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The role of vegetation dynamics in the small-scale water balance of the Okavango Delta

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The Okavango Delta is a tropical freshwater wetland complex with a total flooded area ranging from 12,000 km2 (average years) to 15,000 km2 (extremely wet years). It is part of the semi-arid Kalahari Basin of northern Botswana where the Okavango river connects a variety of savannah woodlands and wetland ecosystems. Ecosystems in the Okavango include non-[U+FB02]ooded uplands, seasonally [U+FB02]ooded [U+FB02]oodplains and stream channels, and their permanently [U+FB02]ooded [U+FB02]oodplains.

One of the most important features of the Okavango Delta is its hydrological pulse. In the summer, rains replenish the Delta. In dry winter, flood originating from the upper catchment bring water to the Delta. Flood water moves very slowly through this low gradient system in such a way that the annual flood arrives during the dry season, long after the end of rains (3 to 4 months). Large-scale water balances from hydrological data of the last 37 years have shown that less than 1% of the inflow leaves the Delta in the southern outlet. That means that essentially most of the water that comes in to the Delta from rainfall and [U+FB02]oods is lost by evapotranspiration. That occurs in both the [U+FB02]oodplains and uplands of the Delta where water that infiltrates is temporarily stored to be later used by vegetation growing in floodplains. If sideways groundwater flow occurs, water in drylands inside the islands is transpired by woody vegetation.

The detailed water budget of the Delta, however, is difficult to calculate and model due to the lack of field observations of several essential components (e.g. transpiration water loss) and the lack of understanding of the factors controlling these dynamics. Quantifying water budget of individual islands is one alternative way to better understand the Delta water budget. The floodplains of individual islands can be considered dead-end systems and the possibility of characterizing tree transpiration in specific vegetation species simplifies the calculations. In our initial step to better understand the controlling factors of the Delta water dynamics, this study focuses on the small-scale ecohydrological processes taking place in one of the Okavango islands.

Sap flow measurements of some of the dominant tree species of the Delta, i.e. Croton megalobotrys, Lonchorcarpuss capassa and a highly salt-tolerant Hyphaene petersiana (wine palm) were conducted during the wet season of 2010 at the Nxaraga island. Measurements of groundwater fluctuations, soil moisture profiles and micro-meteorological data were also acquired as complementary information. In the future, the field observations will be incorporated into a numerical modeling framework to characterize ecosystem-level vegetation water-use.