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Conversion of woodlands changes soil related ecosystem services in Subsaharan Africa

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In remote areas of Subsaharan Africa, growing population, changes in consumption patterns and increasing global influences are leading to a strong pressure on the land resources. Smallholders convert woodlands by fire, grazing and clearing in different intensities thus changing soil properties and their ecosystem functioning. As the extraction of ecosystem services forms the basis of local wellbeing for many communities, the role of soils in providing ecosystem services is of high importance.
Since 2010, "The Future Okavango" project investigates the quantification of ecosystem functions and services at four core research sites along the Okavango river basin (Angola, Namibia, Botswana, see http://www.future-okavango.org/). These research sites have an extent of 100 km2 each. Within our subproject the soil functions underlying ecosystem services are studied: The amount and spatial variation of soil nutrient reserves in woodland and their changes by land use activities, the water storage function as a basis for plant growth, and their effect on groundwater recharge and the carbon storage function. The scientific framework consists of four major parts including soil survey and mapping, lab analysis, field measurements and modeling approaches on different scales. A detailed soil survey leads to a measure of the spatial distribution, extent and heterogeneity of soil types for each research site. For generalization purposes, geomorphological and pedological characteristics are merged to derive landscape units. These landscape units have been overlaid by recent land use types to stratify the research site for subsequent soil sampling. On the basis of field and laboratory analysis, spatial distribution of soil properties as well as boundaries between neighboring landscape units are derived. The parameters analysed describe properties according to grain size distribution, organic carbon content, saturated and unsaturated hydraulic conductivity as well as pore space distribution. At nine selected sites, soil water contents and pressure heads are logged throughout the year with a 12 hour resolution in depth of 10 to 160 cm. This monitoring gives information about soil water dynamics at point scale and the database is used to evaluate model outputs of soil water balances later on. To derive point scale soil water balances for each landscape unit the one dimensional and physically based model SWAP 3.2 is applied.
The presentation will demonstrate the conceptual framework, exemplary results and will discuss, if the ecosystem service approach can help to avoid future land degradation.
Key word: Okavango catchment, soil functions, conceptual approach