Pinus glabra Walt. Spruce Pine

Pinaceae Pine family

Susan V. Kossuth and J. L. Michael

Spruce pine *(Pinus glabra)*, also called cedar pine, Walter pine, or bottom white pine, is a medium-sized tree that grows in limited numbers in swamps, river valleys, on hummocks, and along river banks of the southern Coastal Plain. Its wood is brittle, close-grained, nondurable, and is of limited commercial importance.

Habitat

Native Range

Although spruce pine (fig. 1) is considered a minor southern yellow pine species, it grows in a wide band across the South. It can be found on the low coastal areas from the valley of the lower Santee River in eastern South Carolina, south to the middle of northwest Florida, and west to the valley of Pearl River in eastern Louisiana *(14)*. The natural range lies between latitudes 29° to 33° N. and longitudes 78° to 91° W. *(2)*.

Climate

In the Southeastern United States where spruce pine grows, the climate is characterized by long, hot, humid summers and mild winters. Annual rainfall is about 1270 mm (50 in), which is normally distributed about evenly throughout the year. Fall tends to be the driest season but summer droughts can occur. The growing season is about 240 days and the average annual temperature is 16° C (61° F).

Soils and Topography

Spruce pine grows on acidic sandy loam soils high in organic matter, intermediate between dry sandy soils and alluvial bottom land *(3)*. It grows well on poorly drained areas, often having a high water table, that are intermittently waterlogged, and may be found along stream banks or on rich moist hummocks *(6)*. These soils are most commonly found in the orders Spodosols and Entisols.

The authors are formerly Chief Plant Physiologist, Southeastern Forest Experiment Station, Asheville, NC, and Research Forester, Southern Forest Experiment Station, New Orleans, LA.

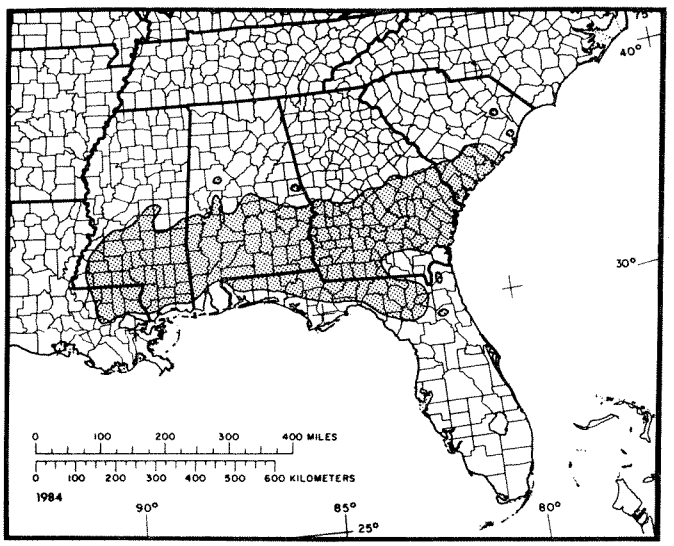

Figure 1—*The native range of spruce pine.*

Associated Forest Cover

Spruce pine is not commonly found in pure stands. More often it is established in the shade of hardwoods such as magnolia *(Magnolia* spp.), gum *(Nyssa* spp.), hickory *(Carya* spp.), beech *(Fagus* spp.), and oak *(Quercus* spp.), where it may eventually overtop them. The forest cover types in which spruce pine is included *(5)* are Loblolly Pine–Shortleaf Pine (Society of American Foresters Type 80), Loblolly Pine (Type 81), Loblolly Pine–Hardwood (Type 82), Slash Pine (Type 84), and Slash Pine–Hardwood (Type 85). Other trees with which it is associated include pine *(Pinus* spp.), elm *(Ulmus* spp.), holly *(Ilex* spp.), cherry *(Prunus* spp.), hawthorn *(Crataegus* spp.), fringetree *(Chionanthus virginicus)*, sweetgum *(Liquidambar styraciflua)*, sassafras *(Sassafras albidum)*, red maple *(Acer rubrum)*, yellow-poplar *(Liriodendron tulipifera)*, pondcypress *(Taxodium distichum* var. *nutans)*, loblolly-bay *(Gordonia lasianthus)*, southern redcedar *(Juniperus silicicola)*, flowering dogwood *(Cornus florida)*, sourwood *(Oxydendrum arboreum)*, redbay *(Persea borbonia)*, and sweetleaf *(Symplocos tinctoria)*. Shrubs and woody vine associates include beautyberry *(Callicarpa americana)*, southern bayberry *(Myrica cerifera)*, inkberry *(Ilex glabra)*, sweet pepperbush *(Clethra alnifolia)*, Alabama supplejack *(Berchemia scandens)*, blueberry *(Vaccinium* spp.), poison-ivy

