



FROM THE BRINK!

THE EFFORT TO RESTORE VIRGINIA'S NATIVE LONGLEAF PINE

2014 Status Report



VIRGINIA DEPARTMENT OF FORESTRY

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INTRODUCTION

A BRIEF HISTORY OF LONGLEAF PINE IN VIRGINIA

Five centuries ago, longleaf pine was perhaps the most common forest tree species on the uplands of southeast Virginia. Although they were looking for and hoping to find gold and silver, John Smith and the other English explorers who arrived in Virginia in 1607 soon found another valuable resource – pitch and tar obtained from longleaf pines growing along the James River – that was both readily available and of great importance. In 1608 when the first “tryalls of pitch and tarre” were exported to England, the naval stores industry was born in America. Given its role in the region’s early economy and its use in building construction, longleaf has been aptly dubbed the “tree that built Tidewater.”

While critical to commerce and transportation, the rise of the naval stores industry marked the beginning of the demise for longleaf forests, both in Virginia and southward throughout the longleaf range in the Atlantic and Gulf coastal plain states. Extraction of pitch across vast acreages, followed by logging, led to the first wave of decline. Forest regeneration was greatly impacted by destructive foraging of feral hogs on the carbohydrate-rich roots of longleaf seedlings. Conversion of forests to agricultural use was swift across the productive, level lands of southeast Virginia throughout the 1600s and 1700s. The suppression of wildfire – critical to the health of longleaf forests – was another main cause for longleaf decline and caused widespread failure of the species to regenerate. Some consider the decline of Native American populations, which used fire extensively, as the beginning of the fire suppression period.

All told, from about 1500 to 1850, more than one million acres of longleaf pine forest disappeared from Virginia. In 1893, longleaf pine in Virginia was pronounced by forester B.E. Fernow to be “...for all practical purposes, extinct.” Today, natural forests in Virginia containing longleaf pines are essentially gone and fewer than 200 mature, native longleaf pine trees are known in the state. The reality is, longleaf forests have

Description



Longleaf pine is one of eight pine species found in Virginia. It occurs naturally in the southeastern portion of the state and most closely resembles loblolly pine, the most common species in the Southeast. Mature longleaf pine is distinguished from loblolly pine by its much longer needles (8 to 20 inches for longleaf vs. 4 to 11 inches for loblolly), larger cone (6 to 10 inches vs. 2 to 5 inches) and stouter terminal branches and buds. Longleaf pine seedlings, unlike all other Virginia pines, have a “grass stage” in which seedlings display delayed vertical growth and take on the aspect of a clump grass. Seedlings transition out of this stage in three to five years with rapid upward growth. Longleaf has been documented to live for more than 300 years and attain sizes of up to 130 feet in height. The lumber properties of longleaf are considered exceptional due to its straightness and strength.



for all practical purposes been eliminated at the northern range of this widely distributed species.

THE “ORIGINAL” RANGE OF LONGLEAF PINE

An estimated 90 million acres of longleaf pine forests once existed within the native range, extending from southeast Virginia to east Texas. The terms “native” or “original” range are in some ways misleading, as they can create the impression of a static area within which a species of plant or animal is and has always been found. Of course, the native range of organisms is constantly shifting as climate and other physical factors, such as fire frequency, sea level, etc., change over time. However, there is general agreement that longleaf pine was a

dominant forest tree in southeast Virginia as of 1607, ranging to probably just north of the James River and westward into the Piedmont of Dinwiddie, Greensville and Brunswick counties, as well as eastward up the length of Virginia’s Eastern Shore (Figure 1). Compared to a more restricted range in Virginia as presented by Little (1971), the map below represents a more recent interpretation by Eberhardt, et al. (2011) as adapted from Frost (1993) based on additional data from biological, historical and archeological evidence. While the exact distribution of longleaf pine in 1607 was not then and cannot today be precisely determined, for forest restoration purposes it really does not need to be.

