Final Project Abstract:

Variable retention and all-aged management require consideration of an almost infinite variety of spatial configurations of the level of removal of different species and tree sizes within a stand, and an almost infinite variety of permutations of residual stand conditions. Forest managers face a complex set of trade-offs in the maintenance of ecological and aesthetic goals, while providing economically viable yields. We use an extension of traditional distance-dependent, spatial competition models that allows independent estimates of (1) the potential maximum tree growth for a given set of climatic and edaphic conditions, as a function of tree species and size, and (2) the magnitude of the competitive effects of neighboring trees on target tree growth as a function of the species, size, and distance to neighboring trees. The analyses provide empirical estimates of inter- and intraspecific competition coefficients, and explicitly partition the competitive effects of neighbours into the effects of shading *versus* the residual effects of "crowding". We used maximum likelihood estimation to test a suite of alternate models. The most parsimonious models generally included terms for (1) the effects of tree size, (2) crowding, (3) shading, and (4) separate competitive effects of the major tree species. The crowding and shading model explained 53-79% of the variation in radial growth of the 4 species. Potential radial growth peaked at small diameters for the species. For all species except trembling aspen, growth declined more steeply as a function of crowding than shading. Aspen radial growth was strongly affected by shading. Results of our analysis can be incorporated into the spatially-explicit SORTIE/BC forest dynamics model. Our results can help guide the design of silvicultural strategies in structurally complex and diverse stands. Managing for specific mixtures and spatial configurations of species can optimize yield.