

REFORESTATION EFFORTS IN INDIANA FOLLOWING THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977

Stephen D. Fillmore and John W. Groninger¹

Abstract—During the summer of 2002, data were collected from 22 post-Surface Mining Control and Reclamation Act sites in southwestern Indiana. Tree growth across these sites was generally poor, with site index values typically less than 40 feet (base age 50) for upland oaks. *Robinia pseudoacacia* (black locust) was observed to be the primary overstory tree throughout sites and was not acting as a nurse tree for other species. No specific mining or reclamation technique encountered in this study was associated with high site quality. Results of this study will be compared with more modern mining and reclamation techniques.

INTRODUCTION

The Surface Mining Control and Reclamation Act (SMCRA) of 1977 was promulgated to address environmental degradation resulting from abandoned surface mines. Topsoil handling provisions of SMCRA designed to prevent water quality impairment resulted in degraded growing media for trees. Soils on post-SMCRA reclaimed sites were typically compacted, nutrient poor, and droughty. Compaction resulted from multiple passes by reclamation machinery. Provisions of SMCRA designed to prevent erosion required mine operators to initially revegetate sites with dense ground covers such as *Festuca arundinacea* (reed fescue) or *Lespedeza cuneata* (Chinese lespedeza). Seedlings planted into these dense herbaceous covers experienced high mortality rates and poor growth. Browsing and suppressed growth led to poor crown form. The potential for forest products is low on the sites due to a lack of marketable stems. These factors have led to a decrease in the forest land base in southwestern Indiana. Prior to SMCRA, most abandoned mine sites were planted to trees, leading to an increase in forest land. After SMCRA, many sites were returned to low-value hay and pastureland, due in part to poor tree growth. This phenomenon has sparked concern from the Indiana Department of Natural Resources and the Office of Surface Mining that poor postmining tree performance contributes to a loss of forest cover in mining regions of the State.

This study was initiated to investigate the success or failure of post-SMCRA reforestation efforts in Indiana. During the summer of 2002, an inventory of 16 mines in Indiana was completed. Objectives included determining the principal factors driving tree-growth patterns, determining how these factors will affect the long-term stand dynamics, and developing recommendations for future reclamation and reforestation efforts.

METHODS

Twenty-two study sites on 16 mines in southwestern Indiana were inventoried. Transects were placed on sites, with random distances between plots generated in the

field. Plots sized 1/735-acre were placed in a cardinal-eight direction plot layout. At each plot, overstory trees were identified, and height and diameter at breast height (d.b.h.) were measured. Percent cover of herbaceous vegetation was estimated by species at every plot. Position of plots in either an upland or a bottomland was recorded, as well as slope percent and aspect.

RESULTS AND DISCUSSION

A total of 1,280 plots were inventoried across 22 study sites; 2,847 trees were inventoried for height, and 2,141 were inventoried for d.b.h. *Robinia pseudoacacia* (black locust) was the most frequently occurring tree species in the inventory, comprising 45 percent of the stems on sites. Commonly occurring volunteer species included *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry). All but four sites were found to be adequately stocked. Stem density ranged from 2,919 to 115 trees per acre, with a mean of 1,119. Basal area ranged from 78.28 to 1.4 square feet per acre, with a mean of 25.6.

The principal herbaceous species recorded on the study sites was *Festuca arundinacea* (reed fescue), a widely-planted cool season grass. *Solidago canadensis* (Canada goldenrod), a volunteer herbaceous species, was the second most commonly occurring herbaceous species. The suitability of sites for forest products production was low. Site indices for the study sites averaged 40 feet at age 50, with a maximum of 65 feet at age 50. Little potential for forest products production exists on these sites beyond *R. pseudoacacia* for firewood.

Potential of sites for carbon capture value was also analyzed. Because site productivity is low on the study sites, current potential carbon market value was also low. The mean carbon capture total rate on sites was 1.36 tons of carbon per acre. The highest total carbon capture rate observed was 3.89 tons of carbon per acre. Potential for carbon capture rates may be increased in the future due to the succession from *R. pseudoacacia* overstories toward fast-

¹Research Assistant and Assistant Professor of Silviculture, Southern Illinois University Carbondale, Department of Forestry, Mailcode 4411, Carbondale, Illinois 62901-4411, respectively.

growing, light-seeded volunteer hardwood tree species. Silvicultural management of these lands may also increase product values.

Plots classified as being in an upland position resulted in significantly higher mean tree heights. Trees in this position tended to be of planted origin and were likely older than stems in the bottomland position.

CONCLUSIONS AND RECOMMENDATIONS

Study sites are moving away from early dominance by planted *R. pseudoacacia* towards a state similar to old field succession. *R. pseudoacacia* is subject to decline due to damage from the locust borer. The locust borer attacks stems and twigs of trees and reduces the crown dominance. This process is creating gaps in the overstory that volunteer species are claiming. These volunteer species are

expected to comprise the majority of the overstory within the next 30 years, if stands are left unmanaged.

Growing conditions on post-SMCRA reclaimed sites would have been more favorable if the growing media had not been compacted. Fortunately, this has been recognized by the industry, and compaction-causing equipment such as scrapers are no longer used. Results from this study suggest that stands are being affected primarily by edaphic conditions. No vegetative interactions analyzed resulted in significant differences.

Proper species selection and recognizing soil changes associated with mining-related soils handling will aid in improving forest productivity on post-SMCRA mined sites. This will also restore more quickly and effectively the look and function of a forest to surface mined sites.