

Longleaf & Gophers

An Odd Pair
Supporting a
Full House



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When European explorers first reached the southeastern United States, they encountered a landscape far different from that with which we are now familiar. Those early adventurers in search of legendary riches found little of the gold they sought. The treasure they found took a far different form. The world they discovered was one dominated by the longleaf pine (*Pinus palustris*). This species and its associated ecosystem would later be found valuable in its own right.

The longleaf pine ecosystem once spread over the Atlantic and Gulf Coastal Plains from southern Virginia through central Florida and all the way to eastern Texas. Estimates vary, but its extent was once somewhere between 60 and 137 million acres. Though species associations varied from location to location, the structure and appearance of these widespread stands was very similar. Open forest canopies were dominated by the towering longleaf, some more than three feet in diameter, 120 feet tall and as much as 500 years old. A scattered but important midstory consisted, for the most part, of fire-tolerant scrub oaks. Relatively little woody understory was present, but the ground was carpeted with a host of grasses, forbs, legumes, and other herbaceous species whose growth and diversity was encouraged by the abundant sunlight reaching the forest floor. The ancient

longleaf forest presented a vista of great beauty matched by few in the world.

FIRE-DEPENDENT AND DIVERSE

The southeastern longleaf pine ecosystem was dependent on another constant, one that initially seems incongruous with the idyllic nature of this unique habitat. Fire — frequent fire — was a part of life in this region. Initially, fires were started by lightning strikes that most often occurred during the growing season. Later, Native Americans set fires to clear land for farming and to improve conditions for hunting. Relatively cool ground fires often burned unimpeded for days or weeks and across many miles of almost unbroken longleaf forest. Coastal Plain woodlands burned regularly, usually at intervals of two to six years. These fires kept ground level fuel supplies low and

inhibited the survival of most shade-tolerant canopy species. Were it not for fire, the shade-intolerant, but remarkably fire-adapted longleaf pines would have been quickly choked out by these other species.

The aesthetically pleasing longleaf pine community also concealed treasures that were not readily apparent. It remains incredibly diverse with regard to the plant and animal species of which it is comprised. Single stands often contain more than 200 plant species, most of which occur in the herbaceous ground layer. Of the 290 reptile and amphibian species native to the Southeast, 170 (96 reptiles, 74 amphibians) are found within the range of the longleaf pine ecosystem. A host of bird and mammal species prospered among the pines as well. Moreover, many of the species associated with the longleaf pine ecosystem are endemic, found nowhere else in the world. On a large

scale, the longleaf pine, through its fire tolerance and tendency to form sunny, open stands makes this beautiful, diverse, and unique ecosystem possible. This irreplaceable role and the fact that its removal from the system would ultimately result in the loss of numerous other species define it as a keystone species of the ecosystem that bears its name.

GOPHER TORTOISE

As important as longleaf pine and the fire to which it is adapted are in shaping the longleaf pine ecosystem, another species also plays a keystone roll. Gopher tortoises (*Gopherous polyphemus*) are a once common and still important component of the longleaf pine ecosystem. Though their range is now fragmented, gopher tortoises were once widely distributed throughout the southeastern coastal plain, most common in areas having sandy well-drained soil. Their range closely paralleled the coastal plain distribution of the longleaf pine ecosystem, which provided the three factors necessary for the long-term survival of gopher tortoise populations: well-drained sandy soils to allow digging of burrows, plenty of low growing plants for food, and sufficient open sunny areas for nesting.

The gopher tortoise is one of only four tortoise species found in North America, and it is the only one found east of the Mississippi River. Gopher tortoises are relatively large and spend their entire lives on land. Adults average 10-12 inches long, but may reach more than 15 inches. Average weights for adults are typically 9-12 pounds. Female gopher tortoises reach sexual maturity when their shells are approximately 9 inches long, which may require 10-21 years depending on location. Male gopher tortoises are on average smaller than females. Gopher tortoise shells are relatively high domed. Upper portions of the shell (carapace) are usually dark brown to gray-black, while the lower shell (plastron) is lighter, often with a yellowish tint. Gopher tortoise shells are not hinged. Gular projections present on the front of the plastron, tend to be longer among males. Female gopher tortoises have flattened plastrons while those of males are more strongly concave. The heads of both sexes are blocky in shape with adult males having enlarged mental glands under their chins. Gopher tortoise

hind limbs are short, stubby, and elephantine in appearance, while the forelimbs are enlarged, flattened, and possess large nails used for digging. Gopher tortoises are estimated to live 40-60 years in the wild and have been known to live more than 100 years in captivity.

