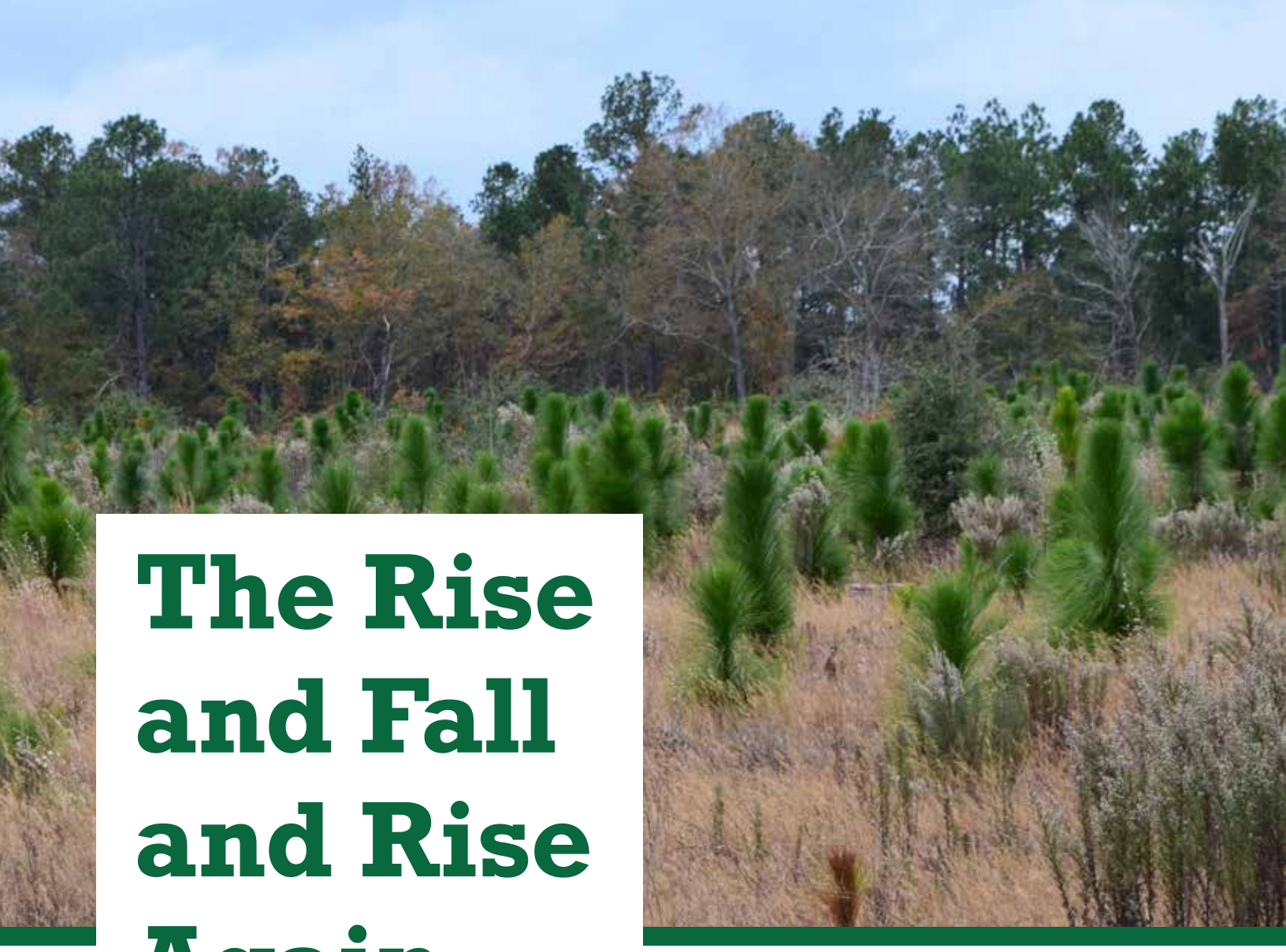


The Rise and Fall and Rise Again of the Longleaf Pine

By Lilla Ross

Over two centuries, the territory of the southeastern U.S. covered by longleaf pine shrank from 93 million acres to just 3 million. Many of the trees were felled to make way for more profitable loblolly and slash pines. But, as Lilla Ross reports, thanks to determined efforts the longleaf is enjoying something of a renaissance as conservationists and business rediscover some of its forgotten and remarkable qualities.

PHOTO CAPTION: Controlled burns are an essential element of longleaf pine forests. *Credit: U.S. Forest Service*

"In 'pine barrens' most of the day. Low, level, sandy tracts; the pines wide apart; the sunny spaces between full of beautiful abounding grasses, liatris, long, wand-like solidago (goldenrod), saw palmettos, etc., covering the ground in garden style. Here I sauntered in delightful freedom, meeting none of the cat-clawed vines, or shrubs, of the alluvial bottoms."

So wrote naturalist John Muir in the 19th century, at a time when the pines he was describing—Pinus palustris or longleaf pine—covered a remarkable 93 million acres of the southeastern United States.

The longleaf pine can live 400 years, so the trees that Muir observed could easily be alive today. They can grow to over 100 feet tall and 28 inches in diameter. Over the centuries, longleafs were tapped for gum, felled for lumber and paper pulp, cleared for agriculture or development, and destroyed by storms and fire.

