

The Pines of Virginia: Identification, Distribution and Ecology

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ABSTRACT

The genus *Pinus* in Virginia is represented by eight native species: *P. echinata*, *P. palustris*, *P. pungens*, *P. rigida*, *P. serotina*, *P. strobus*, *P. taeda*, and *P. virginiana*. In addition, *P. resinosa* and *P. sylvestris*, occasionally escaped from cultivation and (or) widely planted, are introduced pines most likely to be encountered in the field. A key to the identification of the native and common introduced pines of Virginia, with notes on their ecology and distribution in the state, is presented.

INTRODUCTION

Pines (genus *Pinus* L.) are a conspicuous and important component of the woody flora of Virginia. Found throughout the state, pines are the most prominent conifers both ecologically and economically, playing major roles in forest succession and recovery of forests after disturbance (McQuilken, 1940), and providing the basis for a considerable forest products industry (Virginia Division of Forestry, 1980; Waghorne, 1983). Eight species of pines occur naturally in Virginia (Massey, 1961; Mazzeo, 1972; Harvill, *et al.*, 1986): *Pinus echinata*, *P. palustris*, *P. pungens*, *P. rigida*, *P. serotina*, *P. strobus*, *P. taeda*, and *P. virginiana*. In addition, many introduced species are cultivated as ornamentals (*e.g.*, Mazzeo, 1966, 1972), but only two, *P. resinosa* and *P. sylvestris*, occasionally naturalized and (or) widely planted (Gleason and Cronquist, 1963), are most likely to be encountered in the field. As a detailed guide to the field identification and ecology of the pines of Virginia, I have compiled a key to the identification of native and common introduced species and provide notes on their distribution and ecology. The key has been compiled from Gleason and Cronquist (1963), Preston (1976) and Elias (1980). Information on the distribution of pines in Virginia is based on Massey (1961) and Harvill *et al.*, (1986) and is presented by physiographic provinces as recognized by Hoffman (1969). For more detailed information on the distributions of the pines listed below, the reader should consult Fowells (1965) Critchfield and Little (1966) and especially in Virginia, Harvill *et al.*, (1986). Information on the ecology of native pines has been gleaned from various literature sources and personal observations. Notes on the ecology of *P. resinosa* and *P. sylvestris* are not presented; information on the ecology of these introduced species can be acquired from Fowells (1965) and Mirov (1967).

THE GENUS *PINUS* L. - PINES

The genus *Pinus* L. consists of over 90 species worldwide, almost all of which are entirely restricted to the Northern Hemisphere (Little and Critchfield, 1969). *Pinus* belongs to the family Pinaceae which also includes five other genera in North

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America: *Abies* Mill. (firs), *Larix* Mill. (larches), *Picea* A. Dietr. (spruces), *Pseudotsuga* Carr. (Douglas firs), and *Tsuga* (Endl.) Carr. (hemlocks) [Preston, 1976; Elias, 1980; Gleason and Cronquist, 1963; see Mazzeo (1972) for information on these and other gymnosperm genera in Virginia]. Major morphological characteristics of the genus include: 1) linear or needle-like evergreen leaves, usually spirally arranged, fascicled, and enclosed at the base by a sheath; 2) separate male and female strobili (cones); male cones borne in fascicles at the end of the current years growth; female cones woody, maturing in two or three years; 3) two naked seeds subtended by each ovuliferous scale; and 4) generally excurrent, arborescent growth form, small to large in size (Preston, 1976; Benson, 1979; Gleason and Cronquist, 1963).

