

# Silvical Characteristics of Sand Pine


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## SILVICAL CHARACTERISTICS OF SAND PINE

(Pinus clausa, Chapm. Vasey)

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Sand pine (Pinus clausa, Chapm. Vasey) has only recently become one of the important forest trees of the United States; in fact, the largest sand pine concentration in the world is a block of only 280,000 acres in north central Florida. The species is also abundant locally in a narrow strip along the east coast of Florida from St. Augustine southward to Ft. Lauderdale. On the Gulf Coast, the southern limit is in the vicinity of Naples in Collier County. Small tracts of sand pine are found around Tampa and more extensive areas are abundant in western Florida between Panama City and Pensacola, extending westward into Baldwin County, Alabama (fig. 1). Many of Florida's off-shore islands also support sparse stands of sand pine.

### HABITAT CONDITIONS

#### CLIMATIC

The climate in north central Florida is characterized by hot summers with abundant precipitation and mild, rather dry winters. Annual temperature extremes of 15° and 105° F. occur, but they are not common. The average annual temperature is 70°, with an average of 84° in August and 57° in December. A frost-free period of about 275 days is normal. About 60 percent of the annual rainfall of 53 inches falls in the 4 months from June through September.

#### EDAPHIC

Sand pine grows on light, sandy, infertile, and slightly acid soil derived from deep deposits of marine sand and clay. The large block of sand pine in the Ocala National Forest is supported by one geological formation, the Citronelle, which is composed of sand, gravel, and occasional strands of clay. Most of the sand is classified as fine textured and well drained, with three distinct soil series: St. Lucie, Lakewood, and Kershaw. The permanent wilting percentages for these soils are 0.63, 0.65, and 0.73 percent, respectively.<sup>1/</sup>

The sand pine of western Florida grows on shallow littoral deposits which were the bottom of the sea during previous high-water levels.

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<sup>1/</sup> Beal, J. F. A study of the wilting percentages of sandy soils of the Ocala National Forest and their effect on the regeneration of sand pine. Master's thesis, University of Florida. 71 pp. 1951.