In the 1940s and 1950s, plantation forestry came to the South, and what was left of the longleaf was cut out to make room for the more profitable loblolly and slash pines. By the end of the century only 3 million acres were left.

The decimation of the longleaf also meant the loss of its unique ecosystem, home to species of plants and animals that can live nowhere else because every few years longleaf forests are naturally cleansed by fire, which clears and revives the groundcover. The longleaf itself depends on fire to create the conditions for its seeds to germinate.

Longleafs not only stand up to fire, they are resistant to insects like the pine bark beetle and more resilient to hurricanes.

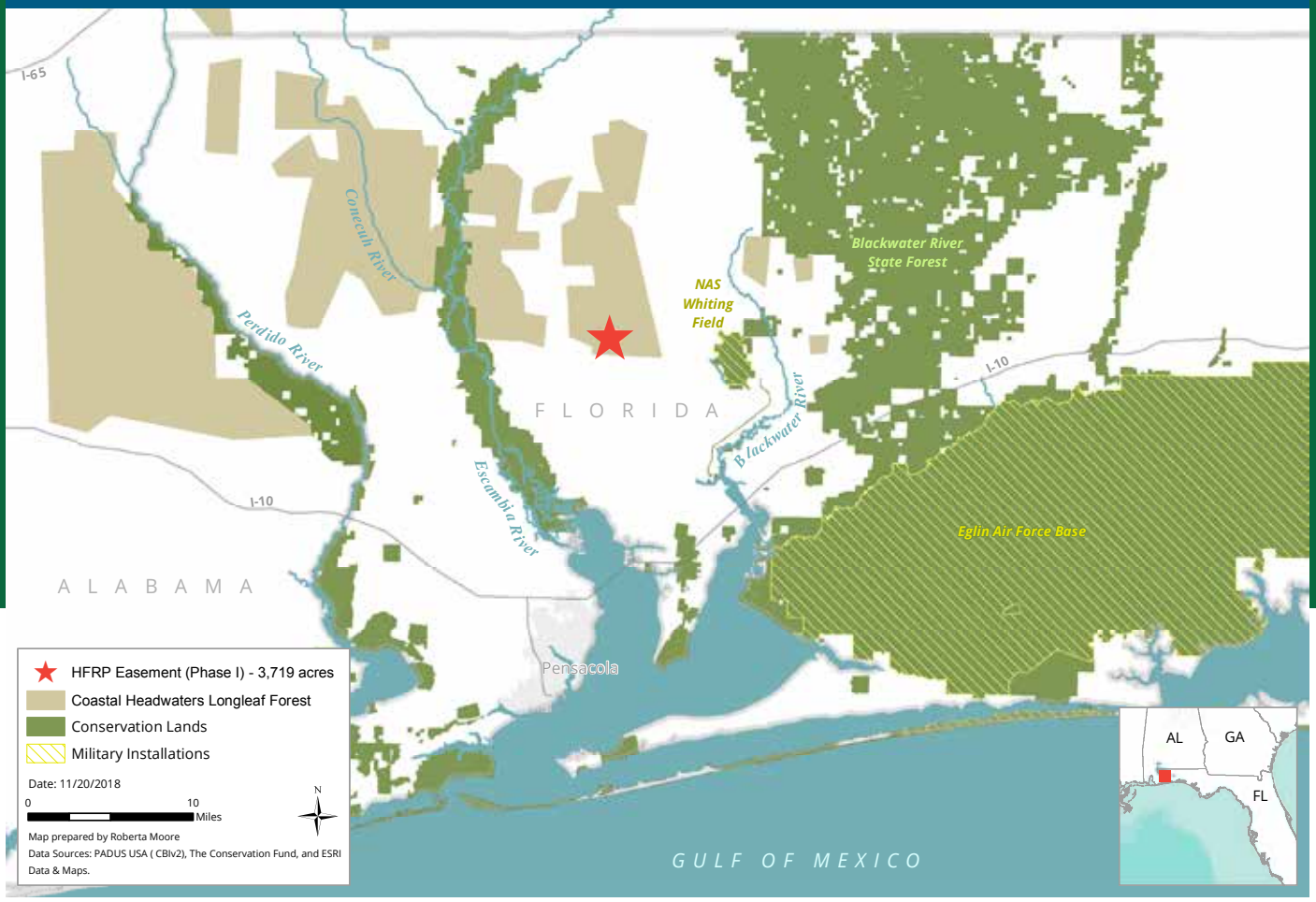
Reforestation Begins

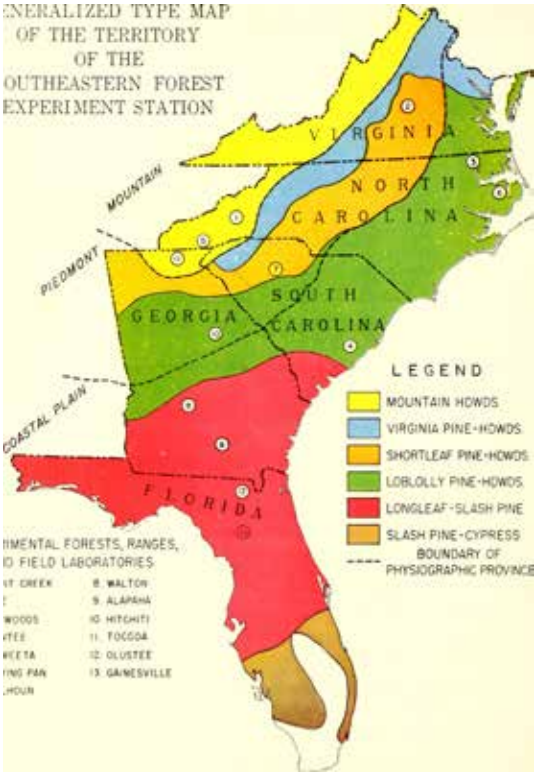
Reforestation efforts began in the 1960s, about 55% on private land and the rest in state and national parks and military bases.

