

Best Practices for Managing Douglas-fir Beetle

Landscape and Stand Level Planning

Nearly all bark beetle outbreaks are landscape level events and generally they cannot be managed on a stand-by-stand basis. This is also true for Douglas-fir beetle (DFB), however this beetle has unique outbreak dynamics with spatially discrete attack centres that can vary in size from a few trees to hundreds of trees, which lends itself to increasing the likelihood of successfully managing stand level infestations in certain situations. DFB is also selective in choosing the optimum host. They prefer the largest, oldest trees in a stand; prefer trees stressed by fire, drought or root disease; or recent windthrow. Such targeted and specialized host selection parameters make it possible to focus management on specific trees and stands and it is critical to analyze landscape level hazard and risk before assigning management areas, strategies and tactics. Because management options are limited (mainly because single tree treatments are not commonly deployed) it is impossible to manage for DFB on all sites on a landscape level where populations may occur, as is being recommended for mountain pine beetle suppression. Careful analyses of values at risk and economic benefits of aggressive management must be conducted prior to assigning management strategies and implementing aggressive control tactics.

The current DFB outbreak of less than 100,000 hectares in the southern interior is a concern (Figure 1). However, it is not on the same scale as the mountain pine beetle epidemic that has so far attacked over 16 million hectares of forest in the last outbreak (1998-2016). Nevertheless, the potential impact of a DFB outbreak on the mid-term timber supply and local ecosystems could be significant, with its effects compounding the damage already incurred by mountain pine beetles in B.C.'s forests.

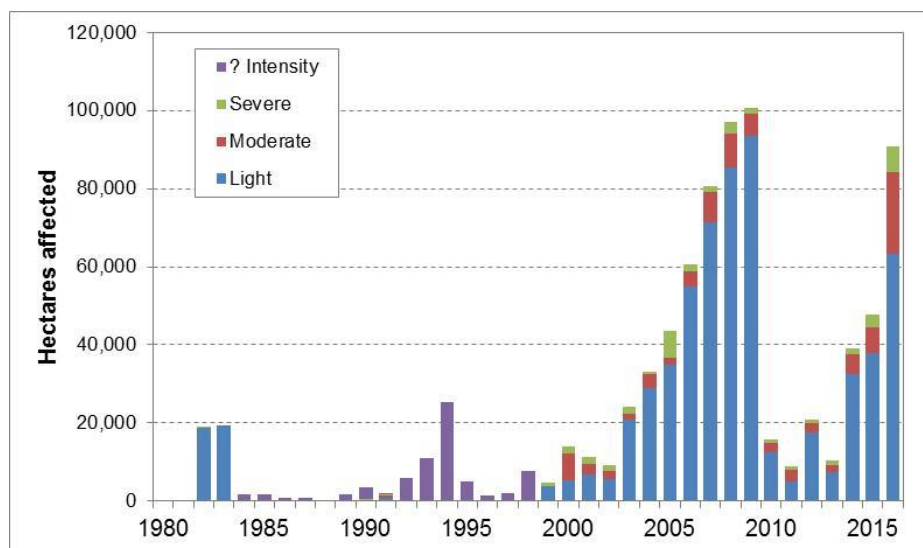


Figure 1. Hectares affected and severity of attack by Douglas-fir beetle as mapped in the Provincial Aerial Overview Survey from 1980-2016.

Table 1. Volume (cubic meters) of Douglas-fir, Spruce and lodgepole pine in Timber Supply Areas (TSA's) of interior B.C. The total volume of live and dead trees is also shown for each TSA.

TSA No.	TSA	Volume (m3)				
		Df	Sx	Pl	Dead	Live
01	Arrow	49,245,174	33,854,205	19,136,737	5,637,201	202,316,289
02	Boundary	16,458,653	8,653,267	24,141,174	1,987,831	75,187,862
05	Cranbrook	17,583,738	23,934,410	46,044,314	4,388,404	126,802,961
07	Golden	21,320,445	60,533,388	13,919,885	5,480,645	137,795,730
09	Invermere	26,420,264	31,333,986	31,879,897	5,163,747	110,684,284
11	Kamloops	91,025,113	101,663,589	14,294,843	18,246,587	314,871,217
13	Kootenay Lake	36,224,317	32,591,476	18,740,123	3,551,690	176,114,527
15	Lillooet	27,342,561	16,476,567	19,024,543	5,171,324	79,984,064
18	Merritt	35,710,079	20,985,260	41,406,450	13,204,327	114,255,068
22	Okanagan	106,879,430	61,727,427	56,244,916	14,116,008	346,127,006
23	100 Mile House	53,952,694	33,591,829	18,642,512	21,925,175	124,295,964
26	Quesnel	28,413,791	77,639,580	55,166,457	60,264,727	205,121,082
27	Revelstoke	8,046,130	29,064,198	259,910	78,333	97,100,259
29	Williams Lake	88,217,932	74,601,450	69,578,557	49,859,229	294,611,025
Total		606,840,322	606,650,633	428,480,318	209,075,227	2,405,267,337