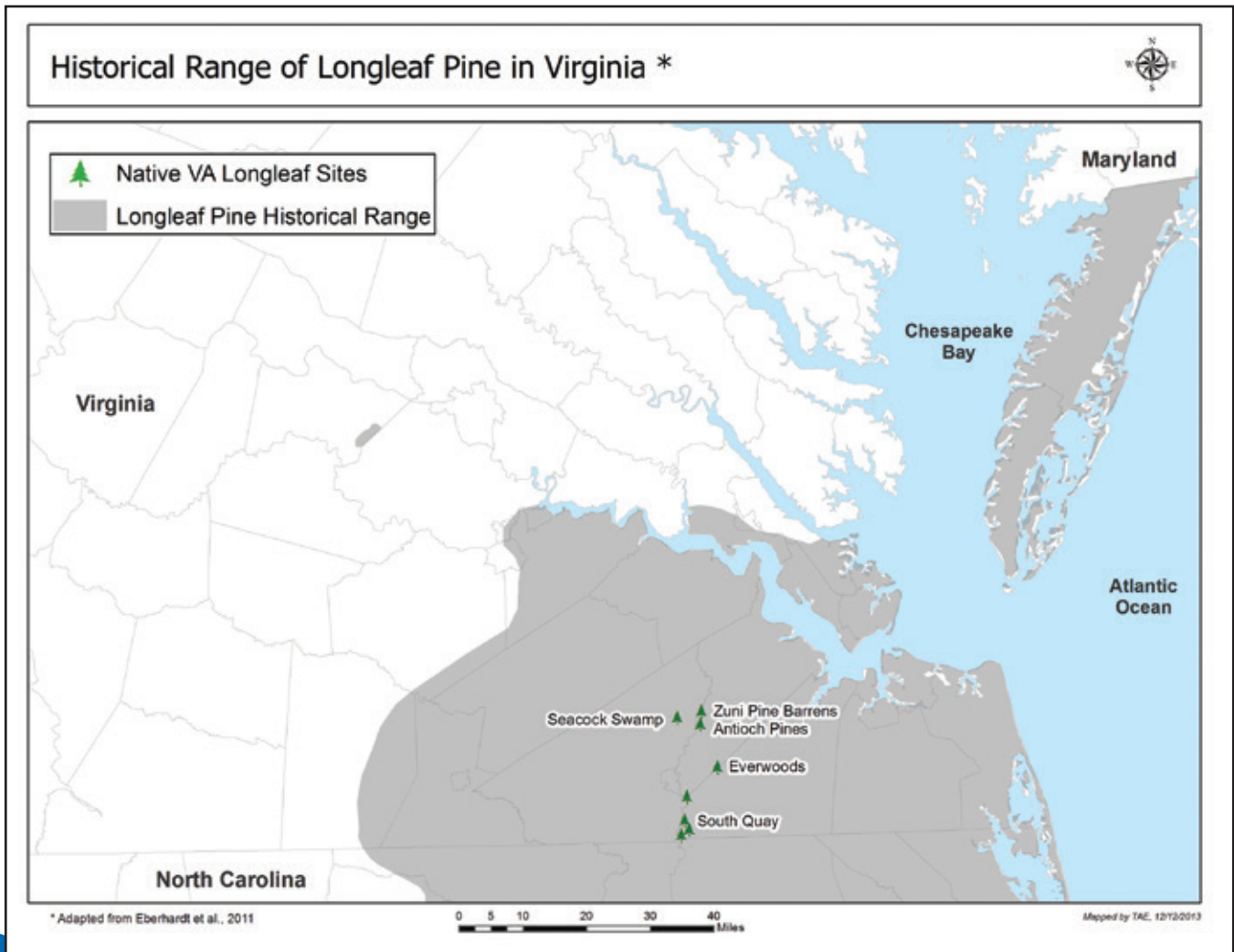


Figure 1.

Historically, longleaf forests were found on a wide range of sites, from wet, poorly-drained coastal flatwoods near sea level inland through the coastal plain where it dominated many upland sites. Longleaf grew well inland from the Atlantic coast, crossing the fall line and occupying lower Piedmont sites. Remarkably, longleaf even ranges into the mountains of northwest Georgia and northeast Alabama up to 2,000 feet elevation.

Longleaf pine has mistakenly been considered by some to be a tree exclusively associated with well-drained, sandy soils. Indeed, many remnant longleaf individuals and stands are found today on dry, sandy sites. Seeing this, those unfamiliar with longleaf ecology and the role of fire might come to the incorrect conclusion that longleaf “likes” sandy soils. In reality, this species historically occupied a broad spectrum of soil textures and moisture regimes. What longleaf “likes” is fire.

LONGLEAF AND FIRE

Longleaf pine forests have been called “the forest that fire made” (Greene 1931). The fundamental role of fire in longleaf regeneration and growth cannot be overstated. Numerous traits point to the species’ resilience and dependence on fire. These include its “grass stage” habit, which protects the stem and terminal bud of young seedlings from fire, and the tree’s thick, corky bark, which insulates critical inner-bark tissue from heat damage. Seeds require contact with bare mineral soil for seedling establishment, a condition that can be achieved only through fire consumption of leaf litter and duff. Longleaf seedling growth and survival also hinges on periodic removal of faster and taller-growing vegetation. An extended absence of fire enables other species, particularly hardwoods and loblolly pine, to gain dominance over longleaf pine and inhibit regeneration, particularly on moister sites. Therefore, successful longleaf pine restoration and natural regeneration depends on the judicious use of prescribed fire to sustain structure, function and composition (Van Lear, et al. 2005).

While fires set by lightning and Native Americans no longer sweep across southeastern Virginia as they had for millennia, fire is making a comeback to the landscape through the efforts of various agencies and private landowners. Controlled fires – implemented by qualified professionals – can be used to control competing vegetation and to establish suitable seedbed conditions for longleaf seedling regeneration.



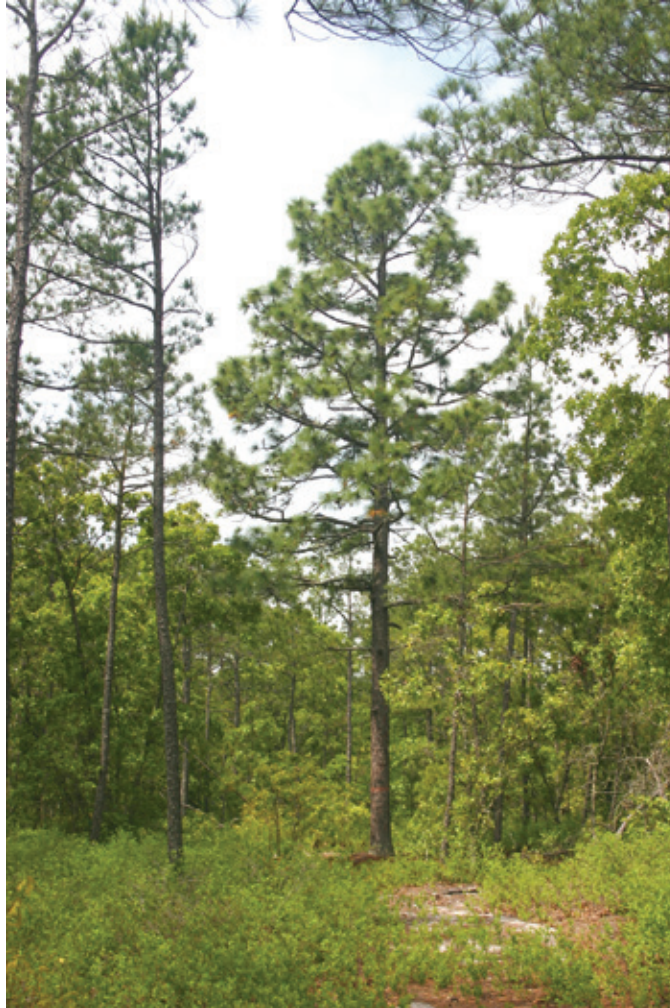
WHAT IS LEFT?

