DEVELOPMENT OF AN UPLAND HARDWOOD DEMONSTRATION FOREST ON THE MARY OLIVE THOMAS DEMONSTRATION FOREST.

Seth D. Hunt, John S. Kush, Rebecca J. Barlow[1]

Abstract—Landowners have experienced a dizzying array of timber prices over the past several years. At one time, hardwood pulpwood brought very little per ton and today it brings as much or more than pine pulpwood. In some markets in the Southeast today, oak sawtimber is bringing more than pine poles. Many landowners, who previously said they wanted their hardwood stands left alone because of the perceived wildlife value, are expressing an interest in upland hardwood management and regenerating their stands. Very few demonstrations are available to show landowners how they might work towards this goal. An effort is underway to establish an upland hardwood management demonstration on the Mary Olive Thomas Demonstration Forest (MOT) near Auburn, AL. The MOT has been managed by Auburn University's School of Forestry & Wildlife Sciences since it was given as a gift to the School in 1984. As part of the effort, a 9.9-acre upland hardwood forest dominated by oak and yellow-poplar will be used. All trees greater than 4.5 inches DBH have been stem-mapped; trees less than that have been sub-sampled and data have been collected on the litter layer/fuel load. Overstory trees have been cored to determine ring count. A preliminary examination of the data indicates there are few species in the midstory or understory that are of commercial value. This presentation will report on the initial stand conditions and discuss the plans for hardwood management.

INTRODUCTION

In today's markets in Alabama, hardwood pulpwood is bringing as much money as pine pulpwood and both oak and mixed sawtimber are going for more than pine sawtimber. This price phenomena is a marked change from historical stumpage trends. Many landowners have refrained from hardwood management for reasons ranging from unfavorable markets to the perception that their hardwood stands should be left untouched for a perceived wildlife value. While this change in markets has brought new opportunities to landowners with hardwood forests, it begs the question of whether landowners are thinking about the regeneration process of these hardwood stands, particularly oak stands.

Successful oak regeneration and management has two main requirements: the presence of competitive oak regeneration and timely release of this oak regeneration (Loftis 2004). In xeric forests, regeneration of oak is dependent on the accumulation of advance reproduction and the creation and maintenance of the conditions that favor such accumulation (Smith 1993). An issue is also falls the poor retention and growth of oak seedlings already present (Lorimer and others 1994). Many landowners are not aware of the need for proper conditions to facilitate oak regeneration through natural means. A demonstration forest could help provide an example to get landowners to think about hardwood management and the subsequent regeneration process.

Currently, the Mary Olive Thomas Demonstration Forest (MOT) is lacking an upland hardwood management demonstration forest. The MOT consists of a 400 acre +/- tract of land five miles outside of the Auburn University main campus. It was given in 1983 to the Alabama Cooperative Extension System for the purpose of demonstration of forest management. Management was delegated to the School of Forestry and Wildlife Sciences. As such, the purpose of this forest is to demonstrate the possibilities of upland hardwood management to landowners as well as to produce opportunities for hardwood management education within the school. The management goals of this forest are to provide a demonstration to help landowners begin thinking about the management and regeneration process for hardwood forests.

METHODS

Sites

The proposed stand is 9.9 acres +/-. Pacolet sandy loam covers most of the stand while Toccoa sandy loam is found along the southern boundary. Topography on the stand is defined by the ridge running through the middle of the stand. Elevation of the stand ranges from 600 feet to 650 feet. The stand was damaged in 1995 by

[1]Graduate Research Assistant; Research Fellow; Alabama Cooperative Extension Specialist, School of Forestry and Wildlife Sciences, Auburn University, Auburn, AL 36849.

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Hurricane Opal though the total impact is unknown. No harvest has been conducted since ownership changed hands in 1983 other than a firewood salvage after Hurricane Opal.

Procedures

All trees greater than 4.5 inches DBH were stem-mapped. For each tree 4.5 inches or greater, species and diameter at breast height to the nearest tenth of an inch were recorded. All stems under 4.5 inches were systematical sampled using 10 1/10th acre plots. On each 1/10th acre plot species abundance was tallied. The leaf litter was randomly sampled using 10 1 meter squared plots. Leaf litter depth was measured to the nearest tenth of an inch to bare soil. Litter was then oven dried and weighed. A dominant or co-dominant oak in each 2 inch DBH class was cored to determine ring count at breast height.

