



Regional Goals

Photo by Holly Campbell, Southern Regional Extension Forestry, GA

The range of diversity in the historic and current condition of shortleaf pine woodlands and the current context of restoration necessitates a regional approach to the development of goals, desired future conditions, and appropriate strategies. The circumscription of these regions is ongoing.

Included in this version of the Plan are the goals for the Interior Highlands Region, the West Gulf Coastal Plain, and the regions east of the Mississippi River. The **Interior Highlands Region**, also referred to as the Ozark-Ouachita Region, encompasses four Level III ecoregions: the Ozark Highlands, the Boston Mountains, the Arkansas Valley and the Ouachita Mountains in the states of Arkansas, Missouri, and Oklahoma (U.S. Environmental Protection Agency, 2013). This region has some of the most extensive stands of shortleaf pine.

The **West Gulf Coastal Plain** ecoregion extends across southeastern Arkansas, southwestern Oklahoma, western Louisiana, and eastern Texas. The area reaches from the Arkansas River Valley in Arkansas and Oklahoma in the north to the coastal prairies and marshes in Louisiana and Texas to the south, and from the Mississippi Alluvial Valley in the east in Arkansas and Louisiana, and west to the Oaks and Prairies in Oklahoma and Texas. Historically, shortleaf pine mixed with oaks (*Quercus spp.*) and hickories (*Carya spp.*) was the predominant pine forest type outside of areas dominated by longleaf pine. Much of the shortleaf pine has been replaced by loblolly pine (Jim Neal, U. S. Fish and Wildlife Service, Nacogdoches, TX).

The area **east of the Mississippi River** encompasses a diverse landscape from the Cumberland Plateau and Ridge and Valley to the Southeastern Plains and the Southern and Northern Piedmont ecoregions. (U.S. Environmental Protection Agency, 2013). Common to these ecoregions is that shortleaf pine has been greatly reduced in abundance and distribution. In the future, this region may be divided into smaller units more appropriate for strategic actions and agency leadership.

GOALS FOR THE INTERIOR HIGHLANDS ECOREGION

The Interior Highlands Region

The Interior Highlands, also referred to as the Ozark-Ouachita Region, encompasses four broad-scale (Level III) ecoregions: the Ozark Highlands, the Boston Mountains, the Arkansas Valley, and the Ouachita Mountains (Omernik, J. M. 1987, U.S. Environmental Protection Agency, 2013; Figure 8).

The Ozark Highlands ecoregion occupies most of southern Missouri and extends into northwestern and north-central Arkansas. It is comprised of dissected plateaus that resulted from erosion of a geologic dome uplifted during the Paleozoic era, along with the St. Francis Mountains, the granite core of the Ozarks. The Boston Mountains ecoregion extends from north-central Arkansas into Oklahoma. It is the highest and youngest of the Ozark plateaus, and the most ruggedly dissected. The Ouachita Mountain ecoregion, extending from central Arkansas west into eastern Oklahoma, has been extensively folded and faulted, resulting in the distinct east-west ridges that are evident in the landscape today. The Arkansas Valley ecoregion, a structural valley but much modified by the Arkansas River, lies between the Boston Mountains and Ouachita Mountains in west-central Arkansas, and extends into eastern Oklahoma.

Oak-hickory forests and woodlands currently predominate throughout much of the Ozarks, with mixed pine–hardwood or pine communities more common in the Ouachitas. Prairie grasses and forbs are found in the understory of woodlands that are subject to recurrent fire. Glades and barrens occur throughout the region where thin soils and dry exposures limit woody growth. Although warm-season grasses and a diversity of forbs characterize glades, eastern redcedar (*Juniperus virginiana*) and Ashe’s juniper (*Juniperus ashei*) invade glades during fire-free intervals. Their presence gave rise to the term “cedar glades,” which often is used colloquially.

The Ozark Highlands (Level III) ecoregion is comprised of

eleven Level IV ecoregions that are differentiated by geologic history, topography, drainage, soils, biota and other features. Elevations range from 144-650 m (400-1800 ft.) above sea level, with local relief of 100 or more meters (300 ft.) typical of the region. The potential natural vegetation is pine, mixed pine-hardwood, oak-hickory forests and woodlands, prairie and glade-woodland complexes. The Missouri range of short-leaf pine (*Pinus echinata*) is centered in the Ozarks of south-central Missouri (Thom and Wilson 1983).

