

Strategic Douglas-fir Bark Beetle Management Plan Cariboo Region

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1.0 Introduction

The Cariboo Forest Region (CFR) is comprised of three Resource Districts and Timber Supply Areas (TSA): Quesnel (Quesnel TSA), 100 Mile House (100 Mile House TSA), and Cariboo-Chilcotin (Williams Lake TSA). The CFR contains 8.2 million hectares of which approximately 5.6 million are managed for timber.

The major bark beetle species currently causing significant damage to forests in the CFR is the Douglas-fir beetle (*Dendroctonus pseudotsugae* Hopk. (IBD)), which periodically reaches outbreak levels in susceptible Douglas-fir forests across the province. During outbreaks IBD can kill large numbers of apparently healthy trees over extensive areas, preferentially attacking large diameter, mature and overmature trees; however, smaller trees may be attacked when populations are locally high. Outbreaks of the IBD pose a considerable threat to mid-term timber supply, and can have extremely negative impacts on ungulate winter ranges (MDWR), preservation of Old Growth Management Areas (OGMAs), recreation and aesthetic values, and watershed management.

A variety of approaches are available to avoid or reduce the amount of mortality caused by the IBD. This Strategic Plan is designed to provide a background to IBD management in the CFR and outline specific strategies and tactics for managing this insect. Complex life cycle and population dynamics have not been included in this document. Management practices are discussed in a basic manner. A detailed, operationally focused Implementation Plan has been drafted by the Cariboo-Chilcotin District Forest Health Committee. Key references for specific policies, strategies and tactics for bark beetle management are provided in Appendix I. Long-term information on Douglas-fir beetle impact from the aerial overview survey and from overwinter mortality surveys are presented in Appendix II.

2.0 Strategic Plan Goals and Objectives

Ongoing and future losses of mature Douglas-fir in the CFR poses an immediate threat to the mid-term timber supply across the region, and in addition impedes long-term resource management and planning. The current outbreak of IBD is a major concern to local forest managers, planners and stakeholders.

The main goals of the strategic plan are:

1. To increase long term forest resource productivity through IBD management practices within the constraints of Cariboo Forest Region's resource management goals and higher level plans: Cariboo Chilcotin Land Use Plan (CCLUP).
2. To protect long-term productivity and sustainability of Douglas-fir forests by minimizing IBD population growth within the CFR.

3. To mitigate damage within infested areas of the Cariboo Forest Region and prevent additional IBD population growth wherever possible.

To attain the goals outlined above the Strategic and Implementation Plans regional and district staff must address the following objectives:

- a. Maintain a timely and complete annual aerial pest survey to ensure consistent and accurate monitoring and detection of IBD (amongst other forest health problems) and to conduct an annual detailed heli-GPS surveys of high priority areas to capture precise locations and extent of newly attacked Douglas-fir;
- b. Explicitly define priority areas and management and mitigation efforts in district based Implementation Plans;
- c. Annually update Beetle Management Units¹ (BMU) within the CFR, including licensee development areas and small business development areas;
- e. Prioritize BMU's for treatment to control IBD populations.

3.0 Bark Beetle Management

Managing forests in order to reduce the impacts of IBD requires the application of various treatment combinations, strategies and tactics. The key to successful management of the IBD is to prioritize and have treatment commitments from stakeholders in areas where the beetle population is new and damage is constrained to spots or relatively small patches. Management activities need to be timely (e.g., removal of infested material before next beetle flight), and the most appropriate treatment or treatment combinations selected.

Beetle management units (BMUs) are the basis for developing landscape level management strategies to deal with bark beetles. BMUs are intended to identify areas where specific beetle management strategies can be applied. Beetle management strategies are broad approaches that have specific objectives. Each strategy has an associated array of applicable tactics or treatments. These treatments are applied to specific infestations or areas within the BMU to achieve the objective of the strategy. BMUs cannot be considered in isolation as each will have an effect on the beetle population of its neighbor. Therefore, the strategy selected for a BMU must be compatible with those taken in adjacent units and with the overall integrated resource use plans for the area.

3.1 BMU Strategies

¹ Beetle Management Unit (BMU): are practical divisions of the forest district based on timber types, physical and legal boundaries, biogeoclimatic zone/sub-zone, and geographical features, which were selected primarily to increase the effectiveness of bark beetle control. They provide a basis for evaluating damage to timber, impact on other resources, effectiveness of treatment, and resource utilization and monitoring.

