

Betula lenta L. Sweet Birch

Betulaceae Birch family

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Sweet birch (*Betula lenta*), also commonly referred to as black birch or cherry birch, was at one time the only source of oil of wintergreen. It is the aroma of wintergreen emanating from crushed leaves and broken twigs to which this birch owes its common name, sweet. Its specific name, *Zenta*, is derived from the tough yet flexible twigs that characterize the species. The wood is also unique. When exposed to air it darkens to a color resembling mahogany and, in times past, was used as an inexpensive substitute for the more valued tropical wood.

Habitat

Native Range

Sweet birch (figs. 1, 2) is primarily a tree of the northeastern United States. It grows from southern Maine westward in southern Quebec, New Hampshire, Vermont, New York, and southeastern Ontario to eastern Ohio; and south in Pennsylvania through the Appalachian Mountains to northern Alabama and Georgia. Forest survey data indicate

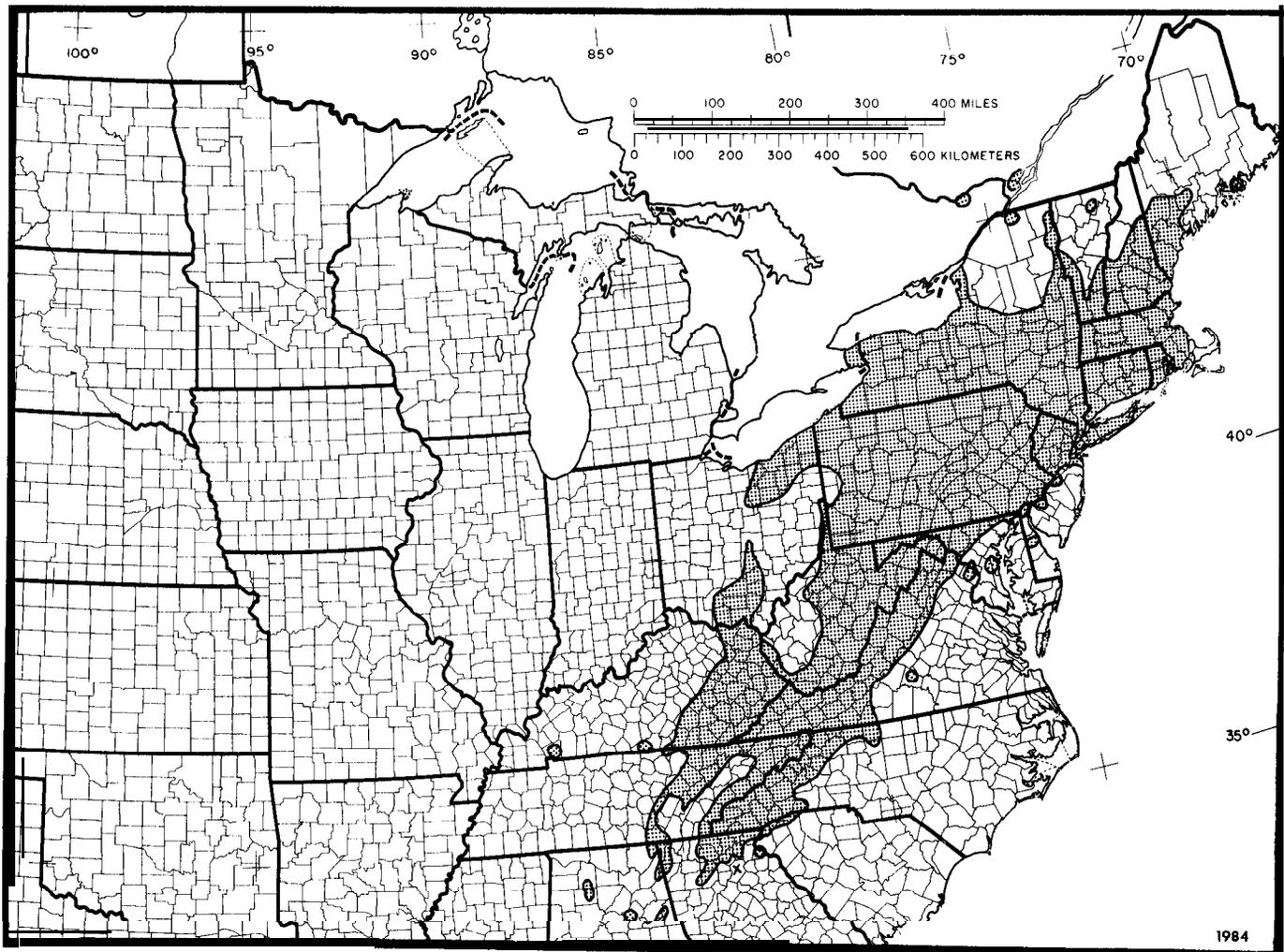


Figure 1-The native range of sweet birch.

