WON'T YOU BE MY NEIGHBOR? COMPACT AND EFFICIENT EXPERIMENTAL DESIGNS TO ANALYZE COMPLEX INTERACTIONS

Keith Woeste[1], Mo Zhou[2], Michael Saunders[3], Jennifer Vandenbussche[4]

[1]Northern Research Station, USDA Forest Service Hardwood Tree Improvement and Regeneration Center, West Lafayette, IN; [2]Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN; [3]Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN; [4]Department of Mathematics, Kennesaw State University, Kennesaw, GA

Current monoculture breeding methods for hardwood trees result in selections likely to be ill-suited to the mixed-species plantations in which they will be planted. Dissonance between breeding methods and preferred deployment persists in part because there are no practical experimental designs that enable forest geneticists to estimate the importance of direct and indirect genetic effects of competitors during plantation development. *To address this need*, we have developed several practical designs for evaluating complex neighbor effects on the growth and quality of trees (or any organism). These designs efficiently and systematically place a target species (or each of several target species) at the center of and equidistant from six neighbors. The neighbors constitute a neighborhood that varies from monospecific to mixtures of species in all possible combinations. We will use three methods to assess neighborhood effects: spatial Durbin model, spatial causality model, and nonparametric neighborhood analysis. The former two will establish structured spatial models to test the impacts of neighboring plant biomass on target plant biomass, while the last one will classify target plant biomasses into groups by neighborhood characteristics This novel class of experimental designs aims to identify and measure community effects on phenotype, opening the door to the genetics of multi-species interactions. These designs are especially suited to precise forest phenotyping methods such as aerial or ground-based LiDAR.