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The Many Faces of Fire Forests: A Guide to Longleaf Pine Habitats for Better Stewardship

Longleaf pine (*Pinus palustris)* once covered nearly 92 million acres across the Southeast, stretching from Virginia to Texas. Today, less than 3 percent of that forest remains, and most of it exists in scattered, isolated patches. Historically, longleaf pine grew on various types of land, from dry, sandy ridges to wet, grassy savannas and flatwoods. What these places had in common was frequent fire. What made them different were their soils, drainage, and landscape position.

Understanding the type of longleaf site you have is one of the most important steps in successful management. A dry sandhill behaves very differently from a moist upland or a flatwood. Fire spreads differently, trees grow differently, and wildlife use the land differently. Restoration works best when it matches the land. That means understanding where longleaf historically occurred, what conditions it preferred, and how those conditions vary across Mississippi and the broader Southeast.

This publication explains the major longleaf pine site types within the U.S. Environmental Protection Agency (EPA) Level III ecoregions and what those differences mean for prescribed fire, timber production, wildlife (including hunting), and biodiversity. By understanding your site type, you can make better management decisions and set realistic expectations for your land.

EPA Ecoregions and Longleaf Pine Distribution

At first glance, longleaf pine country may look similar across the Southeast. However, it grows under many different conditions, from dry sandy ridges to moist rolling uplands and flat coastal terraces. To manage longleaf successfully, it helps to divide the landscape into regions that share similar soils, climate, and landforms. When we compare these regions, clear patterns emerge in how longleaf forests look, burn, grow, and support wildlife.

Several mapping systems exist, but the EPA ecoregion system is especially useful for longleaf pine because it closely

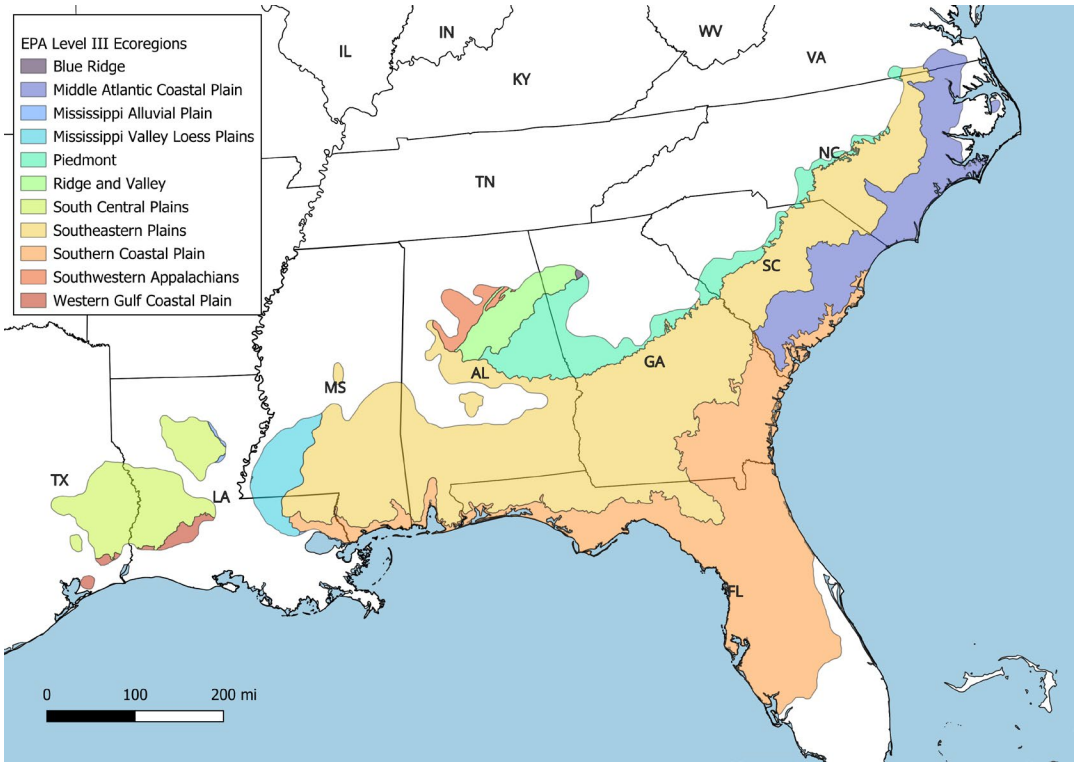

Figure 1. EPA level III Ecoregions within longleaf pine historical range.