One model project is the U.S. Forestry Service's reforestation effort at Francis Marion National Forest in South Carolina. The forest's 250,000 acres were once occupied by rice and

Coastal Headwaters Longleaf Forest
Healthy Forest Reserve Program Conservation Easement

THE CONSERVATION FUND





indigo plantations, turpentine operations for the naval stores industry and later logging. The U.S. government acquired the land in the 1930s and established the national forest.

In 1989, Hurricane Hugo destroyed about a third of the forest's trees, both pine and hardwood. In 2017, the U.S. Forest Service adopted a plan to restore longleaf in the Francis Marion, using data developed at the Santee Experimental Forest on the west end of Francis Marion where the effects of weather, fire and other environmental factors are tested.

Starting this year, about 140 acres of loblolly pine will be harvested and replaced with longleaf. Another 210 acres of longleaf will be thinned to encourage natural regrowth. Researchers will monitor the redevelopment of the ecosystem, using the data to develop other reforestation projects.

Six Generations

To the south in Wheeler County, Georgia, Reese Thompson, and his brother, Frank, are doing their part on their properties adjacent to the Alligator Creek Wildlife Management Area. The Thompson property has been in the family six generations, and for much of that time was covered in pine trees.

"We were in turpentine for at least four generations. Farther back than that, we're not sure," Reese Thompson said.

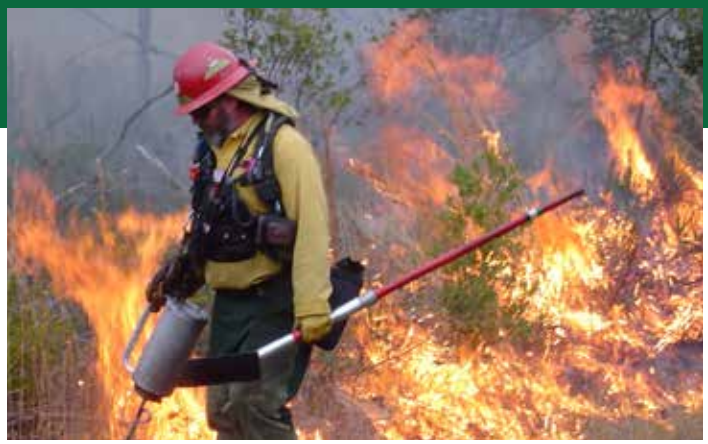


PHOTO CAPTION: When longleaf seedlings are about five years old, they have a growth spurt and can survive controlled burns.

The turpentining operation ended in 1981. "We were bleeding the trees dry because they weren't getting enough rain to refurbish themselves," Thompson said.

Thompson began planting longleaf about 35 years ago. "Longleaf is the only thing I plant," Thompson said. "It is more disease resistant, bug resistant, wind resistant, fire resistant, and it produces a better quality product."

A few of Thompson's longleafs are about 100 years old, and one of them is between 250 and 300 years old. "That tree saw Native Americans," Thompson said. "It's a miracle it hasn't been struck by lightning."

In 1995, the Longleaf Alliance was established by the Solon Dixon Forestry Education Center and Auburn University to put more focus on the management of existing longleafs and reforestation.

"Our mission is the conservation, stewardship and restoration of longleaf," said Robert Abernethy, President of the Alliance. "We work with anybody who wants to do anything with longleaf. We find money for people who want to grow them and tell them how to do it."

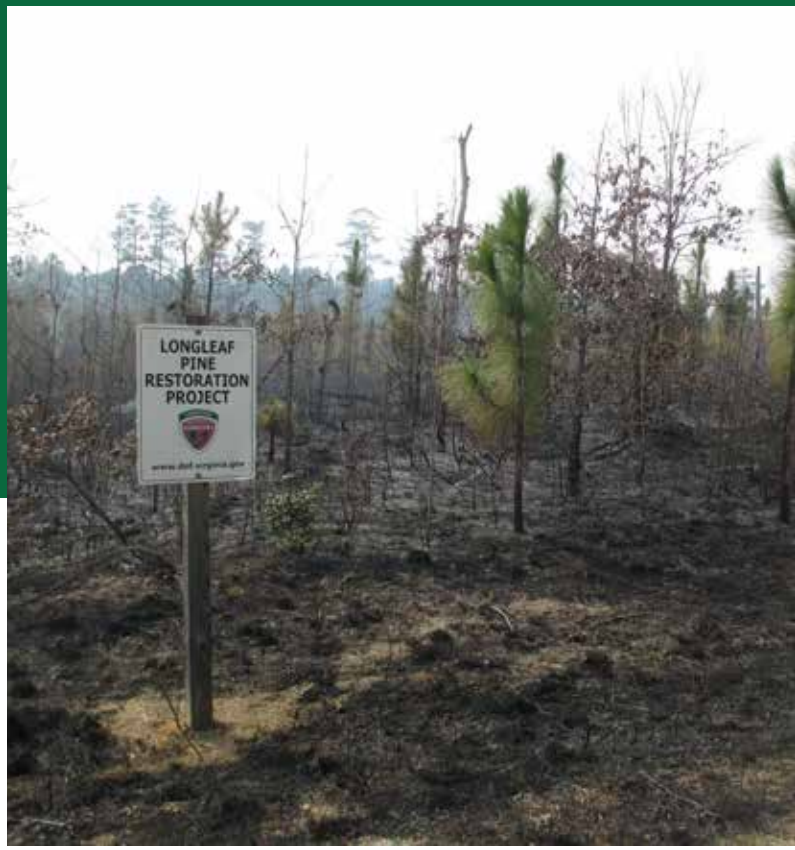
The Alliance spearheaded America's Longleaf Initiative, established in 2009, as a partnership of over 20 nonprofits and government agencies with the goal of having 8 million acres of longleaf by 2025.