Gopher tortoises are primarily grazers, feeding on low growing grasses, forbs, legumes, fruits, and other herbaceous plants. Young, faster growing tortoises eat insects and other invertebrates more commonly than adults, presumably because of their high protein content. Young and old gopher tortoises alike are occasionally known to feed on carrion and sometimes even excrement. The gopher tortoise diet includes a wide variety of plant species. While they are largely opportunistic feeders, it is thought that individuals select among available choices based on immediate and specific dietary requirements. Gopher tortoises are believed to play an important role as seed dispersers for numerous species on which they feed. These tortoises rarely drink standing water, only having been known to do so during periods of extreme drought. The vast majority of their water requirement is obtained from the foods they eat.

BURROW IMPORTANCE

The life of a gopher tortoise revolves around its burrow. Burrows are dug in areas having well-drained usually sandy soil and are frequently 15-30 feet long and up to 10 feet deep. Burrows as long as 50 feet and up to 18 feet deep have been documented. Burrows constructed in soils having a higher clay content tend to be considerably shorter and shallower than average. The depth of a burrow is limited by the depth of the water table. A gopher tortoise burrow is slightly wider than the tortoise that dug it, which allows the animal to turn around at any point. There is an enlarged chamber at the burrow's lowest point. Active gopher tortoise burrows are readily identifiable by their classic flat bottomed, high domed appearance and the characteristic area of excavated dirt and sand (apron) in front of the opening. Gopher tortoises build multiple burrows scattered across their home range. The home ranges of males are larger than those of females and, hence, males tend to construct and use



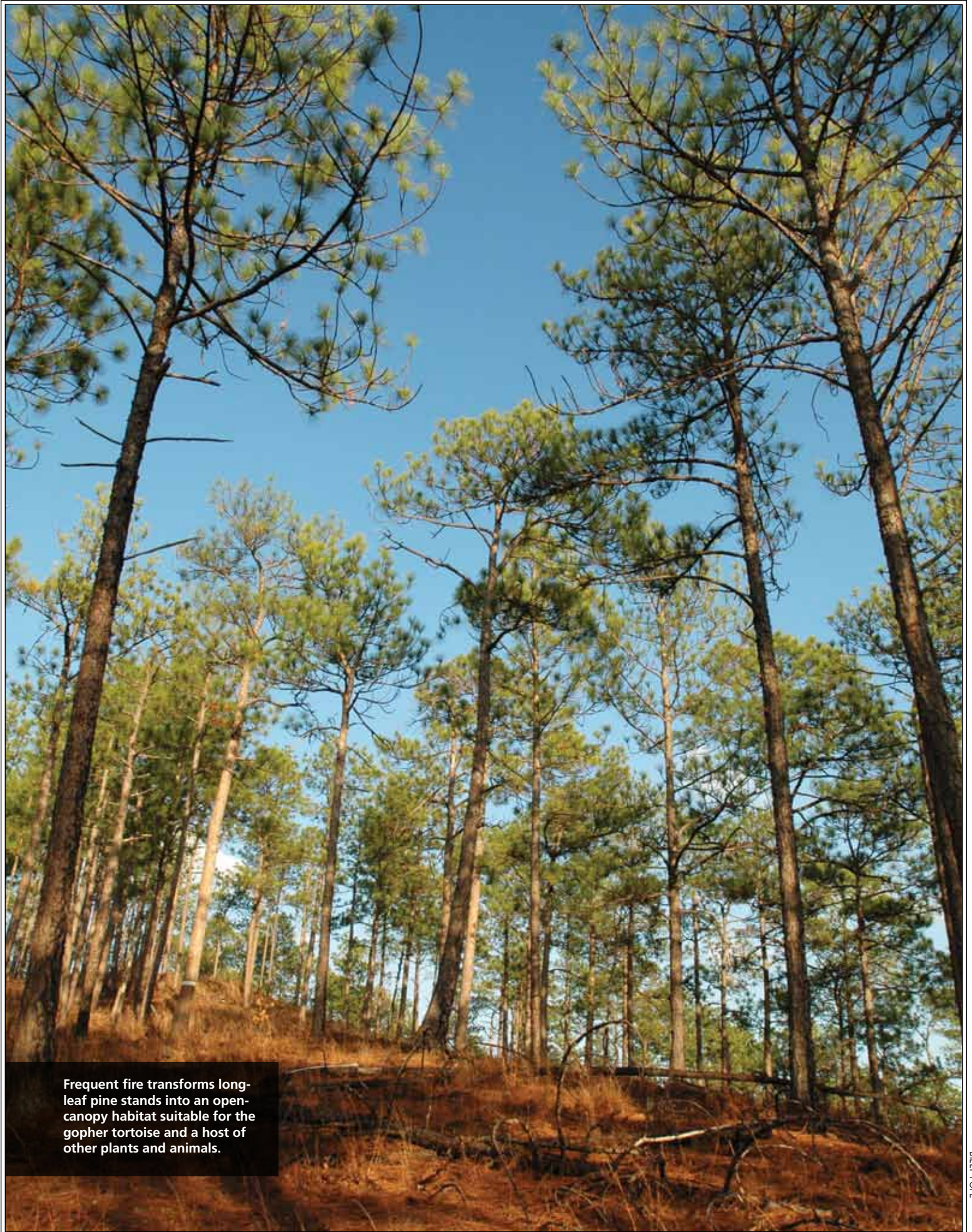
Gopher tortoise burrow.

