Universität Basel

Research Project

Impacts of changing drought conditions on catchment ecology and water cycle – ECOWAT (NCCR Climate Phase 3)

Third-party funded project

Project title Impacts of changing drought conditions on catchment ecology and water cycle – ECOWAT (NCCR Climate Phase 3)
Principal Investigator(s) Körner, Christian ;
Co-Investigator(s) Bader, Karl-Friedrich Martin ; Scherrer, Daniel ;
Organisation / Research unit
Departement Umweltwissenschaften / Pflanzenökologie (Körner)
Department
Project start 01.04.2009
Probable end 30.09.2012
Status Completed

We will provide (1) observational information on the impacts of drought on carbon and water relations of common tree species, (2) a model-based upscaling of these impacts to the catchment level, and (3) an investigation of land-climate feedbacks with a coupled regional climate-vegetation model. The outputs of this project are relevant for forest management (e.g., tree species selection; C sequestration under the Kyoto protocol) as well as for the climate modeling community.

At the local scale, as a follow-up of the CANOPY project, we will verify, over a large area, the species-specific drought sensitivity of trees found at the Swiss Canopy Crane site (elaboration of a drought sensitivity index for Central Europe). We will employ helicopter-based infrared thermography to scan forests across a wide spectrum of Swiss habitats, ground-based moisture sensors and local microcore measurements of the growth response over ten years. Canopy temperature will serve as a proxy for transpiration under known atmospheric evaporative demand. Existing dendrometer data will be used to distil seasonal influences of drought on radial growth, including the 2003 drought episode (link with dendrochronology-based drought investigations by P1.3).

At the catchment scale, data from the above campaign will be used to parameterize the specific drought response of trees in the LPJG-TM model (EcoHydro project of Phase II); we will continue (in collaboration with P3.1 and P3.2) to parameterize non-woody Plant Functional Types. Using empirical data from Switzerland, Poland and the US on the growth-mortality relationship, we will focus on the modelling of drought effects on tree mortality and associated C-cycle changes. Simulation results based on climate scenarios from P2.2 will be aggregated to the grid-cell scale of the CLM2 outputs for consistency checks and in light of the higher process resolution regarding plant demography in LPJG-TM.

At the continental scale, the model CLM2 will be used. It is currently developed at ETH Zurich, coupling the COSMO/Climate-Local Model (cf. P2.1) with NCAR's Community Land Model. Simulations will be performed (1) with the standard CLM2; (2) including carbon-water relationships based on CANOPY data and related findings in Europe; (3) including land cover specifications based on results from LPJG-TM. We will investigate the role of subgrid-scale heterogeneity of vegetation dynamics for continental-scale climate (comparison with LPJG-TM), and assess the role of biosphere-climate feedbacks for future climate (comparison with P2.1, P2.2). In addition, the impact of the changing magnitude and frequency of droughts on these relationships will be investigated with/without soil moisture feedbacks.

Financed by
Swiss National Science Foundation (SNSF)

Follow-up project of 5698 CANOPY – NCCR Climate Phase 2

Add publication

Published results

102345, Leuzinger, Sebastian; Koerner, Christian, Rainfall distribution is the main driver of runoff under future CO2-concentration in a temperate deciduous forest, 1354-1013, Global change biology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

102373, Leuzinger, Sebastian; Vogt, Roland; Koerner, Christian, Tree surface temperature in an urban environment, 0168-1923, Agricultural and forest meteorology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

986162, Scherrer, Daniel; Bader, Martin Karl-Friedrich; Koerner, Christian, Drought-sensitivity ranking of deciduous tree species based on thermal imaging of forest canopies, 0168-1923, Agricultural and forest meteorology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

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