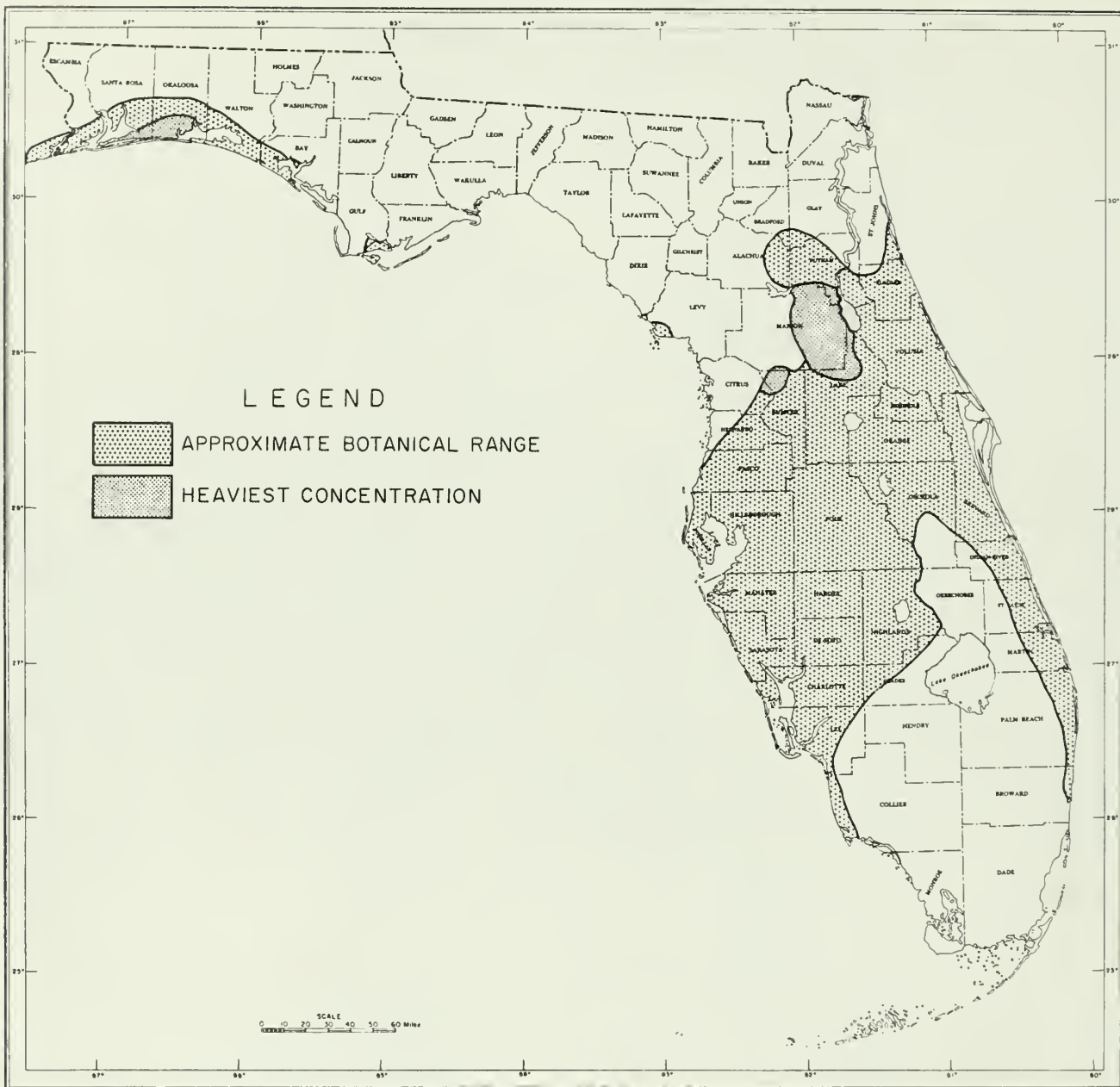


Figure 1.-- Range of sand pine.

Site variation is not significant throughout most of the range of this species.

## PHYSIOGRAPHIC

The north central part of Florida is known as the Central Highlands. This region ranges in altitude from 200 feet to less than 40 feet above sea level. The higher parts, where the depth to ground water is great, are pitted with innumerable sink holes and artesian springs. Gentle rolling hills characterize the bulk of the sand pine terrain.

The western part of Florida, known as the Western Highlands and Coastal Lowlands, support most of the sand pine in that area. An unusual feature of this region is the steepness of the heads of many streams.

## BIOTIC

The sand pine of north central Florida grows in dense, even-aged, pure stands which originated as a direct result of past fires. It is known locally as "Ocala sand pine," and is characterized by serotinous cones which remain tightly closed for many years unless opened by the heat of a wildfire. It is a relatively short-lived tree (70 years maximum) that grows to a height of 70 feet and a normal maximum diameter of 18 inches. It is sometimes found in the longleaf pine-scrub oak type, but is seldom associated with any of the other common southern timber types. Type lines are very pronounced; in many instances roads run along type lines, with sand pine on one side and longleaf on the other.

By contrast, west Florida sand pine, popularly known as "Choctawhatchee sand pine," frequently occurs in uneven-aged stands and often invades oak land. This stand difference is probably caused by the fact that its cones open more readily than those of Ocala sand pine and it does not need killing fires to reproduce itself.

Vegetation commonly associated with sand pine includes rosemary (Ceratiola ericoides), saw-palmetto (Serenoa repens), scrub palmetto (Sabal etonia), Chapman oak (Quercus chapmanii), live oak (Quercus virginiana), sand live oak (Quercus virginiana var. maritima), scrub oak (Quercus myrtifolia), and turkey oak (Quercus laevis). All of these species are in the understory.

The sand pine type, in combinations with other forest types, supports a sizeable population of white-tailed deer (Odocoileus virginianus) and was a popular hunting ground long before it was considered for its wood production. Other animal associates include the black bear (Euarctos floridanus), the gray squirrel (Sciurus carolinensis), the fox squirrel (Sciurus niger), the wild hog (Sus sp.), and the cotton-tail rabbit (Sylvilagus palustris). Common birds include doves (Zenaidura macroura), chewinks (Pipilo erythrophthalmus), blue jays (Cyanocitta cristata), and an occasional wild turkey (Meleagris gallopavo). Seed-eating rodents, particularly the white-footed or deer mice

(Peromyscus floridanus and Peromyscus polionotus), are widespread and have an important bearing on the regeneration of sand pine. Diamond back rattlesnakes (Crotalus adamanteus), coral snakes (Micrurus fulvius), and ground rattlers (Sistrurus miliarius), are the most common poisonous reptiles found in this timber type.