matches the natural differences across the landscape. The EPA ecoregion system groups areas based on recurring patterns in soils, climate, geology, water movement, and native vegetation across the U.S. Because these patterns repeat across the landscape, they provide a practical way to guide restoration, fire planning, and timber management.

The EPA system is organized into four levels, from very broad regions to more detailed local zones: *Level I* divides North America into very broad regions, such as the Eastern Temperate Forest or the Great Plains; *Level II* breaks those into smaller climate-based regions; *Level III* identifies major landscape regions, such as the Southern Coastal Plain or the Southeastern Plains; and *Level IV* further divides those regions into smaller areas that reflect local soil, drainage, and vegetation differences. **Figure 1** shows the Level III ecoregions within the historical longleaf pine range across the Southeast, while **Figure 2** highlights those same regions within Mississippi.

Longleaf Pine Site Types: A Practical Classification

Several scientists have proposed classifying longleaf pine ecosystems based on soils, landscape position, and fire patterns. While these systems differ slightly in terminology and number of categories, they all identify one important point: soil moisture, soil texture, and fire frequency are the primary factors shaping longleaf pine communities.

For clarity and practical application, this publication combines these approaches into five major longleaf pine site types relevant to Mississippi and the broader Coastal Plain: Deep Sandhills, Dry Sandy Uplands, Moist to Mesic Uplands, Pine Flatwoods, and Savannas and Seepage Areas. Each type includes a combination of areas classified by longleaf pine experts Robert K. Peet and L. Katherine Kirkman. These site types align with EPA Level III ecoregions and reflect real differences in how forests burn, grow, and support wildlife.