3.1.1 Suppression

The most aggressive of the available strategies. It is selected when the infestation status is such that aggressive direct control actions are expected to keep an area at a low level of infestation. The strategy demands that each infested polygon be addressed. All possible direct control tactics (treatments) should be considered and applied where suitable. Long-term approaches to reducing future threats to timber or other resources should also be applied.

Suppression is the appropriate strategy for lightly infested areas where resources for direct control or harvesting and milling capacities equal or exceed the amount of infestation. Access must exist or be imminent. The strategy demands detailed detection and follow-up every year to ensure complete sanitation of infested stands. The intent of the strategy is to reduce the outbreak to a size and distribution that can be handled with normal resources. In most cases, this objective should be achievable within a three-year time span.

Objective: To reduce populations and maintain them at a relatively low level. Target is to treat 80 to 100% of the known infestation sites. All harvest and treatment is directed at currently attacked trees. The intent is to “control” outbreak in that area and stop spread.

Treatment Options

A variety of options are available to deal with existing or potential IBD infestations. The selection of the appropriate option depends on the stand condition, level of infestation, condition of adjacent stands, existence of access, and the management objectives for the area. There are four main control methods for Douglas-fir beetle:

- sanitation harvesting
- trap trees
- single tree treatment
- post-logging mop up

3.1.1.1 Sanitation Harvesting

Sanitation harvesting for IBD suppression maximizes the removal of current-attack Douglas-fir to reduce the existing population and inhibit the infestation expansion. All trees containing beetles should be harvested and milled before the adults emerge in the spring (*no later than* April 30). Logging priority should be given to active beetle infestations and adjacent high hazard stands.

Guidelines for sanitation harvesting:

- Remove all infested trees and remove and mill logs before beetle flight (March 31st).
- Keep stumps as low as possible, with a maximum height of 30 cm. Peel stumps if height is greater than 30 cm.
- Remove, destroy, or peel bark off all debris containing beetle progeny if it is 10 cm or greater in diameter and 1 m or greater in length.
- Tops should not be greater than 10 cm diameter.
- Eliminate all infested material from sanitation sites.
- Burn all debris piles completely before beetle flight (March 31st).
- Avoid mechanical damage (scars, root damage, and broken tops) to residual trees, if known damage occurred during harvesting place anti-aggregation pheromones on damaged trees (e.g., MCH).
- If decked wood absolutely cannot be removed before beetle flight baited funnel traps must be deployed on decks and maintained weekly to bi-weekly to mitigate IBD spread. Note: Funnel traps should be 100 m away from susceptible timber to minimize spill-over effects.

Residual stands and trees injured during harvesting and road construction should be monitored and infested trees removed promptly in the following season.

3.1.1.2 Trap Trees

Trap trees are used to reduce overall beetle population levels. They are large, healthy Douglas-fir trees that are felled into the shade to attract IBD. Trap trees attract and absorb emerging beetles and must be removed after the end of beetle flight (fall through early spring). The beetles are killed during timber processing. Trap trees also mop-up beetles emerging from windthrow, stumps, and slash, thereby protecting adjacent healthy timber.

Guidelines for trap tree site location and tree selection:

- Place trap trees as close to the infestation as possible.
- Fall one trap tree for every three to four currently attacked trees. Green windthrow on site may be used as trap trees and reduce the number of trap trees required.
- In chronic beetle areas, or with scattered beetle populations, grid with groups of trap trees at 400 to 600 m intervals.
- Trap trees should be felled into the shade in such a way as to facilitate removal or subsequent treatment.
- Trap trees should be left unlimbed and unbuckled.
- Pre-felled rights-of-way, landings, and skid trails can and should be used as trap trees to absorb beetle populations. Due to the large volume of timber felled during these operations, improper shading should not impede the effectiveness of control.
- Trap tree diameters should be greater than or equal to 30 cm.
- Large openings should not be created at trap tree sites.
- Remove trap trees as early as possible after beetle flight.

- Probe the site for spillover/overflow attack in adjacent standing trees before trap tree extraction.

Incorporate trap trees into logging plans, placing trap trees in recently logged and active logging areas where bark beetles are present. Pre-fell rights-of-way, landings, or portions of cutblocks to act as trap trees and absorb beetles. If not included in the trap tree program, rights-of-way are best felled in late summer.

