Resilience and stability of wetlands: the role of functional diversity

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Abstract. Wetland ecosystems provide valuable ecosystem services at local to global scales. Locally, they provide environmental benefits such as flood control, water quality enhancements and biodiversity habitat. Globally, they play a significant role in the earth's carbon cycle, and can act both as sinks and sources of green house gases. Understanding the response of wetland ecosystems to perturbations (e.g. hurricanes, land use changes, large scale water management projects) is necessary to guide management and restoration efforts.
The dynamics of wetland ecosystems may exhibit multiple stable states, with the implication that large enough perturbations may irreversibly shift the system from a vegetated to an un-vegetated state. Previous investigations have covered a single species model of the vegetation-water table interaction, in which multiple stable states arises because of a positive feedback between water table depth and vegetation cover; this kind of dynamics may make wetlands inherently vulnerable to perturbations. In this research, we present a multiple species formulation, and develop an alternative semi-mechanistic model that incorporates soil water balance and plant carbon balance. These models aim to show the importance of plant functional diversity in flood tolerance for the resilience of wetland ecosystems, and provide insight into the role that different soil and plant physiological characteristics play in determining competitive outcomes between different flood resistance types.

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