

## Using Fire to Control Loblolly Pine in a Young Longleaf Stand

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Fire is an important management tool for the restoration of longleaf pine. Burning young longleaf is critical to keep unwanted pines and woody competition from becoming dominant. Without fire, loblolly pine, since it produces many fast growing seedlings, can quickly crowd out the slower growing longleaf. Once established, options to eradicate loblolly pine become limited and expensive.

Prescribed burning is an effective option to control young loblolly pine in longleaf stands. Small loblolly trees are susceptible to fire, but quickly develop fire resistance as they increase in height and diameter. While longleaf pine is tolerant of fire especially while in the grass stage. However, once longleaf seedlings initiate height growth they too are susceptible to fire damage. Nonetheless, studies indicate that young longleaf is more likely to survive at all stages of early growth, likely because its thicker bark and insulating needles shield sensitive tissue from damage.<sup>2,3</sup> These same studies suggest that a high percentage of both loblolly and longleaf trees can survive low to medium intensity fires once they are taller than 6 feet and have ground line diameters near 2 inches.<sup>2,3</sup> Haywood reported loblolly seedlings and saplings less than 6 feet are much more likely to be killed by fire than longleaf.<sup>1</sup>



Figure 1. The dormant season prescribed burn resulted in flame lengths of 10 to 15 feet in flashy grass fuel. The fire consumed almost 100% of the available fuels and scorched most of the pine trees foliage.

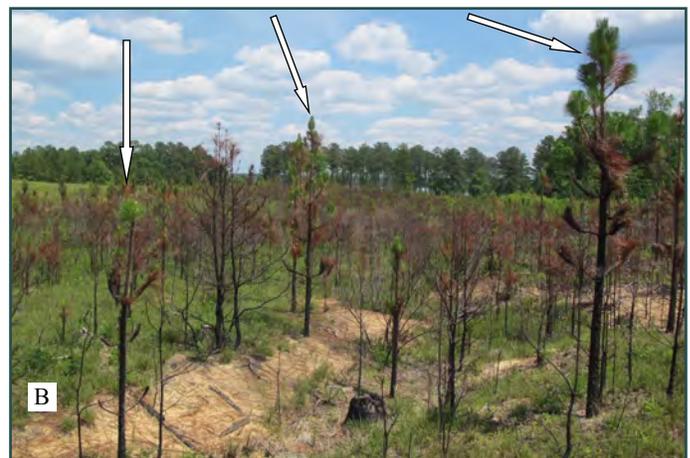


Figure 2. View of the stand following the burn from the same point. A) was taken on April 11th, about 6 weeks after the burn; B) was taken on May 19th about 3 months after the burn. Note the greening-up of the longleaf stems of all sizes.

We installed a study to quantify loblolly fire susceptibility following a dormant season prescribed burn in North Carolina. We were especially interested to document at what height loblolly saplings and seedlings could survive a fire of medium intensity.

### Methods

A medium intensity prescribed burn was conducted in a 6 year old longleaf stand on February 28, 2014 at Jordan Lake Educational State Forest. A primary objective of the burn was to eradicate the numerous loblolly pine stems that threatened the stand. The predominate fuel

was broom sedge grass and various herbaceous vegetation. The stand had previously been burned in the dormant season of 2011. In September 2014 we installed seven plots (1/10th acre) to determine survival, height and diameter of longleaf and loblolly seedlings and saplings. We measured height and ground line diameter (6 inches above the surface) on a total of 220 dead and living trees.

**Results**

We measured 207 loblolly and 13 longleaf trees in our seven plots. The loblolly ranged from 1.5 feet to 13.5 feet tall and averaged 8.3 feet tall. The longleaf trees ranged from 6.1 feet to 16.8 feet tall with an average height of 13.4 feet. The loblolly pine ground line diameter averaged 1.5 inches, ranging from 0.2 inches to 2.3 inches. Longleaf ground line diameter averaged 3.2 inches and ranged from 2.1 inches to 4.3 inches

The burn was successful in controlling loblolly pine stems less than 7 feet tall. Table 1 shows the percent mortality of the loblolly pine by height class. We found 97 percent of the loblolly less than seven feet tall were killed by the fire. Of the loblolly stems taller than 7 feet, 25% were killed by the fire.

It should be noted that all the surviving loblolly were tallied in two plots with wetter soils and denser vegetation. The surviving loblolly trees in this area were also taller. The average height of loblolly killed by the burn was 4.12 feet.

The burn was successful in controlling loblolly pine stems with a ground line diam-

Loblolly Mortality by Height Range			
Height	# dead	# alive	Percent Mortality
< 2 feet	11	1	92%
2 - 3 feet	45	2	96%
3 - 4 feet	36	0	100%
4 - 5 feet	37	1	97%
5 - 6 feet	29	1	97%
6 - 7 feet	12	1	92%
>7 feet	8	23	26%
<b>Total</b>	<b>178</b>	<b>29</b>	

Table 1. Loblolly mortality varied by height, but fire was effective in controlling loblolly less than 7 feet tall.