As of 2018, longleaf forests covered 4.6 million acres.

Fire as a Friend

Longleaf forests are sometimes called "fire forests," because the understory needs to be burned every two or three years. And for some people, whose attitudes toward fire have been shaped by Smokey the Bear, that is a hard sell.

"Of all the mistakes we've made in forestry over the last century, not educating people about the role of fire is one of our biggest," said Eric Sprague, Vice President of Forest Restoration for American Forests. "Keeping fire out of the forests converted them to hardwood stands, which makes them more vulnerable to fire and has changed the habitat."



To re-educate the public about the value of prescribed burns, the Longleaf Alliance developed Burner Bob, a bobwhite quail character to explain the value of fire, complete with personal appearances and YouTube videos.

The longleaf has adapted to fire because for hundreds of years lightning would ignite fires that burned the understory around the trees, wiping out competing trees and opening up the land to sunshine.

During the fires, the animals take shelter in the deep gopher tortoise burrows or in the woodpecker cavities high up in the trees. Within weeks, the wiregrass, browse and other plants sprout. One of the most important plants to germinate after a fire is the longleaf pine.

According to the North Carolina Forest Service, longleafs must be about 30 years old and 10 inches in diameter to produce successful seeds, and even then good cone crops are only produced every five to seven years. The seeds are large and easily caught on plants around the base of the tree, or eaten by birds and other wildlife. To germinate they must fall to the ground in an area that receives sunshine, and that usually means an area cleared by fire.

Though more resilient to fire than other pines like slash and loblolly, under the right conditions—raging wildfires, for instance—even longleaf will burn.

"We're going to have fire no matter what," Sprague said, "but we can manage the impact. With prescribed burns, you can control how hot it burns, how long it burns and manage the air-quality conditions."

Thompson said he is working toward a two-year rotation of prescribed burns on his longleaf acreage in Georgia.

He said he typically burns about 100 acres at a time, which takes about a day. A perimeter of harrowed ground serves as a firebreak. Then Thompson picks just the right day.

"I've been burning since 1980, and I used to think wind speed was the most critical factor, but I've come to the realization that relative humidity is the most important factor," Thompson said.

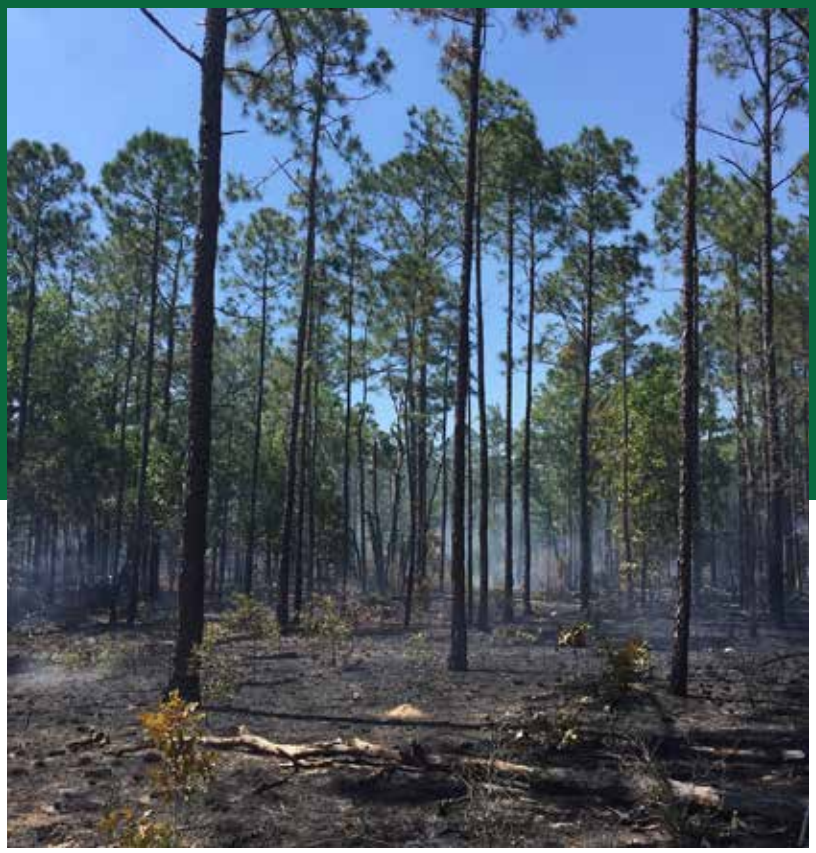
There's a sweet spot between 25 and 50 percent humidity. "If you can get in that sweet spot you can get the fire to do what you want," Thompson said. "We burn against the wind, preferably from the northwest wind. An east wind is the least dependable. We don't burn in March when we get these whipping, swirling winds that are all over the place."

