A Stochastically Driven Model for Savanna Water Resource Dynamics

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Modeling has become an essential part of understanding ecosystem dynamics, and within the savanna ecology community, models are used as a key tool to advance theories about the determinants of savanna as an ecological state between forest and grassland. However, many models have paid little attention to intra-annual water resource availability by adopting mean annual precipitation (MAP) as the primary variable for water resources, despite the fact that savannas typically persist in locations with strong rainfall seasonality.

In this talk, I will introduce a new analytic model that explores the relationship between savanna stand structure, seasonal water resource availability, and fire disturbance in Australia. The model demonstrates how variation in dry season length, rather than mean annual precipitation, can determine savanna stability as an underlying woody total basal area equilibrium. This equilibrium may then be estimated numerically using the daily rainfall record, with fire disturbance acting as a perturbation away from this state. Finally, I will describe the specific woody population dynamics predicted by the model, including the effect of various fire regimes and stochastic fire disturbances.