



## **The Effect of Bark Borer Herbivory on BVOC Emissions in Boreal Forests and Implications for SOA Formation**

Celia Faiola (1), Jorma Joutsensaari (1), Jarmo Holopainen (2), Taina Yli-Juuti (1), Harri Kokkola (3), James Blande (2), Alex Guenther (4), and Annele Virtanen (1)

(1) University of Eastern Finland, Department of Applied Physics, Kuopio, Finland (celia.faiola@uef.fi), (2) University of Eastern Finland, Department of Environmental Science, Kuopio, Finland, (3) Finnish Meteorological Institute, Kuopio Unit, Kuopio, Finland, (4) Pacific Northwest National Laboratories, Atmospheric Sciences and Global Change Division, Richland, Washington, USA

Herbivore outbreaks are expected to increase as a result of climate change. These outbreaks can have significant effects on the emissions of biogenic volatile organic compound (BVOC) from vegetation, which contribute to the formation of secondary organic aerosol (SOA). We have synthesized the published results investigating changes to BVOC emissions from herbivory by the pine weevil, *Hylobius abietis*—a bark borer herbivore. Previous lab experiments have shown that bark borer herbivory on Scots pine trees increases monoterpene emissions 4-fold and sesquiterpene emissions 7-fold. Norway spruce exhibits a similar response. The BVOCs most impacted were linalool, beta-phellandrene, limonene, alpha-pinene, beta-pinene, myrcene, and sesquiterpenes like beta-farnesene, beta-bourbonene, and longifolene. The quantitative results from these studies were used to estimate potential impacts of bark borer herbivory on BVOC emissions at a regional scale using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN was run under baseline and herbivore outbreak conditions for a typical boreal forest environment in spring. Emissions output from MEGAN was used to run a microphysical box model to estimate the SOA formation potential under baseline and outbreak conditions. This estimate could provide us with an upper limit to the potential impact of bark borer outbreaks on SOA formation in a boreal forest.