1991. In: Silvics of North America I. Conifers. Agric. Handb. 654. Washington, DC: U.S. Department of Agriculture: 355-358.

(Toxicodendron radicans), greenbriar *(Smilax* spp.), blackberry (*Rubus* spp.), and grape (*Vitis* spp.).

Life History

Reproduction and Early Growth

Flowering and Fruiting—Spruce pine trees generally begin producing cones by age 10. They are most prolific between the ages of 20 to 40 years *(14)*. The trees are monoecious, with pollen cones on weaker branches below the seed cones. First-year seed conelets appear in March in the northern parts of its distribution in Mississippi and somewhat earlier farther south.

Seed Production and Dissemination—Second-year cones mature during September and October and seeds are disseminated during November. When ripe, cones are green and have a specific gravity of 0.88. Test results show seeds are mature and germinable when the cones float in SAE 20-weight motor oil. Filled seeds sink in absolute ethanol, and empty or partially filled seeds float. Cleaned seeds are small, ranging from 88,180 to 114,640/kg (40,000 to 52,000/lb) and average 101,410/kg (46,000/lb). Seeds at a moisture content of between 5 and 10 percent have been stored for as long as 10 years at −17.8° to −15.0° C (0° to 5° F) and remained viable *(16)*.

Seedling Development—Seeds are not highly viable if the trees are isolated and poorly pollinated. Stratification improves seed germination *(11)*. Sixty percent germination can usually be attained after only 7 days of stratification at 4° C (39° F) *(3)*; however, the recommended cold stratification regime is 0.6° to 5.0° C (33° to 41° F) for 28 days *(16)*.

Germination is epigeal *(16)*. Seedlings develop well in shade of hardwoods and other pines, forming a wide-spreading, lateral taproot near the surface before penetrating deep into the soil *(14)*. When it invades old or cleared fields it may become established in the shade of loblolly and shortleaf pines *(10)*. Natural inoculation with mycorrhizae is highly beneficial to seedling establishment *(3)*.

Vegetative Reproduction—There is no published information on spruce pine vegetative reproduction. The species has been used experimentally as a rootstock for loblolly pine scions. Seed cone reproduction was greater when spruce pine was the rootstock than when loblolly pine was the rootstock *(15)*.

Figure 2—*A spruce pine 61 cm (24 in) in d.b.h. growing in a natural stand in Escambia County, FL.*

Sapling and Pole Stages to Maturity

Growth and Yield—Spruce pine (fig. 2) is one of the larger eastern North American pines, reaching a maximum of 38.1 m (125 ft) in height and 122 cm (48 in) in d.b.h. They are full grown at 60 to 75 years, and as a scattered tree, often grow to a height of 27.4

to 30.5 m (90 to 100 ft) with a d.b.h. of 61 to 91 cm (24 to 36 in) *(8)*. The largest living spruce pine presently recorded measures 128 cm (50.3 in) in d.b.h. and 37.5 m (123 ft) in height. In a stand environment, spruce pine self-prunes to a height of 15.2 to 18.3 m (50 to 60 ft) *(14)*.

Its greatest commercial importance is in Louisiana, south Alabama, and Mississippi, where 80 percent of the standing volume is found *(18)*. Although it is not of great importance regionally, it can support a small, local forest industry. Some spruce pine has been planted on a small scale in South Carolina *(4)*. The volume of growing stock on commercial forest land is estimated at 13 131 000 m^3 (464 million ft^3) and the volume of sawtimber at 56 600 000 m^3 (2 billion ft^3).