Property owners are seeing the value of longleaf as a buffer against wildfires. The Okefenokee Swamp has had several severe wildfires that burned for months. One in 2007, burned 935 acres. Now, landowners around the swamp are planting longleafs to serve as a firebreak.

Standing up to Hurricanes

Longleaf also are more likely to survive hurricanes. After Hurricane Katrina, which hit the Gulf Coast in 2005, foresters discovered that the Category 5 hurricane had snapped off the slash and loblolly pines, which makes it difficult to salvage them as lumber, but most of the longleaf were leaning or downed but intact, Abernethy said.

The longleafs in the Florida Panhandle did not fare as



PHOTOS FROM LEFT TO RIGHT:
Burner Bob is the mascot of controlled burns, countering the anti-fire message created by Smokey the Bear. Credit: Reese Thompson

In the aftermath of a controlled burn, plants will quickly sprout, creating habitat for many native species.

well in 2018 under the 160 mph winds of Hurricane Michael. "A storm as strong as Michael breaks everything," Abernethy said. "But in a storm with 75 to 100 mph winds, longleaf survives better."

The catastrophic damage caused by Michael has presented an opportunity to speed up the planting of longleaf. Melanie Kaeser, an ecologist with the U.S. Fish and Wildlife Service, said Tyndall Air Force Base near Panama City lost 15,000 acres of trees to Michael. As the damaged wood is clearcut, it can be replaced with longleaf. "It's a unique opportunity, but it will depend on funding," Kaeser said.

That will accelerate the longleaf reforestation effort at Tyndall, which typically was harvesting slash pine and replanting with longleaf 450 acres at a time.

Embedded on Air Force Bases

The reforestation effort at the base is part of the partnership between the U.S. Forest Service and the Department of Defense. USFS staff are embedded on six of the seven Air Force bases in Florida to help manage the thousands of acres of woodlands and protected species.

Kaeser has worked at Tyndall for five years, heading up a team of two biologists and two equipment operators. "We work side by side with DOD Natural Resources staff," she said.

The reforestation is still in its infancy. Gopher tortoises have returned, but it will be years before the trees are mature enough to sustain red cockaded woodpeckers, she said.

"We have decent ground cover and that is the more important side of restoration," Kaeser said. "Food and shelter."

A Working Longleaf Forest

Kaeser also is involved at the nearby Coastal Headwaters project, a plan to reforest 200,000 acres that straddle the Florida-Alabama line.

"We want to make it a working longleaf pine forest, where you make revenue off the timber that is harvested in an ecologically sustainable manner, no clearcutting," Kaeser said. "We want to keep the ecosystem viable."

It's the largest public-private longleaf restoration project in the country, a collaboration of more than 30 state and federal agencies and nonprofits working with Resources Management Services (RMS).

"I've never worked with so many partners like this before," said Catherine Phillips, assistant regional director for ecological services, U.S. Fish and Wildlife Service in Atlanta. She was the field supervisor for the project in Panama City when it was getting off the ground.

"It's really large scale with a big footprint," Phillips said. "What makes it different from other conservation projects is that conservation and business are coming together, working together so that we have a healthy ecosystem that is profitable for landowners. A lot of private landowners are watching to see if it's successful."

The idea for the project originated in 2014 with RMS, which manages 2.5 million acres of timberland for institutional investors in nine Southern states, Australia, New Zealand and Brazil. In the U.S., the timber is loblolly harvested for lumber and poles, and to a lesser degree pulp.

"This is a mutually beneficial approach. It's combining conservation and business."

"Some Unique Markets"

Bullock, senior vice president of forest sustainability at RMS, is the man who assesses the economic benefits from longleaf forests. "Longleaf is a slower growing, denser, stronger wood," Bullock said. "It's a high-quality lumber, makes beautiful flooring. There are some unique markets. The trade-off is that it takes 40 years to do what loblolly can do in 28 years."

Bullock said researchers are doing genetics work on longleaf that could eventually produce a tree with a shorter growing cycle that would make it more economically competitive with loblolly.

Bullock describes the Coastal Headwaters project as "a unique opportunity in a unique location."

The area includes four major river systems in a coastal zone affected by the Deep Horizon oil spill in 2010. Restoring the longleaf forests will protect the water quality in the watersheds, assist in the recovery of 45 species endangered, threatened or at-risk and increase carbon sequestration.

Although the goal is to plant 200,000 acres, it is being done incrementally. The first phase of 3,700 acres is being paid for with $35mn in federal grants. Another 20,000 acres are in the pipeline for funding, and additional acreage will be added as funding is available, Bullock said.

The loblolly pines are being clear cut for lumber. Other trees like oaks are killed with herbicide. Site preparation includes controlled burns, which will be maintained on a two-to-three year rotation.

