



**The
Pine
that
Fire
Built**

Burning Young Longleaf



rescribed fire can be a useful and relatively inexpensive tool in managing southern pine forests. As increasing acreage is planted with longleaf pine, many landowners are either required to burn their young stands to comply with cost-share programs or wish to burn to achieve various management objectives. Without experience managing longleaf pine and with little instruction available, many rely on knowledge gained from managing loblolly and slash pine. This usually results in an unnecessary and harmful delay in the use of fire. In loblolly and slash pine plantations, fire used when the trees are young (seedlings or saplings) is rarely beneficial, and is therefore seldom used. Longleaf pine, however, is very tolerant of fire, even at young ages. The ability of young longleaf pine to survive fire is related to factors such as size and vigor of the trees, soil moisture, fuel load, firing technique, timing of the burn, and recent and long-term weather patterns. With experience, landowners can begin to understand the process of prescribed fire, learn how fire behaves on their specific lands, and to recognize how their forest responds to fire in order to meet their land-management objectives.

Using Fire in Young Longleaf Plantations



The ability of young longleaf pine to tolerate fire is closely tied to its anatomical characteristics. The seedling's thick tufts of long needles are expendable during a fire. Research has shown little effect on growth from loss of needles to fire. Needles absorb and redirect lethal temperatures away from the heat-sensitive bud of the tree. Planted longleaf pine that has been in the ground for one growing season and has developed into a stout grass-stage seedling is extraordinarily resistant to fire. From the time seedlings emerge from the grass-stage up until they reach about 5 feet tall (1 to 1.5 inch diameter at ground level), longleaf pine seedlings become more susceptible to fire damage (historically described as the "fire-sensitive stage" though fire-sensitivity can be quite variable). The early development of insulating bark during this stage serves to protect the vulnerable cambium layers of seedlings and saplings when fire passes. Once seedlings grow above 5 feet tall (with 2 inch or greater ground line diameter; often described as saplings at this point), they become increasingly more resistant to fire.

Aside from tree size, the ability of longleaf pine seedlings to survive fire is closely tied to their fitness. Seedlings or saplings under significant stress are at greater risk to damage or mortality resulting from fire. Stress and reduced vigor in seedlings can be caused by drought and herbicide damage. Vigor may also be reduced by factors such as high incidence of fungal blights (most notably brown-spot needle blight), significant insect damage (such as that caused by colaspis beetles or red-headed sawflies), or from competition with other plants (including other longleaf pine). On the other hand, seedlings or saplings that are healthy and vigorous have a much higher probability of withstanding fire.

A portion of seedlings that are topkilled by fire will resprout from the root collar and persist to become part of the stand.

Although burning during the growing season can be effective in controlling unwanted competition such as hardwoods, it must be carefully timed to avoid periods when longleaf pine seedlings are vulnerable to damage. In the early spring, the new growth (called leaders) of the longleaf bolts ahead of its protective needles during a period of rapid height growth. These leaders are succulent, covered with white or silvery down, and are easily damaged by excessive heat. Killing these leaders with fire may or may not result in the death of the tree itself, but impacts on growth are likely. Applying fire when the leader has been covered with new green needles (usually in May or early June) may result in less mortality than fire used in late March or April, when the leaders are unprotected.



Photo by Stephen Hudson

To Burn... or Not to Burn

A common question from land owners and managers about burning young longleaf is *when* to burn (at what age and season of the year). It is vital to remember that prescribed burning is an objective driven process, and that some seedlings may be killed when you burn young longleaf pine. As such, the more important question needs to be *why* you should burn. Once the objective for burning is addressed, the timing of burning becomes much more obvious. The decision to burn longleaf pine early in its life history must balance the known benefits (satisfying management objectives) with predicted mortality. In most situations, mortality of planted longleaf pine seedlings following fire is generally low; typically averaging less than 10%. The amount of damage, however, will be influenced by factors such as amount of fuel on the ground, season of burn, firing technique, and high disease incidence. An average mortality of 10% may not be significant on well-stocked plantations. However, any appreciable mortality can become an issue for those plantations with low tree densities prior to burning (especially if required to maintain a minimum tree stocking by a particular cost-share program).

Some management goals that might require the use of prescribed fire early in the establishment of longleaf pine include:

 **Promoting wildflowers and plant diversity:** fire promotes growth, flowering and reproduction of many showy native plants.

 **Wood quality:** Many cost-share programs require longleaf to be planted at lower densities, increasing the retention of lower limbs and

potentially reducing future wood quality. Fire may be useful in pruning some of these lower limbs (thermal pruning), that might otherwise impact future wood quality.



Control of insects, pests and disease: fire can be applied before insects and diseases (like needle blights or pitch cankers) reach epidemic proportions to help sanitize infected plant parts or remove weakened trees.



The ability of a longleaf pine to survive a fire is closely tied to the vigor of the tree. Trees under stress prior to burning typically have higher mortality following a fire, though the use of fire is sometimes necessary to remove weakened trees.

Vigor can be reduced by insects such as the Colaspis beetle (top left) and red-headed sawfly (top right), man-made problems such as herbicide damage (bottom left), and diseases or pathogens such as pitch canker (bottom right), fusiform rust, or brown spot needle blight. Photos by Mark Hains and John McGuire.



Fuel reduction: Fire can be used when longleaf pine is still young to help keep forest litter from accumulating to the point where it can foster damaging fires. In fact, in areas such as cut-over forests replanted with longleaf pine, waiting too long (10 years or more) to start burning can often kill inordinate numbers of trees because fuels have built up to high levels.



Fuels are often sparse for up to three to four years after an area is replanted and fire intensity can be kept low when applied at this time. Photo by Stephen Hudson.

