in that they can cause significant plantation failures through girdling of stems as they graze on the live bark. The difference is that porcupines prefer to graze on young trees in plantations from 10 – 25 years old, so the damage in terms of lost silviculture investment is that much greater. Control measures are limited, and consist primarily of preventing access by stem collaring, or by predator-odour. Porcupines have caused considerable damage in the past to second growth stands in the Kalum valley, but there was a significant drop in populations caused possibly by changes in habitat, and the re-colonization of natural predators (*personal communication, K Haworth RPF March 2007*). No new areas of recent damage were noted during the 2006 aerial overview survey.

Other Mammal Pests (Squirrel, Deer, Moose)

Current Status: Endemic
Management Strategy: Passive Monitoring
Tactics: Silviculture Surveys

Squirrel and deer populations, and the potential damage their feeding can cause, are cyclical: natural predation will generally control the population before human strategies can be enacted.

Strategies to maintain moose winter range have been identified in the Kalum Land and Resource Management Plan. 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.

4.4 ABIOTIC FOREST HEALTH FACTORS

Windthrow

Current Status: Endemic
Management Strategy: Passive Monitoring; Indirect Action
Tactics: Overview flights; Block design; Salvage

Overall, damage as a result of wind can cause significant forest loss in the Kalum TSA and TFL 1, and to a lesser extent on TFL 41. This is primarily due to two reasons. First, the TSA and TFLs are dominated by old decadent stands that have a significant component of hemlock, which is a shallow-rooted species. Second, the geography of the area consists of many narrow valleys that drain cold air from icefields or the interior plateaus, and flow into seven major drainages

(Nass, Kalum, Skeena, Copper, Kitimat, Kildala, and Kemano): 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, overview information on new patches of windthrow is gathered, and windthrown areas are evaluated for salvage potential. Wherever reasonable, windthrown timber is salvaged within several years of discovery so that damage due to decay or wood-boring insects (e.g. ambrosia beetles) is limited.

Fire

Current Status: Endemic
Management Strategy: Indirect Action; Direct Action when it occurs
Tactics: Fire Prevention Plans; Firefighting

In recent history, fire has not been a major concern in the Kalum Forest District. Nonetheless, fire has the greatest potential to damage the most forest area in the shortest time. Due to this fact, internal fire response plans are prepared by all forest licencees and the Ministry of Forests and Range. These documents address details of fire prevention and management.

Frost

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

Frost damage results from unseasonably cold temperatures that occur while buds have not yet hardened in the fall, or while buds are flushing, in the spring. Frost damage may also occur in cold air drainages and ponding areas, where crop trees may be impacted by unseasonable temperatures during the growing season. Planting of hardier species can be considered where these areas are identified. This is generally not a major factor as long as seedlings are planted within their provenance range.

Ice/ Snow/ Hail

Current Status: Endemic
Management Strategy: Indirect Action
Tactics: Brushing

Ice (freezing rain), snow press, or hailstorms generally will not cause death, but they can cause plantation failure by physically damaging seedlings or young trees to the point where their form is significantly affected and they will not grow into viable crop trees. Of the three, snow press is the most likely damaging agent in the Kalum Forest District, particularly on brushy sites dominated with fireweed: in the winter, the dead fireweed lays down and forms a mat that the snow then presses down on, often breaking the leaders of seedlings/ young saplings. The main

control measure for this issue is brushing treatments where the combination of snow pack and fireweed is considered to be a risk.

Sunscald

Current Status: Endemic
Management Strategy: Do nothing
Tactics: N/A

On unseasonably warm days, when there is enough snowpack or standing water to reflect the bright sun onto the underside of trees, sunscald can result. Sunscald can also cause damage in pruned stands and commercially thinned stands particularly in western hemlock and amabilis fir. An assessment of sunscald damage on these stands is planned (*personal communication, A Woods, NIFR Pathologist, April 2007*). The results of such a study could have implications for management strategies for this damage agent. Generally, sunscald has not been a major factor in the Kalum Forest District. The current treatment consists of ensuring seedlings are planted within their provenance range. Adjusting the timing of pruning, spacing, or brushing could also be considered if an area is determined to be at risk of sunscald. Providing untreated buffers along roadways and openings on stand tending treatments will reduce sunscald and the potential impact of weakened trees being invaded by other forest health factors

5.0 CONCLUSION

This Forest Health Strategy provides strategic direction for the licencees and Ministry of Forests in the Kalum Forest District. Specific practices conducted by each licencee should fall within the strategic direction provided within this document.

