Sensitivity of tropical lowland net primary production to climate anomalies

Florian Hofhansl (1), Johannes Kobler (2), Sigrid Drage (1), Eva-Maria Pölz (1), and Wolfgang Wanek (1)

(1) Department of Microbiology and Ecosystem Science, Division of Terrestrial Ecosystem Research, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria, (2) Abteilung für Ökosystemforschung & Monitoring, Umweltbundesamt, Spittelauer Lände 5, 1090 Vienna, Austria

While drivers of tropical forest productivity such as edaphic properties (geology, topography) and climate (precipitation, temperature, light) are well established, knowledge on the sensitivity of tropical lowland net primary production to climate anomalies remains scarce.

We here investigate tropical lowland forest sites differing in topography and disturbance history to study the response of aboveground net primary production (ANPP) in relation to (1) climate extremes as triggered by El-Niño Southern Oscillation (ENSO), as well as (2) topographic position and (3) land-use history.

In general, climate anomalies resulted in decreased precipitation and increased temperature. The production of wood decreased while the production of canopy material increased in years with prolonged periods of drought and elevated temperature. However, the impact strongly depended on local characteristics of the forest sites, such that ANPP was only negatively affected at ridges but not at ravine forest sites. We moreover show that the productivity of primary forests was significantly affected by precipitation and drought, while in secondary forests temperature was the major predictor of ANPP.

Our results suggest that site-specific parameters such as topographic position and disturbance history determine the response of tropical lowland forests to climate extremes. Hence we conclude that the impact of climate anomalies on tropical forest productivity is strongly related to local conditions and thus will likely prevent uniform responses of tropical lowland forests to projected global changes.