Money off the Land Before Harvest

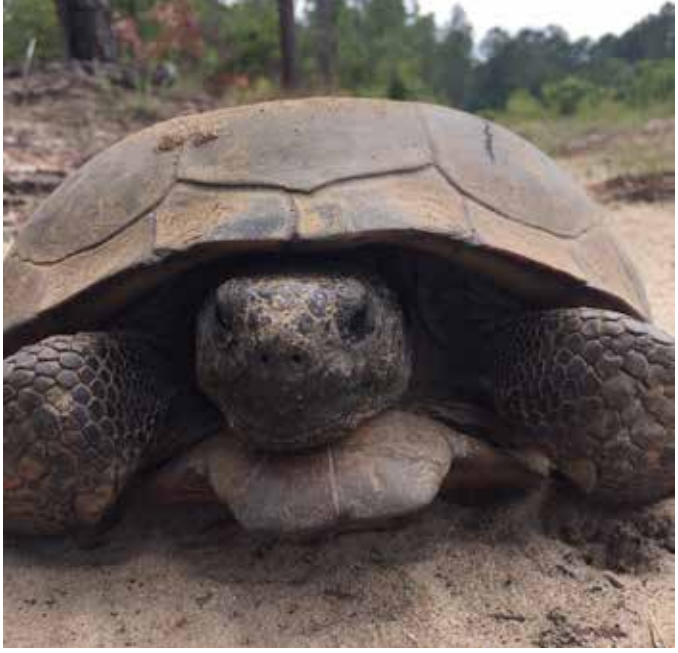
But a landowner can make money off the land years before harvest in a variety of ways. Pine straw is sold for mulch, and longleaf straw is unusually long—10 to 17 inches—and sells for three times the price of loblolly and slash.

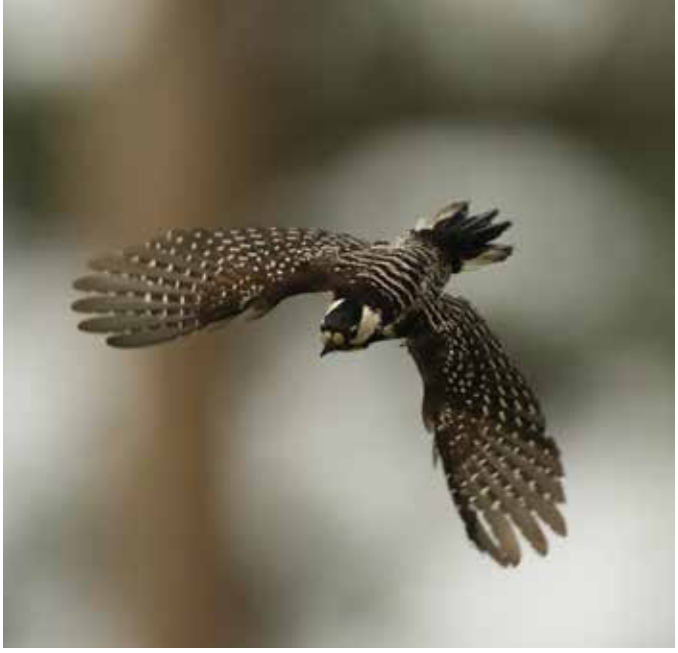
The land also can be leased for hunting and recreation. Longleaf forests support a variety of game popular with hunters, including deer, quail and turkey.

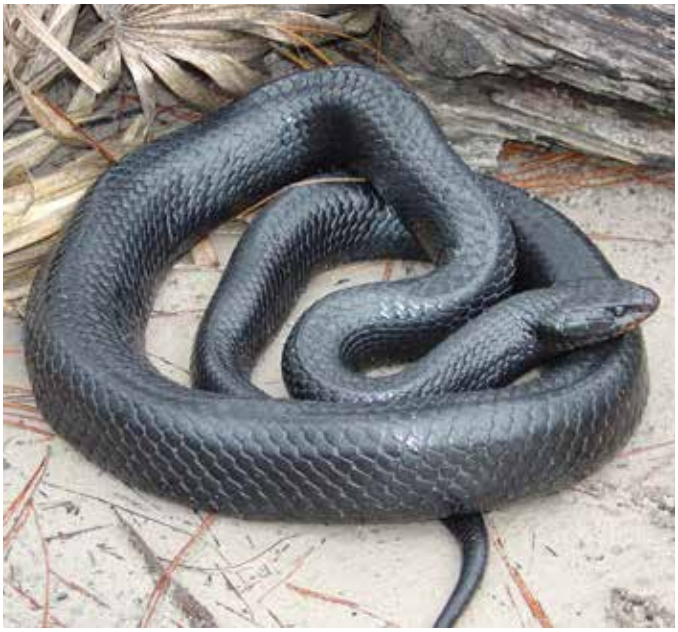
Ecosystem tax credits are available for carbon, water and species mitigation.

And some states offer incentives and cost-sharing for non-institutional private landowners. The state of Florida, for instance, will pay a private landowner up to $10,000 to plant longleaf, with the awarded sum formulated according to, for instance, how many trees they plant, whether work is conducted to restore native species and whether there is a program of prescribed burns.