KEY TO THE PINES OF VIRGINIA

- 1. Leaves in clusters of 5, each having 1 fibrovascular bundle; leaves 8-13 cm long, pale green, glaucous; cones 10-15 cm long, cylindrical; cone scales lacking spines; medium to tall tree (30-70 m) (1.) *P. strobus*
- 1'. Leaves in clusters of 2 or 3, each having 2 fibrovascular bundles 2
- 2. Leaves in clusters of 2 3
- 2'. Leaves in clusters of 3, or of 2 and 3 on the same tree . . . 6
- 3. Cone scales lacking spines 4
- 3'. Cone scales with a terminal spine 5
- 4. Leaves 9-16 cm long, dark green, slender, soft; cones 4-8 cm long, conic-ovoid; medium tree (20-30 m) . . (2.) *P. resinosa*
- 4'. Leaves 2-7 cm long, bluish-green, stiff, often twisted; cones 3-6 cm long, reflexed, short ovoid to oblong; flattened cone scales often pyramidally thickened; bark distinctly orange-colored; medium tree (30-35 m) . . . (3.) *P. sylvestris*
- 5. Cone scales thick, armed with an upcurved spine 3-8 mm long; cones 5-10 cm long, conic-ovoid, usually serotinous, accumulating on branches for several years; leaves 4-7 cm long, dark green, stiff, usually twisted; small to medium tree (3-20 m) (4.) *P. pungens*
- 5'. Cone scales thin to moderately thickened, with slender curved spine; cones 4-7 cm long, ovoid-conic, persistent; young branches often purplish-brown to purplish-gray; branches persistent, often accumulating on trunks; leaves 4-7 cm long, dark green, flexible; small to medium tree (10-15 m) (5.) *P. virginiana*
- 6. Leaves in clusters of 3 7
- 6'. Leaves in clusters of 2 and 3 on same tree 10
- 7. Cones 7 cm or more in length, much longer than broad . . 7
- 7'. Cones not greater than 7 cm in length, broader than long . 8

8. Leaves 20-50 mm long, light green, soft; cones 15-25 cm long, ovoid-cylindric; young branches stout, with leaves in dense tufts at ends; medium to tall tree (30-40 m) (6.) *P. palustris*
- 8'. Leaves 14-25 cm long, dark green, flexible; cones 7-13 cm long, oblong-conic; young branches moderately slender; medium to tall tree (25-40 m) (7.) *P. taeda*
9. Leaves 15-25 cm long, dark green flexible; cones 4-6 cm long, globose-ovoid, often serotinous, accumulating on branches for several years; spines on cone scales weak, deciduous; medium tree (8.) *P. serotina*
- 9'. Leaves 7-12 cm long, dark green, stiff; cones 4-7 cm long, conic-ovoid; cone scales with stiff curved spines; small to medium tree (15-30 m) (9.) *P. rigida*
10. Leaves 7-12 cm long, dark green, soft, flexible; cones 4-6 cm long, ovoid to ovoid-conic; cone scales thin with small spines; medium to tall tree (25-35 m) (10.) *P. echinata*

1. *Pinus strobus* L. - White pine

Distribution: *Pinus strobus* primarily occurs in the Blue Ridge, Ridge and Valley, and Cumberland Mountain Physiographic Provinces and is less common in the Piedmont. It is also widely planted throughout the state. Ecology: *Pinus strobus* is a moderately shade tolerant pine, growing on a wide variety of soils but generally occurring on submesic to mesic sites characterized by acidic, low fertility soils or moist loamy soils (Whittaker, 1956; Massey, 1961; Fowells, 1965; Johnson and Ware, 1982; McCune, 1988). *Pinus strobus* may assume several roles in forest succession depending on site: as a pioneer in old field succession or an early colonizer after fire, as a long-lived intermediate stage species, or as a topographic or edaphic climax species (Cope, 1932; Wood, 1932; Minckler, 1946; Fowells, 1965; Holla and Knowles, 1988). *Pinus strobus* stands often originate as a result of fire although young trees often die following fire (Fowells, 1965), which greatly reduces regeneration (Cope, 1932). Resistance to fire, however, increases with age (Fowells, 1965). On favorable sites in portions of its range, *P. strobus* may be self-maintaining, continually reproducing in the absence of exogenous disturbance (Fowells, 1965; Holla and Knowles, 1988). Self-maintaining populations of *P. strobus* have not been reported from Virginia.

2. *Pinus resinosa* Ait. - Red pine, Norway pine

Distribution: Introduced to Virginia and widely planted as an ornamental and in forest plantations (Mazzeo, 1972), particularly in the Ridge and Valley (C. E. Williams, pers. obs.). A component of the Northern Hardwoods Forest Region of northeastern North America, *P. resinosa* reaches its southernmost natural limit in the mountains of eastern West Virginia (Stephenson, *et al.*, 1986).

3. *Pinus sylvestris* L. - Scots pine, Scotch pine

Distribution: Native to Eurasia. *Pinus sylvestris* is widely planted as an ornamental and is sometimes escaped from cultivation (Gleason and Cronquist, 1963; Mazzeo, 1972).