3.1.1.3 Single Tree Treatments/Fall and Burn

Single tree treatments, suitable for dealing with IBD, are similar to those useful for other bark beetles. The bark thickness of Douglas-fir makes falling-and-burning and bark peeling very difficult and time consuming. These treatments should be considered only when no other option is available. Treatments include:

- falling and burning – bark *must* be burnt as to completely destroy phloem
- peeling and burning the bark (seldom used)
- single tree removal

3.1.1.4 Post logging mop-up

Is absolutely necessary that post-harvest clean-up occurs at the site as the creation of suitable host material from logging debris can be suitable habitat for residual beetle populations. All live Douglas-fir debris greater than or equal to 10 cm in diameter and greater than or equal to 1 m in length must be moved to a landing or clearing and disposed of (burning or chipping) or bucked into pieces shorter than 30 centimetres.

Sanitation harvesting in areas with chronic beetle populations should be followed up with trap trees to absorb residual populations. Use one trap tree for every four standing current attack. *Do not* fall more trap trees than required using this rule of thumb, as providing excessive host material actually increases or continues the beetle problem. Areas where logging has been completed should be monitored yearly to locate fresh outbreaks.

3.1.1.5 Semiochemicals

The use of semiochemicals to deter bark beetles is an appropriate strategy following all the treatments above and is highly recommended.

MCH (3-Methyl-2-cyclohexen-1-one) can effectively protect treated stands by preventing beetles from initiating new attacks through an anti-aggregation pheromone (acts as a dispersal agent). Beetles will move through a treated area and continue to disperse until they find suitable habitat elsewhere or until they die. Because beetles moving through a treated stand will spend more time searching for a host, they presumably will have a greater chance of dying as a result of natural causes. Further, there is no evidence tree mortality in areas directly adjacent to those treated with MCH

is any higher than it would be in the absence of MCH treatment. Consequently, landowners and managers do not need to fear that beetles will “move” from treated stands into neighboring ones.

MCH has considerable tactical use as part of a careful Douglas-fir beetle management strategy, can reduce the negative impact of disturbances such as windthrow and forest fires, and is effective for mitigating beetle impacts in riparian zones, parks, mule deer winter ranges, old growth management areas, and other areas unsuited to traditional Douglas-fir treatments. MCH is an extremely low risk treatment (unlike aggregation pheromones where spill-over is a real risk).

MCH deployment is recommended for the following situations:

- a) To disperse beetles in combination with trap trees in a “push-pull” method for larger Douglas-fir beetle infestations (greater than ten current attacked trees). The MCH is placed in a grid around an inaccessible infestation centre to drive the beetles towards trap trees which were felled to absorb beetles.
- b) To disperse small Douglas-fir beetle infestations of ten trees or less. When infestations are greater than 10 current attacked trees generally the recommended action would be a “push-pull” strategy involving trap trees. However if trap trees are not an option larger sites could be treated with MCH.
- c) To disperse residual beetles post-harvest, such as beetles that remain in stumps or logging debris or trees attacked trees that remained undetected. MCH can prevent infestation in trees on site that may have been stressed or slightly damaged during harvesting.
- d) Fire damaged trees are particularly susceptible to Douglas-fir beetle attack, therefore MCH can be used to prevent beetle build-up in burned areas and protect moderately fire damaged trees from attack and subsequent mortality. By treating with MCH, beetle attack is prevented on stressed fire scorched trees until they have a season to recover from the damage. If the trees have been fire killed, it allows the trees one year to dry out and become unacceptable as breeding sites for Douglas-fir beetle, therefore preventing beetle population build-up;
- e) To prevent attack of patches of fresh green windthrow which due to inaccessibility or economics cannot be salvage harvested. By grid baiting with MCH, the windthrow is kept beetle free until it dries out and becomes unsuitable for beetles; and

MCH is most effective when it is applied before beetles begin to fly and attack trees in the spring. However, if it is applied early in the flight season but after beetles have initiated attacks on some trees, it may still reduce the number of trees that are killed within the treated area compared to doing nothing. Throughout much of the BC Central interior, Douglas-fir beetles begin flying in anywhere from late-March to late-April (depending on elevation, aspect, tree density) so MCH applied by the second week in April should be fully effective unless it is an unusually warm year. The bubble capsule

formulation of MCH will last throughout the period that beetles fly and attack trees, but needs to be reapplied each year that protection is desired. During a typical outbreak, this may require 1-3 annual applications, depending on circumstances and beetle populations.

