

Halesia Carolina L. Carolina Silverbell

Styracaceae Storax family

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Carolina silverbell (*Halesia carolina*) is common and reaches its greatest size in the southern Appalachian Mountains where it is called mountain silverbell. This attractive shrub or small tree, also called snowdrop-tree or opossum-wood, grows in moist soils along streams in the understory of hardwood forests. It has a moderate growth rate and lives about 100 years. The wood is soft and close-grained and a favorite wood for crafts. The white bell-shaped flowers and small size make it a desirable tree for landscaping. The seeds are eaten by squirrels and the flowers provide honey for bees.

Habitat

Native Range

Carolina silverbell (fig. 1) grows mostly in the Piedmont and mountains of the Carolinas, eastern Tennessee, Georgia, and Alabama. Its distribution extends beyond this central area, however, in small populations scattered over the southeastern Coastal Plain, western Virginia, West Virginia, southern Ohio, southern Indiana, southern Illinois, Kentucky, Tennessee, central Arkansas, and southeastern Ok-

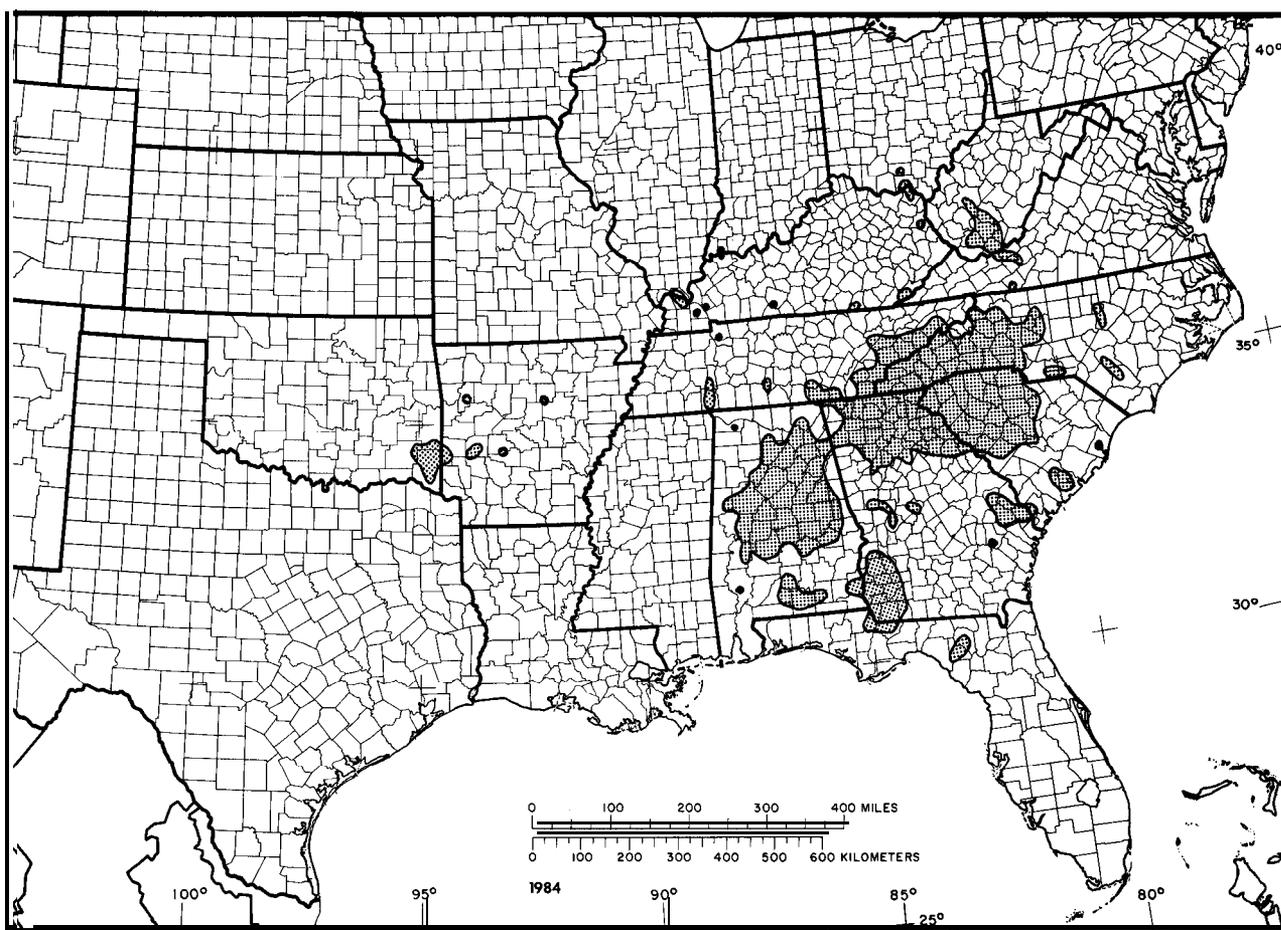


Figure 1—The native range of *Carolina silverbell*.

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lahoma (6,27,30). The species has been successfully cultivated as far north as southern New England, in California, and in Europe (16,17,30).

Climate

The climate over the range of Carolina silverbell is superhumid in the southern Appalachians and humid in the other areas, with temperatures that vary considerably with latitude and elevation. Average annual precipitation varies between 1020 mm and 1140 mm (40 and 45 in) in the northern part of the range to more than 2030 mm (80 in) in the southern Appalachians. Precipitation is well distributed over the year. Average January temperatures range from -1° to 13° C (30° to 55° F) and average July temperatures range from 21° to 27° C (70° to 80° F). The average annual maximum temperatures range from 32° to 41° C (90° to 105° F) and the average minimum from -4° to -21° C (25° to -5° F). The length of the frost-free period ranges from 160 to 280 days.

Soils and Topography

