

# IMPACT OF FIRE IN TWO OLD-GROWTH MONTANE LONGLEAF PINE STANDS

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**Abstract**—The structure of longleaf pine (*Pinus palustris* Mill.) forests of the Southeastern United States Coastal Plains has been the focus of numerous studies. By comparison, the forests in the mountains of Alabama and Georgia are not well understood. Less than 1 percent of longleaf pine stands found in the montane portion of longleaf's range are considered old growth. Several of these stands occur on the Mountain Longleaf National Wildlife Refuge located in northeastern Alabama. A 1998 study documented the conditions in two old-growth longleaf pine stands on the refuge. The 1998 study described the age and stand structure, and shed light on the past disturbance and replacement patterns of two remnant old-growth longleaf pine stands. In 2005 and 2008, these stands were remeasured to document changes. In 2004, one stand was subjected to a relatively intense prescribed fire. In 2006, the other stand was burned with a more conservative approach.

## INTRODUCTION

Mountain longleaf pine (*Pinus palustris* Mill.) forests are a critically endangered component of the once vast longleaf pine forests of the Southeast. Stretching from coastal Virginia to the pineywoods of east Texas, the longleaf pine forest, maintained by frequent fire, has dwindled in acreage and integrity. Several small pockets of this once vast forest remain in the Coastal Plain, but in the mountain region only a small national wildlife refuge in northeastern Alabama contains a forest that approaches the landscape witnessed by European settlers—Mountain Longleaf National Wildlife Refuge (MLNWR).

It is well known and accepted that Coastal Plain longleaf pine forests were fire maintained, but what about the montane longleaf pine forests? Based on observations, it appears that longleaf pine is currently confined to ridgetops and slopes with south/southwesterly aspects. Elsewhere, the tree is found in mixed pine and pine-hardwood mixtures. Historical accounts provided by Sargent (1884), Mohr (1897), Reed (1905), Andrews (1917), and Harper (1905, 1913, 1928, 1943) present a different picture. Each of these has accounts which indicated longleaf pine was occurring in pure stands up to 2,000 feet in elevation and on all aspects of many of the mountains in northeastern Alabama and northwestern Georgia.

Today few stands of longleaf like those described by the above authors remain. Several years of extensive field and laboratory work in the late 1990s on what was once Fort McClellan Army Base found 12 old-growth tracts, lush herbaceous communities, and several management concerns. With the closure of the fort in 1998, the new MLNWR was established on the eastern half of the base in 2003, which now contains nine of these stands. Located just northeast of Anniston, AL, and lying in the growing Birmingham, AL, to Atlanta, GA, corridor, the refuge is 9,016 acres in size. This is the first mountain national wildlife refuge in the Southeast and contains the third highest mountain ridge in Alabama.

Today it is known that MLNWR contains the finest extant of mountain longleaf pine. The refuge objective is to preserve and enhance the natural mountain longleaf pine ecosystem

and preserve a natural diversity and abundance of native fauna and flora with an emphasis towards red-cockaded woodpeckers (*Picoides borealis*). Two of the most intact longleaf pine ecosystems and best examples of fire-maintained old-growth stands are found on Caffey Hill and Red-tail Ridge areas of the refuge.

Why is there so much longleaf pine left on the MLNWR and why are Caffey Hill and Red-tail Ridge in such good shape? The fire regime! When the MLNWR was still Fort McClellan, wildfires were allowed to burn on the fort until the early 1960s, then fire exclusion occurred over most of the fort. However, Red-tail Ridge was allowed to burn every year from 1987 until Fort McClellan closed in 1998, often twice per year and Caffey Hill burned less frequently and often at night.

Caffey Hill and Red-tail Ridge were mapped and measured in 1998. The stands were resurveyed in 2005 and again in 2008. This paper will report on the changes in each stand and their responses to being prescribed burned.

## METHODS

All longleaf pine trees >0.6 inches diameter at breast height (d.b.h.) were stem mapped and measured for d.b.h. Crown and total height were measured on each tree. All trees over 4 inches d.b.h. were cored to determine ring count at 4 feet. Longleaf pine regeneration and nonlongleaf pine species were subsampled using milacre plots randomly located in each stand.