Table 2. Estimated volume (cubic meters) of Douglas-fir burnt in the 2017 wildfires in four Timber Supply Areas (TSA's), by burn severity. The <2% means 2% or less of the stand was touched by fire.

TSA No.	TSA	Burn Severity	Df volume (m3)
11	Kamloops	≤2% burnt	217,682
11	Kamloops	Low	720,847
11	Kamloops	Medium	887,359
11	Kamloops	High	1,000,579
23	100 Mile House	≤2% burnt	809,632
23	100 Mile House	Low	2,306,868
23	100 Mile House	Medium	2,020,209
23	100 Mile House	High	3,146,668
26	Quesnel	≤2% burnt	137,635
26	Quesnel	Low	159,465
26	Quesnel	Medium	203,812
26	Quesnel	High	263,537
29	Williams Lake	≤2% burnt	627,245
29	Williams Lake	Low	2,078,737
29	Williams Lake	Medium	2,744,412
29	Williams Lake	High	5,079,187

Douglas-fir Beetle Management Units

Specialists advocate that strategic level beetle **planning must be done over large landscapes** but acknowledge that **management of DFB cannot be implemented** at the landscape level due to many factors. Therefore, beetle management plans are often incorporated into TSA-level Forest Health Strategy documents, which prioritize specific smaller units where more directed management efforts could be successfully applied. Management strategy selection assumes that resource and land use objectives have been met and are clearly stated in terms of beetle infestation status and the feasibility of reducing damage. The most technically correct strategy may not always be assigned because other criteria/values may supersede technical and biological considerations.

A Douglas-fir Beetle Management Unit (DFBMU) is a spatial planning unit created by Region or District Forest Health Specialists in collaboration with licensees when operational beetle management activities are proposed. DFBMUs spatially outline the exact area to be managed to reduce the spread of DFB and tree mortality in specific, high value areas. **The purpose of a DFBMU is to facilitate the planning, tracking, implementation and efficacy assessment of beetle monitoring and management activities.**

A DFBMU need only be designated and spatially delineated when an activity beyond the Aerial Overview Survey (AOS) is planned within a TSA. DFB management and control in a DFBMU is a multi-year initiative that requires a coordinated effort by all stakeholders (regional and district staff, tenure holders, First Nations and others).

Each designated DFBMU must have:

- 1) **overlying rationale and objectives** as to why an area has been selected for DFB management;
- 2) **concise evaluation** of the values at risk inside and surrounding the area if no DFB management is implemented; and,
- 3) statement outlining the **likelihood of success** in reaching the DFBMU objectives.

The assignment of area-based management strategies is the first and often most important step to achieving stewardship goals. Parks, Old Growth Management Areas (OGMA), Mule Deer Winter Ranges (MDWR) and other constrained or special use areas are part of the landscape and must be considered and integrated when designating a DFBMU. There are four possible levels of management that can be assigned:

- 1) no action – Aerial Overview Survey only (Provincial responsibility)
- 2) light intervention
- 3) moderate intervention
- 4) aggressive management

DFBMU boundaries can be independent of other administrative boundaries and are identified through evaluation of hazard rating maps, resource inventories, access information, tenure, special interest areas (e.g. OGMA, MDWR, Parks), terrain, hydrology, most recent infestation maps and other values. Prior to deciding on a management strategy, a realistic assessment of the degree of intervention required must be made. This is typically a culmination of comparative

values at risk in and out of constrained areas, licensee support and operational feasibility. There should be **no intervention in an OGMA** except under extenuating circumstances, and when all stakeholders concur. This will greatly limit and focus managers to areas where management efforts and intervention can be maximized.