For areas greater than 0.2 ha, bubble capsules should be applied at a rate of 75-100/ha. If added insurance against infestation is desired and cost is not considered prohibitive, a slightly higher rate may be applied. However, there will likely be no benefit to applying rates higher than 100/ha. The first step in conducting a treatment is to determine the size of area to be treated and calculating the number of bubble capsules needed.

Bubble capsules are applied by stapling or otherwise attaching them to trees, snags, shrubs, fence posts or any other object. They are usually applied at a height that applicators can easily reach (e.g., 1.8-2.5 meters), but they can be placed higher in areas such as campgrounds or residential sites where it is likely that they may be disturbed. Ladders can be used to attach bubble capsules at a height where they are beyond reach. If it is necessary to achieve the proper spacing, they can also be attached to objects such as stumps or logs as low as 0.5 meters above the ground. Bubble caps should be attached on the north side of trees and snags where possible to protect them from direct sunlight.

MCH contained in a bubble capsule diffuses through the plastic and is dispersed by air movement. In essence, a cloud of MCH develops around the point at which it is dispensed. The shape and distribution of the MCH cloud depends upon the rate of diffusion, wind speed, and wind direction. The objective in area-wide treatment is to place bubble capsules in a pattern that results in a cloud of MCH sufficient to affect beetle behavior when beetles are searching for host trees.

Several different patterns of placing MCH bubble capsules have been used in operational treatments. Since air movement disperses MCH as it diffuses out of the bubble capsules, there is a lot of flexibility in the distribution of bubble capsules provided the entire area is covered. In the following descriptions, distances between bubble capsules are only approximate and pacing is accurate enough for effective treatments. In all cases, bubble capsules should be placed about 15-20 metres beyond the boundary of the area to be protected to avoid an edge effect.

Two suggested methods for placement:

- 1) Place bubble capsules around the perimeter and in parallel lines across the unit spacing them about five (5) meters (Fig. 1). The number of parallel lines and spacing between them will depend upon the size and shape of the unit. The lines of bubble capsules should be spaced 35-50 meters apart to achieve the desired dose. If possible, these lines should be placed perpendicular to the expected wind direction on warm afternoons in the spring when beetles are most likely to be dispersing. After treating the perimeter and determining the number

of parallel lines that will be needed to cover the unit, the remaining bubble capsules from the predetermined number needed to treat the unit should be divided into a number of lots equal to the number of parallel lines. This will help to ensure that the bubble capsules are evenly spaced across the unit.

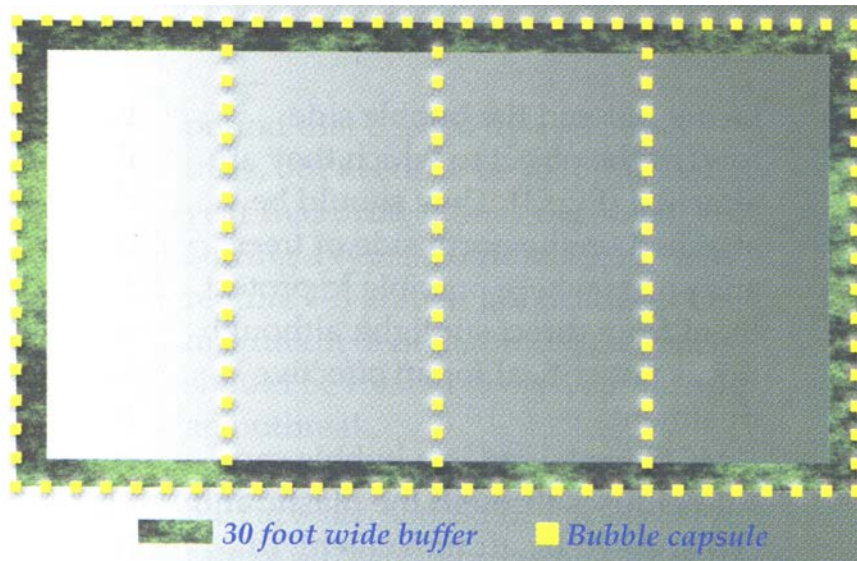


Figure 1 Diagram of the perimeter and parallel line method of deploying MCH bubble capsules. Bubble capsules are spaced 5 meters apart and lines are spaced 35-50 meters apart (not drawn to scale).