The Boston Mountains (Level III) ecoregion is comprised of two Level IV ecoregions distinguished by elevation, temperature, precipitation, biota and other features. Gorges and ravines up to 385 m (1250 ft.) in depth are common. The juxtaposition of forest and woodland types across the Boston Mountains are determined largely by topography. South-to-west facing slopes on sandstone often are dominated by shortleaf pine mixed with drought-tolerant hardwoods such as blackjack oak (*Quercus marilandica*), post oak (*Quercus stellata*), and black hickory (*Carya texana*), while white oak (*Quercus alba*), northern red oak (*Quercus rubra*), and black oak (*Quercus velutina*) are dominant on other slopes. American beech (*Fagus grandifolia*), basswood (*Tilia sp.*), and umbrella magnolia (*Magnolia tripetala*) can be found in deep hollows, ravines, and other mesic sites, principally in the Upper Boston Mountains (Level IV) ecoregion.

The Arkansas Valley ecoregion occupies a transitional zone between the Ozarks and Ouachitas. The (Level III) Arkansas Valley is comprised of four Level IV ecoregions distinguished by topography, biota, and other features. While a large part of the valley is undulating lowland, flat-topped synclinal mountains, remnants of eroded plateaus, and long ridges also are present. The highest elevation in the state is on Magazine Mountain, an isolated, flat-topped mountain within the Arkansas Valley. South-to-west facing slopes on sandstone are often dominated by shortleaf pine along with drought-tolerant hardwoods, while upland hardwood forests are dominant on other slopes. Extensive prairies occurred on undulating topography over shale. Bottomland hardwood forests and swamps can be found along the Arkansas, Petit Jean, and Fourche rivers, and seasonally wet-dry hardwood flatwoods occur on poorly-drained flats above the floodplains.

The Ouachita Mountains ecoregion is characteristically a ridge and valley system of east-west trending mountains lying to the south of the Arkansas Valley. The Level III ecoregion is comprised of five Level IV ecoregions distinguished by topography, geographic substrate, drainage, biota and other features. The Fourche Mountains, the most northern of the Level IV ecoregions, occupy more than half of the Natural Division and have the most typical character, with high east-west trending ridges separated by wide valleys

having a relatively large, low-gradient stream that follows the structural valley. Local relief can be as much as 540 m (1800 ft.). Pine-Oak and oak-hickory forests and woodlands occur in repeating east-west bands on the slopes of the ridges, although purer stands of shortleaf pine occur on sites with large areas having few barriers to fire propagation. Prairies appear never to have been common, although bluestem grasses are associated with glades, savannas, and woodlands. Mesic vegetation is restricted to steep, north-facing, protected slopes.



Figure 8. Ecoregions of the Interior Highlands.

History of Shortleaf Pine in the Interior Highlands Region

Shortleaf pine is the only pine native to the Interior Highlands, with the exception of a relatively small acreage of loblolly pine found on limited, moist sites in the Ouachita Mountains. Shortleaf pine-bluestem and pine-Oak woodlands once occurred in very large acreages and across vast landscapes in the Interior Highlands, favored by periodic, large-scale fires (Guldin 2007, Guyette et al. 2007). Euro-American settlement of the Ozark/Ouachita region began in the early 1800s, although the population grew more rapidly in the latter part of the century after railroads reached the region (Stroud and Hanson 1981, Smith 1986, Stone County Historical Society 1989, Cunningham 2007). Shortly thereafter, a logging boom ensued, and by 1909, Arkansas ranked 5th in the nation for lumber production (Smith 1986). The bulk of the state's production consisted of shortleaf pine harvested in the Ouachitas. Large volumes of oak were cut in areas where deciduous

forests predominated; 500,000 white-oak railroad ties, for example, were shipped via rail from a small town in the White River subdivision of Missouri in 1912 alone (Stone County Historical Society, 1989).

The virgin timber supply was largely exhausted in the region by the 1920s and further west by the 1940s. Natural regeneration occurred, although the stands were characteristically even-aged and/or the original species composition altered. Vast acreages also were planted with pine seedlings, mostly loblolly pine. Fire suppression was encouraged throughout the region to protect tree seedlings and saplings (Smith 1986, Palmer 1991). Some cut over areas were converted to agricultural uses, primarily for livestock production in the uplands and to cropland in the bottoms.