DFBMU boundaries are then drawn around areas with generally consistent levels of beetle infestation, and delineate where there are similar management **rationales and objectives**. Boundaries should be reviewed annually and adjusted where necessary, and based on the most recent aerial and ground survey information and if relevant, changes in management objectives should be considered.

Strategies and treatment options are selected after considering the outbreak status in the DFBMU and the estimated feasibility of achieving desired objectives.

1) No Action

No Action can include a wide range of landscapes potentially covering the range of DFB hazard and infestation levels. **No Action** just refers to the level of targeted DFB management in that designated area and does not impinge upon other planned activities in that landscape, including harvesting. **No Provincial forest health funding** is utilized for management of DFB in **No Action** areas. The Provincial Aerial Overview Survey will be the only action (monitoring) conducted by the Province. Standard harvesting and forestry activities may take place, if permitted, in **No Action** DFBMUs. However, the **No Action** strategy is most often assigned to **special interest areas** where the main objective is to limit or exclude any harvesting (e.g. OGMA's).

2) Light Intervention

Light Intervention is considered for landscapes where there are low to moderate levels of DFB infestation, with some constraints on the land. These constraints can range from steep inoperable terrain to areas containing numerous OGMAs and high priority mule deer winter range. Areas under this strategy will receive **some Provincial forest health funding** for detailed aerial surveys and limited mass trapping and/or MCH work. There may or may not be limited, targeted harvesting depending upon the **overlying rationale and harvesting constraints**.

3) Moderate Intervention

Moderate Intervention is considered for landscapes where there is significant moderate and high hazard host material; moderate levels of DFB infestation; and potentially some constraints on the land. These constraints can be varied such as steep inoperable terrain to numerous OGMA's and high priority mule deer winter range. Areas under this strategy will receive **Provincial forest health funding** for detailed aerial surveys, ground surveys, DFB flight monitoring, mass trapping and/or MCH work. DFBMUs assigned the **Moderate Intervention** strategy will include targeted trap tree placement and harvesting of high priority DFB-infested stands. All DFB management will occur outside of the OGMA's and within MDWR guidelines.

4) Aggressive Management

Aggressive Management is the highest level of DFB intervention. This strategy is applicable for landscapes where there are large areas of moderate or high hazard stands or significant amounts of high hazard host material (e.g. fire damage, windthrow) at imminent risk to DFB infestation. Where possible, other values in these DFBMUs will be respected, but the highest priority objective is to **limit spread and minimize future mortality from DFB**. For this strategy to be effective the area designated must be relatively accessible and stakeholders must support this aggressive action.

Areas under the **Aggressive Management** strategy will receive **Provincial forest health funding** for detailed aerial surveys, ground surveys, population monitoring (e.g. r-values - not an operational activity but occasionally used for research purposes), DFB flight monitoring, mass trapping, MCH deployment and other single-tree treatments.

DFB management techniques can include: targeted trap tree placement and harvesting; baiting and harvesting of high priority DFB-infested stands; heli-logging; mass trapping; MCH deployment; and, peeling and burning of infested trees. Harvesting can include the range of harvest options: infested trees only, patch-cuts and mid-size to larger cut blocks.

Aggressive Management assumes that there is a commitment by all stakeholders (e.g. MFLNRORD, licensees, First Nations, Community Forests and others) to support multiple, consecutive years of DFB control activities that include both short- and long-term strategies. Strict timetables for treatments will ensure the reduction of DFB populations and decrease future threats to resources and ecological values.

MDWR, OGMA, watershed or aesthetic considerations can limit the application of aggressive management tactics and/or directed harvesting. Socio-economic forces will also influence the selection of strategies and tactics. Situations change from year to year, and therefore strategies must be reassessed on an annual basis.

BMU strategies should remain in place for as long as:

- objectives are being met;
- adequate resources are available to implement the strategy;
- insect population status requires the assigned level of intervention (populations may increase or decrease); and,
- the level of hazard or risk requires the assigned level of intervention (e.g. wildfires, drought, windthrow).

Assigning DFB management strategies in an OGMA

The objectives of an OGMA are often divergent from adjacent forested landscapes. Natural disturbances affect all landscapes without prejudice. However, the degree of management within these two landscapes can vary drastically in terms of intervention. If a strategic management rationale and goal exists for each OGMA prior to a DFB infestation occurring, then adequate action plans can be assigned and implemented. Management levels inside an OGMA will still affect adjacent lands; however, prior knowledge of acceptable intervention allows many activities to be anticipated or planned. The timing and degree of intervention in an OGMA must be clearly elucidated to facilitate landscape level planning for DFB management.