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Figure 2—Young 20- to 30-year-old stand of sweet birch in New Jersey.

that sweet birch is most abundant in Massachusetts, Connecticut, New York, and Pennsylvania.

Climate

Precipitation in the range of sweet birch averages about 1140 mm (45 in) a year, about half of it falling during the growing season. In the northern part of the range, snowfall averages 200 to 250 cm (80 to 100 in) a year. Average annual temperature is about 7° C (45° F) in the north and about 13° C (56° F) in the southern Appalachians. The July average is 21° C (70° F) in New England and 23° C (74° F) in the southern Appalachians. Mean January temperatures are -9° to -7° C (15° to 20° F) in New England and -1° to 4° C (30° to 40° F) in the southern Appalachians. The growing season varies from 90 to 220 days, depending on latitude and elevation.

Soils and Topography

Sweet birch grows primarily on three soil orders: Spodosols, Inceptisols, and Ultisols. It grows best on moist, well-drained soils but is also found on a variety of less favorable sites with rocky coarse-textured or shallow soils (7). Because it is occasionally abundant on rocky mountains in Pennsylvania, sweet birch may be valuable for soil protection. On other poor soils, however, such as the excessively dry portions of the Harvard Forest in Massachusetts, sweet birch is partially or completely replaced by oaks and conifers.

Sweet birch grows over a wide range of altitudes from near sea level along the New England coast to an upper extreme of 1220 to 1370 m (4,000 to 4,500 ft) in the southern Appalachian Mountains. In New England, the species is fairly common in southern Maine, the highlands of New Hampshire, western Vermont, the highlands of Massachusetts and Rhode Island, and throughout Connecticut. In the southern Appalachians, where sweet birch grows best, the optimum elevation is between 610 and 1370 m (2,000 and 4,500 ft).

Moist, protected northerly or easterly slopes are considered most favorable for sweet birch in both northern and southern parts of its range.

Associated Forest Cover

Sweet birch is a minor species in 12 Society of American Foresters cover types (3):

- 19 Gray Birch-Red Maple
- 20 White Pine-Northern Red Oak-Red Maple
- 21 Eastern White Pine
- 22 White Pine-Hemlock
- 24 Hemlock-Yellow Birch
- 25 Sugar Maple-Beech-Yellow Birch
- 27 Sugar Maple

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- 28 Black Cherry-Maple
- 39 Black Ash-American Elm-Red Maple
- 57 Yellow-Poplar
- 58 Yellow-Poplar-Eastern Hemlock
- 59 Yellow-Poplar-White Oak-Northern Red Oak

In the southern Appalachian region, sweet birch reaches its best development in Types 21, 22, 25, 57, 58, and 59.

Important associated tree species include yellow-poplar (*Liriodendron tulipifera*), basswood (*Tilia* spp.), white ash (*Fraxinus americana*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), northern red oak (*Quercus rubra*), white birch (*Betula papyrifera*), gray birch (*B. populifolia*), hemlock (*Tsuga* spp.), and eastern white pine (*Pinus strobus*). Understory vegetation varies with locality, but commonly associated shrubs are mountain maple (*Acer spicatum*), striped maple (*A. pensylvanicum*), flowering dogwood (*Cornus florida*), downy serviceberry (*Amelanchier arborea*), American hornbeam (*Carpinus caroliniana*), and eastern hophornbeam (*Ostrya virginiana*). Associated herbaceous vegetation includes Solomons-seal (*Polygonatum pubescens*), marsh blue violet (*Viola cucullata*), clubmosses (*Lycopodium* spp.), mayapple (*Podophyllum peltatum*), trilliums (*Trillium* spp.), jack-in-the-pulpit (*Arisaema atrorubens*), and a variety of ferns. In former clearcut areas where young stands are established, blackberry (*Rubus* spp.) is abundant.