"This is a mutually beneficial approach," Phillips said. "It's combining conservation and business. Landowners want to be good stewards of the land. We are working to do the right thing to conserve the habitat that doesn't encumber landowners. It's innovative, the way of the future." PCR





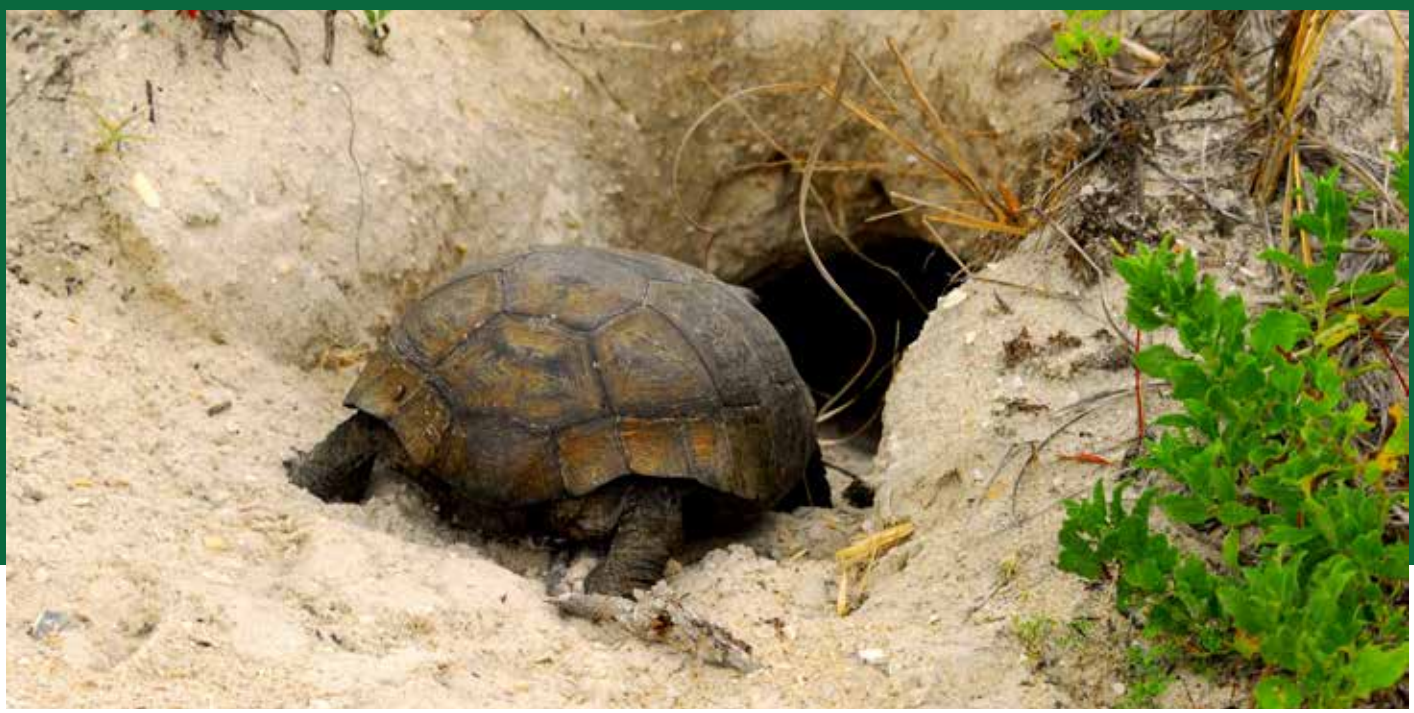


Meet the Longleaf Natives: the Tortoise, the Woodpecker, the Snake and the Salamander

By Lilla Ross

A big part of the impetus behind restoring the longleaf forests is creating habitat for threatened and endangered species. It's the only place they can thrive because of the unique nature of the longleaf forest—its open canopy, ground cover of grasses and flowering plants and periodic fires that clear out dense underbrush.

About 29 animal species native to the longleaf forest are threatened or endangered and another 100 are on a watch list. Of the 290 reptile and amphibian species found in the Southeast, 170 live in the longleaf ecosystem. Moreover, almost 900 plant species are found only in longleaf pine forests. Here is a look at four key species:



Gopher Tortoise *(Gopherus polyphemus)*

The Gopher tortoise, the only tortoise east of the Mississippi, can live 80 years in longleaf pine forests and oak sandhills in a range that arcs from South Carolina to Louisiana. It is considered a keystone species because so many other species depend on their deep burrows. But they are in danger of being declared an endangered species because their habitat is being lost.

They can grow to 15 inches long and weigh up to 15 pounds. With their strong legs, they dig burrows, which can be up to 30 feet long and 15 feet deep, where they live and lay their eggs. The tortoises dig numerous burrows in their range and empty burrows are used by as many as 350 species including snakes, armadillos, owls, rabbits, opossum and quail.

But some of the same animals that use their burrows also eat tortoise eggs, which are laid at the entrance.

To preserve the species and expand its range, two nonprofits, American Forests and the Longleaf Alliance, developed a "head start" program, collecting gopher tortoise eggs and taking them to a lab where they are hatched and raised until they are old enough to be released.

"Those first couple of years are really tough for gopher tortoises. Fewer than 10 percent survive," said Eric Sprague, Vice President of Forest Restoration for American Forests. "If you can raise them for a couple of years and release them that gives them a head start and their survival rate is much higher."

The program is based at the Aiken Gopher Tortoise Heritage Preserve in Aiken, South Carolina. So far, 74 tortoises have been released in longleaf forests on state and federal land.