### Caffey Hill

This stand is 3.7 acres in size and has a south/southeasterly aspect, with slopes running from 40 to 60 percent. Located on the upper slope of a ridge with elevations from 1,350 to 1,500 feet, it was burned in May 2004 where the fire was ignited at the bottom of the slope and allowed to burn upslope.

### Red-tail Ridge

It is 4.4 acres in size. It has a west/southwesterly aspect, with slopes running from 30 to 45 percent. The stand is found upper to midslope on a ridge with elevations from 1,100 to 1,250 feet. It was burned in March 2006 with aerial ignition by helicopter.

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## RESULTS

### Caffey Hill

The density and basal area dropped between the 1998 and 2005 measurements. Density went from 121 to 95 trees per acre and basal area fell from 34.9 square feet per acre to 32.7 square feet per acre. There was only the loss of 1 foot per acre between 2005 and 2008 with basal area increasing to 36.1 square feet per acre. The loss in density between 1998 and 2005 occurred in the lower d.b.h. classes (fig. 1). During this time over 40 percent of the trees in the 1- to 3-inch d.b.h. class were lost. Most of these were killed by the fire, which often burned up entire trees so that only metal tags remained. Over one-fifth of trees >9.0 inches d.b.h. perished in the fire. This is often the size at which trees begin to have fertile cones. Due to fire intensity, there were also instances in this area where trees >20 inches d.b.h. were killed by the fire.

### Red-tail Ridge

The story was a little different for Red-tail Ridge. Despite the fact that this stand was not burned between 1998 and 2005, there was a loss in density from 110 trees per acre to

104 trees per acre (fig. 2). However, basal area increased from 55.4 to 58.6 square feet per acre. With a similar loss in density, from 104 trees per acre to 96 trees per acre in 2008, there was a loss in basal area which dropped to 56.8 square feet per acre. The prescribed fire in March 2006 had a more pronounced effect on stand density, removing trees in the upper diameter classes as well as many of the smaller diameter trees.

## DISCUSSION

Since 1994, field reconnaissance on Fort McClellan, now MLNWR, by Auburn University's School of Forestry & Wildlife Sciences identified a number of old-growth longleaf pine stands. Many of these stands have undergone various lengths of fire suppression and degradation. MLNWR's longleaf pine forests provide the "missing link" to scientists, land managers, and conservationists in the mountain region, providing the only information on (1) age and stand structure and dynamics of frequently burned old-growth forests, (2) composition of pristine plant communities, and (3) landscape extent of mountain longleaf pine forests.

