Describing the Meta-stable Community States of Vegetative Habitats in WCA 3A

Erik N. Powers and Wiley M. Kitchens
powser@wec.ufl.edu

Introduction and Objectives

We are monitoring change in community structure of marsh habitats within Water Conservation Area 3A (WCA 3A) as well as hydrologic fluctuations. In addition to other environmental characteristics we can determine the response of vegetation to fast-acting variables in the context of relatively slow-acting or spatially permanent environmental variables.

The first step in achieving these goals is to document what communities exist in the basin. Physiognomic types exhibit different states depending on the conditions at that site. These meta-stable states are dynamic at specific points in space, varying seasonally and in response to long-term hydrologic trajectories, but are consistently represented throughout the landscape.

The Study

Twenty one-km² plots randomly located along three gradients – elevation, peat depth, and snail kite nest density. Three belt transects that span at least two communities established in November 2002. Biannual destructive sampling events yield a total of 1200 samples of vegetation per event. Species counts and biomass totals are tallied for each sample. Sample data is consolidated into importance values of each species for the community it was sampled from. Community structure for each community unit (approximately 125 units) are determined for each sample event.

In conjunction with the vegetative sampling, hydrology at each plot is monitored with surface-water data loggers. The monitoring stations are tied back into the community units to determine the hydrology at each transect. Additionally peat depths were taken at each community unit. For the time being, soil chemistry is assumed to be constant throughout the study area due to the plots' distant proximity nutrient point sources.

The Issue

Community equilibrium states can vary with environmental conditions. Sometimes one equilibrium exists for each condition of an environmental variable. Usually however, two equilibria can exist for a given condition. That is, multiple states can fill the same environmental niche. There are two ways to shift between community states: (a) If the system is close to the bifurcation point (an environmental threshold), a slight change in conditions induces a shift in state. A backward shift occurs only if conditions are reversed far enough to reach the other bifurcation point. (b) A perturbation induces a shift, if it is sufficiently large.

These community states respond to multiple environmental variables, requiring us to perceive a community state as a reflection of all of the environmental conditions at a site. Transitions may occur as a slight shift in species assemblages, remaining the same general physiognomic type. On the other hand, shifts between physiognomic types occur when the threshold for that type is breached and there is not an alternative state of that community to shift to.

Results

Using a combination of hierarchical clustering analysis and multi-response permutation procedure, the community units for each event were grouped based on similarities in community structure. A total of 11 community states were described using indicator species analyses. These community states can be grouped into the three major physiognomic types of marshes (slough, prairie, and sawgrass) as reference. The community states were identified and profiled by their respective species assemblages below.

A nonmetric multidimensional analysis was applied to plots 7, 8, and 9. These plots were suggested to be within the area of influence of the impoundment effect from Tamiami Trail. Over the course of four years, slough communities have been changing their community structure to typically deeper communities between two regimes which hydrologic parameters are correlated with the change in community structure.