- 2) Second approach is to place MCH bubble caps in an even grid pattern across the area (Fig. 2). Spacing the bubble capsules 12-13 meters apart in the grid will result in the desired dose. Using the grid pattern may require a little more time since more of the unit must be covered by applicators. However, this pattern may be easier for the applicators to follow and result in better coverage, particularly on large areas. Either pattern of deploying the bubble capsules will provide an effective treatment provided the unit is evenly covered. If bubble capsules are left over from the predetermined number needed to treat a given size unit, they should be evenly distributed throughout the unit or placed in areas with a particularly high concentration of host trees.

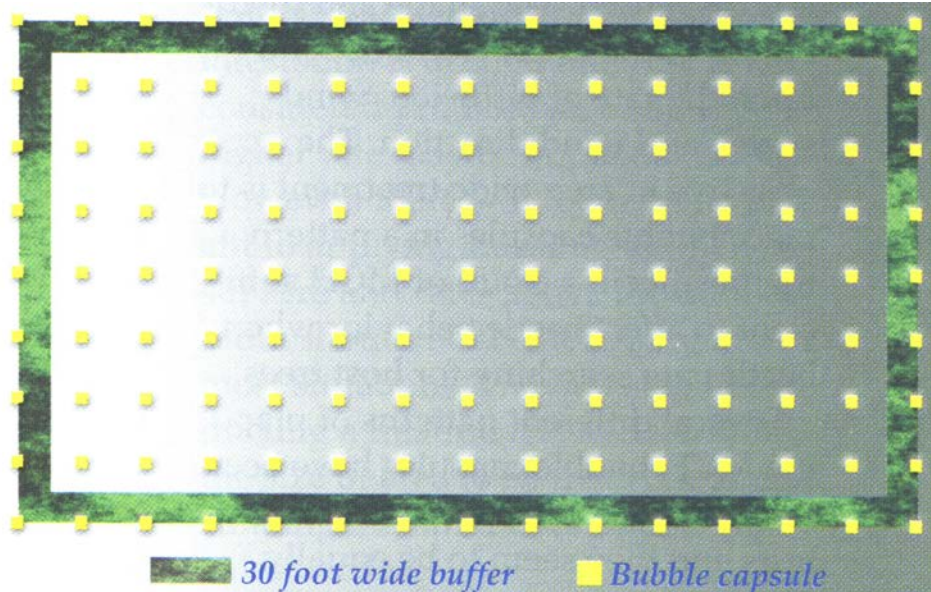


Figure 2 Diagram of the grid method of deploying MCH bubble capsules. Bubble capsules are spaced approximately 12-13 meters apart (not drawn to scale).

If bubble capsules are left in place after treatment, they will eventually fall to the ground and become less noticeable as they break apart over time. However, if this is unacceptable, they can be collected and disposed of after the beetle flight period has ended. Bubble capsules should not be collected before September.

3.1.2 Holding

The intent of this strategy is to maintain an existing outbreak at a relatively static level. It is a delaying strategy until adequate resources are available, or access is created to allow for a more aggressive approach, or to reduce overall loss while waiting for a killing climatic event. This is appropriate in areas with chronic beetle infestations that are too large to deal with using single tree treatments or where access is poorly developed for directed harvesting.

Objective: To maintain the infestation to a relatively static level by treating ~50–70% of the known infestation sites. The level of harvest and/or treatment is equal to the rate of infestation expansion. Harvesting should be concentrated in green attacked trees.

3.1.3 Monitor

This strategy is applied to areas where there are low population levels, where management efforts would be ineffective in substantially reducing the beetle population and subsequent levels of damage, or where there is no short term (less than 5 years) possibility of salvaging dead timber. This may be due to management constraints such as wilderness area, Parks or ecological reserve, or because access cannot be put in place before substantial merchantable degradation of the dead material occurs.

Objective: To record the change in attack level with no action required beyond monitoring and recording. This objective is appropriate in parks, ecological reserves and inoperable areas where the outbreak has peaked, salvage is not possible, and there is no current opportunity for any mitigation of further loss.

3.1.4 Salvage

Applied to areas where management efforts would be ineffective in substantially reducing beetle populations and subsequent levels of damage. Such areas have extensive outbreaks covering a large proportion of susceptible stands. The objective in this case is to salvage affected stands and minimize value loss.

