



Understanding insect disturbances

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Outbreaks of western spruce budworm (*Choristoneura occidentalis*) have been chronic on Douglas-fir in British Columbia's Interior Douglas-fir (IDF) zone for more than 25 years. In 2006, more than 750,000 ha of defoliation ranged from the south Okanagan to the central Cariboo, and resulted in one of the largest spray programs ever undertaken in the province.


The magnitude of this budworm disturbance, however, is overshadowed by the even greater impacts of the mountain pine beetle. As forest managers scramble to utilize beetle-killed trees, Douglas-fir is considered future inventory in severely affected areas. In mixed forests, it is common to selectively remove lodgepole pine and retain Douglas-fir. Although this forest practice reduces a stand's susceptibility to mountain pine beetle, it may inadvertently alter the susceptibility to other high-risk disturbances such as the budworm.

Abundant evidence shows that stand structure influences spruce budworm population dynamics. For example, dendro-ecological studies suggest that changes in land-use patterns, including fire suppression which has increased the density and extent of Douglas-fir on the landscape, increases the frequency, severity, and duration of budworm outbreaks. Outbreaks of spruce budworm are commonly associated with dense, mature forests and damage is greatest in multi-storey stands. Stand modifications are therefore seen as a potential management approach. Some attempts were made to examine the effects of thinning on budworm outbreak dynamics in the US, but the results have been equivocal.

To examine how changes in stand structure affect spruce budworm populations on Douglas-fir in the BC Interior, our study takes advantage of the stand modifications resulting from selective removal of beetle-killed lodgepole pine. We adapted methods developed for eastern budworm species to study the western budworm to address the ques-

tion of changing risks resulting from stand modifications. The project is supported by the Forest Science Program, the BC Ministry of Forests, and the Canadian Forest Service.

The two-year project commenced in 2006. A paired-design was adopted to control for variation in site conditions and spruce budworm density. Each plot pair consists of a stand from which lodgepole pine has been selectively removed and an adjacent stand left intact. Pairs of plots occur from Merritt through to Williams Lake. Estimates of spruce budworm density and defoliation are made by sampling branches at the egg, early-larval, and late-larval stages of budworms. All budworms collected are reared to determine the identity and incidence of natural enemies. Dispersal of budworms is measured with sticky traps. This procedure allows estimation of stage-specific losses of budworm and ultimate damage to the tree.

Although two seasons is a short timeframe in population ecology, our ability to reconstruct past damage extends the data input to four years, and our knowledge of key processes affecting spruce budworm dynamics allows us to focus on the most critical aspects and interpretation within the context of the larger, historical dataset available from long-term study plots in the same area. We are confident that our study results will provide conclusive insights into the interaction between forest practices and large-scale natural disturbances such as spruce budworm in British Columbia. 

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Robert W. Duncan photo

Choristoneura occidentalis.

Western spruce budworm branch sampling.



Natural Resources Canada-Canadian Forest Service photo



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A close-up of defoliation caused by the western spruce budworm.