Geophysical Research Abstracts
Vol. 15, EGU2013-720, 2013
EGU General Assembly 2013

Wood Anatomy and Insect Defoliator Systems: Is there an anatomical response to sustained feeding by the western spruce budworm (Choristoneura occidentalis) on Douglas-fir (Pseudotusga menziesii)?

Jodi Axelson (1), Holger Gärtner (2), René Alfaro (3), and Dan Smith (4)

(1) University of Victoria, Victoria BC, Canada (jaxelson@uvic.ca), (2) Swiss Federal Research Institute WSL, Birmensdorf, Switzerland (holger.gaertner@wsl.ch), (3) Canadian Forest Service, Pacific Forestry Centre, Victoria BC, Canada (ralfaro@nrcan.gc.ca), (4) University of Victoria, Victoria BC, Canada (smith@uvic.ca)

The western spruce budworm (Choristoneura occidentalis Freeman) is the most widespread and destructive defoliator of coniferous forests in western North America, and has a long-term coexistence with its primary host tree, Douglas-fir (Pseudotsuga menziesii Franco). Western spruce budworm (WSB) outbreaks usually last for several years, and cause reductions in annual growth, stem defects, and regeneration delays. In British Columbia, the WSB is the second most damaging insect after the mountain pine beetle, and sustained and/or severe defoliation can result in the mortality of host trees. Numerous studies have used tree rings to reconstruct WSB outbreaks across long temporal scales, to evaluate losses in stand productivity, and examine isotope ratios. Although some studies have looked at the impacts of artificial defoliation on balsam fir in eastern North America, there has been no prior research on how WSB outbreaks affect the anatomical structure of the stem as described by intra-annual wood density and potential cell size variations.

The objective of this study was to anatomically examine the response of Douglas-fir to sustained WSB outbreaks in two regions of southern British Columbia. We hypothesize that the anatomical intra-annual characteristics of the tree rings, such as cell wall thickness, latewood cell size, and/or lumen area changes during sustained WSB outbreaks. To test this hypothesis we sampled four permanent sample plots in coastal and dry interior sites, which had annually resolved defoliation data collected over a 7-12 year period. At each site diameter-at-breast height (cm), height (m), and crown position were recorded and three increment cores were extracted from 25 trees.

Increment cores were prepared to permit anatomical and x-ray density analyses. For each tree, a 15μm thick micro section was cut from the radial plane. Digital images of the micro sections were captured and processed. In each annual ring, features such as cell lumen area (μm2), cell wall thickness (μm), lumen diameter (μm), and total cell width (μm) were measured. Preliminary results indicate that earlywood parameters remain quite stable during WSB outbreak, while latewood parameters such as secondary cell wall thickness and cell length undergo step shifts at the beginning and end of outbreaks. These parameters, tree-level data, and annual defoliation data will further be tested to determine if changes in stem wood anatomy during WSB outbreaks were statistically significant.