Soils over the range of Carolina silverbell are mostly Ultisols but include sandy Entisols in the Southeast, Inceptisols in the mountains, and Molisols in southern Illinois (32). The species prefers rich, moist, well-drained, loamy soil that is slightly acid in reaction (pH 5.0 to 6.0). It can tolerate soils more acid than that and may do well in soils with a pH up to 7.0 (11,23).

Carolina silverbell grows mostly along streams, river bluffs, and ravine slopes in the Piedmont and other lowlands and along streams, in coves, and on moist lower slopes in the mountains (4,8,10,24,28,30). It is significant in frequency at elevations between 1370 and 1680 m (4,500 and 5,500 ft) and locally abundant at elevations between 460 and 1370 m (1,500 and 4,500 ft) in the mountains (10,25).

Associated Forest Cover

Sites preferred by Carolina silverbell, the most mesic with the best soils, are those on which a number of hardwoods reach their best development. Consequently, it is found in association with a large number of hardwood species as well as occasionally with conifers.

In Piedmont areas, the species is associated with yellow-poplar (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), white oak (*Quercus alba*), American holly (*Ilex opaca*), eastern redbud (*Cercis canadensis*), and

bigleaf magnolia (*Magnolia macrophylla*). In the southern part of its range it occurs with American beech (*Fagus grandifolia*), southern magnolia (*M. grandiflora*), American holly, various oaks, cabbage palmetto (*Sabal palmetto*), Florida maple (*Acer barbatum*), eastern hophornbeam (*Ostrya virginiana*), and eastern redbud (4). In the Black Mountains of North Carolina, Carolina silverbell is a significant associate in the northern hardwoods climax association at high elevations and in the cove climax and mesic slope associations at mid-elevations (10). It occurs and may share canopy dominance with eastern hemlock (*Tsuga canadensis*), yellow buckeye (*Aesculus octandra*), white basswood (*Tilia heterophylla*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*) in the Great Smoky Mountains and the Joyce Kilmer Memorial Forest (20,24,25,35). Prominent associates of the species in a gorge in the Blue Ridge Mountains of western North Carolina were northern red oak (*Quercus rubra*), chestnut oak (*Q. prinus*), sweet birch (*Betula lenta*), yellow-poplar, flowering dogwood (*Cornus florida*), and Fraser magnolia (*Magnolia fraseri*).