Little growth and yield data are available, but estimates of different growth rates have been made on 12 trees in fast growth sites and 12 trees in slow ones within the natural range (table 1) *(8)*.

Rooting Habit—Spruce pine has a moderately deep taproot augmented by numerous moderately deep lateral roots.

Reaction to Competition—Little is known about spruce pine's ability to compete for minerals and water. Although it is classed as very shade tolerant, it is a slow grower under heavy competition. When planted with sweetgum and Shumard oak *(Q. shumardii)* on a bottom land site near Charleston, SC, spruce pine did not perform as well as sweetgum but grew slightly better than the Shumard oak. Seedling survival following the first growing season was similar for all three species (more than 90 percent), but by the end of five growing seasons, herbaceous vine and brush competition effects were reflected in overall survival and growth. Sweetgum had a 91 percent survival and grew best (4.1 m, 13.4 ft) on this site, while Shumard oak demonstrated higher survival than did spruce pine (72 percent vs. 48 percent) but did not grow as well (1.68 m vs. 2.38 m, 5.5 ft vs. 7.8 ft) *(19)*. Because of its shade tolerance, spruce pine may be able to compete successfully on cutover lands where other southern pines are unsuccessful *(9)*.

Table 1—Growth rate and age class for spruce pine *(8)*

Growth rate and age class	Growth rate	D.b.h.	Tree height
yr	*rings/cm*	*cm*	*m*
Slow			
15	3.3	12.4	11.6
30	3.7	17.0	15.4
45	3.7	26.9	20.6
Fast			
15	1.8	20.3	14.9
30	1.9	30.7	21.5
45	2.1	42.9	25.5
yr	*rings/in*	*in*	*ft*
Slow			
15	8.4	4.9	38.0
30	9.4	6.7	50.5
45	9.5	10.6	67.5
Fast			
15	4.6	8.0	49.0
30	4.8	12.1	70.5
45	5.3	16.9	83.5

Damaging Agents—Because spruce pine is usually found dispersed, it is less susceptible to insect and disease damage than are the other southern pines. It is immune to infection by *Cronartium quercuum* f. sp. *fusiforme (13)* and is only known to be susceptible to *Cronartium comandrae* when planted outside its native range. Similarly, the Nantucket pine tip moth *(Rhyacionia frustrana)*, can cause severe damage to spruce pine planted outside its range but is not considered a problem within its range *(17)*. A gall mite *(Trisetacus floridanus)*, attacks terminal shoots and causes the formation of galls and shortening of the shoot. No control is known for this insect.

Spruce pine at any age is highly susceptible to fire because of its thin bark (6.4 to 9.7 mm; 0.25 to 0.38 in). In the crown the bark is smooth and light gray, becoming darker with slightly irregular, shallow fissures with flat connecting ridges on mature boles. The ridges develop into small, closely appressed, light reddish brown scales. This finely furrowed bark is not at all plated like other southern pines but more closely resembles that of southern red oak.

Special Uses

Wood of this species is brittle and close-grained, has few resin canals, and is not durable *(14)*. The average shear strength parallel to the grain exceeds that of Douglas-fir *(Pseudotsuga menziesii)* and loblolly pine. Other structural features are similar to white fir *(Abies concolor)*. It is low in strength, with a specific gravity of 0.443 *(20)*.

The average fiber length is two-thirds of that of other southern pines but pulping characteristics are similar. It can be used as it occurs naturally for pulping operations, although use in large quantities for papermaking might require some operational changes to meet strength requirements *(9)*.

Spruce pine responds to treatment with paraquat by producing lightwood, that is, wood soaked with oleoresin. Its response is similar to that of slash pine, and the increase in turpentine produced is proportionately greater than the increase in resin acids *(12)*.

Spruce pine is planted to some extent for use as a Christmas tree. Productivity is about half that of the more popular Virginia pine, and two shearings per growing season are a necessity in southeastern Louisiana *(7)*.