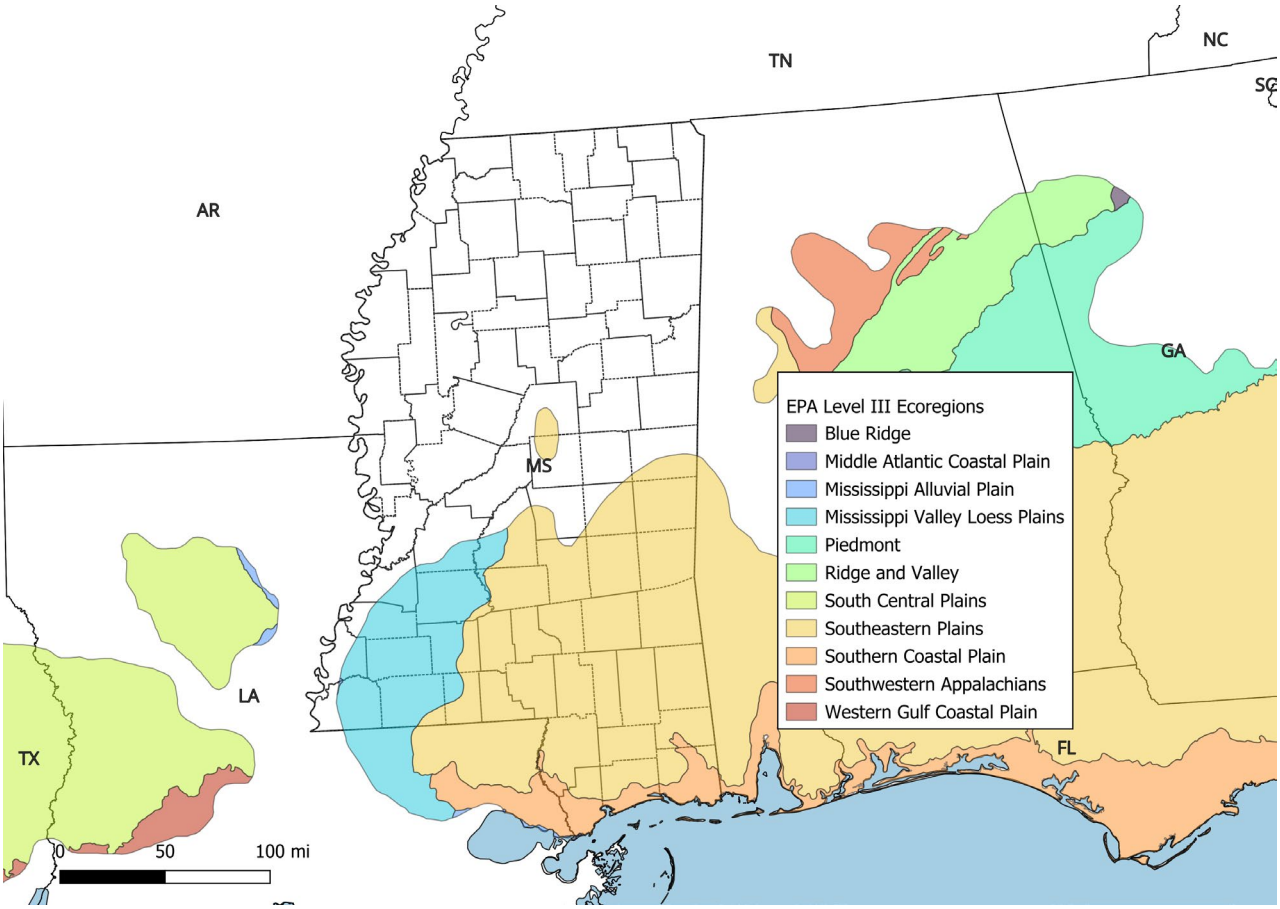

Figure 2. Detail of the EPA Level III Ecoregions within the longleaf pine historical range in Mississippi.

EPA Level III Ecoregions in the Longleaf Pine Historical Range in Mississippi

Longleaf pine historically occurred across several EPA Level III ecoregions. In Mississippi, it was most strongly associated with the Southern Coastal Plain (75) and portions of the Southeastern Plains (65).

Southern Coastal Plain (Ecoregion 75)

The Southern Coastal Plain is characterized by low relief, sandy to loamy soils, and a warm, humid climate. Many areas have flat terrain with shallow water tables, especially toward the Gulf Coast. Historically, this region supported extensive longleaf pine forests, including sandhills, dry uplands, flatwoods, and species-rich savannas. This ecoregion contains the full range of longleaf site types found in Mississippi. Fire behavior and timber productivity vary widely depending on soil drainage, from dry sandhills to seasonally wet flatwoods.

Southeastern Plains (Ecoregion 65)

The Southeastern Plains consist of gently rolling uplands with sandy and loamy soils. The terrain is slightly more irregular than the Southern Coastal Plain and generally better drained. Historically, longleaf pine dominated the well-drained uplands, with mixed pine–hardwood forests on more fertile or less frequently burned sites. Sites in this region often support dry sandy uplands or mesic uplands. Fire typically spreads well, and timber productivity can be moderate to high depending on soil depth and moisture.

Western Gulf Coastal Plain (Ecoregion 34)

The Western Gulf Coastal Plain extends west of the Mississippi River and includes flatter terrain near the coast and more irregular plains inland. Historically, longleaf pine occurred on suitable sandy uplands within this broader forested landscape. Only the easternmost edge of this broader region influences southwestern Mississippi. Management principles are like those in Mississippi's Southern Coastal Plain, but agricultural conversion and pine plantations are more widespread in this region.

Deep Sandhills

Deep sandhills, which combine Peet's Xeric Sand Barrens with Kirkman's Sandhills and River Dunes, are the driest longleaf sites. They occur on deep, coarse sands that drain quickly and hold little moisture or nutrients. Trees are widely spaced, with scattered longleaf pine and fire-tolerant oaks. Ground cover is often sparse, with patches of grass, low shrubs, and lichens. In Mississippi, true sandhill sites are limited but present within the Southern Coastal Plain. The U.S. Forest Service identifies these areas as Xeric Sandhills on some national forest lands. They are typically found on excessively drained sandy ridges.

