Soil elevation as an indicator of Everglades ridge and slough alternative stable states

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The Everglades in South Florida is a large subtropical peat wetland, with important hydrologic, ecologic, and cultural values. The ridge and slough mosaic is a major landscape component of the Everglades, characterized by stands of sawgrass (*Cladium jamaicense*) on elevated ridges interspersed among deeper water sloughs comprised of floating and emergent species as well as extensive periphyton. Autogenic feedbacks among depth and duration of inundation, plant community composition, net primary production, and peat accretion/decomposition are hypothesized to create and stabilize these multiple ecosystem equilibria. While significant research has focused on processes leading to these potential stable states, no formal examination of the existence of stable states exists. This work describes theoretical predictions and observations of the distribution of soil elevations across large landscape blocks (2x4 km) across a gradient of hydrologic impairment in the ridge-slough region of the central Everglades. The multiple state hypothesis leads to the predictions that: 1) soil elevations show strong fidelity to community type with little overlap in probability density functions (pdf) of elevation in minimally hydrologically impacted areas; 2) increasing hydrologic modification decreases pdf separability; 3) hydrologic modification increases the variance of elevations within communities; 4) kurtosis of the joint soil elevation distribution decreases with increasing hydrologic modification; and 5) spatial anisotropy declines with hydrologic modification. Using water depth as a proxy for local elevation, we measured between 400 and 600 soil elevation measurements at nested random locations across 5 landscape blocks. Should the evidence support the contention that ridges and sloughs are alternative stable states, then it will be important to incorporate ecosystem thresholds and feedbacks into modeling and restoration planning in the Everglades, as these may act as constraints on restoration goals.

Keywords: stable state, hydrologic change, Everglades, water depth, ridge, slough