THE SEARCH FOR 'NATIVE' LONGLEAF PINE

A 1998 census of longleaf pine in Virginia found that approximately 4,400 longleaf pine remained on less than 800 acres (Sheridan, et al. 1999). The census counted longleaf pine, including seedlings, on habitats or stands known to contain native trees and did not include non-native ornamental yard trees. Half of the census trees were identified as non-native longleaf pine from Louisiana that were planted by Union Camp Corporation in the 1950s as part of a reforestation project. When even more stringent criteria are used (by coring the trees, determining their age and eliminating those prior to an era of possible planting in the 1950s) we can now claim fewer than 200 longleaf pine trees as being truly native to Virginia. Most of these are located in and around the Blackwater River basin (Figure 1). The census population of native

Virginia longleaf pine pales in comparison to historical estimates (Frost 1993) of hundreds of millions of trees occupying almost 1.5 million acres in the southeastern

Coastal Plain and Piedmont provinces of Virginia. The validity of the lower-peninsula and Eastern Shore range of longleaf pine in Virginia is based on naval store



place names (areas where turpentine, tar and pitch were produced for wooden ships) or one questionable herbarium specimen (McAvoy 2007) and must be viewed with caution. Other trees, such as pitch, loblolly, shortleaf and pond pine, have been used to produce naval stores and, therefore, naval store place names are not a definitive identification of the occurrence of longleaf pine. Likewise, the occurrence of turpentine stumps as evidence of longleaf pine must also be carefully evaluated since other pine species were used for this purpose (Eberhardt, et al. 2011).

Native Virginia longleaf pines are better adapted for in-state planting since they have greater survival, height growth and water use than other southern provenances (Sheridan, et al. 1999, Creighton, et al. 2009 and 2011, Johnsen 2013). Awareness of the value of native Virginia longleaf pine has resulted in the discovery of several old growth trees not

documented in the 1998 census. These old longleaf pine trees are typically found on property boundary lines or within older mixed pine and hardwood stands. We hope that the keen interest now shown in Virginia longleaf pine will result in a few more native trees being discovered. Any additional mature native longleaf pine trees found in Virginia will play a vital role in establishing native seed orchards and restoring locally-adapted longleaf pines to the Commonwealth.

WHY RESTORE LONGLEAF?

THE CASE FOR CONSERVING AND RESTORING VIRGINIA'S LONGLEAF PINE FORESTS

Why is there increasing interest in bringing longleaf back to Virginia? Botanist Roland Harper once said longleaf pine has “probably more uses than any other tree in North America if not in the whole world”. In colonial Virginia, longleaf pine provided quality lumber for construction, excellent masts for ships, naval stores (e.g., turpentine, tar and pitch) and an open understory providing prime grazing land for cattle. In later years, longleaf became valued largely for its high-quality, straight-grained dimensional lumber and its strong durable poles (Wahlenberg 1946). More recently, it has become a preferred source of pine straw for landscaping uses. Longleaf pine is highly resistant to numerous insect pests, such as pine beetles, pine weevils and pine tip moths, and to diseases, such as fusiform rust. In

addition, it is tolerant of salt spray, wildfire and ice, and is generally wind-firm. Therefore, longleaf pine can be a stable investment once well-established.

Beyond the economic or commodity values lie other equally-significant ecosystem benefits and aesthetic values. For example, open-structured longleaf pine forests maintained by frequent, low-intensity fires are some of our most biologically diverse ecosystems. They provide habitat for a great variety of wildlife species, such as bobwhite quail, red-cockaded woodpeckers, Bachman’s sparrows and Mabee’s salamanders, and they support a diverse flora including pitcherplants, orchids, lilies, showy wildflowers, grasses and sedges. Many species associated with the longleaf ecosystem are threatened or endangered (Van Lear, et al. 2005). Because it is generally more long-lived than other native pine species, longleaf forests have the potential for long-term carbon sequestration.



WHY 'NORTHERN SOURCE'?

THE IMPORTANCE OF 'NORTHERN-SOURCE' SEEDLINGS FOR LONGLEAF PINE RESTORATION IN VIRGINIA

Studies conducted by the Virginia Department of Forestry (VDof) and the USDA Forest Service suggest "northern-source" longleaf pine represents a distinct population with unique character traits. A VDof provenance study was planted in early 2006 to compare the performance of seedlings from various geographic origins in terms of establishment success and early growth. The provenances originated from native trees in Virginia, natural stands and a seed orchard in North Carolina and natural stands in South Carolina, Georgia, Florida, Alabama and Mississippi. They are planted in 25-tree plots replicated twice at each of three locations:

What is 'Northern-Source' Longleaf?



"Northern-source" longleaf is defined as those longleaf originating from parents native to an area north of the Neuse River in northeastern North Carolina. "Native Virginia" longleaf is that subset of "northern-source" trees originating from parents found north of the state line. From a restoration standpoint, there is little difference whether seed collected from 50 miles north or south of the Virginia-North Carolina state line is used for restoration in Virginia.

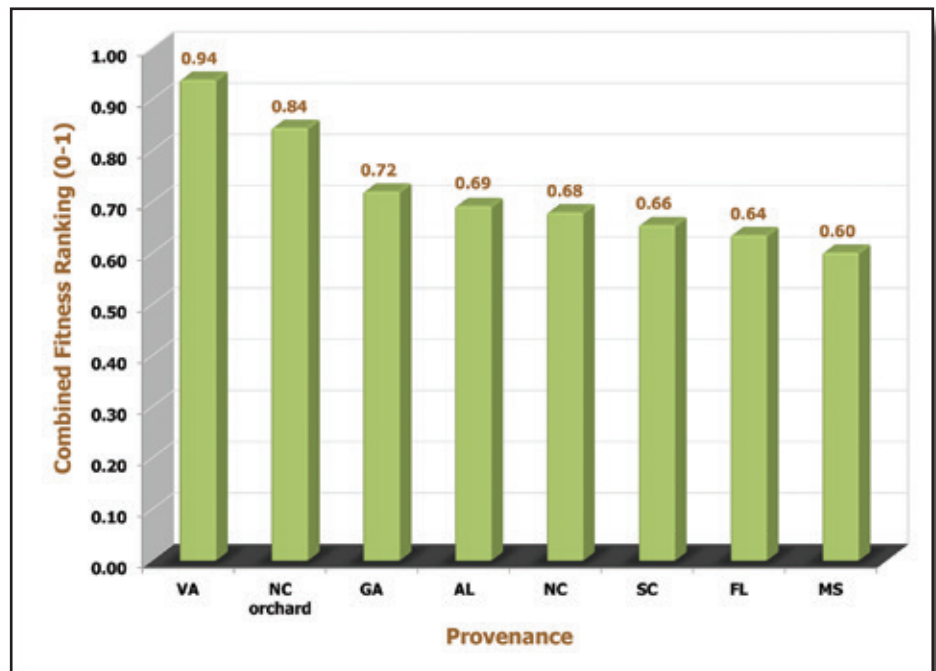


Figure 2. Combined relative fitness ranking (for average age-seven height, diameter and survival) across three locations.

