

DRY LONGLEAF PINE COMMUNITIES

Concept: Dry Longleaf Pine Communities occur in non-wetland mesic to xeric sites in the Coastal Plain and lower Piedmont, where natural frequent fire promoted open woodlands or savannas dominated or codominated by *Pinus palustris*. In natural condition, all have limited midstory and shrub layers, and all but the most xeric have dense grass-dominated herb layers.

Distinguishing Features: Dry Longleaf Pine Communities are distinguished by present or past dominance by *Pinus palustris*. It was usually exclusively or strongly dominant under natural fire regimes, but likely was mixed with *Pinus echinata* and a few other species in the Piedmont and northern areas. In current conditions of inadequate fire, *Pinus palustris* may remain dominant but without reproduction. If it was removed by logging, evidence of past dominance may remain in the form of boundary trees, stumps boxed for sap collection, or associated species. *Aristida stricta* naturally dominated most communities; it is an extremely conservative species that is always associated with these communities, and its presence even as sparse remnant clumps indicates past presence of a longleaf pine community.

Within the theme, communities are distinguished by environmental gradients of moisture and soil texture, as well as by biogeography. Mesic Pine Savannas occur on moist sites with loamy or fine-textured soils. They have a diverse herb layer, often contain some wetland species, and lack scrub oaks other than *Quercus marilandica*. When affected by fire suppression, forest oaks or other hardwoods dominate the midstory. Pine/Scrub Oak Sandhill communities occur with intermediate moisture levels, dry but not xeric, with a variety of loamy, clayey, or sandy soils. They are characterized by a mix of scrub oak species, though, though forest oaks will invade them with long fire exclusion. Herb layers may be low to fairly high in species richness. Xeric Sandhill Scrub communities occur on coarse sandy soils and are distinguished by a scrub oak layer consisting primarily of *Quercus laevis*. Sand Barrens occur on the most extreme coarse sands, where excessive drainage and low nutrient status support only a sparse tree canopy and herb layer even in the absence of mechanical disturbance. *Aristida stricta* occurs only at low density, and other species characteristic of coarse sands are equally abundant. *Quercus laevis*, though not dense, may be the most abundant woody species under natural conditions. Dry Piedmont Longleaf Pine Forest occurs in the Piedmont, on older soils. It lacks *Aristida stricta*, and has a mixed grassy herb layer.

Within the three drier community types, a Coastal Fringe Subtype is distinguished. All are marked by the presence of a suite of plants that, in North Carolina, are generally confined to within a few miles of the coast.

Synonyms: Sandhills, mesic flatwood, mesic savanna.

Sites: Dry Longleaf Pine communities occurred naturally on most upland sites in the Coastal Plain with the exception of bluffs, swamp islands, maritime areas, and other places naturally sheltered from frequent fire. Though few examples remain, these include well-drained upland terraces and flats, as well as relict dune fields, Carolina bay rims, relict floodplain terraces now above flood levels, and low rises in wetter flats. In the Piedmont, they occurred near the Fall

Zone primarily in distinctive areas of sandy soil, silt/clay hardpan on meta-sedimentary rocky, and dry slopes in the Uwharrie Mountains.

Soils: Examples may occur on virtually any kind of non-hydric upland soil, including Entisols and a wide variety of Ultisols.

Hydrology: This theme encompasses the full range up non-wetland hydrology, from the most xeric excessively drained sands to the transition to wetlands. Seasonal high water tables may be present in the marginal examples.

Vegetation: Dry Longleaf Pine Communities characteristically have an open canopy with a woodland or savanna structure. *Pinus palustris* is the virtually the only species present in most examples, but *Pinus echinata* or *Pinus taeda* may be mixed with it in a few of the communities. With long exclusion of fire, the other pines, along with hardwood species, invade most communities. The herb layer characteristically is dense in all but the most xeric communities. *Aristida stricta* dominates in most communities, while *Schizachyrium scoparium* dominates in Piedmont and far northern communities, and a mix of xerophytic species characterize the most xeric sands. Herbaceous species richness ranges from fairly low to extremely high. Mesic Pine Savannas can have some of the highest values recorded anywhere at small to moderate scales.

The xeric to dry communities have a midstory of small hardwoods, predominantly scrub oaks (*Quercus laevis*, *Quercus marilandica*, *Quercus incana*, *Quercus margarettiae*), which may become dense with exclusion of fire. The mesic communities tend to lack a midstory when frequently burned, but may be invaded by a variety of hardwoods in the long absence of fire. A low shrub layer generally consists of sprouts of midstory hardwoods and patchy to sparse shrubs of a variety of species. With fire exclusion, shrubs may become dense.

Dynamics: Fire at frequent return intervals and low to moderate intensity is the crucial ecological driver of longleaf pine communities, which occur over a tremendous range of site and soil conditions but rarely occur in settings not conducive to fire spread. Though fire generally is referred to as a disturbance, in these communities it historically was predictable enough that it might better be considered merely a part of the environment. All of the characteristic plant species are well adapted to surviving fire, so that a given fire causes almost no turnover of individuals. However, frequent fire is the crucial factor that excludes uncharacteristic species from the community, and is the predominant factor in nutrient cycling and removal of litter. Fires kill the above-ground parts of most understory trees as well as shrub and herbs. Most trees, as well as the shrubs, therefore naturally existed as short sprouts, escaping enough fires to grow larger only in uncommon patches.