Objective: To salvage timber previously attacked to minimize value loss. Indications are that holding the infestation static will fail due to influx of populations from heavily infested BMUs in proximity. Emphasis is more to retrieve values at risk and maximize Crown revenues by directing harvest towards killed stands prior to significant degradation. Treat <50% of the currently infested sites. This objective is appropriate in areas where suppression and holding actions are no longer appropriate or feasible.

4.0 Plan Summary

The success of an integrated Strategic and Implementation Plans for Douglas-fir beetle is contingent on cooperation and coordination between major stakeholders, and implementing plans in a timely and efficient manner. The plan must be revised annually after aerial and ground survey data has been compiled and after treatments have been conducted. A review of the activities carried out in the previous year and re-prioritization of affected BMU's will be carried out by TSA Forest Health Committees.

Appendix I – Internet Resources

Guidance on Blanket Salvage Permits (policy change - August 2014):

<https://www.for.gov.bc.ca/hth/timber-tenures/blanket-salvage-permit/blanket-salvage-permit.htm>

Small Scale Salvage (SSS):

<https://www.for.gov.bc.ca/hth/timber-tenures/small-scale-salvage/index.htm>

The Bark Beetle Management Guidebook:

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

Beetle Hazard Rating Maps (updated 2014):

<https://www.for.gov.bc.ca/ftp/RSI/external/!publish/Forest%20Health/Bark%20Beetle%20Hazard%20Maps/2014/>

Detailed Heli-GPS survey data (2013-2015):

<https://www.for.gov.bc.ca/ftp/RSI/external/!publish/Forest%20Health/Detailed%20BB%20Heli-flight%20Data/>

Appendix II – Beetle Population Trends

The Aerial Overview Survey (AOS) which is conducted annually over ~80 to 90% of the province independent of ownership status. This survey is a critical monitoring tool that provides a way to track changes in various visible forest health agents. The graphs below are based on AOS data from 2003 to 2015. Some pest damage is underestimated as surveyors can only record what is visible at the time of the survey.

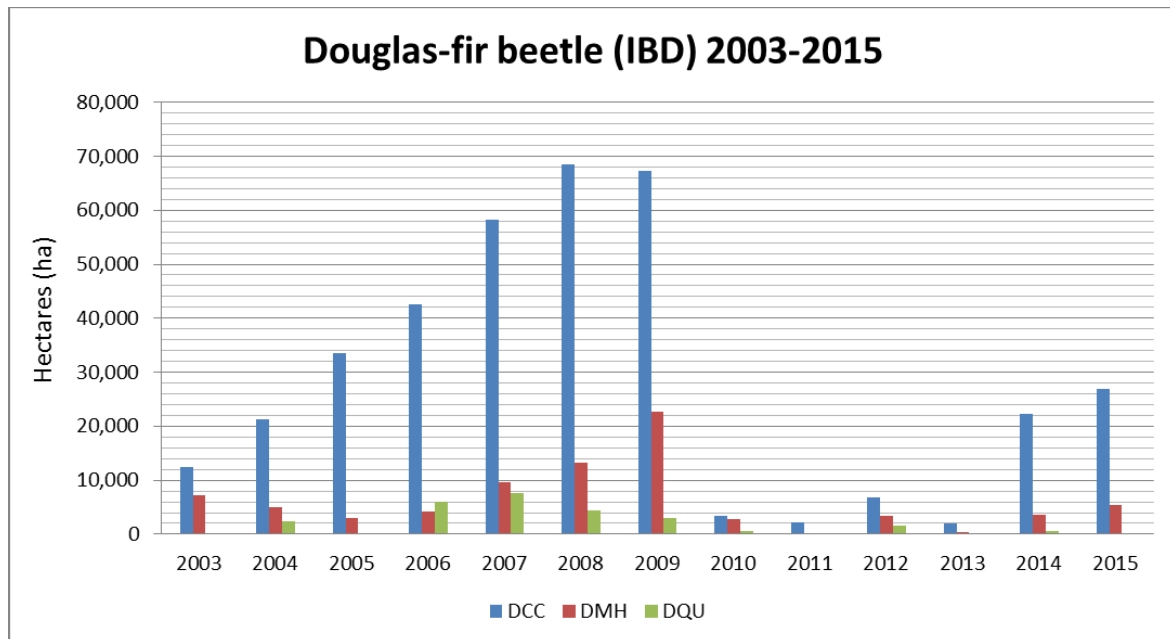


Figure 3 Total area impacted (hectares) in each district in the Cariboo region. DCC=Cariboo-Chilcotin, DMH=100 Mile House, and DQU=Quesnel.

