Can Landscape-scale Management Influence Insect Outbreak Dynamics? A Natural Experiment for Eastern Spruce Budworm

Main Presenter: Brian R. Sturtevant

The balance of evidence suggests forest insect outbreaks today are more damaging than ever because of changes in forest composition and structure induced by fire suppression and post-harvest proliferation of tree species intolerant to herbivory. We hypothesized that landscape connectivity of acceptable host trees increases defoliator population connectivity, altering the dynamics and spatial structure of defoliator populations, and thus increasing forest susceptibility to insect pest damage. We evaluated this hypothesis for eastern spruce budworm (*Choristoneura fumiferana*; Clemens) within a 2 million ha "experimental" landscape at the international border between Minnesota and Ontario, containing wilderness plus two contrasting patterns of harvesting (coarse vs. fine). Wavelet analysis of forest composition maps produced by remote sensing revealed fine spatial structure and offered some support to the existence of separate zones of host species spatial structure corresponding with political boundaries of the study landscape. Yet current spatial structure in host trees was complicated by abundant lakes and as well as overlapping disturbances including harvest, fire, budworm, and wind. Initial application of AFLPs from spruce budworm larvae found geospatial genetic structure within the study landscape, where populations within the northern region appear more connected than within the southern region. Tree ring chronologies show a clear 32-year outbreak cycle in the undisturbed wilderness region, a poorly synchronized and lower intensity 15-year cycle in fragmented Minnesota, and a heterogeneous mix of the two signals in coarsely fragmented Ontario. Collectively, our results are consistent with the hypothesis that fragmentation and reduction of host abundance reduced the synchrony of outbreaks in the fine-scale zone thus explaining the difference in population connectivity as well as the periodicity and intensity of outbreaks. Our study is among the first to show that forest management can not only influence insect damage associated with budworm outbreaks, but also the nature of the outbreaks themselves.

Sturtevant, B. (1*), V. Quinn (2), L.-E. Robert (3), D. Kneeshaw (3), P. James (4), M.-J. Fortin (4), P. Wolter (5), P. Townsend (5), B. Cooke (6), and D Anderson.

(1) US Forest Service, Northern Research Station, Rhinelander, WI, 54501 USA.
(2) Purdue North Central, Department of Biology/Chemistry, Westville, IN 46391-9542.
(3) University of Quebec at Montréal, Centre d'Étude de la Forêt (CEF), Montreal, QC, Canada, H3C 3P8
(4) University of Toronto, Ecology and Evolutionary Biology, Toronto, ON, Canada M5S 3G5
(5) University of Wisconsin, Department of Forest and Wildlife Ecology, Madison, WI 53706
(6) Canadian Forest Service, Northern Forestry Centre, Edmonton, AB, Canada T6H 3S5
(7) Manaaki Whenua - Landcare Research, PO Box 40, Lincoln, New Zealand 7640

* Main Presenter E-mail: bsturtevant@fs.fed.us; Phone: 715-362-1105; Fax: 715-362-1166
Presentation Type: Oral

Brian R. Sturtevant
Research Ecologist
Institute for Applied Ecosystems Studies
US Forest Service
Northern Research Station
5985 Hwy K
Rhinelander, WI 54501
715-362-1105