Prior to the 1990s, especially on the national forests, even-aged management, or “clear cutting,” was the most widely used silvicultural prescription for managing forests. This began to change when the USDA Forest Service adopted a “New Perspectives and Ecosystem Management” approach following a visit by then Chief F. Dale Robertson to the Ouachitas in 1990 (Robertson 2004). Other management techniques (e.g. group selection and shelterwood cuts) began to be tested as methods for managing pine systems in the Interior Highlands during the 1990s and were the focus of a symposium on ecosystem management in the Interior Highlands in 1999 (Guldin 2004).

The role of fire in structuring historic shortleaf pine communities was also coming to the attention of managers, but the concept was adopted more slowly. Mark Twain National Forest staff, for example, noticed very positive grass and forb effects following a wildfire in pine woodlands in the early 1980s. Both excited and curious about the effects of the fire and its implications for the ecosystem, Forest Service staff selected two relatively small sites for pine woodland demonstration areas. They burned a 118 acre site in the spring of 1987, 1989 and 1992 following thinning with horses in 1986, and another 139 acre site in spring of 1988, 1989 and 1992, again following understory thinning (Paul Nelson, personal communication).

The listing of the Red-cockaded Woodpecker, a pine-woodland obligate, as federally endangered played a key role in terms of increasing interest in pineland restoration projects around that time; the development of a recovery plan for the species, beginning in 1985, helped identify the scale at which restoration would be needed, as well as the structural characteristics that managers would need to work toward. The Ouachita National Forest, with a small population of the woodpecker, committed to the restoration of some 250,000 acres of shortleaf pine-

bluestem ecosystems with the revisions of their forest plans in 1994, 1996, 2002, and 2005 (Hedrick et al. 2007).

In 1998, managers began work to identify sites and landscapes with the best restoration potential in the Missouri Ozarks as well. The Nature Conservancy developed and implemented a rapid ecological assessment technique to identify those sites with the best restoration potential based upon their current condition, remnant vegetation, and floristic quality, and determined that the only opportunities to recover Missouri’s historic pineries at a large or landscape-scale were on the Mark Twain National Forest (Ladd et al. 2007). The assessment led to the selection of the Pineknott project area in Carter County, Missouri, initially targeting a tract of more than 12,000 acres, although the thinning and burning needed to restore the woodlands at Pineknott weren’t fully implemented until 2006.

By the early 2000s, pine-bluestem and pine-Oak restoration had gained traction among a wide array of conservationists in both Missouri and Arkansas. By 2005, both states had completed their first State Wildlife Action Plans, which emphasized natural community restoration of glade-woodland complexes, oak woodlands, and pine and oak-pine woodlands. The number of acres that could be treated, however, was limited by the amount that management agencies on both sides of the state line could fund in addition to their traditional responsibilities. A cross-border partnership came together and successfully applied for a Doris Duke Foundation grant to not only accelerate the habitat work, but also to foster better regional communication and coordination (Nigh 2007). Once those funds were expended, however, outside funds for restoration work remained largely unavailable and the partnership ceased to meet.

In 2009, an opportunity to secure significant funding for woodland restoration work was made available through passage of Title IV of the Omnibus Public Land Management Act and establishment of the Collaborative Forest Landscape Restoration Program (CFLRP). The CFLRP, administered by the U.S. Forest Service, was intended to encourage collaborative, science-based ecosystem restoration of priority forest landscapes on and around National Forest lands across the United States. Re-establishing natural fire regimes to reduce the negative consequences of uncharacteristic wildfire are also part of the goal. As a result, up to \$40 million can be appropriated annually from 2009-2019, with up to 4 million a year available for any particular project.

Development of the Interior Highlands SLP Restoration Initiative

The opportunity to secure significant levels of funding for accelerating shortleaf pine and pine–Oak restoration through the CFLRP, with its emphasis on partnerships and collaboration, provided a renewed incentive for land-managing agencies and organizations with a focus on natural community restoration of shortleaf systems in the Interior Highlands to come together once again. Partnerships formed in the Missouri Ozarks, Arkansas Ozarks, and Ouachitas in support of each national forest’s CFLRP proposal, and in January 2011, key federal, state, and non-governmental organizations and agencies were brought together by the Central Hardwoods Joint Venture in an effort to communicate and collaborate on shortleaf-related restoration efforts across the Interior Highlands as a whole.¹

A subcommittee consisting of community ecologists from multiple agencies in both states was tasked with developing a set of desired future conditions, or DFCs, for pine–bluestem and pine–Oak communities as a result of the 2011 meeting. The draft DFCs were presented to the larger partnership at its second meeting in April 2012 (see Appendix G). By the time of the April meeting, all three National Forests in the region had been awarded more than \$2 million in funding, via the CFLRP or related programs, for restoration work in 2012, with the potential for that amount or more each year, through 2019. If congress continues to support and fund the CFLRP, more than 500,000 acres of pine and pine–Oak woodlands should be well on its way toward restoration within the next decade on National Forest lands alone. In more recent years, the partnership has continued to meet periodically to communicate successes and challenges and consider new needs and opportunities to keep pine restoration moving forward.