Douglas-fir Bark Beetle Management Strategy – Cariboo Region
October 2015 to October 2016

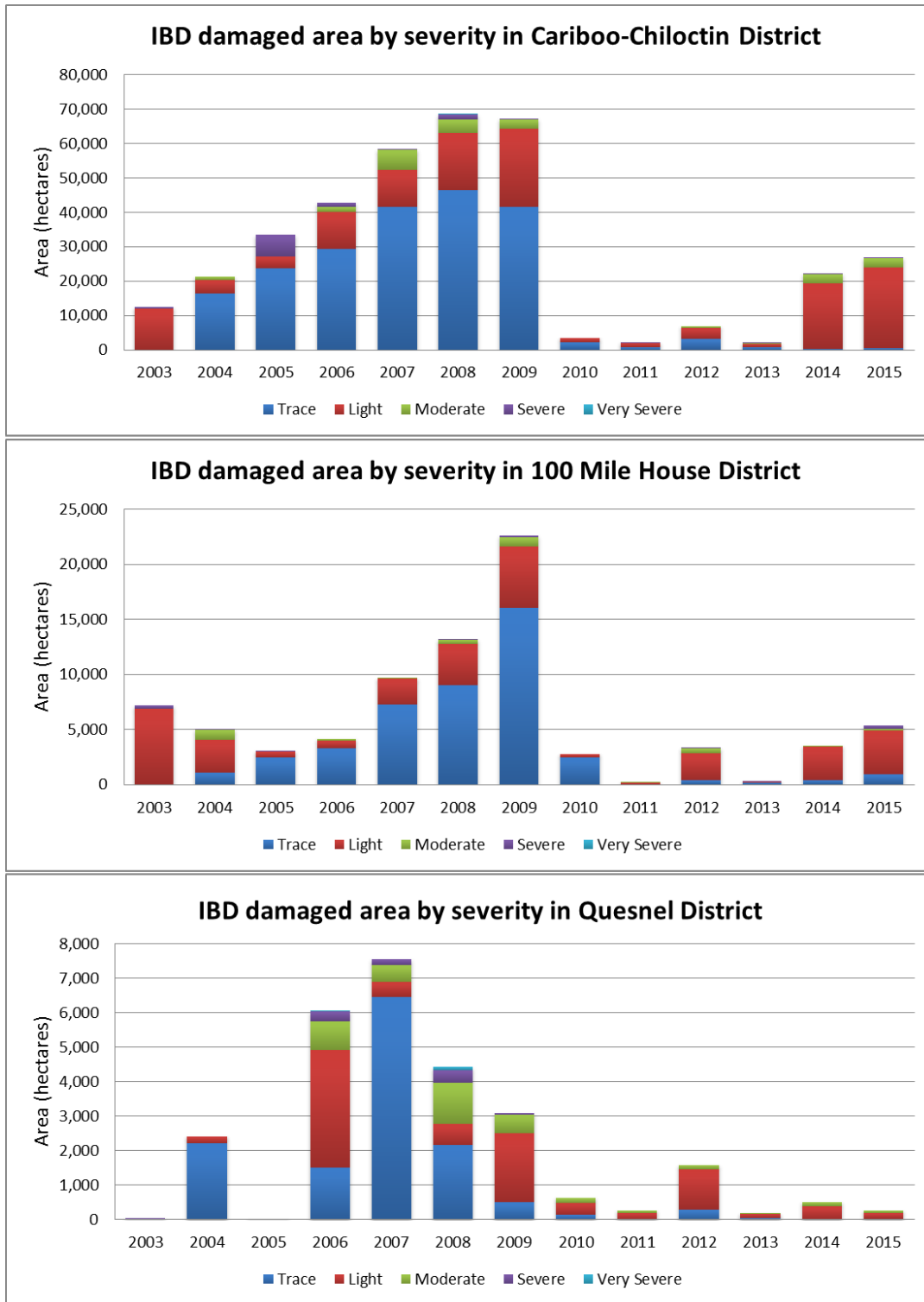


Figure 4 Total area impacted (hectares) by severity category in each district of the Cariboo region from 2003-2015. Severity categories: trace = less than 1% of trees recently killed; light = 1 to 10% of trees recently killed; moderate = 11 to 29% of trees recently killed; severe = 30 to 49 % of trees recently killed; very severe = 50 % and greater trees recently killed.

