ABSTRACT

Primary Succession on the Pumice Plain at Mount St. Helens, Washington:
Resolving the Significance of Individual-Level Interactions
to Community-Level Dynamics Using
Grid-Based Analysis and Simulation. (August 1993)
William Michael Childress, B.A., University of Texas at Austin;
M.S., North Texas State University.
Chair of Advisory Committee: Dr. Edward J. Rykiel Jr.

I used spatial analyses and simulations to investigate the significance of inter-specific interactions in a successional plant community on the Pumice Plain at Mount St. Helens. Annual surveys determined locations and diameters of all individuals in a 14x12m study plot during 1983-87, and counted all individuals in 1x1m quadrats during 1988-92. *Lupinus lepidus* dominated the plot during this period.

Analyses and modelling were conducted at the individual level to utilize individual data in 1983-87, and at the 1x1m quadrat level for 1983-92. Spatial analyses of individuals determined statistical associations between number of neighbors and recruitment, growth, and survival. Spatially-explicit demographic simulations implemented these results in "full-interaction" and "no-interaction" alternative versions in which effects of neighbors were included and excluded. Regression analysis was used to project number of individuals in quadrats for each species, using as independent variables number of conspecifics, percent cover of washes, and numbers of individuals in taxonomic classes. Presence of lupines, presence of washes, and presence of conspecifics in adjacent quadrats were used to estimate probabilities of dispersal into quadrats. Simulations of quadrat-level dynamics adapted a metapopulation approach in which species in each quadrat are considered independent populations.

Analyses and simulations of individuals indicate that *Lupinus* facilitates its own recruits and those of *Epilobium angustifolium* and *Anaphalis margaritacea*, two abundant species during 1983-87. In the no-interaction model, *Lupinus* numbers were released from conspecific density-dependent suppression, but *E. angustifolium* and *Anaphalis* numbers were reduced, indicating loss of facilitation by *Lupinus*.

Significant regressions for quadrat dynamics were found for *Lupinus* each year from 1983-92. R^2 values were high, considering the variability in numbers for each species and the different significant independent variables among years. *E. angustifolium*, *Anaphalis*, and *Epilobium watsonii* never dispersed to quadrats not previously occupied by *Lupinus*.

Lupinus and washes significantly influenced recruitment, growth, and survival and numbers of individuals in quadrats for many species. Interactions among species with respect to growth and quadrat numbers were complex and usually not consistent across years, nor consistent within years between the individual and quadrat-level analysis results.