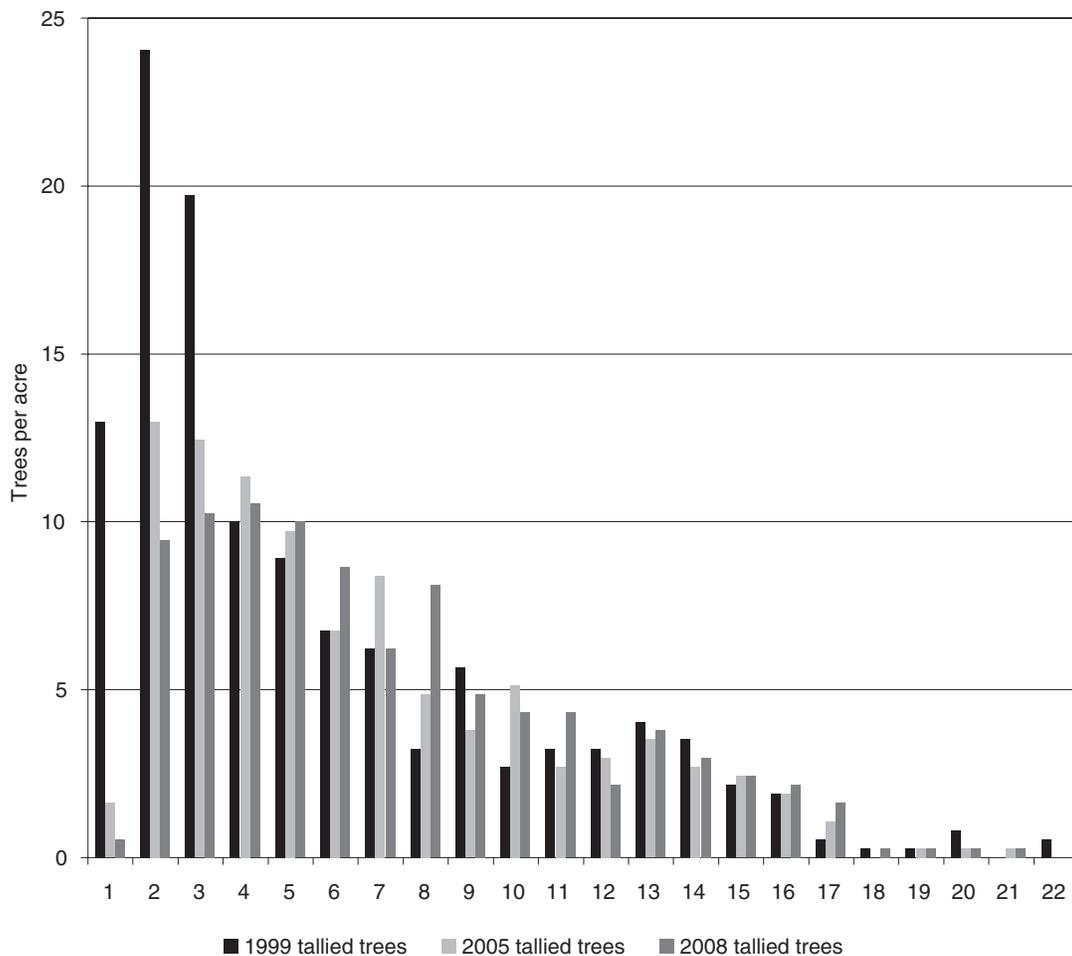


Figure 1—Longleaf pine diameter distribution (trees per acre) for the Caffey Hill location at the Mountain Longleaf National Wildlife Refuge near Anniston, AL.