more burrows than females. Adult gopher tortoises are not known to share burrows simultaneously except for brief intervals where a threatened gopher seeks the first available refuge and that refuge happens to be an already occupied burrow. They will, however, sometimes use an unoccupied burrow constructed by another tortoise. Gopher tortoise home range size in general is inversely related to the amount of herbaceous ground cover (food) present. The more food that is available the smaller the home range.

Gopher tortoises are active in the day (diurnal) during which they forage for food, bask in the sun, and visit the burrows of other tortoises. Gopher tortoise activity levels depend largely on daytime temperatures. During the winter months, gophers may not leave their burrows at all during extended periods of cold. They will, however, bask near the mouth of their burrow on warm days even though little food may be available. As the weather warms in the spring, gopher tortoise activity increases with most activity occurring from April through September. During the heat of the summer, tortoises often become largely crepuscular (most active during the early morning and late afternoon), spending the middle, hottest portion of the day in their burrows.

TORTOISE BREEDING

Though some breeding activity is known to occur among gopher tortoises from April through November, most actual copulation takes place during August and September. Breeding rituals are known to include males making low croaking noises and thumping their plastron on the apron outside the burrow of a female. Both sexes engage in head bobbing during courtship and prior to copulation. Battles sometimes occur between males for the attention



Frequent fire transforms long-leaf pine stands into an open-canopy habitat suitable for the gopher tortoise and a host of other plants and animals.



Left: The gopher tortoise is a protected non-game species in Alabama; populations west of the Tombigbee and Mobile rivers are federally listed as threatened. Right: Efforts by natural resource agencies and landowners are currently underway to restore longleaf pine to its natural range in the Southeast.

of a female. Female gopher tortoises engage in sperm storage. Regardless of when actual copulation takes place, most females ovulate (with subsequent fertilization of the eggs) during April and May. Females lay one to 25 eggs (average five to eight) shortly after mating (usually May-June). The eggs are laid either in the apron of the female's burrow or in a nearby sunny spot. Incubation of the eggs in the warm soil requires 70-110 days (80-90 average) depending on soil temperature. Incubation at temperatures greater than 85 degrees Fahrenheit mostly results in female hatchlings, while incubation temperatures below this produce mostly males. Most hatchlings emerge during August and September. Some hatchlings may temporarily share the burrow of their mother while others use a nearby unoccupied burrow in which to overwinter. Some young gopher tortoises dig shallow burrows for themselves almost immediately.

Gopher tortoise populations, by their very nature, tend to be slow growing and

hence slow to recover and/or expand into unoccupied habitat. Reaching sexual maturity alone requires 10-21 years after which females lay only one clutch of eggs per year. Loss of gopher tortoise eggs to nest predators, especially raccoons and fire ants, is frequently 80 percent or more. Finally, young gopher tortoises are prey to a host of reptilian, avian, and mammalian predators until their shells are fully hardened at 6-7 years of age. Though they have few effective predators as adults, it is estimated that as few as three of every 100 hatchlings survive to reproduce.

VALUABLE SPECIES

As previously mentioned, gopher tortoises are considered a keystone species of the longleaf pine ecosystem. As in the case of the longleaf pine itself, many species in the ecosystem depend on the gopher tortoise for survival or derive significant benefit from the tortoise' presence. The value of the gopher tortoise to the ecosystem as a whole goes far beyond its role a seed disperser for its plant food

species or the fact the young tortoise itself is food for many other species. The gopher tortoise contributes something much more important to the system — its burrow. The digging of the burrow itself provides recycling of leached nutrients, but the finished structure is a key to survival not only for the gopher tortoise, but for many other species as well. While gopher tortoises avoid sharing burrows with others of their own kind, they don't seem to mind sharing space with much of anything else. More than 360 species of mammals, birds, reptiles, amphibians, and invertebrates are known to spend all or a portion of their lives in either active or abandoned gopher tortoise burrows. Some species such as the gopher frog, the pine snake, the indigo snake, the scrub jay, the Florida mouse, the burrowing owl and gopher crickets are completely or largely dependant on these burrows for survival.