Prescribed Fire

Deep Sandhills often carry fire unevenly because grasses and other fuels are patchy. Some areas may burn lightly while others may not burn at all. As a result, ignition techniques may need to be adjusted to ensure adequate coverage. A three- to four-year burn interval is typically sufficient on these dry sites. More frequent burning may not always increase fire coverage due to limited fuel. If fire is excluded, scrub oaks can quickly form dense thickets that reduce visibility, limit grass recovery, and make future burns more difficult.

Timber

Tree growth on deep sands is slower than on more fertile soils. These sites typically produce lower timber volumes, but longleaf pine performs better here than most other southern pines because of its deep root system and drought tolerance. Sandhills are often best managed for sawtimber, under long rotations and uneven-aged management. They are generally less suited for high-density plantation management.

Wildlife

When regularly burned, sandhills provide excellent habitat for several wildlife species, including Northern bobwhite quail, wild turkey, gopher tortoise, and Bachman's sparrow. The open structure improves visibility for hunting and promotes insect-rich brood habitat for upland birds. If fire is excluded and oak thickets develop, habitat quality for quail and turkey declines significantly.

Biodiversity and Ecosystem Services

Although plant diversity is lower than in wetter longleaf types, sandhills support specialized drought-adapted species and important reptile habitat. These sites recharge groundwater, resist catastrophic wildfire due to lighter fuels, provide habitat for rare upland species. They are among the most drought-resilient longleaf ecosystems.

Dry Sandy Uplands

Dry Sandy Uplands, which combine Peet's Sub-xeric Sandy Uplands with Kirkman's Dry Upland Forests, occur on rolling terrain with deep sandy soils. Water drains quickly through the sand, so the soils dry out easily during warm weather. The density of understory trees depends largely on fire history. With regular fire, the understory stays open. Unlike the driest sandhills, these uplands usually support a nearly continuous grass layer, often dominated by wiregrass and little bluestem. These dry uplands are widespread across the southern and central Coastal Plain and represent one of the most common longleaf site types in the state (**Figure 3**).

Figure 3. Longleaf pine forest belonging to the Dry Sandy Uplands habitat at Lake Thoreau Environmental Center in Forrest County, Mississippi.

Prescribed Fire

These sites typically carry fire well due to continuous grass cover. A fire return interval of two to three years maintains an open woodland structure and suppresses hardwood encroachment. If fire is delayed beyond four to five years, oaks establish in the midstory and fuel loads increase, making subsequent burns hotter and harder to control.

Timber

Dry Sandy Uplands are moderately productive longleaf sites. Growth rates are higher than in deep sandhills but lower than on mesic uplands. These sites are well-suited for thinning-based management, mixed-age stands, and longleaf restoration projects. Proper spacing and regular fire are critical to maintain high-quality stems.

Wildlife

Dry uplands provide strong habitat for white-tailed deer, wild turkey, and bobwhite quail. Frequent fire promotes legumes, soft mast, and insect production. The open canopy improves hunter visibility and deer movement. These sites often offer one of the best balances between forage production and cover.

Biodiversity and Ecosystem Services

Groundcover diversity can be high when fire is frequent. These areas support native grasses, forbs, and pollinators. They also help reduce soil erosion and improve water infiltration compared to denser unmanaged forests.

Moist to Mesic Uplands

Moist to Mesic Uplands combines Peet's Silty Uplands and Mesic Savannas with Kirkman's Mesic Uplands. These sites occur on loamy sands that often have a clay layer beneath the surface. Because they hold more moisture and nutrients than deep sands, trees grow faster here. Historically, these were some of the most extensive longleaf sites in the region. Because these soils are fertile, many of these areas were converted to agriculture before 1900. As a result, intact examples are less common today. In Mississippi, they primarily occur in the upper and central Coastal Plain.

Prescribed Fire

Mesic uplands produce heavier fuels due to greater plant growth. Fire spreads readily and may burn more intensely if intervals are too long. A burn interval of about two years is often ideal to maintain an open woodland structure and prevent hardwood establishment. Because fuels accumulate quickly, consistent fire is especially important.

