

The Summer Undergraduate Research Fellowship (SURF) Symposium  
6 August 2015  
Purdue University, West Lafayette, Indiana, USA

## The Photosynthetic Response of Northern Red Oak (*Quercus rubra* L.) and American Chestnut (*Castanea dentata* (Marsh.) Borkh) Under Varying Light Intensity and Weed Competition

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### ABSTRACT

Although widely distributed across Indiana and the United States Midwest, conifer plantations consist largely of non-native species that are of no value to the state's forest products industry. This project's goal is to develop science-based protocols and specific silvicultural prescriptions for successfully converting conifer plantations to higher value native hardwoods. Quantifying photosynthesis rate in a plant is an important tool to help us discern the best methods for implementing conifer conversion. Seedlings from two different native species, northern red oak (*Quercus rubra* L.) and American chestnut (*Castanea dentata* (Marsh.) Borkh), were distributed among three different silvicultural cutting treatments (control, thinning and clear cut). Inside each one, two distinct categories of herbaceous control treatments (weed control and no weed control) were installed. Using an AccuPAR LP-80 sensor, canopy PAR (photosynthetically active radiation) interception was measured. Photosynthetic capacity was assessed with a LICOR 6400-XT analyzer to evaluate efficiency in resource use (water, light, gas exchange) and productivity. Among the treatments, clear cut presented maximum PAR intensity, followed by thinning and control, respectively. Both American chestnut and northern red oak seedlings demonstrated the highest photosynthesis rate ( $A_{max}$ ) under high light conditions (clear cut), though photosynthesis of chestnut was greater than that of northern red oak. No significant differences were found between species in the weeding treatment for photosynthesis. Results of this study will provide valuable silvicultural prescriptions to Non-Industrial Private Forest (NIPF) landowners, forestry professionals, as well as state and federal agencies in Indiana and other Midwestern states.

### KEYWORDS

Forest conversion, conifer plantation, American chestnut, Northern red oak, photosynthesis