As a member of mixed pine–hardwood communities it provides some habitat and food for wildlife.

Genetics

Wood specific gravity showed no trends in any of the four compass directions over the range. A few trees on plots near the Atlantic and Gulf Coasts had higher specific gravities (0.44 to 0.50) than did those inland (0.40 to 0.46) *(20)*.

Spruce pine has been successfully crossed with shortleaf pine but only when the latter was the female parent *(1)*. No natural hybrids have been reported.

Literature Cited

1. Critchfield, W. B. 1962. Hybridization of the southern pines in California. *In* Proceedings, Forest Genetics Workshop. p. 40–48. Sponsored Publication 22 of the Southern Forest Tree Improvement Committee, Macon, GA.
2. Critchfield, W. B., and E. L. Little, Jr. 1966. Geographic distribution of the pines of the world. U.S. Department of Agriculture, Miscellaneous Publication 991. Washington, DC. 97 p.
3. Dial, S. C., W. T. Batson, and R. Stalter. 1976. Some ecological and morphological observations of *Pinus glabra* Walter. Castanea 41:361–377.
4. Dorman, Keith W. 1976. The genetics and breeding of southern pines. U.S. Department of Agriculture, Agriculture Handbook 471. Washington, DC. 407 p.
5. Eyre, F. H., ed. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 p.
6. Grimm, W. C. 1962. The book of trees. Hawthorn Books, New York. 487 p.
7. Hu, S. C., and Conrad W. Brewer. 1978. Shearing is a necessary cultural practice for Virginia pine Christmas tree production. Southern Journal of Applied Forestry 2:135–136.
8. Koch, P. 1972. Utilization of the southern pines. vol.1. The raw material. U.S. Department of Agriculture, Agriculture Handbook 420. Washington, DC. 734 p.
9. Koch, R. O., J. E. Sapp, and R. L. McCray. 1958. Kraft pulping of spruce pine. Tappi 41:349–353.
10. Manwiller, F. G. 1972. Wood and bark properties of spruce pine. USDA Forest Service, Research Paper SO–78. Southern Forest Experiment Station, New Orleans, LA. 25 p.
11. McLemore, B. F., and J. P. Barnett. 1967. Effective stratification of spruce pine seed. Tree Planters' Notes 18:17–18.
12. Peters, William J., and Donald R. Roberts. 1976. Paraquat-induced lightwood develops in all southern pines. *In* Proceedings, Lightwood Research Coordinating Council. p. 55–56. Mary H. Esser, ed.
13. Powers, H. R., Jr. 1975. Relative susceptibility of five southern pines to *Cronartium fusiforme*. Plant Disease Reporter 59:312–314.
14. Sargent, C. S. 1947. The silva of North America. vol. 11. Coniferae. p. 131–132. Peter Smith, New York.
15. Schmidtling, R. C. 1973. Rootstock influences early fruitfulness, growth, and survival in loblolly pine graft. *In* Proceedings, Twelfth Southern Forest Improvement Conference. p. 86–90.
16. Schopmeyer, C. S., tech. coord. 1974. Seeds of woody plants in the United States. U.S. Department of Agriculture, Agriculture Handbook 450. Washington, DC. 883 p.
17. Scriven, G. T., and Robert F. Luck. 1980. Susceptibility of pines to attack by the Nantucket pine tip moth in southern California. Journal of Economic Entomology 73:318–320.
18. Sternitzke, H. S., and T. C. Nelson. 1970. The southern pines of the United States. Economic Botany 24:142–150.
19. Stubbs, J. 1963. Survival and growth of sweetgum, Shumard oak and spruce pine planted on a creek bottom site in the Carolina coastal plain. Journal of Forestry 61:386–388.
20. Taras, M. A., and J. R. Saucier. 1968. Wood density surveys of the minor species of yellow pine in the eastern United States. Part I. Spruce pine (*Pinus glabra* Walt.). USDA Forest Service Research Paper SE–34. Southeastern Forest Experiment Station, Asheville, NC. 15 p.