Life History

Reproduction and Early Growth

Flowering and Fruiting-Sweet birch flowers are monoecious and borne in catkins. Staminate catkins are formed in late summer or autumn and open in the spring after elongating to about 20 mm (0.75 in). Pistillate catkins appear with the leaves and are borne terminally on short, spurlike branches. Flowers open in April and May. Seeds ripen from about mid-August through mid-September and are contained in erect strobili (1).

Seed Production and Dissemination-Seed fall is during mid-September through November. Seed dispersal is normally by wind and seeds may be blown some distance over crusted snow. Nothing is known about quantities of seeds produced or how far they are spread. Seed production begins when trees are about 40 years old; large seed crops are produced every 1 or 2 years. Cleaned sweet birch seeds average 1,367,000/kg (620,000/lb) (1).

Recommended storage conditions for birch seeds are 1 to 3 percent moisture content at 2° to 3° C (36° to 38° F) (1). Stratification does not generally improve germination, but best germination is obtained when seeds are tested under light (1).

Seedling Development-Under forest conditions, seeds normally germinate during the spring after they are dispersed. Nursery experience indicates that germination may extend over 4 to 6 weeks. Germination is delayed when the embryo is dormant. Moist mineral soils, rotten logs, and humus are suitable germination media.

In nursery practice, birch seed is usually sown in the fall after collection in the late summer or fall. Seeds are broadcast and covered as lightly as possible or not at all if the seedbed is to be kept moist. Epigeal germination is usually complete 4 to 6 weeks after sowing.

Seedlings require light shade for 2 to 3 months during the first summer. Tree percent is low; only 10 to 20 percent will produce 1-0 seedlings. Desirable seedling density is 270 to 485/m² (25 to 45/ft²). Usually 1-0 and 2-0 barerooted seedlings are planted (1).

Sweet birch seedlings develop best during their early years when protected by side shade or light overhead shade. Scattered individuals frequently grow as advance reproduction in openings in mature stands or under younger stands of light to moderate crown density. In the Harvard Forest, sweet birch is sometimes present in the advance hardwood growth under old-field white pine about 50 to 70 years old (7). On fairly cool, moist sites-sheltered ravines, north to east aspects, or moderately heavy soils—heavy cutting or clearcutting of these stands generally results in a higher proportion of sweet birch in the succeeding reproduction than was present in the advance growth. On the other hand, studies in northwestern Pennsylvania have shown that clearcutting of immature second-growth northern hardwood stands before an understory has developed is followed by an abundance of intolerant species with only a poor representation of sweet birch and tolerant hardwoods (7).

Vegetative Reproduction-Sweet birch has been known to reproduce well from small stumps but seems to be less prolific than many of its associates—red maple, sugar maple, beech (*Fagus grandifolia*), yellow-poplar, and northern red oak.

Sapling and Pole Stages to Maturity

Growth and Yield-Sweet birch saplings grow relatively rapidly. The following data have been

reported: In northwestern Pennsylvania, at age 12, 1.8 m (6 ft) in height; in western Pennsylvania and central West Virginia, at age 20, 14 m (46 ft) in height and 10 cm (4 in) in d.b.h.

On the very best sites, sweet birch grows 21 to 24 m (70 to 80 ft) tall and 61 to 152 cm (24 to 60 in) in d.b.h. In most areas, however, it is a tree of medium size, 15 to 18 m (50 to 60 ft) tall and 61 cm (24 in) or less in diameter. One of the largest trees on record is 147 cm (58 in) in d.b.h. and 21 m (70 ft) tall.

According to a study in virgin hemlock-hardwood stands in northwestern Pennsylvania, sweet birch saplings in the understory grow about twice as fast as hemlock, beech, sugar maple, and red maple, slightly faster than yellow birch, and at about the same rate as black cherry (*Prunus serotina*) (7).

Data from plots on apparently average sites in Delaware County, NY, and Forest and Potter Counties, PA, show that sweet birch can attain a diameter at breast height of about 10 cm (4 in) in 20 years, 18 cm (7 in) in 40 years, and 25 cm (10 in) in 80 years (7). In unmanaged sites in the anthracite region of Pennsylvania, sweet birch reached 36 cm (14 in) d.b.h. in 85 years on high sites (Site I) and 30 cm (12 in) in 80 years on average sites (Site II). It is estimated that in managed stands, the same sizes would be reached in 10 to 15 years less time (7).

