Geophysical Research Abstracts
Vol. 14, EGU2012-6398, 2012
EGU General Assembly 2012

Changes in soil CO_2 efflux of organic calcaric soils due to disturbance by wind

M. Mayer and K. Katzensteiner
Institute of Forest Ecology, University of Natural Resources and Life Sciences, Vienna

Disturbances such as windthrow or insect infestations are supposed to have a significant influence on the soil carbon balance of affected forests. Increasing soil temperatures and changes in the soil moisture regime, caused by the removed tree layer, are expected to change soil CO_2 efflux, also known as soil respiration. Beside an anticipated stimulation of the carbon mineralization, the main part of root allocated CO_2 is offset due to the blown down trees. On mountain forest sites of the Northern Limestone Alps, where highly active organic soils above calcareous parent material are characteristic (Folic Histosols and Rendzic Leptosols), an increase of the mineralization rate of carbon may contribute to enormous humus losses. Serious site degradation can be the consequence, especially on south exposed slopes where extreme climatic conditions occur. The present study tries to give insights to disturbance induced changes in temporal and spatial behaviour of soil respiration for a montane mountain forest located in the Northern Limestone Alps of Upper Austria.
Soil respiration, soil temperature and volumetric water content were measured on two windthrow areas (blow down dates were 2007 and 2009 respectively) as well as in an adjacent mature mixed forest during the vegetation periods of 2010 and 2011. Soil respiration in both years was mainly driven by soil temperature, which explained up to 90 % of the concerning temporal variation. Volumetric water content had a significant influence as additional temporal driver. After removing the temperature trend, significant differences in basal soil respiration rates were found for the disturbance area and the forest stand. Inter seasonal declines in soil respiration were ascertained for the mature stand as well as for the recent windthrow. Particular decreases are related to drought stress in summer 2011 and a proceeded decomposition of labile soil carbon components at the windthrow site. An interaction between soil type and stratum showed a distinctive decrease in the soil CO_2 efflux pattern for organic soils by comparing the recent and old disturbance areas. Such a downward trend was also detected on the more recently disturbed area in the consecutive years. These findings support the assumption that carbon mineralization can account for excessive losses in soil organic carbon after forest disturbance, whereas organic humus soils are supposed to be particularly vulnerable.
This study is part of the INTERREG Bayern-Österreich 2007 -2013 project ‘SicAlp – Standortssicherung im Kalkalpin’ which is funded by the European Regional Development Fund (ERDF) and national funding.