Timber

These are among the most productive longleaf sites. Trees grow faster and produce higher timber volume than on drier sites. However, fertile soils also favor competing hardwoods. Without regular fire, longleaf pine may lose dominance. These sites are wel- suited for high-quality sawtimber, uneven-aged management, and restoration of historically converted lands.

Wildlife

Mesic uplands are highly valuable for wildlife. They support deer (due to higher forage production), turkey, songbirds, and many pollinators. For hunting, these sites often provide excellent nutrition for deer and strong brood habitat for turkeys when regularly burned.

Biodiversity and Ecosystem Services

Mesic longleaf woodlands can support very high plant diversity when burned frequently. They contribute to carbon storage, soil fertility, pollinator support, and water filtration. Historically, many were converted to agriculture, making intact examples particularly important for conservation.

Pine Flatwoods

Pine Flatwoods, which combine Peet's Flatwoods with Kirkman's Pine Flatwoods, occur on nearly level landscapes across the outer Coastal Plain. Soils are sandy and acidic, and the water table is often close to the surface. These sites are often wet in winter and spring but can become very dry during summer droughts. In Mississippi, they occur extensively across the outer Coastal Plain.

Prescribed Fire

Flatwoods can burn differently depending on soil moisture. During dry periods, fire may move quickly through accumulated shrubs. During wet periods, fire spread may be patchy. A two- to three-year burn interval helps maintain an open structure and reduce shrub thickets. Without fire, dense gallberry, saw palmetto, and other shrubs can accumulate, increasing wildfire risk (**Figure 4**).

Figure 4. Longleaf pine forest belonging to the Flatwoods habitat at Grand Bay National Estuarine Research Reserve in Forrest County, Mississippi.

Timber

Timber productivity varies depending on drainage. Slightly elevated flatwoods can produce moderate longleaf yields. In contrast, poorly drained areas grow more slowly. These sites are often converted to slash pine plantations, but longleaf can perform well when fire is maintained.

Wildlife

Flatwoods provide bedding cover for deer and habitats for turkey nesting, small game, and amphibians and reptiles. Shrub patches offer cover, while burned openings provide forage. A mix of burn stages often gives the best results for wildlife.

Biodiversity and Ecosystem Services

Flatwoods regulate water movement across the landscape. Their seasonal wet-dry cycle supports amphibians and specialized plants. They serve as ecological transition zones between uplands and wetlands. Maintaining fire preserves plant diversity and reduces severe wildfire risk.

Savannas and Seepage Areas

Savannas and Seepage Areas combine Peet's Savannas and Seeps plus Kirkman's Wet-Mesic Transitions. These are open, seasonally saturated sites with extremely high plant variety. They often contain pitcher plants, orchids, lilies, and various sedges and grasses. Small differences in soil moisture or drainage can create noticeable changes in plant composition across short distances. In Mississippi, savannas occur across the Coastal Plain, often forming transitions between drier uplands and wetter flatwoods (Figure 5).

Figure 5. Rich and varied understory of a longleaf pine forest belonging to the Savannas and Seepages habitat at The Crosby Arboretum in Pearl River County, Mississippi. *Photo by Patricia Drackett*

Prescribed Fire

Savannas require frequent fire, often every one to two years, to maintain open structure and prevent shrub encroachment. Because fuels can be fine and continuous, fire spreads readily under appropriate conditions. Without fire, woody species quickly dominate and plant variety declines.

Timber

Savannas are generally managed more for biodiversity than timber production. Tree density is naturally low, and growth rates vary depending on soil moisture. Where timber is present, longleaf pine typically grows at moderate rates.

Wildlife

Savannas are among the most wildlife-rich longleaf habitats. They provide forage for deer, insect-rich habitat for turkey broods, and habitat for rare amphibians and reptiles. For hunting, adjacent uplands often provide better stand placement, while savannas contribute to overall habitat quality.

Biodiversity and Ecosystem Services

Savannas are some of the most plant-diverse ecosystems in North America. They support orchids, pitcher plants, native grasses and sedges, and pollinators. They also improve water quality, support rare species, and increase landscape resilience. Frequent fire is essential to maintain this biodiversity.

