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Restoring Longleaf Pine Forest Ecosystems in the Southern United States

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Longleafpine *(Pinus palustris)* forests were historically one of the most extensive ecosystems in North America, covering 38 million ha along the coastal plain from Texas to Virginia and extending into central Florida and the Piedmont and mountains of Alabama and Georgia. Throughout its domain. longleaf pine occurred in forests, woodlands and savannas on a variety of sites ranging from wet flatwoods to xeric sandhills and rocky mountain ridges. In the western coastal plain. longleaf pine understories are dominated by bluestem grasses *(Andropogon* spp. and *Schizachyrium* spp.) and from Florida eastward, longleaf pine is commonly associated with wiregrass *(Aristida* spp.) The open, park-like stand structure of longleaf pine ecosystems is a product of frequent understory fires, which are facilitated by the combustibility of grasses and accumulated pine needles. Lightning strikes and ignition by Native Americans were the principal sources of fire that shaped longleaf pine ecosystems for many millennia.

While the influence of 17th and 18th century European immigrants was largely confined to coastal areas and nearby uplands, rapid population growth and westward expansion during the 19th century brought with it increasing impacts upon these forest ecosystems from commercial timber harvest, intensified agriculture and development of the naval stores industry. By the early 20th century, longleaf pine harvesting peaked, leaving only 8 million ha remaining by 1935. Since then. extensive damage has been done to regenerating seedlings by feral hogs *(Sus scrofa),* forest management policies have promoted the active suppression of all fires and harvested longleaf pine have been frequently replaced by faster growing loblolly pine *(Pinus taeda)* or slash pine *(Pinus elliottii).* Urban expansion, discouraging planting and elimination of fire have resulted in a continuing decline of longleaf pine, with only 1.2 million ha remaining by 1995 (~3 % of its original area). Numerous species of plants, mammals, birds and reptiles are adapted to longleaf pine ecosystems, ranking them among the most species- rich forest ecosystems outside the tropics. Longleaf pine losses and hardwood invasion of remaining lands have greatly reduced and degraded the available habitat and caused increased rarity of many obligate species. In the absence of frequent understory fires, the proliferation of woody plants in the understory and midstory has greatly increased the risk of additional longleaf pine ecosystem losses from catastrophic fire.

An important part of the South's natural heritage, longleaf pine ecosystems have had great social importance, providing timber, turpentine, cattle forage and wild game, and framing the natural landscape for many generations. Although the long-term negative trend has been recently slowed, resource assessments forecast a continuing decline without active intervention to reverse these losses. Since longleaf pine still exists in numerous small fragments throughout its natural range, it is reasonable to conclude that it can be restored. In recent years, the Longleaf Alliance has had success in changing attitudes in the forestry community toward greater acceptance of longleaf pine, resulting in increasing interest in reforestation with longleaf pine seedlings and ecological restoration of the broader ecosystem.

Rather than attempting to return to pre-contact conditions or another arbitrary point in history, restoration is focused on re-establishing the natural structure and function in the ecosystem by adjusting species composition, modifying stand structure and ensuring that ecological processes, especially the essential processes such as periodic fire and longleaf pine regeneration, remain fully operational at multiple spatial and temporal scales. Restoration is regarded as a long-term process of serial approximation, moving forest sites from current (i.e., degraded) toward desired (i.e., healthy) conditions, drawing upon the ecological theory of scientific research and appropriate silvicultural techniques applied through adaptive management. In achieving ecological restoration at the field level, physical, chemical and biological methods are employed as single or multiple treatments.

Benefits derived from restoration of longleaf pine ecosystems can be measured in ecological, economic and social terms. These include (1) expanding the habitat available to aid in the recovery of numerous imperiled species, (2) improving habitat quality for many wildlife species, (3) diversifying the forest land base to produce greater amounts of high-quality longleaf pine timber products that bring higher prices than the low-value pulpwood of other trees, (4) provide increased opportunities for harvesting pine straw, (5) create new recreational opportunities in an aesthetically pleasing environment and (6) preserve natural and cultural legacies and a broader range of management options for future generations. While initial establishment costs may be substantial, longleaf pine is more productive than other pines beyond age 30, making it in the long-term an economically competitive species for reforestation and restoration. With most of the natural range of longleaf pine occurring on numerous non-industrial private lands, the challenges of management coordination to restore these forest ecosystems are formidable. Outreach efforts by the Longleaf Alliance have made genuine progress in this endeavor. Meanwhile, a host of ecological and management information needs concerning improved restoration approaches are being addressed through scientific research.