Biodiversity Committee members, MFLNRORD managers and specialists, and stakeholders will assign a DFB management strategy to each OGMA as outlined above.

Each OGMA DFBMU assigned the **No Action** designation must have:

- 1) **overlying rationale and objectives** for the OGMA;
- 2) **concise evaluation** of the forest inventory at risk inside the OGMA (DFB Hazard); and,
- 3) statement outlining the **risk to adjacent lands** in terms of DFB, wildfire and other natural disturbances.

Each OGMA DFBMU assigned the **Light Intervention** designation must have:

- 1) **overlying rationale and objectives** for the OGMA;
- 2) **concise evaluation** of the forest inventory at risk inside the OGMA (DFB Hazard);
- 3) statement outlining the **risk to adjacent lands** in terms of DFB, wildfire and other natural disturbances;
- 4) adjacent DFBMUs must be assigned **Moderate** or **Aggressive** management strategies; and,
- 5) clearly document the monitoring and efficacy assessment protocol in place that evaluates the DFB management program.

DFB control treatments may include:

- 1) sanitation harvest of infested trees;
- 2) mass trapping outside the OGMA boundary; or,
- 3) anti-aggregation pheromone treatment for smaller infestations.

Light Intervention strategies will allow harvest of currently infested trees within 100 meters of the OGMA boundary or within 100 meters of currently maintained roads within the OGMA. Non-target harvest or damage of trees greater than 27.5 cm DBH must be less than 10% of the total volume of current attack harvested from each **contiguous infestation**. “Currently maintained roads” refer to roads that, without surface modification or removal of any trees could accommodate a logging truck. A **contiguous infestation** is defined as all currently infested trees separated by no more than 100 meters from any other currently infested tree or trees.

DFB infestations within 500m of **Light Intervention** designation OGMA boundaries (on provincial crown forest land) must be given the highest priority for action to reduce populations and thereby decrease further risk to the OGMA.

Each OGMA DFBMU assigned the **Moderate or Aggressive Intervention** designation must have:

- 1) **overlying rationale and objectives** for the OGMA;
- 2) **concise evaluation** of the forest inventory at risk inside the OGMA (DFB Hazard; Douglas-fir inventory by age class);
- 3) adjacent DFBMUs must be assigned **Moderate** or **Aggressive** management strategies; and,
- 4) clearly document the monitoring and efficacy assessment protocol in place that evaluates the DFB management program.

DFB control treatments may include:

- 1) small patch or targeted sanitation harvest with pre- and post-harvest trap trees;
- 2) trap trees placed within 500 m of infestation;
- 3) mass trapping where applicable; or,
- 4) anti-aggregation pheromone treatment for smaller infestations.

Moderate or Aggressive Intervention strategies will allow harvest of currently infested trees and/or red and grey trees in targeted sanitation of small patch cuts within the OGMA boundary. The use of currently maintained roads or skid trails within the OGMA should be maximized and new skid trails to facilitate high priority DFB removal should only be created as needed. Non-target harvest, or damage of trees greater than 27.5 cm DBH must be minimized and treatment of stumps and logging debris must meet the current best practices standards.

DFB infestations on adjacent provincial crown forest land must be assigned high priority for action to reduce populations and thereby decrease further risk to the OGMA.

Efficacy Monitoring

Monitoring the implementation and effectiveness of DFB control is a requirement for science-based management that balances beetle suppression with the maintenance of ecological and socio-economic values. Without this information, it is very difficult to make sound decisions on treatment alternatives. Monitoring information must be clearly documented and circulated to industry, government and other partners in a timely fashion. Results of efficacy monitoring should be evaluated over a multiple-year time horizon as well as annually, to make effective yearly adjustments if and when necessary.

Key elements for monitoring include:

- hazard;
- number of hectares of old, large Douglas-fir (at-risk host resource);

- number of spot and polygon infestations recorded in the AOS (by polygon severity);
- detailed aerial surveys: number of hectares infested and number of infested sites;
- area covered by the detailed aerial surveys (using GPS track files);
- number of hectares harvested (track whether the block had trap trees, was baited, or had no treatment);
- amount of funding applied to monitoring and control activities;
- number of sites treated (with an estimated number of current attack destroyed) before the next beetle flight; and,
- Red:Green ratio – a measure of population growth rate.