



## Canadian Forest Service spruce budworm L2 processing lab

Forest managers and researchers use a variety of methods to assess spruce budworm populations in our forests. The sampling of overwintering second-instar larvae (L2) provides a good indication of the number of spruce budworm that will be present the following year. It is the best tool for determining whether a local population might need to be controlled.

Since 2014, Natural Resources Canada's Canadian Forest Service has been researching a new and innovative approach to managing spruce budworm outbreaks – an early intervention strategy. The early intervention strategy can potentially protect forests from damage by minimizing the rise and spread of spruce budworm populations.

The early intervention strategy involves intensive L2 monitoring to identify areas where populations of spruce budworm are beginning to rise (i.e. hot spots) and treating these areas with insecticides to control growing populations. The objective is to keep populations low to prevent an outbreak from occurring, thus limiting defoliation of forests and impacts on the wood supply and the economy. The ecosystem services that spruce-fir forests provide would also be preserved.

The Canadian Forest Service has established an L2 processing lab at the Atlantic Forestry Centre in Fredericton, New Brunswick, to support the ongoing efforts to monitor spruce budworm. The need for this lab stems from the increased requirement for processing branch samples resulting from the research and from operational needs of the early intervention strategy against the spruce budworm. The spruce budworm L2 processing lab serves all of Atlantic Canada and provides a service to other jurisdictions such as other provinces and the state of Maine.

## Spruce budworm

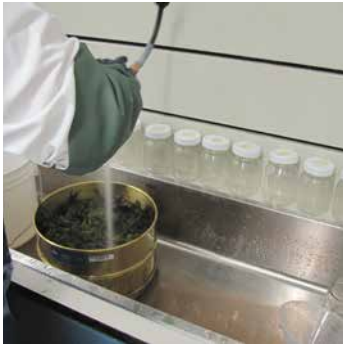
The spruce budworm is the most serious native pest affecting the forest of northeastern North America. Outbreaks of this insect generally occur every 30 to 40 years. During this cycle, populations of spruce budworm range from being very low (endemic) to very high (epidemic). The previous outbreak of spruce budworm in Atlantic Canada ended around 1990. Since that time, natural controls (natural enemies and climatic factors) have kept numbers at almost undetectable levels.

The spruce budworm completes its life cycle in a single year. After emerging from its pupa, the female moth mates and lays an average of 180 eggs on the needles of spruce and fir trees. The eggs hatch in about 10 days and shortly after, the young larvae crawl into bark crevices, under bud scales, or into other sheltered areas and overwinter as L2 in a small, silky cocoon (hibernaculum). In spring, the larvae emerge, begin feeding and eventually transform into adults (moths), thus completing the one-year cycle.

## Sampling process

Starting in September, field crews collect branch samples from fir and spruce trees that may contain hibernating spruce budworm larvae. The sampling is conducted largely to learn where populations are growing throughout the region and whether early intervention strategy treatments are helping to suppress further population growth. Sampling is more intensive in areas that have increasing spruce budworm populations.

Branches are collected from the mid-crown of three trees at each site, trimmed to 75 cm and placed in paper bags. Information on species, defoliation level and location are recorded for each branch.



A) Following a soak in NaOH solution, the branches are rinsed to remove any remaining L2 larvae.



B) Remaining materials are funnelled through hexane and water to capture L2 larvae and remove sunken debris.



C) The remaining mixture (containing L2 larvae) is set on filter paper.



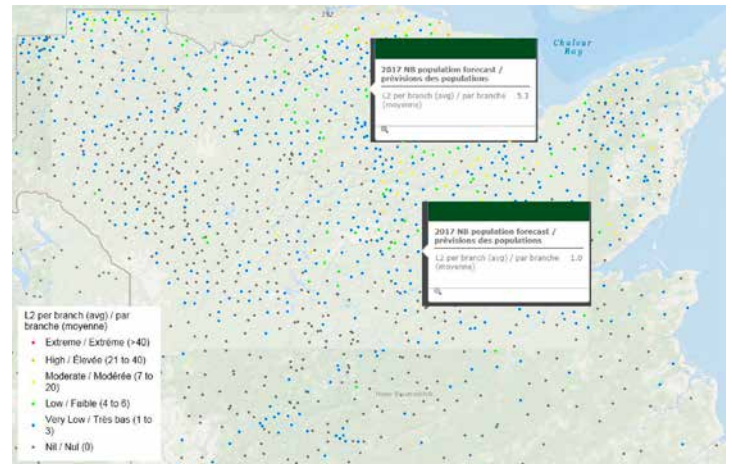
D) L2 larvae are counted under a dissecting microscope.

In the lab, each branch is cut into smaller pieces and placed in a bucket containing a solution of sodium hydroxide (NaOH) and warm water. This NaOH solution dissolves the silky cocoon and releases the larvae. The mixture is then rinsed and filtered through a series of sieves, and the larger material is discarded. The remaining material containing the budworm larvae and small debris is gently rinsed into a jar.

The contents of the jar are then poured through a funnel containing cold water and hexane. The hexane floats on top of the water and captures the budworm larvae while most of the debris sinks to the bottom. Most of the water and debris is drained off. The remaining material is drained onto a moistened filter paper and placed under a dissecting microscope, and the number of budworm larvae counted.

All information is recorded and mapped. In the following map, each point represents an average of L2 collected from three branches. The mapping provides a visual representation of the number of overwintering budworm larvae and a tool to help researchers and managers in planning protection strategies for the upcoming year.

The number of spruce budworm larvae varies greatly. During a serious outbreak, several hundred overwintering larvae may be found on a single 75-cm branch. Under the early intervention strategy, the threshold for hotspots is 7 larvae per branch. Once spruce budworm numbers reach this level, the population is more likely to continue to rise into a full-blown outbreak. Keeping populations below this threshold is the essence of the early intervention strategy.



Map of northern New Brunswick shows the L2 counts for 2017

Source: Healthy Forest Partnership website <http://www.healthyforestpartnership.ca/en/>

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