

SAFL SEMINAR SERIES

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ST. ANTHONY FALLS LABORATORY ~ AUDITORIUM



Ecosystem stability and resilience at the desert margins

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Dryland plant ecosystems are known for their ability to exhibit complex dynamics arising both from ecohydrological feedbacks and random environmental variability. Feedbacks between vegetation dynamics and abiotic processes such as rainfall infiltration or soil erosion play a crucial role in determining the possible emergence of alternative stable states in the dynamics of arid landscapes, with important implications for ecosystem resilience. The strength of ecohydrological feedbacks is here investigated along an aridity gradient, and their effect on ecosystem dynamics is analyzed under different regimes of rainfall variability. Generally considered as important disturbances, stochastic fluctuations of precipitation have been usually associated with disorganized deviations of the system from its long-term average state. Here it is shown how the randomness inherent to environmental drivers may play a more fundamental role by inducing ordered states in the dynamics of vegetation. The random alternation between stressed and unstressed conditions resulting from the effect of interannual rainfall fluctuations on the soil water balance may induce stability in the dynamics of aridland vegetation, enhance the resilience of stable vegetated states, sustain biodiversity, and determine the emergence of well-defined patterns in vegetation. Drawing from case studies from North America and Southern Africa, I present a set of models relating shifts in vegetation composition to the rate of biotic-abiotic interactions, and identify some recurrent mechanisms of land degradation involving feedbacks between vegetation structure and the physical environment. The stability and resilience of arid landscapes to random environmental drivers is analyzed in the context of changes in climate and disturbance regime.

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