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Branching Out
from the Canadian Forest Service - Laurentian Forestry Centre

Spruce Budworm: Mass Flights under the Radar

Long-distance flights are a very common phenomenon among insects. This strategy helps maximize their survival in various environments. Researchers with the Canadian Forest Service (CFS) have devised their own strategy for observing the movements of the spruce budworm (SBW), the most destructive pest in the Canadian boreal forest: they use weather radars.

Wayward moths

Because the spruce budworm (SBW) causes significant environmental and economic losses, its movements are of great interest to CFS researchers and their partners. Several methods exist to track SBW populations, such as sampling insect populations to determine the egg-to-adult and sex ratios, as well as population genomics. It is possible to collect moths in flight in order to document SBW spread, but this method is costly and its scope is limited.

Weather radars, which are already serving other purposes, represent an interesting alternative for those involved in forest research. Indeed, weather radars have the advantage of making it possible to visualize various types of particles called "meteors" live and at a large scale.

Photo: NRCan

Gone with the wind

Insects travelling over long distances frequently fly inside specific atmospheric layers in order to maximize the distance of their dispersal. By identifying these layers, researchers are able to better understand the SBW's dispersal pattern.

It seems that the SBW can spread over long distances at high altitudes (from 200 to 2,000 m). This spread could influence the beginning and development of outbreaks as it could increase egg populations inside border areas that previously were only slightly affected or not at all. Consequently, local natural enemies are unable to curtail this sudden population increase. It is therefore important to keep track of such dispersals as part of a rapid response strategy.

Photo: NRCan

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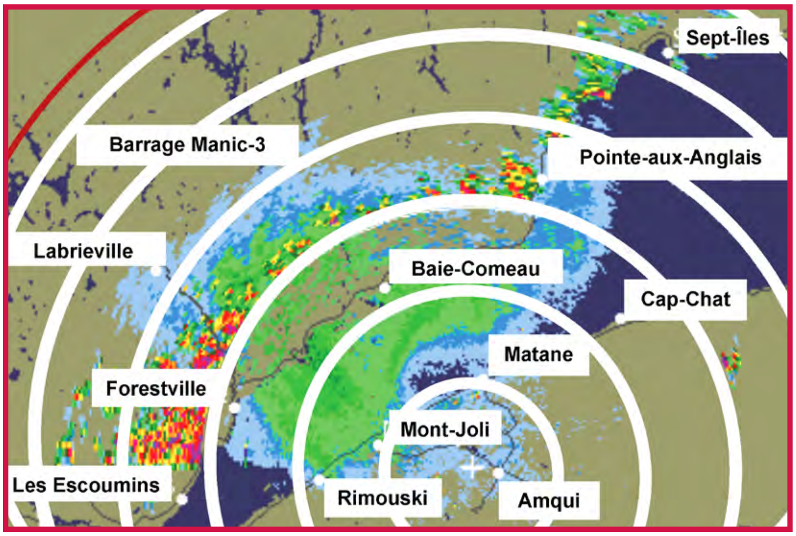

SBW moths appear on this radar picture taken on the night of July 15 to 16, 2013. Green areas present a greater concentration than blue areas. Source: http://climate.weather.gc.ca/radar/index_e.html

What a night!

During the night of July 15 to 16, 2013, a mass flight of SBW was observed in Rimouski, in the Lower St. Lawrence region. CFS researchers matched the weather radar images from Val d'Irène (Matapédia, Quebec) with modelled meteorological data. The radar data used (for each 200 m layer) were temperature, wind direction, and wind speed. As a result, the researchers were able to compare the speed of the SBW with that of the wind at various altitudes, which made it possible to determine which weather conditions favoured the dispersal of the SBW.

They concluded that the moths came from both the south shore and the north shore of the St. Lawrence River, with the majority originating from the heavily defoliated forests of the Côte-Nord region. During that night, some moths travelled more than 200 km. Similar phenomena were observed in July 2017.

A tool, not a panacea

The use of weather radars represents an excellent tool for observing the trajectory of SBW mass flights, as they make it possible to know where the moths originate from, their density, as well as the speed and direction of their flight. However, it will not answer all the questions concerning SBW moth migrations. Studies are therefore still being carried out in order to identify what type of atmospheric conditions would restrict these mass flights, to develop tools that can detect mass flights in real time, and to link weather radar images with traditional methods of detection, among other things.

Photo: NRCan

Photo: Radio-Canada

Rapid response strategy 101

A rapid response strategy is based on the idea that the nature of SBW epidemics resemble that of forest fires: they originate in a stand and spread to neighbouring stands, until the entire region is affected. An obvious solution would be to eliminate the epicentres by spraying them with insecticides, which would slow down the progress and reduce the severity of the outbreak. This type of rapid intervention strategy aims to alter the course of a new outbreak (by interrupting or slowing its progress) by targeting insect populations from the outset.

For more information, please contact:
Yan Boulanger
Natural Resources Canada
Canadian Forest Service
Laurentian Forestry Centre
1055 du P.E.P.S., P.O. Box 10380, Stn. Sainte-Foy
Quebec City, Quebec G1V 4C7
418-648-5834 • yan.boulanger@canada.ca
nrcan.gc.ca/forests

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