Periodic review of the Forest Health Strategy will allow adaptive management principles to be used. While the current focus of the Forest Health Strategy is on Dothistroma, the plan to conduct reviews on an annual basis will ensure forest managers regularly turn their minds to other potential sources of damage or risk to the forest.

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.

Forest managers will need to evaluate stocking standards that will develop genetically diverse forests of mixed species that will be healthier and less susceptible to the infection and spread of forest health factors. For example this may require looking at longer regeneration delay periods in the Nass TSA that will promote natural regeneration of mixed forests from a genetically diverse population.

The effects of promoting and limiting reforestation to a few species and the risks to forest health and timber supply are apparent with the Dothistroma outbreak in the northwest, and the spruce weevil infestations on spruce plantations. The effects of the Mountain Pine Beetle on the mature forests of the central Interior and the subsequent spin-off to previously thought unsusceptible age classes of lodgepole pine are having significant impacts on timber supply that is not yet fully understood.

The active co-operation of licencees and the MOFR in 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.

APPENDICES

APPENDIX 1: Sources of Information

APPENDIX 2: Dothistroma Decision Making Matrices: Ground and Aerial Survey Decision-making processes (2005)

APPENDIX 3: Tomentosus Root Disease Management

APPENDIX 1: SOURCES OF INFORMATION

1. *2006 Summary of Forest Health Conditions in British Columbia*. BC Ministry of Forests, 2006; website (website accessed March 2007): http://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/2006/Aer_OV_final.pdf
2. *Common Tree Diseases of British Columbia (Web version).* Canadian Forest Service – Pacific Forestry Center website (website accessed March 2007): http://www.pfc.cfs.nrcan.gc.ca/diseases/CTD/index_e.html
3. *Forest Health Network Archives - Pest Data for British Columbia.* Canadian Forest Service – Pacific Forestry Center website (website accessed March 2007):http://www.pfc.cfs.nrcan.gc.ca/entomology/pests/index_e.html
4. *Forest Health Aerial Overview Survey website*. Forest Practices Branch, BC Ministry of Forests; website (website accessed March 2007): http://www.for.gov.bc.ca/hfp/health/overview/overview.htm
5. *Forest Health Studies and Trials - Summary (Kalum TFL 1)*. Forest Investment Account, 2003
6. *Forest Health Studies and Trials - Summary (Kispiox TSA)*. Forest Investment Account, 2003
7. *Forest Pest Leaflets (Nos. 3, 4, 7, 13, 17, 21, 22, 24, 25, 37, 43, 44, 55, 56, 59, 64, 69, 72, 76, 77)*. Forest Insect & Disease Survey, Pacific Forestry Centre, 1991- 1997
8. *Forest Practices Code Act of BC* Guidebooks; BC Ministry of Forests; website (Sept 2003): http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/guidetoc.htm
   - Generic Forest Surveys Guidebook (2001)
   - Defoliator Management Guidebook (1995)
   - Pine Stem Rust Management Guidebook (1996)
   - Root Disease Management Guidebook (1995)
   - Tree Wounding and Decay Guidebook (1997)
9. *Impact of Porcupine Feeding Damage on Intensive Forest Management in the Prince Rupert Forest Region: Problem Analysis*. Sullivan, T.P., and C. Cheng; Applied Mammal Research Institute, 1989
10. *Inventory of Forest Health Projects (Nass TSA)*. Misty River Forest Consulting, Forest Investment Account, 2003
11. *Key to Injury of Conifer Trees by Wildlife in British Columbia*. Harested, A.S., F.L. Bunnell, T.P. Sullivan, and L. Andrusiak; Research Branch, BC Ministry of Forests, 1986
12. *Kispiox Forest Health Strategy*, Prince Rupert Forest Region, BC Ministry of Forests; website (website accessed March 2007Sept): http://www.for.gov.bc.ca/hfp/dfam-website/resources/Kispiox%20FH%20Strategy31.pdf
13. *Provincial Forest Health Strategy (unpublished draft, version 7).* Woods, A., K. White (with input from others), Prince Rupert Forest Region; BC Ministry of Forests, 2003
14. *Vole Monitoring in the Terrace and Pemberton Areas*. Applied Ecosystem Management, undated
15. *TSA Forest Health Strategy Template* http://www.for.gov.bc.ca/hfp/health/fhdata/TSA_strategy.htm