Carolina silverbell is associated with the following forest cover types (Society of American Foresters) (13):

- 23 Eastern Hemlock
- 24 Eastern Hemlock-Yellow Birch
- 25 Sugar Maple-Beech-Yellow Birch
- 26 Sugar Maple-Basswood
- 27 Sugar Maple
- 28 Black Cherry-Maple
- 57 Yellow-Poplar
- 58 Yellow-Poplar-Eastern Hemlock
- 59 Yellow-Poplar-White Oak-Northern Red Oak
- 60 Beech-Sugar Maple
- 74 Cabbage Palmetto
- 76 Shortleaf Pine-Oak
- 82 Loblolly Pine-Hardwood
- 87 Sweetgum-Yellow-Poplar
- 91 Swamp Chestnut Oak-Cherrybark Oak

Life History

Reproduction and Early Growth

Flowering and Fruiting-Carolina silverbell (fig. 2) has perfect flowers which appear as the leaves begin to expand in March to May, depending upon location (8,24,30). Each flower has a four-celled ovary, but usually only one cell produces a viable seed (15,17). Larger flower crops are produced annually after the 20th to 25th year (17). The fruit is



Figure 2—Foliage and flowers of *Carolina silverbell*.

a dry, oblong, four-winged drupe that matures in the fall.

Seed Production and Dissemination—Large seed crops are produced annually by older trees of *Carolina silverbell* but much of the seed is sterile. The fruits are persistent and dissemination occurs well into the winter. The seeds are dormant to varying degrees at maturity and require special handling to break the dormancy. They require 2 to 3 months of warm, moist storage at 21° to 27° C (70° to 80° F) followed by a similar period of cold stratification at 1° to 5° C (34° to 41° F). Even with this treatment, germination of filled seeds may be 50 percent or lower (1,15). Seeds disseminated in nature or sowed in a nursery without special treatment germinate mostly during the second growing season (11). Fruits to be stored should be kept dry and cold, but no data are available on long-term storage (5).

Seedling Development—Germination of *Carolina silverbell* seeds is epigeal. Seedlings grow

to about 12 cm (5 in) the first 7 weeks. Growth continues at a moderate rate for a few years, then slows considerably (17).

Vegetative Reproduction—*Carolina silver bell* can easily be propagated by root and greenwood cuttings and by air-layering. Rooting hormones are not necessary for success but may enhance rooting at certain times of the year. For best success, cuttings should be taken after elongation of new growth but before hardening begins. Roots should not be disturbed until the end of the second season. Micropropagation techniques are being developed (1,3,11,17).

Sapling and Pole Stages to Maturity

Growth and Yield—Over most of its range, *Carolina silverbell* (fig. 3) is an understory shrub or small tree usually reaching heights of 6 to 12 m (20 to 40 ft) with a crown spread of 4.5 to 9 m (15 to 30 ft) and stem diameters of 12 to 27 cm (5 to 11 in). On good sites in the Great Smoky Mountains, how-



Figure 3—Two mature stems on a common stump of *Carolina silverbell* growing on the bank of the Ocmulgee River, Jones County, GA.

ever, some trees reach 30 m (100 ft) in height and 90 cm (36 in) in d.b.h. Only on cove and north slope sites in the mountains do trees of this species maintain crown positions in the upper canopy and reach large sawtimber size (8,12,23,24). Growth rates of individual trees are moderate to slow, the smaller ones showing 6 to 9 rings per centimeter (15 to 23/in) (12,17,24). No data are available on volumes per unit area, but the species could be expected to contribute significant volumes to the mixed hardwood stands only on the best sites in the mountains. Estimated total cubic volumes in 1980 in the mountains of three States are as follows (19):

	m^3 thousands	ft^3
Georgia	81	2,861
North Carolina	1171	41,353
South Carolina	42	1,492

Rooting Habit-The rooting habit of Carolina silverbell has not been studied, but the root systems are known to be very persistent, because stumps sprout repeatedly when trees are cut from pastures (8).

