Geophysical Research Abstracts
Vol. 13, EGU2011-949-3, 2011
EGU General Assembly 2011

The Ubiquitous Nature of Nutrient Depletion and the Consequences for Ecosystem Structure

Yiwei Cheng (1), Marc Stieglitz (1,2), Greg Turk (3), and Vic Engel (4)

(1) Georgia Institute of Technology, School of Civil and Environmental Engineering, Atlanta, Georgia, United States (yiweicheng@gmail.com), (2) Georgia Institute of Technology, School of Earth Atmospheric Sciences, Atlanta, Georgia, United States (marc.stieglitz@ce.gatech.edu), (3) Georgia Institute of Technology, School of Interactive Computing, Atlanta, Georgia, United States (turk@cc.gatech.edu), (4) Everglades National Park, South Florida Natural Resources Center, Homestead, Florida, United States (Vic_Engel@nps.gov)

Vegetation patterns are ubiquitous to resource (water and nutrient) limited ecosystems. Spatial pattern formation in these ecosystems reveal dominant ecological processes and may indicate catastrophic shifts between ecosystem states. Most land surface models developed to study landscape responses to climate change and management across various spatial and temporal scales are configured such that resources flow primarily along topographical gradients. However, there are models that account for vegetation-resource flow feedbacks, which have been developed to simulate vegetation pattern formations. These latter models are generally spatially explicit advection-diffusion-reaction schemes and permit a vegetation patch to modify the flow field within a sphere of influence. In this work, we seek to understand the fundamental differences in dynamics between these two model frameworks. Specifically, for a northern bog, we explore the water-nutrient-plant dynamics using these two model frameworks. We show that for equivalent simulations the model that includes for vegetation-resource flow feedbacks produces higher plant biomass, higher nutrient retention, and significantly different post-disturbance trajectories. Results also suggest that the dynamics of the vegetation-resource flow feedbacks cannot be replicated through simple calibration of the topographically driven modeling framework. If as this study suggests, small scale vegetation-resource flow feedbacks significantly affect the large-scale dynamics, and that which cannot be captured through simple parameterization, then these small scale ecosystem processes need to be accounted for in regional-scale assessments.