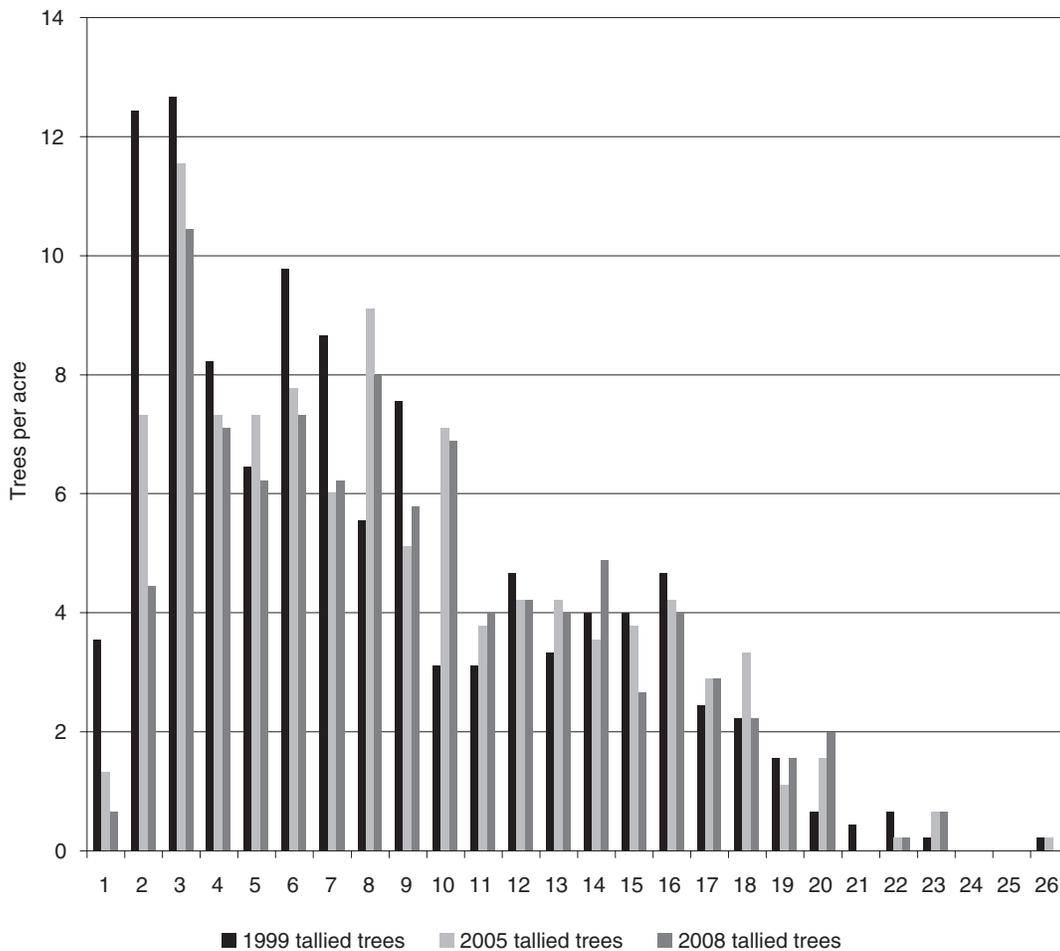


Figure 2—Longleaf pine diameter distribution (trees per acre) for the Red-tail Ridge location at the Mountain Longleaf National Wildlife Refuge near Anniston, AL.

In the past, Fort McClellan’s forest management program was based on wildfire prevention, endangered species protection, timber harvesting, and forest regeneration. Contact with the public, other than in conjunction with the robust hunter program, was minimal. Prescribed fire and forest management restrictions were based on Army and U.S. Department of Defense policies. Yesterday’s Fort McClellan is gone, and the challenges that face this landscape are increasingly complex. First, MLNWR’s mountain longleaf pine forests will face new management objectives. Restoration and management of MLNWR should become the highest priority. Natural area management will likely take the place of the former timber/fire management program of what was once Fort McClellan.

Next, and most importantly, conditions acceptable for performing prescribed fires will drastically change. As a U.S. Army post, Fort McClellan’s prescribed fire “windows” were more liberal—minimal smoke concerns, minimal public involvement. With changing ownership, both smoke and

the public’s perception of forest fire will reduce the window available for fire management of the MLNWR landscape. At the same time, forests on the refuge are now viewed by the public as a preferred neighbor for housing development. This has resulted in an increasing challenge involving wildland fire-urban interface issues.

Smoke sensitivity will increase not only from changing ownership, but also from in-holdings and potential highway access. A bypass route adjacent to MLNWR will limit the smoke window further, making times and conditions suitable for burning extremely limited. Development along this corridor would only decrease the fire window. Proposed industrial development in the northwest portion of what was Fort McClellan may likewise limit burning anywhere along Choccolocco Mountain.

Finally, as Anniston and the Birmingham–Atlanta corridor continue their expansion, problems mentioned above (smoke and public perception of fire) will only intensify without an

aggressive extension and education effort. As an Army post, Fort McClellan was considered the “Military Showplace of the South.” With closure and military evacuation in 1999, natural resource managers have the opportunity to maintain and recreate a piece of southern biological history—pristine mountain longleaf pine forests.

Several publications describing the site, the restoration goals and process, and early findings have been published (Maceina 1997; Maceina and others 1997, 2000; Varner 2000; Varner and others 2000, 2003a, 2003b).

## CONCLUSION

The MLNWR has some of the best fire-maintained old-growth montane longleaf pine stands left. However, fire intervals have been increasing since the refuge was created from what was part of Fort McClellan. This increase in fire interval has potentially led to problems when fire is applied to the stands. It appears fire is the underlying cause for mortality of longleaf pine in the steeper areas of the MLNWR. The refuge managers need to be careful not to lose any/many more overstory trees. There is a need to monitor cone crops to catch seed and then monitor regeneration, if any. When longleaf regeneration gets established then there needs to be a more cautious approach to applying fire. The MLNWR without longleaf pine cannot be called the Mountain Longleaf National Wildlife Refuge!

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