Silvicultural Research In the News

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A recent study looks to determine the factors that affect sprouting of shortleaf pine after a fire

Shortleaf pine evolved in an ecosystem where fire was common. Shortleaf pines ability to survive periodic low intensity fire provides a competitive advantage that allows it to develop and maintain a place in the forest canopy. Without fire, hardwoods and other more competitive pines tend to dominate. Once a shortleaf tree is about 10 -15 feet tall and has a ground line diameter of 4-6 inches it becomes naturally resistant to surface fires. Shortleaf has many adaptations to survive fire including a unique trait to sprout. However, not all the young trees sprout after top-kill. In fact, several studies show that only about half of shortleaf seedlings and saplings sprout following a fire.

An article in Forest Ecology and Management looks at the factors that affect sprouting to give us a better understanding of shortleaf pines sprouting potential. The paper is authored by Curtis Lilly, Rodney Will, and Charles Tauer of Oklahoma State University; and Jim Guldin and Martin Spetich of the US Forest Service, Southern Research Station.

The study reports on how seedling size, maximum temperature at the basal crook, and severity of crown scorch affects seedling sprouting and survival. The article discusses other factors including: age, basal crook depth, potential to sprout after multiple fires, and season of the burn. Seedlings size ranged from 0.125 to 3.5 inches ground line diameter (GLD), and 2.75 to 59 inches tall in the study.

Results and conclusions they reported are:

- Of the 195 seedlings sampled, 37 percent died and did not sprout (72 seedlings).
- Only 7 percent of the seedlings that survived were not top-killed. These seedlings were the largest of the seedlings sampled averaging almost 6 feet tall and 1.6-inch GLD.
- Basal crooks of the non-top killed seedlings were twice as deep and surface temperature were lower than those of the seedlings that died.
- Dead seedlings had the highest crown scorch at 77 percent, Non top-kill the lowest at 25 percent.
- After one growing season since sprouting, 40 of the 109 top-killed seedlings had died. These seedlings tended to be larger and to have their basal crook closer to the surface.
- Seedlings that sprouted and survived the first growing season had fewer sprouts per seedling and more vigorous (based on height) than those that sprouted and died.
- Average sprout height one growing season after the burn was just under 8 inches.
- The smaller sprouted seedlings (GLD between about 0.25 inch and 1.4 inch) showed the best survival at 45 percent.

The entire article is available to read and download at:
http://www.srs.fs.fed.us/pubs/ja/2012/ja_2012_lilly_001.pdf

ABSTRACT: *Shortleaf pine (Pinus echinata) is a fire dependent species that is declining across the southeastern US. Its unique basal crook is an adaptation that protects dormant buds from fire and facilitates prolific sprouting of seedling rootstocks following top-kill. Understanding what influences shortleaf pine sprouting after fire could greatly increase success of natural regeneration efforts. We examined the relationship between sprouting and seedling size, basal crook depth, and maximum basal crook temperature of shortleaf pine seedlings following a mid-intensity prescribed fire in the Ozark-St. Francis National Forest of northwestern AR, US. We hypothesized that larger seedlings with deeper buried crooks would exhibit greater sprouting after top-kill from fire. A total of 195 seedlings were measured for a variety of site, size, and fire damage characteristics. 'Simulated crooks' were constructed and calibrated to estimate basal crook temperature and were buried adjacent to each seedling. Prescribed fires were implemented during the early growing season, resulting in a wide range of seedling damage from slightly charred stems to complete immolation of aboveground biomass. Fourteen of 195 seedlings were not top-killed and were larger and experienced lower crown scorch than those that were top-killed. Of the 181 seedlings that suffered top-kill, 72 did not sprout and died. Over the course of the growing season 40 of the sprouted seedlings died. Sprouted seedlings that survived the entire growing season had similar size and crook soil depths as seedlings that initially died and were smaller (ground line diameter of 1.5 vs. 3.1 cm) with shallower crook depth (0.2 vs. 0.7 cm) than seedlings that sprouted and later died. Crook temperature and crown scorch values were similar among sprouted seedlings that lived and died, but were lower than for seedlings that never sprouted. These results suggest that the ability of top-killed seedlings to sprout following fire is sensitive to heat and fire damage, while the ability of a seedling to survive once sprouted decreases with seedling size. Low intensity fires when seedlings are 1–2 cm in diameter can be used to bank seedlings until adequate stocking is achieved or until regeneration cutting can be timed with a bumper seed crop to supplement existing advanced regeneration.*

For more information on shortleaf pine management visit The Shortleaf Pine Initiative website at: http://shortleafpine.net/

Citation: Lilly, Curtis J.; Will, Rodney E.; Tauer, Charles G.; Guldin, James M.; Spetich, Martin A. 2012. Factors affecting the sprouting of shortleaf pine rootstock following prescribed fire. Forest Ecology and Management 265:13-19.