Reaction to Competition-Carolina silverbell grows as an understory tree over most of its range and as a codominant in the mountains. It is classed as a shade-tolerant tree. A moist, loamy, partially shaded soil makes the best seedbed for either natural or artificial regeneration, although the species has been found with mixed hardwoods which regenerated a large, burned area in eastern Tennessee (7,23,24,26). In hemlock stands in western North Carolina, the species occurred with greater frequency on areas without a rhododendron cover than with (25). It competes well with other species regenerating in gaps left by treefalls in Southern Appalachian forests (29,36).

Damaging Agents-Carolina silverbell appears to be free of serious insect pests or diseases (17,23).

Special Uses

The wood of Carolina silverbell has many fine properties which make it very desirable for veneer, cabinet work, carving, and turning. It is a favorite wood of craftsmen who make woodenware for the tourist trade. The wood is soft with white or creamy sapwood and light cherry-colored heartwood streaked with white. Wood from larger trees has been sold as cherry or birch and the wood is acceptable for pulping along with other hardwood species. In the tourist

trade it is sold under such names as bellwood, tisswood, and boxelder (14,17,18,26).

Squirrels use Carolina silverbell seeds for food and the trees for dens. The heavy flower crops in spring are very attractive to bees, and eastern Tennessee beekeepers speak highly of the species as a honey plant (12,22,33).

Carolina silverbell is best known for its ornamental qualities. Its heavy crop of white, bell-shaped flowers in the spring and its small to medium growth habit make it a favorite for small gardens, lawns, patios, and tubs. It was first cultivated in 1756 and since has been successfully cultivated in the Eastern United States, California, and western and central Europe (23,30). It transplants well as balled and burlapped or container-grown stock (11). Its best ornamental uses include border plantings in combination with low-growing plants such as azaleas, at corners of buildings and against a background of large evergreens. Its blooms can best be seen from below, so the tree needs to be conveniently accessible. Sprays of the flowers go well with cut-flower arrangements (2,16,19,34). The large form from the mountains should not be used in small gardens but can be used with delightful results for street plantings, although it is not quite as hardy as the smaller form. Some trees have predominantly pink flowers, but a shady site may be required to produce this trait (11,20,34).

Genetics

The first published description of Carolina silverbell appeared in 1731 in Mark Catesby's *Natural History of Carolina* (17). Linnaeus made a taxonomic description of it in 1759 and named it *Halesia carolina* L. There is evidence that the specimen used by Linnaeus may have been a different species; nevertheless, *Halesia carolina* is the name currently accepted. The genus has two other species with limited distribution in the southeastern and southern Piedmont and Coastal Plain. They are *H. parviflora* Michx. and *H. diptera* Ellis. All have $n=12$ chromosomes (7,9,27,31).

No studies on population differences in this species have been reported. However, its wide and discontinuous distribution likely has produced significant variation among and within populations over its range.

The large form of Carolina silverbell that grows in the southern Appalachian Mountains was at one time considered to be a separate species from the smaller form that occupies the rest of the range. It was given the name *H. monticola* (Rehd.) Sarg. but it differs from the smaller form only in size, and

recent authors consider it synonymous with *H. Carolina* (7,11,20,34).

Intergradation between *H. Carolina* L. and *H. parviflora* Michx. (little silverbell) is suspected in the northern Coastal Plain where their distributions overlap (7).

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