



Vegetation Dynamics in Response to Interannual Rainfall Variability in Southern Africa

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In the Kalahari region of southern Africa, vegetation cover is highly sensitive to interannual variability in rainfall, a property that is detectable at the regional scale through the use of remote sensing. The disparate sensitivities of the dominant functional forms of the savanna vegetation (i.e. trees and grasses) to rainfall provide a means by which to disaggregate the overall vegetation cover into these functional forms. Through the application of a land surface hydrological model, the dynamical nature of the savanna vegetation is shown to be essential for closing the hydrological budget such that losses from the base of the root zone are minimal. We show that vegetation assemblages comprised of tree cover (which is influenced by mean annual rainfall) and grass cover (which dynamically responds to interannual variability in rainfall) is ideal suited for maximizing use of a fluctuating, limiting resource (i.e. water) in this semi-arid environment. The ability of vegetation to optimally use water is explored through the application of a single metric, stress-weighted plant water uptake, which represents a trade-off between maximizing water use while minimizing water stress. Finally, like many arid and semi-arid regions of the world, the Kalahari seems to be experiencing "greening" over recent decades, at least according to temporal trends in AVHRR-based vegetation indices. We combine MODIS-based Enhanced Vegetation Index (EVI) data with a Tropical Rainfall Measuring Mission (TRMM) product to evaluate such trends in the Kalahari region. In particular, we rely upon an analysis of the sensitivity of EVI to interannual variability in rainfall as a means to determine if there have been any detectable shifts in tree/grass cover composition in the Kalahari associated with this apparent greening.