Loblolly Mortality by GLD Range			
GLD (inches)	# dead	# alive	Percent Mortality
0-.25	14	0	100%
.26-.50	66	2	97%
.51-.75	41	2	95%
.76-1.0	32	5	86%
1.01-1.5	18	5	78%
1.51 - 2.0	5	10	33%
>2.0	2	5	29%
<b>Total</b>	<b>178</b>	<b>29</b>	

Table 2. Loblolly mortality varied by GLD but fire was effective in controlling loblolly less than 1.5 inches in GLD.

eter (GLD) less than 1.5 inches. The average GLD for loblolly killed was 0.66 inches while the GLD for the surviving loblolly was 1.45 inches. The GLD for the dead loblolly ranged from 0.17 inches to 2.35 inches. Table 2 shows the loblolly percent mortality by GLD class. Of the 178 loblolly killed by the fire 150 (84%) were less than 1.0 inch GLD and 96% were less than 1.50 inches GLD. Eighty-nine percent (89%) of the total loblolly pine trees less than 1.5 inches in GLD (were killed by the burn.

Burning reduced the overall number of loblolly pine stems. Overall, 178 of the 207 (86%) loblolly pine was killed by the fire. All 13 longleaf pine measured survived. Tree density before the burn averaged 186 longleaf trees per acre and 2986 loblolly trees per acre (TPA). The prescribed burn reduced the loblolly stocking to 414 trees per acre. However, it varied widely across the stand (Table 3.) Two of the plots, accounting for all the loblolly tallied, has 1450 trees per acre, while the remaining plots have no surviving loblolly stems.

No longleaf pine was killed by the burn.

**Discussion**

The ability of southern yellow pine to survive a prescribed fire is effected by many factors including fire intensity and size of the trees. When unwanted pines are small, a medium to low intensity prescribed burn is an effective control option. Waiting too long to burn allows the fast growing loblolly pine seedling to reach sizes where fire of this intensity is ineffective. Once loblolly pine is greater than 6 feet tall or attains a GLD greater than 1.5 inches, its ability to survive a fire of this intensity increases. Our study concurs with results of other research studies.<sup>1,2,3</sup> In our study fire was effective in the control of loblolly saplings less than 7 feet tall. As expected the longleaf pine in our study survived a burn of this intensity, even though the foliage was completely scorched (Figure 1 and Figure 2). Other studies have reported good longleaf survival across all height classes once they had a ground line diameter of two inches.<sup>1,2</sup>

Before burning the stand was overstocked with loblolly pine seedlings that would have been competitive with the longleaf pine and hinder the development of a herbaceous ground layer. The fire was effective in reducing the loblolly stocking by 86%, but still left 414 stems per acre to compete with the longleaf. However, the seedlings that accounted for the post-burn loblolly stocking were located in only 2 of the 7 plots leaving a majority of the tract free of loblolly seedlings after the burn.

Prescribed burns create a receptive seedbed that encour-

ages unwanted pines to seed-in. While not a part of our study, we noted numerous first year seedlings had established since the February burn. Another prescribed burn will be needed to control the next crop of unwanted pines before they get too tall.

This study documents the susceptibility of loblolly pine seedlings and saplings to fire and quantifies a height and ground line diameter upper limit where loblolly pine becomes fire resistant and increasingly more difficult to control. Because loblolly pine exhibits fast early growth it can reach these size parameters in 2 to 3 years. Natural resource managers can use this knowledge to plan future burns.

**References**

1. Haywood, J.D. Prescribed burning and hexazinone herbicide as release treatments in a sapling hardwood-loblolly pine stand New Forest (1995) 10: 39. <https://doi.org/10.1007/BF00034175>
2. Johnson, Rhett. 2013 Using fire to manage longleaf forests. Longleaf 101 Academy Workshop. Southern Pines, NC. Powerpoint file (slides 24-42)
3. Mitchell, Ryan 2018. Burning longleaf: Situations where extra care is warranted. Loblolly to Longleaf Workshop. April 5, 2018. Brunswick County, NC. Powerpoint file.

	Longleaf						Loblolly					
	Alive			Dead			Alive			Dead		
	Height (feet)	GLD (inches)	Count									
Plot 1	11.2	2.7	3	-	-	0	-	-	0	3.35	0.5	29
Plot 2	15.8	4.1	1	-	-	0	-	-	0	4.18	0.65	24
Plot 3	13.3	2.9	1	-	-	0	-	-	0	4.04	0.7	29
Plot 4	12.6	2.8	2	-	-	0	-	-	0	4.18	0.75	30
Plot 5	15.7	3.8	3	-	-	0	6.9	1.35	12	3.58	0.52	24
Plot 6	0	0	0	-	-	0	9.6	1.54	17	4.23	0.56	19
Plot 7	11.5	2.9	3	-	-	0	-	-	0	5.26	0.95	23
Average	13.35	3.2	13	0	0	0	8.25	1.45	29	4.12	0.66	178

Table 3. Average height, ground-line diameter, and survival counts for loblolly and longleaf trees by plot. Longleaf larger size allowed it to survive while the loblolly had significant mortality.