How to Identify Your Longleaf Pine Site Type

Many people might ask: "How do I know whether my longleaf stand is flatwoods, dry upland, or something else?" The answer usually comes down to five main clues:

1. soil
2. water movement and drainage
3. topography
4. vegetation (and its response to fire)
5. vegetation's response to fire

A careful observation of these features provides valuable information.

Step 1. Observe the Landscape (Topography)

Topography is often the easiest clue.

- Nearly level ground that stays flat for long distances: likely Flatwoods.
- Gently rolling hills or ridges: likely Dry Sandy Uplands.
- Steeper sandy ridges with very loose sand: likely Deep Sandhills.
- Low areas between uplands that feel slightly wetter: possibly Savannas or seepage zones.

Step 2. Observe the Soil

A simple shovel test can reveal a lot (a soil analysis is not needed). Dig about 12–18 inches deep in the soil and examine it.

- Is the soil loose and sandy all the way down? Likely Deep Sandhills.
- Is it sandy near the surface but firmer or clayey deeper down? Likely Dry or Moist Uplands.
- Does the soil feel damp or show gray colors or mottling within 12 inches? Likely Flatwoods or seasonally wet site.
- Does water stand after heavy rain? Likely Flatwoods.

Step 3. Watch Water After Rain

After heavy rainfall, observe how long water remains.

- Drains within hours: likely Sandhills or Dry Uplands.
- Damp for several days: likely Moist/Mesic Uplands.
- Standing water for days or weeks: likely Flatwoods or Savanna.

Note: Flatwoods often have a shallow water table that rises in winter and early spring.

Step 4. Examine the Groundcover

Vegetation provides some of the strongest clues.

- Sparse grass, bare sand, lichens: likely Deep Sandhills.
- Continuous grass layer (wiregrass, little bluestem): likely Dry Sandy Uplands.
- Dense shrub layer (gallberry, saw palmetto) on flat terrain: likely Flatwoods.
- Presence of pitcher plants, orchids, or sedges: likely Savannas or Seepage areas.

Step 5. Observe Fire Behavior

Note how fire behaves during a prescribed burn.

- Fire spreads slowly and patchily: Sandhills.
- Fire spreads evenly through grasses: Dry Uplands.
- Fire spreads well but fuels accumulate quickly: Mesic Uplands.
- Fire behavior changes dramatically depending on season and moisture: Flatwoods.

Five Questions to Identify Your Longleaf Pine Site

1. Is my land flat or rolling?
2. Does water stand after rain?
3. Is the soil deep sand or sandy over clay?
4. Is the groundcover sparse or continuous?
5. How does fire typically spread here?

Table 1. Management-focused summary for each longleaf pine ecosystem type.

Site Type	Soil and Moisture	Fire Interval	Timber Potential	Wildlife Value	Main Management Focus
Deep Sandhills	Deep, dry sands	3–4 years	Low–moderate	Quail, turkey, tortoise	Prevent oak thickets
Dry Sandy Uplands	Sandy, drought-prone	2–3 years	Moderate	Deer, turkey, quail	Maintain grass layer
Moist to Mesic Uplands	Loamy sands over clay	about 2 years	High	Deer, turkey	Control hardwood encroachment
Pine Flatwoods	Sandy, shallow water table	2–3 years	Moderate	Deer, turkey, reptiles	Reduce shrubs
Savannas and Seeps	Seasonally wet	1–2 years	Low	High biodiversity	Maintain frequent fire

Conclusion

Longleaf pine management cannot rely on a single management strategy. Fire, timber production, wildlife habitat, and biodiversity outcomes all depend on matching management to your site's soils, drainage, topography, and fire history.

By identifying whether your land is sandhills, dry uplands, mesic uplands, flatwoods, or savannas, you can set realistic goals and apply practices that work with the land (Table 1). Frequent fire remains the foundation of longleaf stewardship, but its behavior and effects vary by site type.

Understanding these differences helps reduce wildfire risk, improve timber quality, enhance wildlife habitat, and protect one of North America's most resilient and diverse forest ecosystems.

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