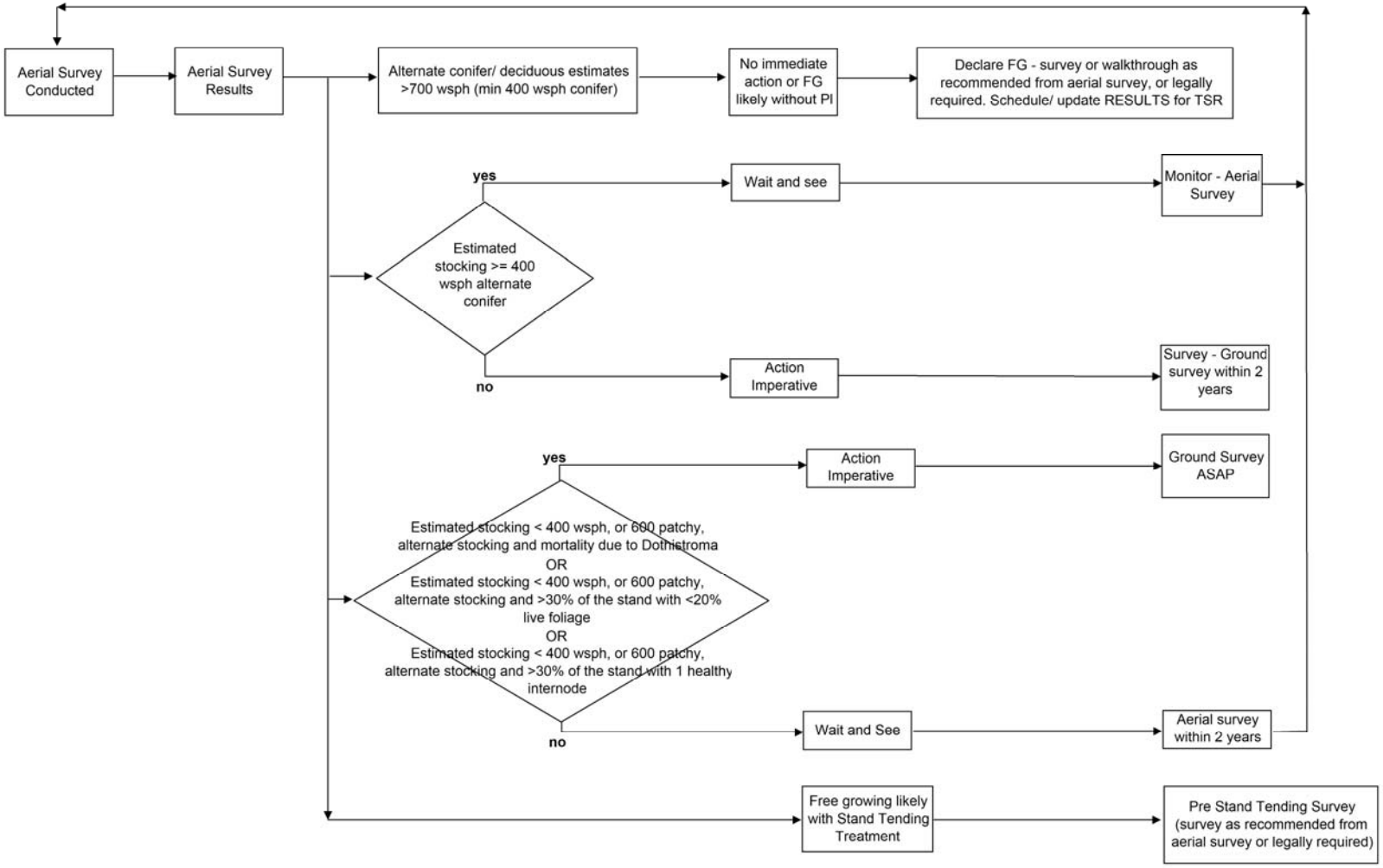
16. *BC Ministry of Forests and Range 2007b Forest Health Program*
17. *BC Ministry of Forests and Range March 2007 Forest Health Implementation Strategy*
18. Woods A. Regional Pathologist NIFR Ministry of Forests and Range
19. White K. Regional Entomologist NIFR Ministry of Forests and Range
20. Ebata T. Forest Health Project Specialist Ministry of Forests and Range, Victoria
21. Corstanje J. BCTS Silviculturist Skeena Business Unit
22. Hana P. Silverwood Consulting, Terrace
23. Haworth K. Kingfisher Consulting , Terrace
24. Fekete W. Resource Manager Nisga Lisims Government
25. Hicks S. Stewardship Officer MOFR Kalum District
26. Tromp L. MOFR Skeena Stikine District
27. *Bennett J. Cypress Consulting , Terr*ace

