

# CAN PRESCRIBED FIRES BE USED TO PROMOTE THE RECRUITMENT OF WHITE OAK (*QUERCUS ALBA*) SEEDLINGS?

G. Geoff Wang, David H. Van Lear, and William L. Bauerle<sup>1</sup>

## Poster Summary

Widespread oak replacement by mesophytic tree species, especially on good quality sites, has been occurring across the Eastern United States, because advance oak reproduction is severely limited by the development of heavy midstory and understory. Anecdotal evidence suggests that the development of heavy midstory and understory coincides with the implementation of a fire exclusion policy in the 1920s. Effective fire exclusion over the past 80 years has, therefore, contributed to the current problem of oak regeneration. Using prescribed fire to promote oak regeneration has been successful, but prior studies generally focused on how to use prescribed burning to enhance the relative competitiveness of advance oak regeneration. How does prescribed fire affect the recruitment of new oak seedlings? This important question has not been studied. The objectives of this study were to (1) investigate the effects of prescribed fires on white oak seedling survival and growth during the first growing season following a heavy mast year; and (2) to determine if white oak seedling survival and growth during the first growing season were affected by forest floor depth and understory light intensity.

## METHODS

Three hardwood forest stands dominated by oaks (mainly *Quercus alba* L.), hickories (*Carya* spp.), and yellow-poplar (*Liriodendron tulipifera* L.) were selected in the Clemson University Experimental Forest. White oak had its first heavy mast crop in 2002 since the prescribed fires in 1999 and 2000. In May 2003, 6 to 8 dominant white oak trees were randomly selected in each stand. Four 2-m-radius quadrats were established around each selected tree, and total germinated and surviving seedlings were counted and marked within each quadrat. In August 2003, percent full sunlight was determined at 30 cm above each quadrat, and forest floor depth (litter and duff) was measured at four points and averaged for each quadrat. In October 2003, each quadrat was revisited. White oak seedlings were recounted, and up to three seedlings per quadrat were randomly selected, excavated, and brought back to the laboratory to determine above- and below-ground biomass. Analyses of variance (with stands as blocks, burned vs. non-burned as treatments and trees as replicates) were conducted on white oak seedling measurements and site variables. Nonlinear and linear regression analyses were used to quantify their relationships.

## RESULTS AND DISCUSSION

Burning significantly affected density and biomass but not mortality and root to shoot ratio. Biomass was 58 percent higher in burned plots compared to control. Fire effects on density, forest floor depth, and light intensity varied among stands. With increasing forest floor depth, both seedling density and biomass significantly decreased, following a power relationship. Similarly, both density and biomass significantly increased with increasing understory light intensity. Our study indicated that prescribed fire had a positive effect on both density and biomass of oak seedlings after their first growing season. Effects of burning on density differed greatly among the three stands, suggesting fire behavior may be an important factor to consider when using prescribed fires to promote oak seedling recruitment. It would be beneficial if prescribed fires could be timed to coincide with a good mast year to ensure that acorns have a favorable environment for germination, survival, and growth. More studies are needed to elucidate the effect of fire behavior on initial recruitment and subsequent development of oak seedlings.

## CONCLUSIONS

White oak seedling establishment and growth during the first growing season benefited from prior prescribed fires. The fires reduced forest floor depth and increased understory light intensity, effects that remained significant at the time of the study. Seedling survival and growth were positively related to understory light intensity but negatively related to forest floor depth. For the purpose of promoting white oak seedling recruitment, prescribed fire should be conducted a year or two prior to a good mast year; the fires should be of sufficient intensity/severity to consume the forest floor and kill under- and mid-story competing vegetation.

## ACKNOWLEDGMENTS

The authors would like to thank Trey Cox for field assistance. Funding was provided by Clemson University.

---

<sup>1</sup> Associate Professor and Bowen Professor, respectively, Clemson University, Department of Forestry and Natural Resources, Clemson, SC 29634; and Assistant Professor, Clemson University, Department of Horticulture, Clemson, SC 29634.

Citation for proceedings: Connor, Kristina F., ed. 2006. Proceedings of the 13th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-92. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 640 p.