

# THINNING AND PRESCRIBED FIRE ALTERS HARDWOOD SEEDLING SPROUTING IN THE WILLIAM B. BANKHEAD NATIONAL FOREST, ALABAMA

Callie Jo Schweitzer, Daniel C. Dey, and Yong Wang<sup>1</sup>

## ABSTRACT

### Introduction

The William B. Bankhead National Forest is using active management to shift mixed *Quercus-Pinus* forests towards forests more dominated by upland hardwoods. We studied the use of three levels of thinning (none, light thin, and heavy thin) and three levels of prescribed fire (none, one burn, and two burns) and all combinations in a factorial experimental design to assess the level of juvenile sprouting in the hardwood reproduction cohort. Stands were either unthinned, thinned to 75 square feet of residual basal area (light thin), or thinned to 50 square feet residual basal area (heavy thin). The burn treatments included one burn, which was done on all burn treatments within 3 to 5 months post-thin, or two burns, where the second burn was conducted 3 years after the initial burn. All burns were conducted during the dormant season. In all 36 treatment stands, we surveyed five permanent vegetation plots before treatments were initiated, in the first growing season following treatment (thin and initial burn), following the third growing season, and in the fourth growing season (after the second burn). The density of reproduction with multiple sprouts (clumps), the number of sprouts per clump, and the density of all the sprouts were analyzed using all species, all *Quercus* species combined (seven different species, with the majority being *Q. alba* L., *Q. prinus* L., and *Q. coccinea* Muench.) and for *Acer rubrum* L., the primary competitor with oaks.

### Results and Discussion

The density of clumps increased in all treatments over time. Pretreatment stands had approximately 1,400 clumps per acre and did not differ among stands. Four growing seasons following treatment, stands averaged 4,500 clumps per acre, with significant treatment differences. All stands that received two burns had more clumps per acre, with heavy thinned stands > light thinned > no thin (Table 1). Most *Quercus* clumps occurred in the two burn treatments. The light thin and two burn treatments had the highest density of clumps and were significantly greater than the no thin + no burn, no thin + one burn, heavy thin + no burn, heavy thin + one burn, and light thin + one burn treatments. *Acer rubrum* clumps were most dense on the thin (both light and heavy) and two burn treatments compared to all other treatments. The density of sprouts also changed with treatment and time, with higher densities on the two burn treatments, which increased to approximately 30,000 sprouts per acre. *Quercus* sprouts increased the most in the stands where two burns were done under light thinning (9,200 sprouts per acre) and heavy thinning (6,600 sprouts per acre). *Acer rubrum* also increased in both of these treatments by 11,000 sprouts per acre.

---

<sup>1</sup> Research Forester (CJS), U.S. Forest Service, Southern Research Station, 730-D Cook Avenue, Huntsville, AL 35801; Research Forester (DCD), U.S. Forest Service, Northern Research Station; and Professor of Biometry and Wildlife Ecology (YW), Alabama A&M University. CS is corresponding author; to contact, call 256-603-0969 or email [cschweitzer@fs.fed.us](mailto:cschweitzer@fs.fed.us).

**Table 1.—Change in the number of clumps and sprouts per acre by treatment after four growing seasons**

Treatment	All species		All <i>Quercus</i> spp.		<i>Acer rubrum</i>	
	Clumps	Sprouts	Clumps	Sprouts	Clumps	Sprouts
	<i>Change in the number per acre</i>					
No thin + no burn <sup>†</sup>	720 c <sup>‡</sup>	2040 c	400 b	1300 c	160 b	280 b
No thin + 1 burn	1180 c	5520 bc	160 b	620 c	860 ab	3920 ab
No thin + 2 burns	3260 abc	13600 bc	900 ab	2980 bc	1420 ab	7020 ab
Light thin + no burn	2680 c	11640 bc	840 ab	2960 bc	1000 ab	5360 ab
Light thin + 1 burn	3020 bc	16080 b	320 b	1140 c	2040 a	12280 a
Light thin + 2 burns	5980 ab	29320 a	2360 a	9280 a	1520 ab	11420 a
Heavy thin + no burn	1800 c	7920 bc	480 b	1240 c	800 ab	4180 ab
Heavy thin + 1 burn	2500 c	11900 bc	280 b	700 c	1360 ab	7120 ab
Heavy thin + 2 burns	6320 a	30460 a	1340 ab	6600 ab	1860 ab	11940 a

<sup>†</sup>Thinning treatments: no thin; light thin = 75 square feet per acre residual basal area; heavy thin = 50 square feet per acre residual basal area. Prescribed burn frequencies: no burn = no prescribed fire; 1 burn = burned within 3 to 5 months after thinning; 2 burns = burned 3 to 5 months after thinning and again 3 years after the initial burn.

<sup>‡</sup>Within a column, values followed by the same letter do not differ at  $\alpha \leq 0.001$ .

Changes in the densities of the number of clumps and sprouts over time were also considered and somewhat mirrored the total densities (Table 1). For all species, the change in clumps after four growing seasons was greatest in those treatments receiving two burns and did not differ among the thinning treatments that received two burns. Changes in *Quercus* clumps among all treatments did not show any differences following the thin and first burn. Following the second burn, *Quercus* clumps were greatest for the two burn treatments, but those did not differ from the change incurred in the light thin + no burn after four growing seasons. *Acer rubrum* clumps had the greatest change in the light thin + one burn treatment. The greatest change in the densities of sprouts for all species (*Quercus* and *Acer rubrum*) was following the two burns under light and heavy thinning.

It is well established that a majority of oaks in new stands grow from seedling sprouts that have accumulated over time before regeneration harvesting. Both time and disturbance frequency influenced the regeneration cohort in this study. The density of clumps and sprouts increased following thinning and after each subsequent burn, with the greatest densities in the heavy thinned + two burn treatment. For *Quercus*, the density of clumps and sprouts was highest following thin and two burns; while thin and one burn treatments had lower densities than thin with no burn treatments. *Acer rubrum* clump and sprout densities appeared to be favored by thinning and both one burn and two burns.

The content of this paper reflects the views of the author(s), who are responsible for the facts and accuracy of the information presented herein.