Removal of fire from longleaf pine communities drastically alters these communities, increasingly so over time. Understory trees or shrubs proliferate, and their shade, along with accumulation of litter, suppresses and gradually eliminates the herbaceous species. Longleaf pine is intolerant of shade and is unable to regenerate in the shade of the understory, even if canopy gaps are available. Its “grass stage” delay in initiation of height growth makes it vulnerable to suppression even by shrubs. The accumulation of oak litter and the loss of grass reduces the effectiveness and likelihood of future fires, while scrub oaks which have grown large

are fairly tolerant of fire. It therefore is difficult to restore examples that have gone too long without fire.

Most associated species have conservative life histories. Though most have not been studied in detail, the characteristic herb species appear to have long life spans, rarely reproduce by seed, don't readily invade open areas, and don't have persistent seed banks. *Aristida stricta* is only rarely observed to reestablish in sites once it has been eliminated by mechanical disturbance or shading. B.W. Wells (>???) noted an old field adjacent to an intact stand of the species, which showed no reestablishment of it after 50 years. Fire is necessary for many of the species, including *Aristida stricta*, to flower but additional conditions appear to be necessary for many to successfully establish even in openings.

Longleaf pine also is a conservative species. It is among the most long-lived trees in the region, capable of exceeding 400 years (xxxx). The species has numerous adaptations to the frequent low-intensity fires characteristic of its habitat, and also survives strong winds better than most trees. Longleaf pine begins to produce seed at an older age or larger size than most trees, and abundant seed crops occur only every few years (xxxx). Reproduction requires a seed crop to coincide with a recent fire, and requires the high light levels in canopy gaps. Though appearing highly specialized, these conditions were prevalent enough that the species dominated most of the Coastal Plain landscape.

Longleaf pine canopies naturally occur as old-growth, multi-aged woodlands. The natural population structure and dynamics of longleaf pine in North Carolina are believed to be similar to that found by Platt, Evans, and Rathbun (1988) in old growth longleaf pine forest in Georgia. The age structure there was irregular, reflecting irregularities in both reproduction and mortality of the pines in response to environmental conditions and natural disturbances. *Pinus palustris* seed production is cyclic, and seedlings do best in years following fires, so regeneration is somewhat episodic. Essentially all ages were represented, up to well beyond 200 years, indicating continuous establishment of long-lived trees. Younger trees tended to establish in small even-aged clumps, in areas with lower density of adult trees. Over time the clumps thinned and became less distinct, so that the old trees were more randomly distributed. This natural patch structure has been lost in most present examples, where past clearcutting has resulted in more uniform even-aged stands. Typical thinning also homogenizes any developing patch structure, but older canopies can be seen to be starting to develop a patchy structure as gaps form.

Some characteristic animals such as *Picoides borealis* (red-cockaded woodpecker) have similar conservative life histories. Other, such as many insects, apparently do not readily escape fire; they depend metapopulation structures and on rapid reproduction of individuals in unburned patches to repopulate burned areas.

Comments: Most of the subtypes in this theme were treated as variants in the 3rd Approximation, after being recognized in natural heritage surveys of longleaf pine communities. Most were confirmed by early analysis of CVS data (Duncan, et al. – unpublished manuscript). Recent thorough analysis of CVS plot data (Palmquist, et al. in prep), supplemented by data

ranging from Virginia to Florida, confirmed the identity of these units. Most of the descriptions here are based on that analysis, but are supplemented by other observations.

Longleaf pine communities, dry and wet, are the prevailing natural vegetation of the entire Coastal Plain of the Southeastern United States, from southernmost Virginia to eastern Texas. As in North Carolina, they occur over a very broad range of landforms and soil conditions. However, analysis of plot data from Virginia to Florida found that the strongest variation in vegetation was with biogeography. Plots in North Carolina were more similar to each other than they were to plots with comparable moisture levels in Florida (Palmquist et al. in prep). Species richness increases southward, but there also is significant species turnover through the range, with several centers of endemism. The dominant grasses also vary. *Aristida stricta* reaches its northern range limit north of the Neuse River, as well as being absent in the Piedmont. It ranges southward only through the northern third of South Carolina. *Aristida beyrichiana* dominates from southern South Carolina through Florida and the eastern Gulf Coast, but other grasses dominate in central South Carolina, in some inland areas of the Gulf Coastal Plain, and farther west.

The more broadly defined longleaf pine ecosystem is widely regarded as among the most endangered, with an extreme decline from its original abundance (Noss,xxxx). The conservative nature of most of its flora, including the dominant species, makes restoration difficult. However, areas that retain *Aristida* and other characteristic herbs, can be restored by planting *Pinus palustris*.

References:

Platt, W.J., G.W. Evans, and S. L. Rathbun. 1988. The population dynamics of a long-lived conifer (*Pinus palustris*). American Naturalist 13: 491-525