Garland Gray Forestry Center (Sussex County, VA), New Kent Forestry Center (New Kent County, VA) and Sandy Point State Forest (King William County, VA) and have been assessed through age seven. Relative fitness rankings based on a combination of survival, height and diameter have shown throughout the study that Virginia longleaf pine has outperformed the others (Figure 2).

A separate study by USDA Forest Service scientists from the Southern Research Station in Research Triangle Park, NC, and Saucier, MS, has identified northern-source seedlings as having the highest water-use efficiency, likely due to differences in photosynthesis among the different provenances (Johnson et al., 2013).

A third study is exploring genetic relations between subpopulations within the northern source area (Echt, et al., 2012). Due to relatively small populations of northern-source longleaf pine, future inbreeding is a concern. Although superior or equivalent performance can be obtained from a narrow genetic base, seed collections for conservation or breeding should be done in the context of spatial genetic analyses to ensure that genetic diversity is maximized for long-term restoration success (Echt 2013).



Mississippi-source (left) and Virginia-source (right) longleaf pines in the 2006 provenance test at age seven.



THE FUTURE OF ‘NORTHERN-SOURCE’ LONGLEAF PINE

SEED COLLECTION, SEEDLING PRODUCTION, ORCHARD DEVELOPMENT

Current restoration efforts on public lands in Virginia rely heavily on seed collected from a few scattered individuals and small stands of wild longleaf in southeastern Virginia and northeastern North Carolina. Historically, almost all of the seedlings have originated from parents located on the Virginia Department of Conservation and Recreation’s South Quay Sandhills Natural Area Preserve, located in the southwest corner of Suffolk and bordering the Blackwater River (Figure 1).

Longleaf pine seed yield is irregular, with peaks every five to seven years. On average, Virginia cone-bearing trees have produced 22 seeds per cone and yielded 3,500 de-winged seeds per pound. Cone collection has been an intensive process with unpredictable results due to widely scattered trees that are difficult to access. Furthermore, cones that are high up in the canopy of a large tree can be difficult to reach and to protect from insect damage. Since 2006, the seedling crop has ranged from zero in 2008 to more than 150,000 in 2009, with an average of just under 72,000 per year.

To overcome these limitations, VDOF has established a six-acre longleaf pine orchard at its New Kent Forestry Center near Providence Forge, VA. With use of improved grafting techniques, cone-bearing trees are expected by 2020. Seed production is planned to eventually provide an annual crop of 250,000 seedlings. Until the seed production orchard matures to cone-bearing age, however, we will continue to rely on the available open-pollinated wild trees, and seedling supply will continue to be variable and limited.

Northern-source seedlings have thus far been primarily used for restoration projects on land owned and managed by state agencies and other permanently conserved lands. Locations are prioritized with an ecosystem restoration objective encompassing a wide area.

How Do We Establish a Seed Orchard?



To be sure we include only exact genetic duplicates of the native trees, we graft branch cuttings (called “scions”) collected from the mature parent trees in the spring onto young longleaf pines (called “rootstock”) planted in a grafting bed. After one season in the grafting bed, the successful grafts are transplanted to the seed orchard area in a pattern designed to ensure a random mixing of pollen in the future crops. A key advantage of grafting onto existing rootstock is that the scion can utilize a developed root system to absorb water and nutrients more quickly and efficiently and therefore grow to seed-bearing maturity faster. Parent trees being included in this orchard are selected based on form (mainly straightness) and vigor (absence of insect, disease or mechanical damage). The goal is to have as many as 25 surviving genetic copies (grafts) from each selected parent tree in the final orchard. Our target is to have 500 parent trees capable of producing 250,000 or more seedlings per year.

HONORING WILLIAM L. 'BILLY' APPERSON



William "Billy" Apperson is the Johnny Appleseed for longleaf pine in Virginia. Billy, a 48-year-veteran forester of the Virginia Department of Forestry, who retired in 2012, began diminished species restoration efforts nearly 35 years ago while working with American chestnut and Atlantic white cedar. His work later included longleaf pine when the last remaining native Virginia trees were found in southeastern counties of the state. With official support from VDOF, Billy made it his mission to begin collecting cones and seed from these last remaining vestiges of this magnificent species that once covered more than a million acres of Virginia forestland. Seeds yielded native longleaf pine seedlings, which are slowly beginning to return

to the landscape. A further endeavor by Billy to create a native longleaf pine seed orchard at the VDOF New Kent Forestry Center yielded its first crop totaling two cones in 2012. In the future, the orchard is expected to produce enough cones to generate 250,000 seedlings annually to help bring back this species that was nearly lost in Virginia. Billy's efforts were recognized in January 2013 by the Virginia General Assembly, who commended him on his accomplishments through House Joint Resolution No. 559. Billy did not rest on his laurels and has continued to work part-time for VDOF on diminished species restoration since his retirement. For his tireless efforts, we and our future generations can all say thank you, Billy.

SPECIAL PLACES: WHERE ARE WE RESTORING LONGLEAF PINE AND WHY?

Longleaf pine restoration projects blanket southeastern Virginia, extending from the species “core” area south of the James and east of the fall line to more distant sites on the Northern Neck and Eastern Shore and as far west as Halifax County in the Piedmont (Figure 3).

