



Linking vegetation pattern formation and biodiversity

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According to the habitat heterogeneity hypothesis spatial heterogeneity positively correlates with species diversity. Numerous studies have confirmed this hypothesis in various ecological contexts, but little attention has been given to the origin of spatial heterogeneity and to possible heterogeneity-diversity feedbacks. In particular, the link between spatial heterogeneity induced by vegetation pattern formation, and species diversity has remained unexplored. In this presentation we describe a mathematical modeling approach for exploring this link in the context of water-limited vegetation, and apply it to woody-herbaceous systems. We first address the relation between vegetation-landscape diversity and resource diversity, and discuss mechanisms of species-diversity change. We show that woody patches can buffer species-diversity loss as a result of an aridity stress, and that species diversity can also be affected by woody-pattern changes at the landscape scale. We then describe the derivation of community-level properties, such as diversity-resource relations. Community-level properties are derived by extending the space over which biomass variables are defined to include trait subspaces, where different points represent distinct species. We demonstrate this approach with a simple example of a spatially uniform herbaceous community, choosing the tradeoff between investments in above and below-ground biomass as the axis that spans the trait subspace. We then extend this study to include the effect of a spatially localized woody patch on the diversity of herbaceous species. We conclude by delineating directions for further model studies and development.