RESULTS AND DISCUSSION

The stand averaged 138 trees and 96 square feet of basal area per acre. Basal area per species group were 22.3, 17.5, 17.3, 21.2 square feet for white oaks (*Quercus spp.)*, red oaks (*Quercus spp.)*, yellow-poplars (*Liriodendron tulipifera*), and hickories (*Carya spp.*), respectively. Notable species found in the overstory consist of white oak (*Quercus alba*), northern red oak (*Quercus rubra)*, yellow-poplar, pignut hickory (*Carya glabra*) and American beech (*Fagus grandifolia)*. The midstory is comprised mostly of American beech of both small and large diameters. American beech accounted for 8 square feet of basal area per acre. The understory is relatively open, lacking much in the way of advance regeneration of desirable species and has a developed leaf litter layer. The litter layer averaged around 2.9 +/- .8 inches with an average dry weight of 5.1 +/- .9 tons per acre. Tree cores from oaks indicated that the oaks were generally over 60 years of age at breast height.

The stand offers several options in terms of upland hardwood management. Depending on the objectives, management and the subsequent regeneration process of the stand can focus on either oaks or yellow-poplar. Given the presence of white oak and northern red oak, the stand offers a unique opportunity to demonstrate oak regeneration techniques. However, widespread difficulty has been encountered when trying to regenerate oaks on average or productive sites due to erratic seed production, acorn consumption by animals, defoliation and browsing of oak, decreased fire frequency, and climatic change (Lorimer and others 1994).

Oaks are more competitive on drier mesic or xeric sites compared to mesic sites (Hodges and Gardiner 1993). Where site indexes for oaks are 60 feet or below (at 50 years), they are likely to support stable oak forests, however, where site indexes are greater than 60 feet, they are prone to much more competition (Lorimer 1993). The shelterwood method is often recommended to promote the establishment of oak regeneration but competition from yellow-poplar, red maple (*Acer rubrum)*, and sweetgum (*Liquidambar styraciflua)* developing in response to overstory removal and understory disturbance have caused mixed results (Brose and others 1999).

For northern red oak and white oak, the initial growth strategy is root development in lieu of shoot development (Lorimer 1993). White oak is moderately tolerant of shade while northern red oak is intermediately to moderately tolerant and both are capable of developing under moderate shade with good survival rates (Clark and Watt 1971, Smith 1993). However, low understory light levels may be the most limiting factor for the establishment and growth of oak regeneration (Hodges and Gardiner 1993). Therefore, it is suggested to reduce competition, make oaks more competitive, or do both (Loftis 2004). Removal of overstory trees can create increased light conditions. However, even if an opening in the overstory is made, a midstory of shade-tolerant species will not provide enough light for seedlings oaks (Johnson 1979).

The high occurrence of American beech in the stand could pose a problem for oak regeneration. The presence of American beech in this stand is a product of fire exclusion and high basal area (Abrams 2003). Mechanical, chemical, or fire treatments can reduce midstory stems and create increased light levels (Cunningham 2012). In general, American beech is capable producing root suckers and will sprout, however, these sprouts have a high rate of mortality (Wagner 2010). Fire, which could possibly reduce midstory stem densities, could also serve a dual purpose in reducing the leaf litter layer. Development of a large litter layer will inhibit oak regeneration from establishing. Reducing the litter and duff layers below 2 inches before the seed fall and leaf fall with prescribed fire can favor oaks seedlings (Dey and Fan 2009).

Historically, fire played an important role for oak development (Abrams 2003, Lorimer 1993). Oaks are capable of surviving higher intensity fires and are more fire resistant than their competitors (Brose and others 1999, Van Lear 2004). Burning is beneficial for oak by reducing competition and top-killing poorly formed oak advance reproduction (Loftis 2004). Single burn research has shown mixed results, however research with multiple burns has shown more positive results (Brose and others 2014). Thinning with multiple burns was shown to successfully increase the relative density of large oak and hickory seedlings (Iverson and others 2008). Timing of burn is crucial. Multiple winter burns have been shown to reduce competition (Barnes and

Van Lear 1998). Growing season burns are better for competition control than winter burns (Brose and others 2014). With growing season fires, oak is likely to survive if advance regeneration is greater than .5 inches root collar diameter and is capable of sending up new sprouts. (Van Lear 2004). Winter fires, where root reserves are at their highest, have the greatest ability to cause hardwoods to sprout following being top killed. Spring and summer fires can cause mortality in small diameter oak stems but can benefit the larger ones (Van Lear 2004). A study by Adams and Rieske (2001) showed that for white oak, seedling growth (height, shoot elongation, diameter, and specific leaf mass) was greatest on once burned sites, intermediate on twice-burned sites, and least on unburned control sites. While loss of growth does occur, multiple burns can greatly reduce competitors to oak.

CONCLUSION

To aid landowners with upland hardwood management, a demonstration forest stand was proposed for the MOT demonstration forest. The inventory of the stand showed a high proportion of oaks in the overstory, a beech dominated midstory, and absent understory. Reduction of the high amount of leaf litter and beech in the understory are top priority for facilitation of oak regeneration. Future management decisions largely hinge on reductions of the leaf litter layer and changes in basal area and light conditions created with the removal of American beech and sweetgum.

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