As of 2013, more than 150 landowners have been involved in longleaf restoration projects, all of whom share an interest in the tree’s natural history and its associated wildlife benefits. The state’s largest planting projects are found on select private lands, most notably those owned by Bill Owen in Sussex County, and on public lands managed by Virginia Department of Conservation and Recreation (DCR), VDOF and the Virginia Department of Game and Inland Fisheries

(DGIF). Private conservation organizations active in the region, primarily The Nature Conservancy and Meadowview Biological Research Station, are restoring longleaf pine on their preserves, as is Old Dominion University, which holds the distinction of managing the state’s oldest longleaf project on its 319-acre Blackwater Ecological Preserve in Isle of Wight County. While longleaf is largely absent from industrial timberlands in the region, several landowners, including The Westervelt Company, are partnering with others to re-establish the species on their lands. Spanning a wide range of soils, planting techniques and fire management settings, the projects collectively serve as valuable demonstration sites for Virginia’s longleaf recovery movement.

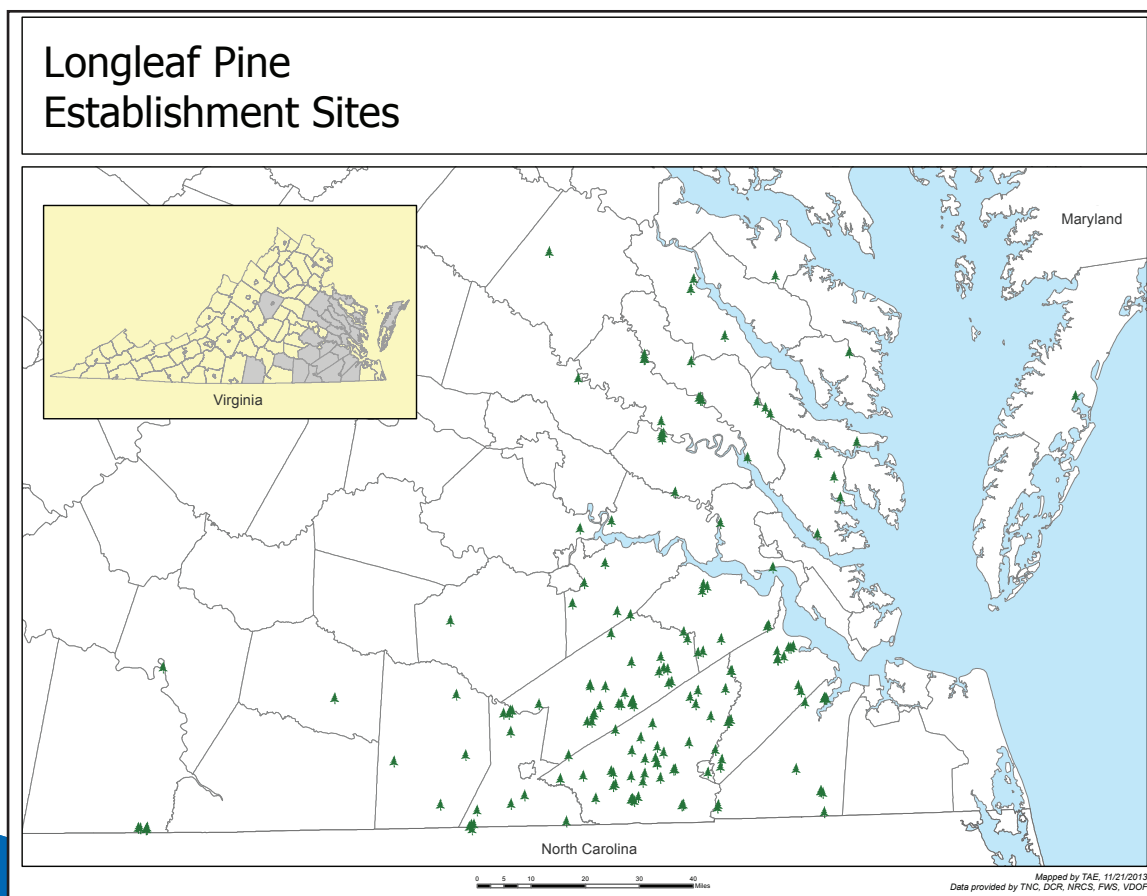


Figure 3.

LONGLEAF RESTORATION AREA PROFILES

The following are brief profiles of several key longleaf restoration areas in Virginia:

CHUB SANDHILL NATURAL AREA PRESERVE; ANTIOCH PINES NATURAL AREA PRESERVE; SOUTH QUAY SANDHILLS NATURAL AREA PRESERVE

Landowner: Virginia Department of Conservation and Recreation (DCR)

Location: Sebrell, Sussex County; Zuni, Isle of Wight County; South Quay, City of Suffolk

Size/Description: 5,226 acres total. Chub Sandhill (1,066 acres) and Antioch Pines (1,017 acres) are situated on well-drained terraces along the Nottoway River and Blackwater River, respectively. South Quay Sandhills encompasses 3,143 acres along the Blackwater River and includes the state's most extensive pine sandhills community. The properties are managed with prescribed fire to provide suitable habitat for dozens of rare plant and animal species.

Longleaf Pine Acreage/Description (as of March 2013): 357 acres total. 155 acres at Chub Sandhill (planted in 2007, 2008 and 2013); 202 acres at Antioch Pines (planted in 2011 and 2012). South Quay Sandhills contains the state's largest remaining natural stands of longleaf pine with a total of 75 acres of pine forests containing longleaf as a major overstory component. Seed collected from South Quay by VDOF and DCR is used for propagation of native longleaf pine seedlings, most of which have been planted on state natural area preserves.

Restoration Goals: All suitable sites on these three, plus two additional state natural area preserves representing more than 2,500 acres, will be converted to longleaf pine as existing loblolly stands are harvested and northern-source seedlings are available. Only northern-source seedlings are used to establish longleaf pine on Virginia state natural area preserves.





BLACKWATER ECOLOGICAL PRESERVE

Landowner: Old Dominion University

Location: Zuni, Isle of Wight County

Size/Description: 319 acres embedded within Antioch Pines Natural Area Preserve together comprising the Zuni Pine Barrens Natural Area.

Longleaf Pine Acreage/Description: About 50 acres, the northernmost longleaf pine community on deep sand terraces. Numerous tar kilns and turpentine stumps are of archeological value. There are well-documented botanical studies from the 1930s when Harvard botanists explored the area over several years.

Restoration Goals: Planting of northern-source longleaf is planned in former loblolly plantations. Regular prescribed burns have restored numerous rare plant species, at least one formerly listed as eliminated in the state.



