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Branching Out
from the Canadian Forest Service - Laurentian Forestry Centre

Spruce Budworm: Heading North?

The spruce budworm, (*Choristoneura fumiferana* – SBW), a native insect found throughout Canada, is considered the most serious pest of fir and spruce forests in North America. It has been the subject of research for more than half a century, but questions remain: for example, with climate change, will the SBW change its diet or its distribution area? Canadian Forest Service (CFS) researchers have examined this issue.

In eastern Canada, the SBW destroys as many trees as fire. The outbreak cycle varies between 30 and 40 years. Since 2006, SBW population levels have been rising in Quebec, and areas defoliated by the SBW have been doubling every year, particularly on the North Shore, where 70% of Quebec's defoliated areas are situated.

Climatic conditions: an obstacle?

Climate change adaptation measures vary from one insect to another; some fly to new areas with milder weather, while others increase their number of generations per year. With milder weather conditions, the SBW's distribution area could move northward. While less severe in the south, outbreaks could become more damaging in northern areas.

Photo: NRCan

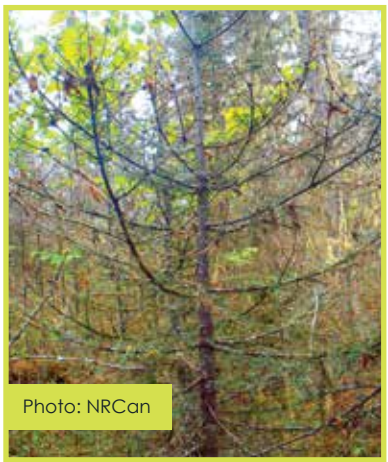

Photo: NRCan

Is black spruce protecting fir trees?

In order of preference, the SBW feeds on fir, white spruce, red spruce, black spruce, Norway spruce and tamarack.

Historically, the SBW has caused the greatest damage in balsam fir stands; late flowering in black spruce may be responsible for its relative immunity to severe damage by the SBW. However, the impact of the last three outbreaks has been different, as it was felt further north in spruce stands.

To evaluate the insect's performance on balsam fir and black spruce, CFS researchers set up a research facility in the North Shore region of Quebec. They weighed SBW pupae (developmental stage between larva and adult) in various stand types at different degrees of defoliation. They found that the females perform better on less defoliated fir trees.

Stand composition, however, does not affect the rate of defoliation in balsam fir trees; the presence of black spruce in these stands would therefore not provide them with protection. For their part, black spruce trees are more vulnerable in fir stands when an outbreak is developing.

Photo: NRCan

Balsam fir stands are defoliated earlier in the outbreak cycle than stands dominated by black spruce. As defoliation increases, the SBW becomes less attracted to fir trees due to the decline in the quality of their foliage. It takes an increase in SBW population levels to see an infestation in black spruce.

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The domino effect

Spruce budworm outbreaks affect forest succession and productivity. Forest response varies, depending on the regional proportion of SBW host species. For example, balsam fir stands undergo cyclic succession, while in mixed stands recruitment takes place in non-host species - including hardwoods - during outbreak periods.

In the context of climate change, the most severe outbreaks anticipated in the north could affect the black spruce stand ecosystem in terms of nutrient cycling. With mortality there not being as high as in balsam fir stands found further south, there would be an acceleration in the succession of black spruce stands to balsam fir. In rich sites, this would lead to an increase in forest productivity. In poor sites, however, where the SBW could turn some spruce stands into open spruce stands, there would be a loss in productivity.

Photo: NRCan

Photo: NRCan

The importance of knowing

Research increases knowledge concerning the impact of spruce budworm outbreaks in an ecosystem dominated by black spruce. Setting up research stations makes it possible to establish a long-term database on the factors that affect the severity and distribution of SBW outbreaks and their impact. These data will populate models that can be used to prioritize watering and salvage logging operations.

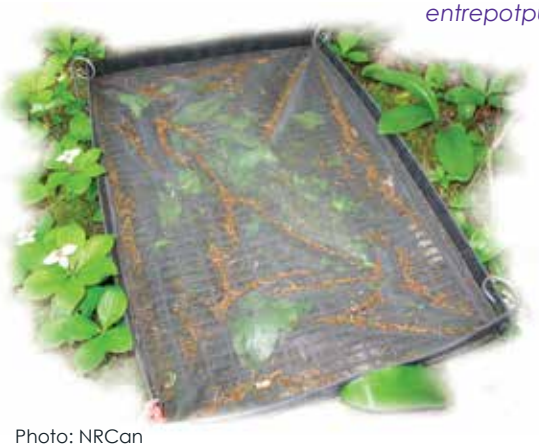

Photo: NRCan

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Useful links

Fact sheet:
http://tidcf.nrcan.gc.ca/en/insects/factsheet/12018

Spruce budworm research at the Laurentian Forestry Centre:
http://scf.rncan.gc.ca/entrepotpubl/pdfs/33589.pdf

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