Geophysical Research Abstracts
Vol. 21, EGU2019-405, 2019
EGU General Assembly 2019

Water use and growth responses of Norway spruce and European larch to experimental drought at the subalpine tree line

Florian Oberleitner (1), Roland Hasibeder (1), Julia Wagner (1), Henrik Hartmann (2), Adriano Losso (3), Stefan Mayr (3), Walter Oberhuber (3), Gerhard Wieser (4), and Michael Bahn (1)

(1) Department of Ecology, University of Innsbruck, Innsbruck, Austria, (2) Department of Biogeochemical Processes, Max Planck Institute for Biogeochemistry, Jena, Germany, (3) Department of Botany, University of Innsbruck, Innsbruck, Austria, (4) Department of Natural Hazards, Austrian Research Center for Forests, Innsbruck, Austria

Climate projections suggest an increased severity and frequency of drought events across many parts of Europe. Little is known on how trees in regions with previously ample water supply respond to sustained and recurrent drought periods. At a recently established subalpine LTER-forest site (Stubai, Austria, south-facing slope at 2000 m) we performed a replicated rain exclusion experiment, excluding a large percentage of the precipitation during three subsequent growing seasons. For the two dominant tree species Norway spruce (Picea abies) and European larch (Larix decidua) we continuously monitored radial growth and sap flux dynamics under ambient and drought conditions. Drought effects on radial growth were pronounced. They were similar for both species during the first year, but became significantly larger for spruce under recurrent drought. Sap flow rates and their threshold responses to environmental drivers were less affected by drought, but tended to decrease under drought during periods of high evaporative demand, effects being more pronounced for spruce than for larch. Contrary to our expectation, saplings did not show any stronger drought responses of sap flow than adult trees. In 2018, at the end of the drought treatment stem conductivity was measured on spruce using in situ tomography, demonstrating that drought had significantly reduced conductivity across all sections of the trunk. This indicates the potential for an increased vulnerability of spruce to dry periods extending into the late season. Overall, our findings indicate that at the treeline prolonged and recurrent drought periods can significantly reduce tree growth, affecting spruce more strongly than larch. However, while reducing hydraulic conductivity, extended drought periods were found to have only minor effects on water use at the alpine tree line.