Interactions Between Competing Vegetation, Herbivores, and Environmental Conditions Affecting Regeneration of Northern Red Oak (*Quercus rubra* L.)

David S. Buckley[1], Terry L. Sharik[1], Judson G. Isebrands[2], and William J. Mahalak[3]

Competing vegetation and herbivory are thought to contribute to regeneration failure of northern red oak (Quercus rubra L.) in the Great Lakes Region. Several studies have focused on these factors individually. Few have examined the interactions between discrete vegetation layers, environmental factors, and herbivores simultaneously. Objectives of this study were to compare the importance of vegetation in the herb, shrub, and canopy layers as competitors and to document changes in environmental and other factors produced by vegetation removal. Northern red oak acorns and 2 year-old nursery seedlings were planted in plots receiving various levels of overstory removal combined with understory vegetation removal. Overstory treatments consisted of a control and removal of overstory vegetation to produce 75% cover, 25% cover, and 0% cover. Understory treatments consisted of a control, removal of vegetation in the herb layer less than 25 cm tall, and removal of vegetation in the shrub layer 25 cm tall or greater. Plots were located in northern red oak and red pine (Pinus resinosa L.) stands on intermediate sites. Seedling performance and survival, vegetation characteristics, and environmental data were obtained during 1991-92. Along the gradient from no removal to complete vegetation removal, mean height growth increased by as much as 66% while the mortality rate from factors such as deer herbivory and frost increased from less than 1% to as high as 28%. These results indicate that the benefits of increased resource levels associated with low amounts of competing vegetation may be nullified, depending on the local incidence of deer herbivory and frost events.

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[1]Michigan Technological University, Houghton, MI.

[2]USDA Forest Service, North Central Forest Experiment Station, Forestry Sciences Laboratory, Rhinelander, WI.

[3]Michigan Department of Natural Resources, Forest Management Division, Roscommon, MI.