BIG WOODS WILDLIFE MANAGEMENT AREA

Landowner: Virginia Department of Game and Inland Fisheries (DGIF)

Location: Wakefield, Sussex County

Size/Description: 2,200 acres of former International Paper Company timberland acquired by DGIF in 2010.

Longleaf Pine Acreage/Description: 42 acres were planted with North Carolina seedlings in 2009 in a recently harvested loblolly pine stand.

Restoration Goals: The property is managed primarily for pine savanna habitat to benefit the red-cockaded woodpecker, quail and other early-successional species.

BIG WOODS STATE FOREST SANDY POINT STATE FOREST ZOAR STATE FOREST

Landowner: Virginia Department of Forestry

Location: Wakefield, Sussex County; King William, King William County; Aylett, King William County

Size/Description: Big Woods State Forest contains 2,200 acres of predominantly loblolly pine plantation formerly owned by International Paper Company. Sandy Point State Forest contains 2,043 acres of mixed pine/hardwood, including 470 acres of wetlands. Zoar State Forest contains mixed pine/hardwood stands on 378 acres. In addition, VDOF maintains a longleaf pine seed orchard at its New Kent Forestry Center.

Longleaf Pine Acreage/Description: 68 acres planted at Big Woods State Forest in 2009; 47 acres planted at Sandy Point State Forest. Both plantings were in former loblolly pine stands. An additional five acres are planned for planting on Zoar State Forest beyond 2013.

Restoration Goals: As suitable sites are identified and seedlings are available, additional acres of longleaf pine will be planted on the state forests. These stands will be used to demonstrate to landowners how longleaf can be managed on private lands in addition to helping expand its range across key conservation areas.



GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE

Landowner: U.S. Fish and Wildlife Service

Location: City of Suffolk, City of Chesapeake

Size/Description: 112,000 acres of predominantly-forested wetlands. Well-drained soils along the Dismal Swamp's Suffolk Scarp boundary historically supported longleaf pine and are now dominated by loblolly pine/mixed hardwood forest. Approximately 300 acres of refuge is considered suitable for longleaf.

Longleaf Pine Acreage/Description: 30 acres of longleaf pine planted in 2011.

Restoration Goals: Additional acreage along the Suffolk Scarp will be planted with longleaf as existing loblolly pine stands are harvested.





JOSEPH PINES PRESERVE

Landowner: Meadowview Biological Research Station

Location: Disputanta, Prince George County

Size/Description: 232-acre preserve dedicated to the restoration of longleaf pine and pitcher-plant communities.

Longleaf Pine Acreage/Description: 46 acres of longleaf pine planted between 2001 and 2009. All longleaf pine seedlings were propagated from Virginia native seed. Stands are managed with annual growing season prescribed fire.

Restoration Goals: To represent the genetic variation of native Virginia longleaf pine on a protected, managed property within its historic range. To restore uplands and wetlands using a combination of chemical and mechanical methods combined with prescribed fire. To provide safe harbor and habitat for a minimum of 18 rare plants and three animals as part of integrated ecosystem restoration.



OWEN TRACT AND RACCOON CREEK PINELANDS

Landowner: William Owen and The Nature Conservancy

Location: Yale, Sussex County

Size/Description: 1,800 acres of loblolly and longleaf pine plantation on well-drained sands. 1,400 acres are protected under a conservation easement with The Nature Conservancy.

Longleaf Pine Acreage/Description: The largest longleaf pine restoration project in Virginia, 830 total acres with plantings spanning 2003-2013, all in former loblolly pine stands. Longleaf pine treated with fire on approximately three-year rotation.

Restoration Goals: Under terms of the conservation easement, the entire property will transition to longleaf pine as loblolly pine stands are harvested.



PINEY GROVE PRESERVE

Landowner: The Nature Conservancy

Location: Wakefield, Sussex County

Size/Description: 3,200-acre preserve of predominantly older-growth loblolly pine managed for pine savanna habitat to support the federally-endangered red-cockaded woodpecker, Virginia's rarest bird species.

Longleaf Pine Acreage/Description: 150 acres of thinned 30-year-old loblolly pine underplanted with longleaf pine in 2012-2013. Stands will transition to 100 percent longleaf pine after final harvest of loblolly pine.

Restoration Goals: Longleaf pine areas will be regularly burned to establish herbaceous understory; additional acreage will be planted when canopy gaps occur.



WESTERVELT TRACT

Landowner: The Westervelt Company

Location: Wakefield, Sussex County

Size/Description: Several thousand acres of former International Paper Company timberland dominated by loblolly pine plantations. The property lies adjacent to Big Woods State Forest and Big Woods Wildlife Management Area.

Longleaf Pine Acreage/Description: 192 acres planted with North Carolina seedlings in 2012-2013; 25 acres planted in 2004.

Restoration Goals: Longleaf pine acreage will be burned periodically under a management agreement with The Nature Conservancy (TNC). Additional acreage may be planted in coordination with TNC and other partners.



SPECIAL PROGRAMS

LONGLEAF PINE RESTORATION ON PRIVATE LANDS

Forest industry owned significant forested acres in Virginia's historic longleaf range through the 1990s. Major industrial owners included Union Camp Corporation (later International Paper), Gray Lumber Company and Champion International. Much of this land has since been sold to timber investment organizations, conservation organizations, public agencies or private landowners. Incentives for long-term forest management have been widely used to help owners overcome the initial investment hurdle of forest establishment and early maintenance. This is particularly important for longleaf pine, where establishment costs are significantly higher than for traditional loblolly pine reforestation. Both state- and federally-sponsored programs that support longleaf pine work are described below. Additionally, the VDOF, USDA Natural Resources Conservation Service, Virginia Department of Game and Inland Fisheries, and private consulting foresters provide professional assistance to landowners in longleaf establishment.

There have been some plantings of longleaf pine on private lands over time. It is not uncommon to see longleaf pine of varying ages and sizes in yards and along property lines. These were most likely brought or transplanted from farther south. Plantings were rare before 2000, but began to increase around 2004. As of 2013, there have been approximately 4,400 acres of plantings on private land. The average planting is 26 acres, ranging from a few trees to 300 acres in size. The plantings are concentrated in southeast Virginia (south of the James River and east of Interstate 95), but there has been interest in the Coastal Plain north of the James and some lands in the southeast Piedmont. However, southeast Virginia remains the focus area (Figure 3).

