MS Thesis
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Title: The Relative Influences of Local Habitat Heterogeneity and Productivity on Species Richness

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ABSTRACT

As natural habitats continue to decrease and become fragmented, pressure increases to better understand the complex systems of species-habitat interactions and the spatial scale at which habitat characteristics are measured. I explored the relative importance of habitat heterogeneity and productivity, at multiple spatial scales, as predictors of species richness in 19 vertebrate guilds across 3 taxonomic classes, birds, frogs, and mammals. Habitat heterogeneity and productivity metrics were derived from LiDAR and hyperspectral data obtained from the National Ecological Observatory Network's airborne observation platform. A combination of passive acoustic monitors and camera traps provided species occurrence data of birds, frogs, and mammals. Species richness of each group was modeled based on their detectability using a Bayesian multi-species occupancy model. To select the most appropriate scale of habitat characteristics for each guild, I systematically calculated the receiver operating characteristic area under the curve for each model iteration, quantifying the uncertainty in model predictions with each scale.

Performance of the models depended on the spatial scale at which habitat heterogeneity and productivity were measured, and were different for each taxonomic group. Frog and bat species richness were most strongly related to habitat heterogeneity and

productivity measurements within a 20m radius of the survey location. Bird species richness, regardless of guild type, had an optimal scale of an 80m radius. Terrestrial mammal richness was optimal at a 180-meter radius buffer. Results indicated the appropriate scale for each taxon is at, or smaller in area than seasonal or home range areas for these taxa.

The relative influence of habitat heterogeneity and productivity were further investigated for bird species richness with indicator variable methods. Productivity resulted as the most important factor for species richness within bird guilds. Habitat heterogeneity was not influential for guild specific species richness. When all bird species were assessed together habitat heterogeneity and productivity were important in determining species richness. Overall, fine resolution measures of habitat heterogeneity and productivity are important determinants of species richness across local landscapes for different taxa and point to key measures for conservation management planning. For birds, focused efforts on increased understory vegetation, heterogeneity in productivity, and vertical structure are predicted to yield higher avian species richness, prioritizing early successional habitats and small localized disturbances.