Geophysical Research Abstracts
Vol. 17, EGU2015-11194, 2015
EGU General Assembly 2015

Temperature-enhanced decomposition contributes to a decline in soil carbon stocks of a mountain forest after windthrow

Mathias Mayer (1), Bradley Matthews (1), Hans Göransson (1), Boris Rewald (1), Andreas Schindlbacher (2), Douglas Godbold (1), and Klaus Katzensteiner (1)

(1) University of Natural Resources and Life Sciences, Vienna, Institute of Forest Ecology, Department of Forest and Soil Sciences, Vienna, Austria (mathias.mayer@boku.ac.at), (2) Department of Forest Ecology, Federal Research and Training Centre for Forests, Natural Hazards and Landscape – BFW, Vienna, Austria

Forest soils store large amounts of organic carbon (OC); the carbon dioxide (CO_2) efflux from the soil is one of the largest fluxes in the forest carbon budget. Forest disturbance can significantly affect soil carbon stocks and fluxes of forest ecosystems. As disturbance events are expected to increase under climate change, a detailed understanding of respective effects on the soil carbon budget of forest ecosystems is of major importance. We investigated the temporal dynamics of soil OC stocks and soil CO_2 efflux following stand-replacing disturbance by wind in a temperate forest in the Austrian Alps. Over the course of four years, measurements were conducted within a disturbance chronosequence (undisturbed control and two windthrow areas disturbed in 2007 and in 2009, respectively). The annual soil CO_2 emissions were estimated at $\sim$ 5 and 5.5 t C ha-1 yr-1 for the windthrow areas and for the control stand, respectively. About 15 to 20 % of the annual soil CO_2 emissions from the windthrows were attributed to a disturbance-related increase in soil temperature (up to +4 °C). A clipping experiment (aboveground vegetation was removed) at the windthrow areas revealed that about three-quarter of the soil CO_2 efflux originated from microbial respiration, suggesting a large loss of soil OC to the atmosphere. In accordance, significantly lower soil OC stocks were observed at the 2007 windthrow area when compared to the control stand in the seventh year post-disturbance. Thus, temperature-enhanced decomposition significantly contributes to the decline in the soil OC stocks following forest disturbance by wind. This study was funded by the European Regional Development Fund (ERDF), national funding and the Austrian climate research program StartClim2012.