Overwinter mortality surveys, and the derived R-values², are conducted semi-annually for different bark beetles to predict populations the following spring. The R-value is the ratio of surviving brood to initial attack. For Douglas-fir beetle, R-values over 1.35 indicate increasing populations.

In the Cariboo Region R-values have been considerably higher than 1.35 since 2012. If beetle populations are small surveys are not annually conducted in all districts.

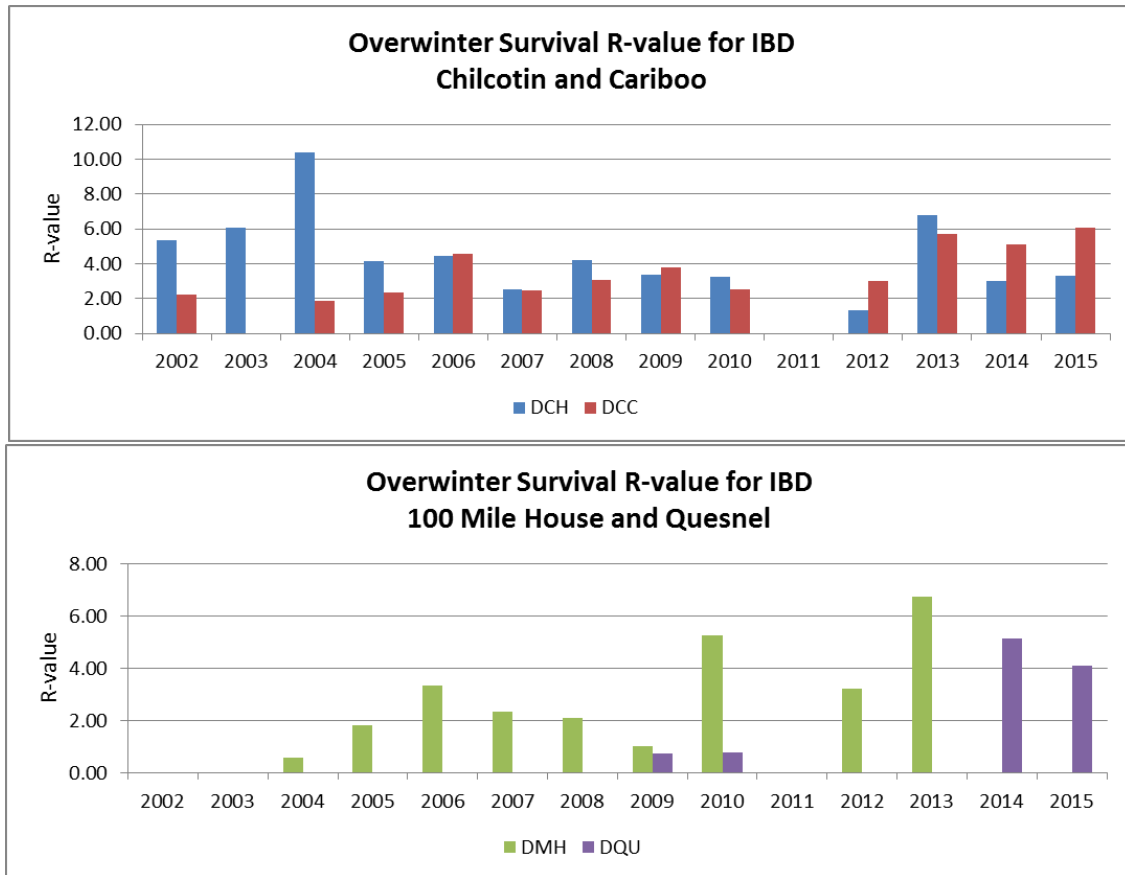


Figure 5 R-value surveys for the Chilcotin and Cariboo (top) and 100 Mile and Quesnel (bottom). No survey was conducted in 2011 in the region, and due to very low Douglas-fir beetle populations the survey was not conducted in 100 Mile in 2002-03 and 2014-15 and in Quesnel from 2002-2008 and 2013.

² To obtain a copy of the overwinter mortality report and/or data please contact the Cariboo Regional Entomologist