Geophysical Research Abstracts
Vol. 14, EGU2012-8660-1, 2012
EGU General Assembly 2012

Effects of drought on C allocation and turnover in a Mediterranean shrub community - A 13C field labeling study

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Predicting impacts of climate change on terrestrial ecosystem functioning is a big scientific challenge. Large-scale manipulation experiments may provide realistic estimates of the responses of biological processes to changes in their principal regulators such as temperature, CO_2, and water availability.
A field drought manipulation experiment has been established in a Mediterranean shrub community of Porto Conte (Sardegna, Italy) in 2002 as part of the INCREASE network. The INCREASE network aims at developing non-intrusive technologies for realistic climate change manipulations to study vulnerable shrubland ecosystems over Europe. In Porto Conte summer drought is extended by excluding precipitation with transparent roofs in order to mimic potential future changes in precipitation patterns.
In October 2011 we performed a field 13C pulse labeling to explore effects of drought on carbon allocation and turnover in the shrub land of Porto Conte. For this purpose, Cistus monspeliensis, the dominant shrub species within the experimental site, was labeled in three plots subjected to extended summer droughts and in three control plots.
Allocation of the tracer between various pools and fluxes in the plant-soil system was studied over a period of two weeks with an one day frequency. Aboveground carbon allocation and turnover was accessed by monitoring 13C content in shoots and in shoot-respired CO_2. Belowground carbon allocation and turnover was explored by repeated determination of 13C label in roots, microbial biomass, and soil respired CO_2. Two approaches of soil respired $13CO_2$ sampling were utilized and confronted here. Soil respiration and its δ13C were determined by Keeling plot approach. Additionally, cumulative amount of the soil respired CO_2 and its isotopic signature were determined by trapping the evolved CO_2 with soda traps. Conclusions on the sensitivity of C. monspeliensis to drought and its consequences for C cycling in shrub lands under extended summer droughts were drawn.