## LIFE HISTORY

### SEEDING HABITS

Flower buds of sand pine are formed early in the summer and become discernible the following December. Pollen usually ripens between December 20 and January 10. Conelets grow very little the first year, but they develop quite rapidly during the spring of the second year and reach mature size by late summer. The seeds, about 75 per cone, ripen in October; viability of fresh seed averages 75 to 80 percent. A pound contains 60,000 to 70,000 seed.

### Seed Production and Dissemination

Sand pine bears cones at an early age and usually produces heavy cone crops every year. Mature cones frequently occur on 5-year-old trees. The species is similar to jack pine (Pinus banksiana) and lodgepole pine (Pinus contorta), in that the cones are very persistent and serotinous. The specific name clausa, meaning closed, refers to this feature (fig. 2).



Figure 2. --The crown of a young sand pine tree loaded with closed cones.

This closed-cone characteristic occurs mostly in the Ocala sand pine growing in peninsular Florida. Unmanaged stands of these trees have in the past regenerated from wildfires. When a killing fire sweeps through such a stand of cone-bearing trees, the cones open and release tremendous quantities of seed. More than one million seed per acre were recorded after one such fire (1). But when a sand pine stand below cone-bearing size is burned, very few seeds are dispersed, and reproduction does not come back. The persistence of closed cones on Ocala sand pine causes an accumulation of cones of many ages on one tree, and the viability of seed in these cones decreases rapidly with age (3); in fact, only 10 to 20 percent of the seed in a 5-year-old cone is viable. Very little sand pine seed is released naturally from standing trees, and the greatest number of viable seed recorded annually was 16,000 per acre, most of which fell during the hottest summer months. Tightly closed cones on the tops of harvested trees, however, open and release their seed when subjected to high surface temperatures (2). The seed so released from sand pine slash is important in obtaining adequate regeneration following harvest cuttings in central Florida.

The situation in western Florida is somewhat different. Here, among the Choctawhatchee sand pine, open cones are much more frequent. Stands of sand pine in west Florida are expanding as a result of fire protection (the same holds true of longleaf islands in the Ocala).

#### SEEDLING DEVELOPMENT

Sand pine seed are often consumed by rodents, principally the white-footed or deer mouse (Peromyscus floridanus), Florida harvester ants (Pogonomyrmex badius), and birds. The influence of these seed eaters is quite important in cutover stands where seed release occurs over an extended period of time. After killing fires, however, complete seed release usually takes place within a month's time in quantities sufficient to satisfy the demands of both regeneration and the seed-eating population.

Another condition limiting sand pine germination and survival is the lethal surface soil temperatures which occur during 8 months of the year. Soil surface temperatures of 162° F. have been recorded during June. Normal germination usually occurs from November through January, when surface temperatures are sublethal, or less than 130° F., as suggested by Haig (4).

Given adequate moisture and favorable germinating temperatures, sand pine seeds usually germinate in 15 days. New radicles dry out easily if temperatures are high and moisture is low; many seed fail to develop into seedlings because of these conditions. Root penetration is quite rapid if the radicles escape these extremes; germinating seed develop a radicle at least 2 inches long within 10 days after emergence. On bare areas, where the soil 2 inches or more below the surface rarely loses enough moisture to reach its wilting point, established seedlings seldom die because of moisture deficiencies. With a normal amount of vegetative competition, however, the increased loss of moisture may result in the death of young, established plants. Young sand pine seedlings are also susceptible to frost damage, damping-off, root rot, and nematode injury.

Germination may occur at almost any time of the year, but many of the seedlings that begin their lives during the hot months of the year succumb. Even after the heavy seedfall of a killing spring fire, successful seedling establishment does not usually occur until November or December.

Seedlings usually experience two growth spurts each year; the first takes place in March and April and the second late in the summer, usually September. Height growth varies considerably but may be as much as 24 inches annually. A normal 3-year-old seedling with little competition will average about 3 feet in height.

Sand pine seedlings are not easily transplanted, although once established they become quite hardy. Root disturbance and the other shocks which accompany lifting and planting usually result in early mortality. Under the best of conditions, survival will not average much above 50 percent. Competition for moisture may be one of the determining factors, however, since acceptable survivals have been obtained from plantings on cleared ground. Young seedlings often suffer deer browsing, which induces excessive branching. Since young sand pine trees develop into nice Christmas trees, there is considerable interest in growing them for such a crop.