STATE-SPONSORED LANDOWNER ASSISTANCE PROGRAMS

VIRGINIA REFORESTATION OF TIMBERLANDS (RT) PROGRAM

Started in 1970, this program is funded by a forest products tax on pine timber and by general state funds. Administered by VDOF, the program provides private landowners with a reimbursement for a portion of site preparation, tree planting and follow-up vegetation control. More than 1.6 million acres and 40,000 pine reforestation or improvement projects have been completed over the life of the program. Beginning in 2004, VDOF added a practice that included longleaf pine planting or site preparation and longleaf planting. Incentive rates for these practices were roughly double that of loblolly pine planting. Other programs (listed below) have developed with higher incentive rates and, while still available, RT is less utilized for longleaf.

VIRGINIA DEPARTMENT OF FORESTRY'S SOUTHERN PINE BEETLE PREVENTION PROGRAM

In 2003, the USDA Forest Service Office of State and Private Forestry, Forest Health Protection began the Southern Pine Beetle (SPB) Prevention and Restoration Program to assist the National Forest system as well as state forestry agencies with implementing pine silvicultural practices that prevent and mitigate the impacts of the southern pine beetle. With significant annual funding, VDOF created a state-wide Pine Bark Beetle Prevention Program in 2004, which has



emphasized pre-commercial thinning of pine forests in the form of cost-share assistance for non-industrial private forest (NIPF) landowners. Almost all of these practices are applied to loblolly and Virginia pines (rarely white pine), the primary pine plantation species in Virginia.

An additional SPB prevention tactic is to plant longleaf pine, which is much more resistant to the southern pine beetle as well as numerous other insect and disease pests that plague loblolly, Virginia and other pine plantation species. In addition, because longleaf pine is more resistant to blow-down, breakage and lean from wind and ice storms, secondary pest problems that can result from this injury may be less prevalent in longleaf pine forests. Therefore, Virginia's SPB Prevention Program has supported planting of longleaf on appropriate sites by way of cost-share assistance to NIPF landowners from 2005-2013. In addition to planting support, the Program also provided assistance for site preparation, herbicide release or burning treatments during the first five years of plantation establishment, in acknowledgment of the greater difficulties in successfully establishing longleaf pine. To date, cost-share assistance under this program has helped restore and manage more than 1,000 acres of longleaf pine, including several major plantings now under protection and management by The Nature Conservancy.

FEDERALLY-SPONSORED LANDOWNER ASSISTANCE PROGRAMS

The USDA Natural Resources Conservation Service (NRCS) has taken an active role in longleaf pine restoration efforts both nationally and in Virginia. NRCS has focused efforts on training, outreach and targeted funding that has resulted in increases in longleaf pine. NRCS has developed guidelines (job sheets Practice #643), to be used with USDA cost assistance programs. These include WHIP, EQIP and CRP.

Wildlife Habitat Improvement Program (WHIP), an NRCS program: Since the longleaf ecosystem has many wildlife habitat values, longleaf pine is one of five priorities in the Virginia WHIP Plan. In 2007 and 2008, WHIP provided 100 percent cost share (essential habitat) for longleaf pine establishment, resulting in approximately 400 acres of longleaf restoration. In 2010, WHIP assisted owners with 369 acres of planting or management.

Environmental Quality Incentive Program (EQIP), an NRCS Program: The EQIP program provides cost assistance to landowners for establishment and management practices, including site preparation, planting, release and burning. Payments to landowners are based on 75 percent of regional average costs and, therefore, are higher for longleaf than for other pine species. There have been two dedicated EQIP funding allocations for longleaf pine. In May of 2012, \$26,000 was contracted for longleaf pine work (two projects for 51 acres). In early 2013, more than \$200,000 has been allocated for longleaf.

Conservation Reserve Program (CRP), USDA Farm Services Agency (FSA): The CRP program is focused on protecting land and enhancing wildlife habitat on cropland. Participants generally receive a sign-up incentive, cost assistance on practice installation and an annual rental payment for either 10 or 15 years. NRCS assists FSA with the programs. There have been two CRP programs that have targeted longleaf pine restoration:

- ▲ CRP Longleaf Pine Initiative (Practice CP36). This assisted in the establishment of 385 acres on 19 sites.
- ▲ State Acres for Wildlife Enhancement (SAFE, Practice CP38). This has resulted in the establishment of 362 acres on 14 sites.

Partners for Fish and Wildlife, U. S. Fish and Wildlife Service: This incentive program to landowners for longleaf helped with initial work on the Owen property in Sussex County, a concentration for longleaf pine restoration.

Partnerships on Private Land: Quail populations have plummeted in recent years in Virginia. Longleaf pine and its associated management (low stocking, open, frequent burning) provides habitat favorable to quail. NRCS partnered with the DGIF in 2010 to hire five wildlife biologists focused on early successional habitat for Virginia's Quail Action Plan. One of these biologists is located in southeast Virginia and emphasizes longleaf pine as an element of quail habitat restoration.



LONGLEAF ON PRIVATE LAND: TWO CASE STUDIES

As noted previously, landowners are becoming interested in longleaf pine. Here are two noteworthy examples:

BILL OWEN, SUSSEX COUNTY

Landowner Bill Owen has the largest acreage of longleaf pine in Virginia. Mr. Owen sought to do something different than loblolly pine on his family's property near Yale. So, in 2002, he began with a one-acre project, followed by 15 acres in 2005, 180 acres in 2006 and 105 acres in 2009; Mr. Owen then planted another 100 acres of longleaf pine in Surry County. He has utilized many forest management tools to do this, including site preparation, release and several prescribed burns. He takes an active role in planning and management on the property. Six agencies have cooperated with Mr. Owen. Funding for the initial project was provided by the U.S. Fish and Wildlife Service. Virginia NRCS cost assistance and the VDOF SPB Prevention Program have helped on the larger projects. DCR and DGIF have provided technical assistance as well. Finally, Mr. Owen has donated a conservation easement to The Nature Conservancy on this 1,400 acres of family land and is in negotiations with TNC for an easement on an adjoining 450 acres. This is the core for TNC's Raccoon Creek Pinelands Conservation Area. In 2013, Mr. Owen planted an additional 525 acres of longleaf pine – 400 acres with NRCS funding and 125 acres with funding from the U.S. Fish and Wildlife Service and Norfolk Southern Foundation – making this by far the largest concentration of longleaf in Virginia. Mr. Owen is a model landowner and was recognized with the Governor's Environmental Excellence Award in 2009 for his efforts.