Fire also is of critical importance to gopher tortoises, which are herbivores that eat grasses, berries, prickly pear cactus and mushrooms. These plants are low-growing. When a longleaf forest goes for several years without fire, other plants take over. Often these plants are taller and grow more densely, and tortoises cannot feed. Periodic fires clear out the dense undergrowth and encourage native plants to emerge.

Red Cockaded Woodpecker *(Picoides borealis)*

Another keystone species is the red cockaded woodpecker, which despite its name is a small black-and-white woodpecker with white check patches. The males have a tiny red streak on the cheek.

They live in family groups in pine forests from New Jersey to Florida, west to Oklahoma and Texas and inland to Missouri and Kentucky. The red cockaded woodpecker is the only woodpecker that excavates its cavity in a living pine tree and will excavate several cavities over 200 acres to accommodate family members.

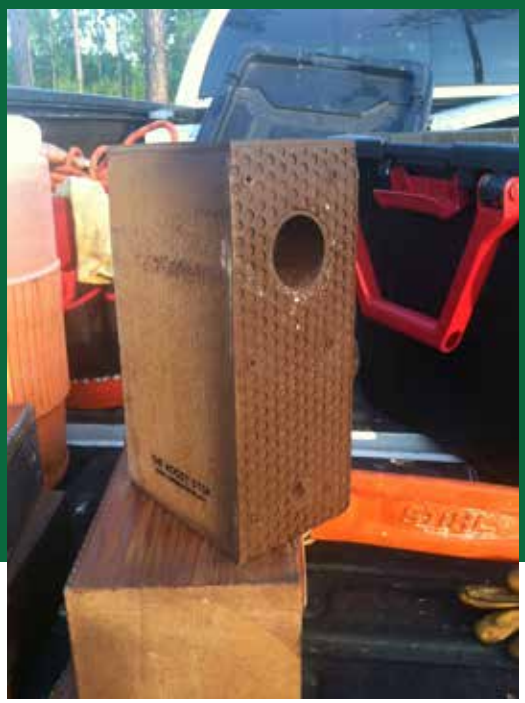
"Woodpeckers like longleaf because they can live 400 years, so the next generation inherits the hole," said Robert Abernethy, President of the Longleaf Alliance.

The cavities are used by other species of birds and squirrels, lizards, snakes and frogs.

But habitat destruction has threatened the species, and wildlife groups and scientists installed inserts in trees to create nesting boxes to expand their range.

In 1989, Hurricane Hugo slammed South Carolina, destroying $1.7bn in trees and devastating the habitat of the red cockaded woodpecker and other species.

The Francis Marion National Forest, with 36,000 acres of longleaf, was hit hard with 95% of the mature pines snapped off and 63% of the red cockaded woodpecker population killed.



PHOTOS FROM LEFT TO RIGHT: A red cockaded woodpecker and a nesting box that is cut into a longleaf pine. *Credit: Robert Abernethy*

To help the birds recover, 537 artificial nesting boxes were installed in surviving trees, attracting 249 family groups by the following year.

The Longleaf Alliance is one organization that has continued the practice, which has allowed for the introduction of the woodpeckers in new areas.

"We work with landowners who have good, well-managed habitat and we put in the inserts in the trees to attract the birds that might already be there," Abernethy said. "If the property is large enough, we'll transfer birds from public land."

Biologists go into the forests in the fall to trap the birds and drive them to the new site. A screen is put over the opening of the insert overnight.

"When we take off the screen, they'll start calling, looking for a mate," Abernethy said. "We move about 50 to 75 birds a year to try to grow the population, and we have a 60% success rate of mating pairs."

Eastern Indigo Snake *(Drymarchon corais)*

The eastern indigo snake, the largest native snake in North America, is known as the Emperor of the Forest. It can live a quarter of a century and grow to 8.5 feet. It is found in swampy lowlands in Georgia and Florida, though its range used to stretch from South Carolina to Mississippi.

It is one of the species that is dependent on the gopher tortoise, sheltering in the burrows where the females lay up to 10 eggs.

Though nonvenomous, the indigo snake is considered an apex predator, feeding on small mammals, birds and reptiles, most famously diamondback rattlesnakes.

The eastern indigo snake has been listed on the federal threatened species list since 1978 because of the destruction of its habitat and collection for the pet trade.

Wildlife organizations, universities and government agencies have been working to revive the snake population. The Orianne Society does annual surveys in the sandhill habitats of southern Georgia. Others collect eggs and release the young in new habitats. In June, 15 young snakes were released in the Nature Conservancy's Apalachicola Bluffs and Ravines Preserve west of Tallahassee.

Flatwoods Salamanders *(Ambystoma cingulatum and bishopi)*

This black and gray salamander is found in an arc from South Carolina to Mississippi, where it lives in low-lying longleaf and slash pine forests and wetlands, where it breeds.

The salamander dates back millions of years, when Florida was warmer and wetter. Biologists now recognize the flatwood salamander as two species—reticulated and frosted—separated by the Apalachicola River, with the reticulated to the west and the frosted to the east.

They shelter underground during the day and come out to hunt at night. They are opportunistic feeders, eating primarily worms, beetle larvae and termites.

The female can lay up to 160 eggs, which stick in clusters on vegetation in wetlands. As the wetlands fill, the eggs are submerged and mature.

Flatwoods salamanders are threatened because of habitat destruction and the lack of fire to clear the forest floor. PCR