#### SAPLING STAGE TO MATURITY

After establishment, sand pine is quite resistant to temperature extremes, drought, insects, and disease. The trees often develop a lean from high winds, but uprooting is not common. Sand pine trees are, however, easily killed by fires, and wildfires in the sand pine type are difficult to control. Hot ground fires with accompanying needle scorch kill as readily as do true crown fires. Fires move rapidly in dense stands with relatively little ground fuel, as well as where there is an accumulation of inflammable material. In fact, most of the disastrous burns have occurred in well-stocked stands, where the fire moves from crown to crown with astonishing speed.

Because of the closed-cone characteristic of the sand pine trees of central Florida, clear-cutting during the summer, fall, and early winter is the most feasible way of obtaining natural reproduction. The cones lying close to the ground on slash from felled trees will open, releasing seed at a time when soil moisture and ground temperatures are favorable for germination and establishment. Mechanical ground scarification and partial logging and scattering of cone-bearing branches from the tops of harvested trees usually improves stocking and distribution.

The stands of western Florida are more adapted to conventional methods of cutting.

Sand pine is not highly susceptible to diseases. Round galls (Cronartium cerebrum) are common, but seldom serious. Mature trees are subject to red-heart (Fomes pini), especially where large branch stubs are common.

The black turpentine beetle (Dendroctonus terebrans), southern pine beetle (Dendroctonus frontalis), and Ips engraver beetles (Ips sp.) may cause mortality of sand pine, particularly in trees injured or weakened by fire or lightning. Insect borers such as the southern pine sawyer (Monochamus titillator) also may quickly invade weakened trees. The red-headed pine sawfly (Neodiprion lecontei) occasionally defoliates sand pine, and pitch moth larvae (Dioryctria sp.) frequently damage twigs and cones.

### Growth and Yield

Sand pine is often described as "scrub pine" because of its poor form, but under certain conditions it grows well and develops into a good pulpwood tree. Although an occasional tree on better sites will grow to a diameter of 26 inches and a height of 75 feet, smaller sizes are more common (fig. 3). As a result, most of the trees are cut for pulpwood and used to make sulphate pulp. Sand pine lumber is susceptible to early decay when exposed to the elements, but it may be used for interior work where strength is not of primary importance.



Figure 3. --Dense stand of 35- to 40-year-old sand pine on an average site on the Ocala National Forest.

On the best sites, site index 70, the trees should average 16 to 18 inches in diameter and 70 feet in height at maturity. On average sites, site index 60, the trees should average 12 to 13 inches in diameter and 60 feet in height at maturity. On the poor sites, site index 50, the trees should average 8 to 10 inches in diameter and 50 feet in height at maturity.

Estimates of yield are guesses, since very few sand pine stands have been managed for optimum yields. Yields of 20, 15, and 10 cords per acre are predicted for high, average, and poor sites, respectively, at 40 to 45 years (rotation age) in well-stocked stands. Stands tend to break up considerably after they reach 50-60 years of age. Yields for sand pine plantations on the same sites are expected to exceed these figures, but none of the plantations has reached merchantable size to date.

### Reaction to Competition

Sand pine has been rated as moderately intolerant, but in its early establishment it is rather tolerant to shade and competition, becoming more intolerant with age. It expresses very little dominance in its usual growth pattern.

### SPECIAL FEATURES

The closed-cone characteristic and its regeneration capacity following a killing wildfire are sand pine's only claim to fame. Its adaptability to severe sites, however, brands it as a possibility for other dry, unproductive sites in the South. If and when its transplanting difficulties are overcome, this possibility may become a reality.

### RACES

The sand pines of western Florida, particularly those between Panama City and Pensacola, are characterized by open cones. Instead of the dense, even-aged, closed-cone stands of eastern Florida, the stands are more uneven-aged, the trees are less crowded, and good reproduction can be found in the openings. No morphological differences have been found between the sand pine trees from those two geographic areas in Florida, but common names to distinguish the races are in use (5). The typical sand pine with closed cones is called Ocala sand pine or Ocala race; the sand pine of western Florida with open cones is called Choctawhatchee sand pine or Choctawhatchee race.

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