Seedlings planted by heavy logging debris will have excess mortality following fire.



Observational evidence is showing that fire can be used to some degree to help prune lower limbs on longleaf pines that are planted at low densities. Photo by John McGuire.



Fire can be used to remove other southern pines while preferentially retaining longleaf pine. Photo by John McGuire.



Other southern pines are strong competitors with longleaf pine and can quickly invade an area in absence of fire. Photo by John McGuire.



Creation of wildlife habitat: Fire creates habitats rich in the grasses and forbs that provide ideal food and cover for many animal species such as bobwhite quail and other grassland birds, wild turkey, and gopher tortoises. Some of these have otherwise become uncommon or rare in the Southeast. Fire can be used shortly after longleaf is planted to create these habitat conditions, which is not the case with loblolly or slash pine.



Competition control: Site-preparation for planting longleaf pine creates a receptive seed bed

for other nearby pines (notably slash, loblolly and shortleaf pine). Site-prep can also create a favorable environment for hardwoods to seed-in or resprout. Fire can be used to remove these seeded-in and resprouted pines and hardwoods, while leaving the young longleaf relatively unharmed, reducing harmful competition for moisture, nutrients, and sunlight. In areas where this is a problem, waiting too long to burn (typically 5 years or more) allows these off-site pines and hardwoods to begin to reach sizes where fire is largely ineffective in removing them and effectively allowing them to crowd out the longleaf seedlings.

Rules of Thumb

when burning young, planted longleaf pine

Age/time when planted longleaf pine seedlings should *not* be burned:

 Planted longleaf that have been in the ground for less than one full growing season or that have not developed into vigorous grass-stage seedlings.

 March/April timeframe when longleaf pine seedlings are experiencing dramatic active height growth (called candling).



Although fire has typically been excluded from longleaf pine plantations when seedlings have just emerged from the grass-stage, fire can (and should) be used if your objectives warrant its use. Photo by Stephen Hudson.

Seedlings can be burned but increased mortality or damage is expected when:

 Ambient temperatures are greater than 80°F and wind speed is less than 5mph.

 Humidity is lower than approximately 25%.

 Tree vigor is reduced by disease, insects, herbicide damage, drought or intense competition.

 Seedlings have emerged from grass-stage until they reach about 5 feet tall. (Note: this is aggravated as tree vigor declines, fuel loads increase and also by some firing techniques.)

 Backing fires (with longer residence times) are used on seedlings just emerging from grass-stage (basal diameter less than 1.5 inches). A grid ignition is a good substitute for backing and head fires if seedlings must be burned at this size.

 Headfires in seedlings above 5 feet tall that char up to $\frac{3}{4}$ of the tree's height and/or consume all of the needles.

 Time since last burn or time of first burn exceeds 10 years or whenever shrubs, grasses or other fuels overtop the longleaf after longleaf has bolted.



Seedlings are planted in close proximity to heavy logging debris or other heavy concentrations of fuels.



Seedlings less than 5 feet tall are growing in fuel grasses such as bermudagrass, bahiagrass, or noxious weeds like cogon grass.



Non-native grasses such as cogon, bahia, and bermuda grass can significantly increase fire intensity and result in unacceptable levels of seedling mortality. Photo by John McGuire.



Higher than average mortality can be expected when small seedlings are burned in the months of March and April with their terminal buds actively growing (candling). Photo by Mark Hains.



Seedlings can be burned with few ill effects when:



They are vigorous in the grass-stage or taller than 5 feet.



In recently planted areas where fuel load around seedlings is light, such as scalped agricultural fields or cutover-sites with little logging debris or waxy shrubs.



Ambient temperatures are lower than 45°F.



If burning seedlings in the spring, mortality may be reduced if fire is introduced after the "candle" has become covered with green needles, typically in May or June.



Although the appearance of longleaf pine seedlings scorched by fire is often unattractive, fresh regrowth typically begins within weeks after burning.

A small portion of longleaf pine seedlings can resprout if otherwise topkilled. Photos by Stephen Hudson and John McGuire.

Key Terms

Seedling – tree prior to forming its first branches. In longleaf pine this is typically less than 5 feet tall and 2 inches diameter at the ground. Although resistant to fire at this size, fire may kill some trees.

Sapling – tree after it has formed its first branches. Under commonly accepted prescribed burn weather, mortality in longleaf pine saplings is rarely seen. Burning on hot summer days (above 85°F) with surface winds less than 5mph can cause mortality in this size class.

Grass-stage – stemless period in the life of a longleaf pine seedling (typically 1-2 years in today's plantations) when it is not actively growing above ground and resembles a clump of grass. Unless severely afflicted by disease (like needle blights) mortality at this stage is rare even if all needles are burned off.

Stem-elongation stage - aka “rocket” or “bolting” stage. A period when longleaf pine starts to rapidly grow in height and is typically ½ foot to 12 feet tall (1-2 inches diameter at ground level). Seedlings in this stage are most susceptible to fire damage and mortality. Mortality is increased by backing fires, higher ambient temperatures, and whether or not the growing terminal bud is protected by needles or not. Severe head fires may cause higher mortality in some situations. A grid ignition pattern is a good compromise if trees must be burned at this size.

Summary

Longleaf pine seedlings and saplings are fire resistant but not fire proof. A common mistake made by managers is assuming that longleaf can withstand fire applied at a much greater intensity or frequency than what is needed to achieve their objective(s). Often this can lead to unnecessary loss in growth or survival. As a fire-tolerant species, however, longleaf is a very forgiving tree to burn. In cases where fire varies slightly outside of prescribed generally accepted weather conditions, the results are often still beneficial overall. Landowners should weigh the predicted loss of some young longleaf against the anticipated significant benefits when planning prescribed burns.





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