4. *Pinus pungens* Lamb. - Table mountain pine

Distribution: Considered an Appalachian endemic (Zobel, 1969), *Pinus pungens* is found primarily in the Blue Ridge and Ridge and Valley Physiographic Provinces but also occurs infrequently in the Piedmont, chiefly on river bluffs (Zobel, 1969). Ecology: *Pinus pungens* commonly grows on dry, mid to high elevation mountain slopes and ridgetops, where it may produce self-maintaining or nonsuccessional populations (Zobel, 1969; Barden, 1977, 1988; Whittaker, 1956, 1979; Williams, 1990). *Pinus pungens* also colonizes more mesic sites following fire, but the low availability of suitable seedling habitat and competition with shade tolerant hardwoods greatly limits regeneration in the absence of fire (Williams, 1989, 1990, 1991; Williams and Johnson, 1990; Williams, *et al.*, 1990). Cones of *P. pungens* are typically serotinous throughout the range of this species (Zobel, 1969), although they may open at relatively low ambient temperatures [ca. 30°C (McIntyre, 1929)] allowing seeds to be dispersed year-round (Williams, 1989). *Pinus pungens* may be decreasing in importance in forests of the southern Appalachians primarily a result of human-altered fire frequency (Harmon, 1982; White, 1987).

5. *Pinus virginiana* Mill. - Virginia pine, scrub pine

Distribution: *Pinus virginiana* occurs statewide but is most common in the upper Piedmont (McQuilken, 1940), Coastal Plain (Rice and Ware, 1983) and mountains. Ecology: *Pinus virginiana* is an early invader of abandoned fields in the upper Piedmont (McQuilken, 1940) and lower elevation mountains (Whittaker, 1956; C. E. Williams, pers. obs.), and rapidly colonizes sites disturbed by logging in the Coastal Plain of Virginia (Monette and Ware, 1983; Rice and Ware, 1983). It is tolerant of dry, nutrient-poor sites (Fowells, 1965), often growing on exposed shale outcrops and barrens in Virginia (C. E. Williams, pers. obs.) and heath balds of the southern Appalachians (Whittaker, 1956, 1979). Stands of *P. virginiana* on former farmlands are dense and even-aged, sometimes exceeding 3000 stems per hectare (Fowells, 1965). Typically cone production is limited until the stand ages and density decreases. Seedlings are very intolerant of shade (Fowells, 1965). *Pinus virginiana* is less tolerant of fire than many other pines of the eastern United States; thin bark and low sprouting ability render trees and seedlings vulnerable to fire and limit postfire recovery (Fowells, 1965; Zobel, 1969).

6. *Pinus palustris* Mill. - Longleaf pine

Distribution: *Pinus palustris* is limited to the extreme southeastern Coastal Plain of Virginia, the northernmost portion of the range of this species. Ecology: *Pinus palustris* usually grows on dry to mesic sand ridges in Virginia (Frost and Musselman, 1987) and is a characteristic species of the sandhill, pine savanna, and palmetto flatwoods communities in the Coastal Plain of the southeastern United States (Fowells, 1965; Christensen, 1979; Myers, 1985; Natural Areas Journal, 1989). Reproduction of *P. palustris* is enhanced by fire and recent evidence suggests that this species may possess certain traits that facilitate ground fires, thus favoring its reproduction over other trees, particularly hardwoods (Williamson and Black, 1981; Platt, *et al.*, 1988). Seedlings of *P. palustris* remain in a "grass stage" for three or more years during which height growth is suppressed but root growth is extensive (Fowells, 1965; Barbour, *et al.*, 1980). Long, slender, drooping needles protect the meristematic region of the grass stage seedling from heat damage due to fire (Barbour, *et al.*, 1980). *Pinus palustris* was probably more abundant in Virginia and other parts of its range prior to European settlement but extensive lumbering,

boxing for turpentine, grazing, and fire suppression contributed to the decline of this species (Frost and Musselman, 1987; Noss, 1988). Due to its limited distribution in Virginia, *P. palustris* has been officially listed as a species of special concern (Terwilliger, 1989).