Gopher tortoise burrows benefit the tortoises and their commensals (species who receive benefit from living in close

association with another species without causing the other species harm) in numerous ways. Clearly, tortoise burrows provide safety from predators. This role applies both to species who actually reside in the burrow and to those who use them opportunistically. In the same way, they provide refuge from the regular fires, which function to maintain the structural and vegetative components of the longleaf pine ecosystem. Without access to gopher tortoise burrows, many species would be hard pressed to survive long term in this frequently hostile environment. Finally, and of at least equal importance, gopher tortoise burrows provide shelter from the environmental extremes of cold, heat and drought. Because of their length and depth, gopher tortoise burrows maintain a much more constant temperature and humidity regime than that of the world outside. In the winter, burrows provide a more moderate environment during periods of cold. Similarly, during the summer, the burrows provide shelter from the frequently extreme heat in what has been termed by some “the southeastern desert.” Possibly more important than protection from the heat, the relatively constant humidity in the depths of a gopher’s burrow provides critical protection from dehydration during periods of drought especially for amphibians and some reptiles. It has been well documented that, as populations of gopher tortoises decline, so do the populations of species dependant on their burrows.

POPULATION DECLINE


Times change and the world changes with human priorities. The landscape of the southern coastal plain has been no exception. As might be expected, the fortunes of the gopher tortoise have followed a path similar to that of its primeval habitat. The extent of the longleaf pine ecosystem in the southeastern United States has been reduced to less than 3 million acres, a small fraction of its former range. Of the remaining longleaf forest, only four sites, totaling a mere few thousand acres, remain in a virgin state. The rest are second, third, or fourth generation stands. Land clearing for the purposes of agriculture, mining, road building, and urbanization have each taken their toll. Timber harvests, many of the “cut out and get out” variety, during the late nineteenth

and early twentieth centuries stripped the landscape of a treasure not recognized as such by those doing the cutting. Economic influences have dictated that most past and present reforestation in the Southeast has been to faster growing species such as loblolly or slash pine. In the past, many of these forest stands were planted at close spacings. At these planting densities, canopies quickly closed with little sunlight reaching the ground. The widespread exclusion of fire has allowed development of dense midstory and understory forest components while precluding the development of a diverse groundcover. The rolling savannah-like world of the southeastern coastal plain is, for the most part, gone, and it is estimated that gopher tortoise populations have declined by at least 80 percent in the last 100 years.

If current trends continue, more than a beautiful landscape may be lost. At least 27 plant species associated with the longleaf pine ecosystem are federally listed as endangered with 99 more listed as threatened or as species of special concern. More than 30 vertebrate species (amphibians, reptiles, birds, and mammals) historically tied to the longleaf community have declined to the point of listing as well. Gopher tortoises are currently federally listed as threatened west of the Tombigbee and Mobile rivers and eastern populations are being considered for listing as well. Gopher tortoises are considered a species of high conservation concern in Alabama and are fully protected by law. They are listed as threatened or endangered at the state level in South Carolina, Georgia, Florida, Mississippi, and Louisiana. Some of the other more publicized species for which concern exists include the red-cockaded woodpecker, indigo snakes, red hills salamanders, gopher frogs, Florida mice and several species of pitcher plants. Many declining species are associated with bog, seep, and ephemeral pool microhabitats embedded within the remaining longleaf stands and are found nowhere else.

RESTORATION INITIATIVES

Although recent trends have dealt the longleaf pine ecosystem a heavy blow, all may not be lost. The developing Longleaf Restoration Initiative provides hope that we may not only conserve what remains of the longleaf pine ecosystem but see it

expand. The aforementioned initiative is a joint effort by numerous government and non-government agencies with the shared goal of seeing longleaf pine and its associated ecosystem restored on suitable sites across its historical range. The U.S. Forest Service has made restoration of the mature longleaf pine ecosystem a priority on its lands in the southeastern region. In time, through reforestation of suitable sites to longleaf pine and the reestablishment of a more natural burning regime within existing stands, considerable acreage of mature or maturing longleaf pine habitat may be restored. Also encouraging is the fact that numerous landowner cost-share programs, both state and federal, are prioritizing planting of longleaf pine on sites best suited to them. The Alabama Forestry Commission, the Alabama Department of Conservation and Natural Resources, and the Natural Resource Conservation Service are leaders in this regard. Many non-government agencies such as the Longleaf Alliance are working systematically through research, education, and commercial activities, to promote retention and restoration of longleaf pine on productive sites throughout the southeast. Together, the renewed interest in the longleaf pine and its associated ecosystem, combined with the commitment of those working toward its reestablishment, may well have turned a bleak future several shades brighter for many unique species including the gopher tortoise. 

FOR MORE INFORMATION

Alabama Department of Conservation and Natural Resources
www.outdooralabama.com

Alabama Forestry Commission
www.forestry.alabama.gov

U.S. Forest Service – www.fs.fed.us

Natural Resources Conservation Service – www.nrcs.usda.gov

America’s Longleaf Initiative
www.americaslongleaf.org

Longleaf Alliance
www.longleafalliance.org