WRIGHT'S ISLAND SPORTSMEN'S CLUB, JAMES CITY COUNTY

Wright's Island has been owned by a group of individuals who have enjoyed hunting and the woods since 1910. It is located on the east side of the Chickahominy River, not too far from Williamsburg. Retired VDOF Area Forester William 'Billy' Apperson had a long working relationship with the owners and custodian of the property. When it was time to harvest a loblolly pine stand on a sandy, level site near the river, Billy recommended longleaf pine. Following harvest, the area was prepared and planted with longleaf in 1998 and subsequently burned several times. The Wright's Island site is one of the first of the longleaf pine restoration projects on private, non-industry land.

NORTHERN RANGE EXTENSION FOR LONGLEAF PINE

The natural range of longleaf pine is in southeast Virginia, with very few remnant trees. There is speculation and discussion regarding longleaf on the Eastern Shore or north of the James River. There have been a number of recent plantings in the northern Coastal Plain and as far west as Halifax County in the Piedmont. There is considerable scientific discussion about the northern migration of southern species with changing climate. How will longleaf pine grow and react farther north? To predict this, it may be helpful to look at examples of longleaf pine planted outside of its native range. Citizens have been moving longleaf pine north for years. Longleaf can be found in yards and homesteads in many areas in the Coastal Plain and Piedmont, including the Richmond and Fredericksburg areas. Many of these open-grown trees show the effects of snow and ice damage and can be crooked. But, there are also examples of longleaf with good form grown outside of their native range.

Perhaps the best and oldest example of longleaf established outside of its native range is in Albemarle County on the Virginia Department of Forestry Headquarters Shop property in Charlottesville (photos taken 2013). This western Piedmont site (38.02357° N -78.53365° W) is approximately 550 feet in elevation and about 80 miles northwest of the nearest point on the Eberhardt, et al. (2011) longleaf range map. It was originally used as a tree seedling nursery. Around the nursery beds, test plantings of a number of trees not native to the area were established. One block included longleaf pine according to a map dated May 1934. Some of the original longleaf still survives in the form of approximately 50 dominants ranging from 70 to 105 feet in height and about 16 to 30 inches in diameter at breast height (DBH). Despite some mortality, form is good on many of the remaining trees, many averaging two to three merchantable logs. While the biggest trees were too large to be cored with a standard increment borer, core samples from some smaller ones (under 22 inches DBH) revealed an approximate age of 60 years. It's possible some of larger trees on the site date back to the original 1934 planting. Regardless of tree age, the success of this stand demonstrates that longleaf will survive and grow fairly well this far out of its native range.



THE FUTURE... GOALS AND CHALLENGES

The story of longleaf pine in Virginia is long and fascinating. Interest and investment in preserving the few remaining longleaf and restoring it has grown and is now well-established. Many agencies and organizations have longleaf restoration as part of their strategic goals. So, what does the future hold for longleaf in Virginia? The tree and its ecosystem are desirable in many ways and for many reasons. Because of this, private landowners and natural resource agencies and organizations will likely continue to expand efforts in longleaf restoration. Landowners and organizations with a heavy focus on wildlife, aesthetics and ecological diversity will be most active. Longleaf is growing well in the Coastal Plain north of the James, the Eastern Shore and into the southeastern Piedmont. Expansion of longleaf into these areas seems natural and desirable.

What are the challenges and opportunities? As noted, the majority of the forestland in the native range and potential range expansion is private. Private landowners have diverse goals and abilities to invest. However, public lands are much more limited in extent. Because of this, creating a longleaf-dominated landscape of large size will be quite difficult. However, coordinated efforts among agencies and conservation organizations can go far at connecting core areas and increasing benefits. There has been strong federal interest and funding for longleaf pine restoration. Private funding sources are also becoming more available. Dedicated, long-term investments will be needed, particularly with private landowners, due to the high up-front cost of establishment. There is strong initial interest by private owners, often called the “early adopters” and those willing to try new and different practices. There is generally a transition period with new initiatives until they will become fully adapted and operational and more routine for larger numbers of owners.

Expanded funding and technical assistance may be needed as this happens.

A real challenge to successful

longleaf restoration is follow-up management, particularly prescribed burning. Regular and frequent burning is a cornerstone of the longleaf ecosystem management. It will be necessary to develop the structure, financing and capacity so that burning becomes part of the expectation and culture of forest management in the area. Smoke management will be a continual and growing issue, due to the expected population increase in eastern Virginia.

The short-term economics of loblolly versus longleaf pine will be a factor in decision making, particularly for large owners and timber management investment organizations. Over time, timber supply and capacity may become an issue. There have been many recent changes in the forest industry in the area that will affect landowner decisions. Sawmills and a paper mill have closed while wood energy, pulp and pellet plants are opening. These signal the need for many tons of fiber, not pine poles or high-quality sawlogs that longleaf may produce. Commercial pine straw production, a key component of longleaf economics in the South, has not yet started in Virginia.



So, what should the goal for longleaf restoration be in Virginia? One goal, suggested in the VDOF operational plan of 2008 was to: “Maintain longleaf pine on the landscape as an operational forest type.” There are a number of inferences here that could be expanded to be wider in scope. “Maintain” implies that restoration will occur. “Landscape” implies a wide area. “Operational” implies that there will be enough to meet needs, whether it is for game populations for hunting, needles for straw, timber, or rare or threatened species protection. “Forest type” implies the forest ecosystem is associated with a dominant tree species. The goal, how much and where will rest with those interested in longleaf in Virginia and those dedicated to its restoration. Collaboration and cooperation will be the key to setting and achieving meaningful goals that will meet resource needs.

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