APPENDIX 2: DOTHISTROMA DECISION MAKING MATRICES

Aerial Survey Process (2005)

Ground Survey Process (2005)

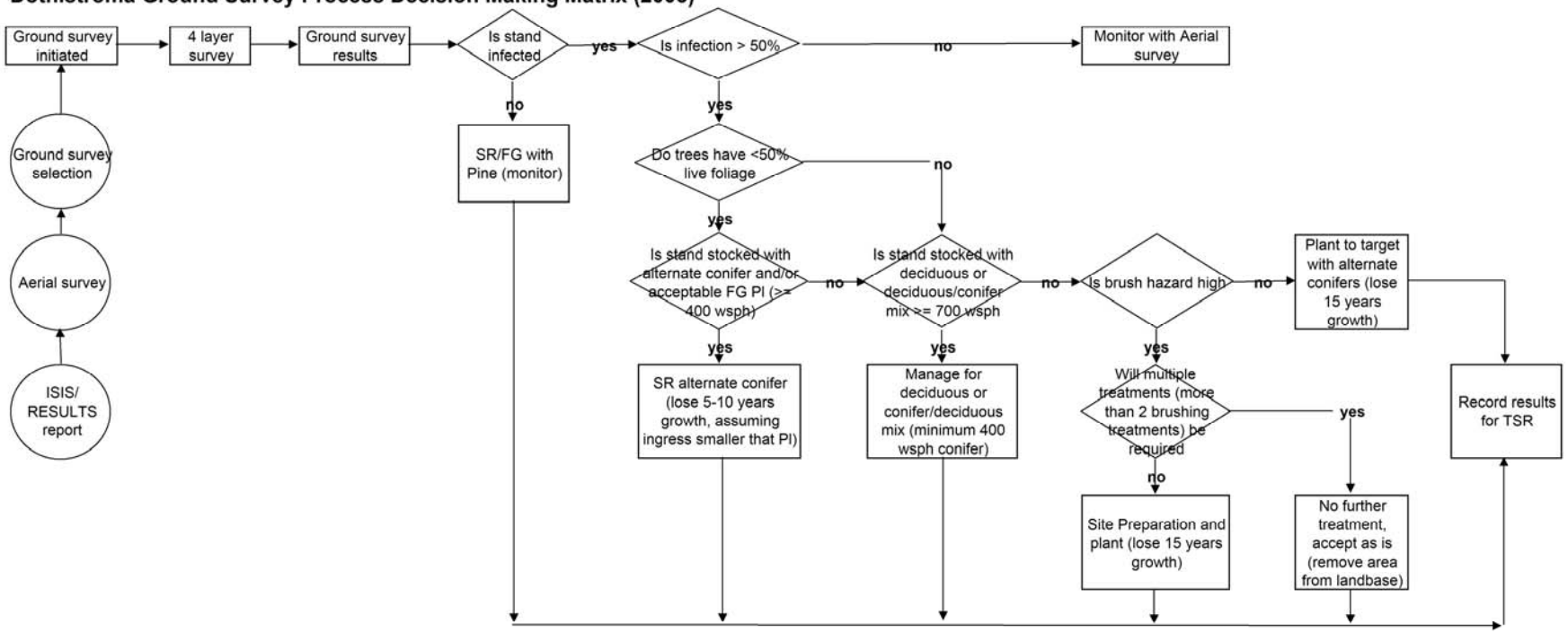
Dothistroma Aerial Survey Process Decision Making Matrix (2005)



Comments:

1) Aerial survey was conducted on all obligations including MoF, BCTS, Licensee and Nisga'a Lands
2) All Aerial Surveys were done in 2002 for the Kispiox/ Cranberry TSA and a small portion of Nass TSA, covering only ICH Biogeoclimatic Zone
3) Aerial Sureveys were done in 2003 for the nass and Kalum TSA covering ICH and CWH Biogeoclimatic Zone
4) Aerial surveys were done n 2004 for the Cranberry/ Kispiox and Bulkley TSAs covering the ICH and CWH
5) Assessed areas must be > 2 ha
6) Ground Surveys may include 1 plot/ha to 1 plot/strata (i.e. walk thru)

Dothistroma Ground Survey Process Decision Making Matrix (2005)



Comments:

1) Ground Surveys have been conducted on priority area identified in the Aerial Survey as Action Imperative between 2002 and 2003
2) Ground Survey Standards have been evolving since 2002 and information gathered is inconsistent at times
   (i.e. pine information was not always gathered)
3) Current standards involve a multi-layer survey consisting of 4 layers, described as follows:
   - I1 - Inventory label with Pine
   - I2 - Inventory label without Pine
   - S1 - Silviculture layer with Pine
   - S2 - Silviculture layer without Pine
   - S3 - Deciduous layer
   - S3a - Deciduous layer including coppice
   - S4 - Conifer/Deciduous mixed layer
4) Brushing and staking equal one treatment
5) Area must be greater than 2 ha to assess for Dothistroma
6) Defoliation must be caused by Dothistroma

APPENDIX 3: TOMENTOSUS ROOT DISEASE MANAGEMENT

Tomentosus Root Disease Detection

A large proportion of spruce-leading mature stands in the ICH zone either contain some Tomentosus, or are at risk of infection. Tomentosus is less prevalent outside of the ICH zone. Therefore, in the ICH zone within the Kalum Forest District, it is safe to assume that if spruce is a leading tree crop species, tomentosus will be present. Fallen spruce trees with small root wads and a honeycomb like pattern visible on the cross section of broken roots is a positive sign of disease.

Post Harvest Stump-Top Survey

Stump-top surveys are only suggested for use when spruce is the preferred species for regenerating a site. Stump-top surveys involve the identification of infected stumps and the marking of these stumps with highly visible persistent paint (timber marking paint). Stump-top surveys should be conducted as soon as possible following harvest. Tomentosus root disease produces a bright brick-red stain in spruce, which sharply contrasts with the healthy cream-white wood. Unfortunately, this stain typically remains visible for only 3 weeks once exposed to sunlight. If stump-top surveys are conducted immediately after harvesting of infested stands, the identification of infected stumps is much easier. If this is not possible, signs of the disease can still be relatively easily identified as Tomentosus root disease leaves a honeycomb-like pattern of decay. The use of feller-bunchers for harvesting leads to rougher stump top surfaces, making the disease more difficult to detect. For openings harvested with feller-bunchers, a sharp axe may be required to chop into the stump top to find evidence of the stain or decay pattern of Tomentosus. To minimize future risk, stump-top surveys should consist of a complete census of all spruce stumps in an opening. If this level of confidence is not required, transect surveys as outlined in the Root Disease Management Guidebook may be used.

Option 1: Reforesting with Non-Host Species

By planting western hemlock, true firs, or western redcedar the probability of the disease continuing to survive on the site is greatly reduced. This is the most economical option in the short term. No further surveys for the disease are required under this option.

Option 2: Inoculum Avoidance Planting with Spruce

Root contacts are believed to be the most important means of spread for Tomentosus root disease. By avoiding planting spruce seedlings near infected spruce stumps, the disease is managed and the site can be reforested with the productive timber species. The location of the disease-infected stumps must be determined prior to planting (see Stump-Top survey). By marking infected stumps with timber marking paint prior to planting, the licensee can help ensure that spruce is not planted within close proximity (3m) of infected spruce stumps. Mixed-bag planting with spruce and a Tomentosus resistant species suitable for the site can then be used to reforest these sites.

Option 3: Inoculum Removal at the time of Site Preparation

This option should be used when there is enough debris left on the site that mechanical site prep is required. A stump-top survey is required. This treatment uses an excavator, preferably with a 'thumb' attachment, to conduct the site prep/stumping operation. With the infected stumps identified with timber marking paint, the equipment operator can clearly see which stumps require removal. The machine operator pulls the infected stumps and inverts them in place. This management option minimizes the future risk of Tomentosus root disease and allows the forest manager to plant spruce in a manner that maximizes the productivity of the site. This option should only be used on sites suitable for stumping (i.e., slopes <35% and medium to coarse textured soils). Refer to the Root Disease Management Guidebook for more details.

Option 4: Ignore the presence of the disease (Do Nothing)

This option maximizes the risk of Tomentosus root disease potentially causing significant losses to future site productivity. This option also maximizes the licensees probability of failing to achieve a Free Growing declaration on an opening. If this option is chosen, the Ministry must ensure that the Free Growing Damage Criteria are strictly followed. The criteria state that for every well spaced infected tree or stump found in a 3.99m radius plot, two healthy, well spaced susceptible trees will be subtracted from the plot total. If the site has a high incidence of Tomentosus and spruce has been planted and there is little ingress of other Tomentosus resistant species, this option poses a very high risk of not meeting Free Growing.