In the Pennsylvania anthracite region, periodic cubic volume production begins to decline when the trees are 36 to 41 cm (14 to 16 in) in d.b.h. (7); that is, in about 100 years. Older trees are common and two individuals 192 and 265 years old have been found in Pennsylvania (7).

Rooting Habit-No information available.

Reaction to Competition-Sweet birch is classed as intolerant of shade. A long, fairly clean bole is developed in dense stands, while low, thick branches are produced on open-grown trees. Sweet birch may seed in heavily after clearcutting in the Appalachian region, but a majority of the stems succumb to competition by age 20 (4). Sweet birch is one of the species that has replaced American chestnut in stands where chestnut was once a major component. Sweet birch has been reported to occupy 15 to 20 percent of the basal area of 40-year-old stands in Connecticut (12), all-aged stands in southwestern North Carolina (8), and 20-year-old even-aged stands in West Virginia. In a 70-year-old even-aged stand in West Virginia, 20 years of uneven-age management did not significantly change the proportion of sweet birch, which remained at about 18 percent of the basal area of stems 13 cm (5 in) and larger in diameter (13).

Damaging Agents-In northwestern Pennsylvania, glaze storms have caused appreciable damage to crowns of sweet birch trees. Available data indicate, however, that this species may be rated as intermediate to fairly resistant to glaze in comparison with other northern hardwoods and common associates (7). In addition to the primary effects of ice damage in directly reducing crown volume, glaze storms may contribute to the decline and subsequent death of both yellow and sweet birches by allowing wood decay organisms to enter or, possibly, by causing crown deterioration from sudden excessive exposure.

Sweet birch does not seem to be very susceptible to winter killing. The severe winter of 1942-43 partly or completely killed trees of many species in Maine, but sweet birch appeared to be uninjured (7).

A study of the effects of the 1930 drought on oak forests in central Pennsylvania indicated that sweet birch is intermediate in drought resistance. Drought-caused mortality reduced basal area by 36 percent for sweet birch, 11 percent for sugar maple, 50 percent for red maple, and 15 percent for white ash (7).

Several fungi attack living sweet birch trees, and stems frequently become highly defective at an early age. In unmanaged sawtimber stands in the anthracite region of Pennsylvania, cull exceeded 20 percent of the total cubic-foot volume of trees 43 cm (17 in) in diameter on Site I and 23 cm (9 in) on Site II (7). The most important pathogens are white trunk rot (*Phellinus igniarius*), yellow cap fungus (*Pholiota limonella*), and Nectria canker (*Nectria galligena*) (5). Sweet birch is one of the most susceptible species to Nectria canker. Cankers on the bole are more serious than branch cankers because they reduce merchantable volume and increase susceptibility to stem breakage.

Sweet birch is easily damaged by ground fires because it has extremely thin bark. Several fires may kill the tree, but even light scorching at the base of the tree will lower its resistance to the attacks of various diseases or insects such as the ambrosia beetle (*Xyloterinus politus*) (9).

Several leaf-feeding insects occasionally infest sweet birch. The most prevalent ones are birch tubemaker (*Acrobasis betulella*), birch skeletonizer (*Bucculatrix canadensisella*), oriental moth (*Cnidocampa flavescens*), gypsy moth (*Lymantria dispar*), and dusky birch sawfly (*Croesus latitarsus*) (6).

Special Uses

Sweet birch wood is quite similar to yellow birch (2). Lumber and veneer of the two species often are not separated in the market, although production of

yellow birch far exceeds that of sweet birch. Sweet birch is used for furniture, cabinets, boxes, woodenware, handles, and millwork, such as interior finish and flush doors. Paper pulp made from sweet birch is used in various amounts with other pulps to produce such products as boxboards, book and newsprint paper, paper toweling, and corrugated paper. Birch oil has been produced commercially from sweet birch bark, but its use has declined with the introduction of synthetic products.

Genetics

Sweet birch is closely related to yellow birch. Efforts to cross the two species have been successful, but the F_1 hybrids have low vigor and seed germination rates (11). No natural hybrids have been verified.

Virginia round-leaf birch, *Betula uber*, at one time was classified as *Betula lenta* var. *uber*. The known population of this species consists of 12 mature trees, 1 sapling, and 21 seedlings in Smythe County, VA (10). In 1978, it was officially listed as an endangered species.

A natural hybrid of *Betula lenta* and *B. pumila* that occurred at the Arnold Arboretum was designated *B. jackii*.

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