FPInnovations

SBW-AID: DRONE BASED ADAPTIVE AND INTELLIGENT SBW DEFOLIATION DETECTOR

Native forest insects are an essential part of the forest ecosystem. However, increased density beyond a threshold, or their invasive nature – as seen with Spruce budworm (SBW) in eastern Quebec in recent years – can cause long-lasting damage to a healthy ecosystem. Developing tools and means for identifying risk early on, to effectively deploy control measures, has been one of the critical objectives of collaborative research through the "SBW Early Intervention Strategy" network, with researchers from NRCan-CFS, the Healthy Forest Partnership, provincial governments, universities, industry, and FPInnovations. This information is especially needed for the comprehensive forest management program used for timely intervention in New Brunswick.

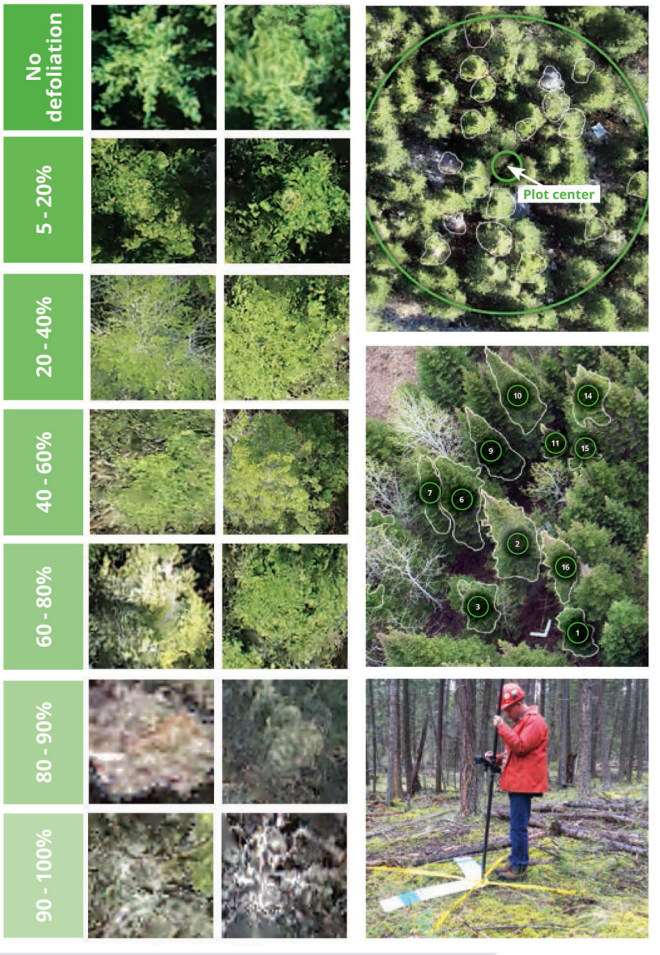
Exploiting reddish coloration of canopies during insect feeding, visual or automated remote sensing solutions were always used to assess the broad impact of insect epidemics. Despite technological advances, detection of the early signs of insect epidemics (i.e., low levels of severity seen annually or cumulatively over time) remains challenging, as this requires learning of insect impacts in a multitude of conditions, which can be expensive. Given the industry's current familiarity with drones (UAV), and the ability to rapidly cover sufficiently large areas using this technology, drone-based approaches are being investigated by FPInnovations. The goal is to evaluate the effectiveness of providing an assessment of the infestation at any point of time during the year. With UAVs increasingly becoming part of the forester's tool kit, a solution with a standard RGB (red, green, and blue) sensor can make it extremely rapid and economical.

During bud burst (late June to early July), the feeding debris entangled in the silken web, generally concentrated towards the top canopies, has a reddish-brown appearance. The discoloration, in this short window of opportunity, had been the only visual indication of the annual damage perceivable on large spaces, especially over the canopy.

A model is as good as the data that it is trained on. To develop a robust autonomous defoliation predictor, data should ideally be captured in varying defoliation and stand conditions at different times (environmental conditions) during the year. Ground and aerial surveys were conducted at multiple times during 2018-2020 at 9 sites south of Campbellton, N.B., and west of Causapscal, Quebec. Based on in-situ and UAV images, a reference library of over 5000 trees was compiled, covering a gradient of annual/cumulative defoliation of the host trees. These trees were visually assessed on the ground, and geo-located with a precise RTK-GPS. A model was then trained iteratively and adaptively as the information was added each time to attain good accuracies, especially in separating healthy trees from low levels of defoliation (5-20%). Current achievement is better than 80%.

The work in assessing the defoliation is still in progress. More images will be added in the next season, and we expect the tree library to grow, especially in the high-defoliation classes. A more operational solution is in sight. This is the first line of defence in keeping the SBW out of the Atlantic Bubble!

Figure 1. Sample tree library (left) – created from precise geolocation on identification (right)



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