The Partnership’s Capacity

Number of Partners and Varied Expertise: As of spring 2015, numerous state and federal wildlife and land-managing agencies, non-governmental organizations, and a university

1 The Central Hardwoods Joint Venture, a public-private partnership for bird conservation (see www.chjv.org), has targeted shortleaf pine and pine-oak systems as natural communities capable of providing high-quality habitat for several bird species of conservation concern, including the Red-cockaded Woodpecker, Bachman’s Sparrow, Brown-headed Nuthatch, and Prairie Warbler, Northern Bobwhite, and others. While the CHJV’s mission is to conserve viable populations of priority bird species within the Central Hardwoods Bird Conservation Region, it also recognizes the importance of shortleaf restoration to support other flora and fauna of conservation concern (see Masters 2007).

have been represented at meetings of the Interior Highlands Shortleaf Pine Restoration Initiative (IHSLPI; Table 1). This diverse group reflects expertise in timber management, restoration ecology, community ecology, research, wildlife conservation and private lands programs, exemplifying the depth and breadth of the partnership and its ability to integrate the multiple facets of a restoration enterprise.

American Bird Conservancy
Arkansas Forestry Commission
Arkansas Game and Fish Commission
Arkansas Natural Heritage Commission
Central Hardwoods Joint Venture
L-A-D Foundation
Lower Mississippi Valley Joint Venture
Missouri Department of Conservation
Missouri Department of Natural Resources
National Bobwhite Conservation Initiative
Natural Resource Conservation Service
Oak Woodlands and Forests Fire Consortium
Shortleaf Pine Initiative
Southeast Conservation Adaptation Strategy
The Nature Conservancy
University of Missouri, Columbia
U.S. Fish and Wildlife Service
U.S.D.A. Forest Service (National Forests)
U.S.D.A. Forest Service (Research Stations)

Table 1. Agencies and organizations associated with the Interior Highlands Shortleaf Pine Restoration Initiative.

The vision, mission and operating principles of the IHSLPI have been defined as follows:

Vision - A future where shortleaf pine and associated natural communities regain prominence, enhance biodiversity, and provide sustainable natural resource commodities throughout their historic range within the Interior Highlands region.

Mission - Provide a forum for professional land managers, research scientists and others to work together to advance the restoration of shortleaf pine and pine–Oak communities within the Interior Highlands of Arkansas, Missouri and Oklahoma for the benefit of biodiversity and people.

Operating Principles - In working to fulfill our Vision and Mission, the Interior Highlands Shortleaf Pine Restoration Initiative embraces the following operating principles:

- *Science-based Foundation* – Our actions and decisions are firmly rooted in science.
- *Strategic and Adaptive Approach* – Restoration is targeted to those sites and landscapes most capable of recovering and sustaining shortleaf pine and associated natural communities over the long term. Our practice of conservation incorporates evaluation and adaptive learning.
- *Partnerships and Collaboration* – Our diverse partnership will share our experiences in shortleaf pine restoration with each other and our constituents to promote effective management practices suitable to the restoration of shortleaf pine and associated natural communities.

Criterion and Acreage Goals for the Interior Highlands

Shortleaf Pine Natural Communities in Interior Highlands (AR/MO/OK) region:

Natural Community Definition: Natural communities are distinct assemblages of native plants, animals and microorganisms that occur in repeatable and often mappable patterns across the landscape. Interior Highlands natural communities in which shortleaf pine is dominant or important are the result of specific combinations of factors related to soils, bedrock and disturbance patterns (e.g. drought, fire, wind and ice storms). Shortleaf pine occurs primarily within dry and dry-mesic chert, sandstone and igneous woodlands across Missouri, but also occupies igneous and sandstone glades and igneous, chert and sandstone cliff tops. It occurs in similar sites in the Arkansas Ozarks, except that igneous substrates are lacking, and novaculite provides a unique substrate. In the Ouachitas,

it is typically on south-facing aspects of extensive east-west trending ridges, and pine–dominated areas are typically larger than in the Ozarks. Mixed hardwood-pine communities are relatively more common in the Ozarks than in the Ouachitas (Guldin 2007).