7. *Pinus taeda* L. - Loblolly pine

Distribution: *Pinus taeda* occurs in the Coastal Plain and Piedmont Physiographic Provinces and is widely planted for timber and pulpwood. Ecology: *Pinus taeda* tolerates a wide variety of sites but grows best in poorly drained soils (Fowells, 1965). *Pinus taeda* is a characteristic secondary successional species in the Coastal Plain and Piedmont, often colonizing fields in the first year after abandonment and dominating pine reproduction in old fields (McQuilken, 1940; Spring, *et al.*, 1974; Monette and Ware, 1983; Rice and Ware, 1983; Christensen and Peet, 1984). However *P. taeda* is generally replaced in time by more tolerant hardwoods (Harcombe and Marks, 1978; Felix, *et al.*, 1983). Regeneration of *P. taeda* is favored by disturbances that expose mineral soil, including fire and logging, and heavy litter accumulations greatly reduce seedling establishment (Trousdel, 1950). *Pinus taeda* is extensively planted on converted second growth forests in the Piedmont of Virginia where it does not regenerate naturally (Felix, *et al.*, 1983).

8. *Pinus serotina* Michx. - Pond pine

Distribution: *Pinus serotina* occurs only in the southeastern Coastal Plain, especially in the Dismal Swamp (Dean, 1969). Ecology: *Pinus serotina* grows in poorly drained, wet soils and is a characteristic species of pocosin communities in the Coastal Plain of the southeastern United States (Woodwell, 1958; Fowells, 1965; Christensen, 1979) including Virginia. Fire is crucial for the regeneration of *P. serotina*, since it exposes mineral soil, reduces competition from other trees and shrubs, and facilitates dispersal of seeds from serotinous cones (Crutchfield and Trew, 1961; Fowells, 1965). Cone serotiny, however, varies considerably among populations (Smouse and Saylor, 1973). *Pinus serotina* sprouts vigorously when injured and most reestablishment following fire is by vegetative sprouting (Christensen, 1979). Because of its limited distribution in Virginia, *P. serotina* has been officially listed as a species of special concern (Terwilliger, 1989).

9. *Pinus rigida* Mill. - Pitch pine

Distribution: *Pinus rigida* primarily occurs in the Blue Ridge, Ridge and Valley, Appalachian Plateau, and Cumberland Mountain Physiographic Provinces and is less common in the Piedmont where it grows on river bluffs (Zobel, 1969). Ecology: *Pinus rigida* principally grows on mid-elevation ridgetops and mountain slopes of southerly aspect, often replaced by *P. pungens* at higher elevations and *P. virginiana* at lower elevations (Whittaker, 1956; Massey, 1961; Fowells, 1965; Zobel, 1969; Ross, *et al.*, 1982; Johnson and Ware, 1982; Williams and Johnson, 1990). Regeneration of *P. rigida* is usually facilitated by fire; poor seedbed conditions, particularly heavy litter accumulations, restrict establishment of *P. rigida* seedlings in the absence of fire (Bramble and Goddard, 1942; Fowells, 1965). *Pinus rigida* recovers quickly from fire-induced injury by vegetative sprouting; dormant buds, shielded by thick bark, assume active growth when stimulated (Ledig and Little, 1979). Seedlings of *P. rigida* typically have a basal crook of the stem that insulates dormant buds from fire by bringing them in close contact with mineral soil (Little and Somes, 1956). Cone serotiny occurs sporadically among *P. rigida* populations, particularly

in the northern part of its range (Ledig and Little, 1979; Selender, 1980), but has been reported in a Virginia population (Smouse and Saylor, 1973).

10. *Pinus echinata* Mill. - Shortleaf pine

Distribution: *Pinus echinata* is most common in the Coastal Plain and Piedmont and occurs locally in the Blue Ridge, Ridge and Valley, and Cumberland Mountain Physiographic Provinces. Ecology: *Pinus echinata* frequently occurs on mesic, well-drained sites but will grow on a variety of soils and sites (Minckler, 1946; Fowells, 1965; Walker and Wiant, 1966) including mid-Appalachian shale barrens in Virginia (Platt, 1951). In the Piedmont of Virginia and North Carolina, *P. echinata* is often associated with *P. taeda*; one or both species is usually the first to invade abandoned fields (McQuilken, 1940). However postlogging succession in the Coastal Plain of Virginia favors *P. virginiana* and, to a lesser extent, *P. taeda* but not *P. echinata* (Monette and Ware, 1983; Rice and Ware, 1983). Regeneration of *P. echinata* may be favored by fire. In some areas of the southeastern Coastal Plain, *P. echinata* may produce large, even-aged stands following fire (Fowells, 1965; Walker and Wiant, 1966). *Pinus echinata* sprouts profusely after fire; this attribute, thick bark, and the insulating basal crook of seedlings, allows virtually all age classes of *P. echinata* to survive repeated fires of moderate intensity (Jemison, 1943; Little and Somes, 1956; Fowells, 1965).

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