While drought, wind, and ice storms influenced shortleaf pine ecosystems, fire was the most consistent disturbance. Fire regimes are affected by site conditions described above and involve variability in intensity, seasonality (time of year), and frequency (time between fires). Large-scale fires occurred over portions of the landscape roughly every 20-40 years, in conjunction with severe droughts.

The purpose of restoration is to recover the biodiversity associated with these shortleaf community types, especially the highly diverse grass/forb component of the groundcover (Masters 2007). Not all shortleaf restoration work in the Interior Highlands is focused on recovering biodiversity and natural community structure and function per se, but that is a main impetus for the work on some state agency lands as well as the three National Forests, where the acreage targeted is by far the greatest.

Following the development of the IHSLPI in 2011, a subcommittee consisting of community ecologists from multiple agencies in both states was tasked with developing a set of DFCs for pine–bluestem and pine–Oak communities (see Appendix G: Desired Future Conditions for Shortleaf Pine Communities in the Interior Highlands). For the public lands, acreage targets are presented here as “at or near desired condition,” “restoration (thinning and/or burning) implemented,” or “restoration is planned but not started” (Table 2). Acreage targets are provided for the following three pine and pine–oak combinations:

Shortleaf pine–bluestem: This shortleaf association exhibits the most open canopy condition of the three described here, as a result of frequent fires of varying intensity and seasonality that serve to control most other woody growth. The herbaceous ground cover is abundant. These communities occur on less dissected landscapes where larger areas of relatively gentle topography allowed for greater and more frequent disturbances, especially from fire. Pine comprises roughly 85% of the canopy and canopy cover typically ranges from 30-60%.

Shortleaf pine–Oak, where pine comprises more than 50% of the stand or landscape. This can occur as a Dry-Mesic Pine–Oak community, where shortleaf pine mixes with oak species (either can be dominant) on more deeply dissected hills, even on upper north-facing slopes, and canopy varies from 50 - 80%, or as Dry Pine–Oak, where shortleaf mixes with oak species on steep, south-facing upper slopes and ridgetops, and canopy varies from 30-50%.

Oak-shortleaf pine, where oak comprises more than 50% of the stand or landscape. Again, this is typically associated with a Dry-Mesic Pine–Oak community, where shortleaf pine mixes with oak species (either can be dominant) on more deeply dissected hills, even on upper north-facing slopes, and canopy varies from 50 - 80%.

Interior Highlands Acreage Goals for Private Lands

Of the 4.1 million acres of Shortleaf Pine in the western region it is estimated that 3.5 million acres (85%) occurs on private land. Therefore private land, and private forest landowners, will play a critical role in the success of the SLPI. Except for a few cases it is understood that we cannot expect most private SLP forest to be managed and maintained to the same desired future conditions as planned on public land. However, private land forests are critical in maintaining the distribution and health of shortleaf pine in its western range.

To be successful, the Initiative will need to ramp up the commitment and economic support to assist landowners in conserving SLP on their lands. At a minimum we must encourage landowners to at least maintain SLP in their existing stands and encourage regeneration of new cohorts across the region. As we build awareness of the cultural,

ecological and economic importance of the SLP resource in the region we must provide increased incentive and technical assistance to forest landowners who want to expand or enhance SLP within their ownerships. To sustain progress on private land, a concerted effort must be made to maintain existing markets in the southern portion of the range and develop new markets in the north. In addition, private forest adjacent to public lands will be important to achieving landscape-level restoration projects and should continue to be included as plans are developed.

Though it varies by state, recent programmatic data indicate that resource professionals are presently working with less than 0.5% of private forest landowners in the region and effect approximately 12,000 acres of forest land per year (all forest land, not just SLP acres). With additional incentives, awareness campaigns, and increasing technical assistance capacity, it is estimated we can achieve a goal of improving or restoring 36,000 acres of shortleaf pine annually.

A critical part of the Initiative will be monitoring progress. Presently there is no protocol or record keeping system to track SLP improvements on private land. The Initiative will need to work with all private land conservation partners in the region to develop or modify existing data systems to capture progress.

	At or Near Desired Condition	Restoration Implemented	Restoration is Planned But Not Started
Shortleaf Pine–Bluestem	215,000	215,000	125,000
Pine–Oak	65,000	70,000	110,000
Oak–Pine	2000	20,000	40,000

Table 2. Interior Highlands Acreage Goals for Public Lands