

Betula nigra L. River Birch

Betulaceae Birch family

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The most beautiful of American trees—that's what Prince Maximilian thought of river birch (*Betula nigra*) when he toured North America before he became the short-lived Emperor of Mexico (11). Also known as red birch, water birch, or black birch (15), it is the only birch whose range includes the southeastern coastal plain and is also the only spring-fruited birch. Although the wood has limited usefulness, the tree's beauty makes it an important ornamental, especially at the northern and western extremes of its natural range (fig. 1).

Habitat

Native Range

The primary range of river birch (fig. 2) is the southeastern quarter of the United States from eastern Texas and southeastern Iowa to Virginia and northern Florida. Scattered populations are found along rivers and streams as far north as southern Minnesota, central Wisconsin, and the middle New England States (8). Its northern limit in the Great Lakes region corresponds to the boundary of the terminal moraine of the Wisconsin glacier (7). Major exclusions within the primary range are the southern half of the Mississippi River flood plain, the lower coastal plain, the Appalachian Mountains, and limestone areas of southern Missouri, central Tennessee, and central Kentucky. In western North Carolina, river birch is found primarily below 550 m (1,800 ft) elevation but has been found as high as 670 m (2,205 ft) (17). Mountainous exclusions may be related to the scarcity of alluvium along streams at higher elevations and faster current streams that sweep seeds downstream (7).

Climate

With its geographic range encompassing almost the eastern half of the United States, river birch grows throughout a wide range of climate. It is most abundant in the hot, humid Southeast where the frost-free season averages from 210 to 270 days and annual rainfall averages about 1270 mm (50 in). At the northern extreme of its range in Minnesota and Wisconsin, annual precipitation averages less than

760 mm (30 in) and the frost-free season is 150 days or less (8).

Soils and Topography

Although river birch is primarily a plant of alluvial soils (Entisols), it occasionally becomes established on dry soils. The western limit of its range coincides roughly with the eastern boundary of the prairie soils. A study in North Carolina indicated a positive correlation of total clays with presence of river birch stands. The same study found that the tree not only tolerated high soil moisture but also required soils that maintain soil moisture near field capacity year-long (17).

Despite its affinity for water, river birch is only moderately resistant to flooding, a characteristic that may account for its absence on much of the Mississippi River flood plain. Its high tolerance for acid soils is illustrated in Ohio, where it is the primary invader and dominant on stream bottoms made too acid (pH 2 to 4) for other bottom-land trees by coal mine drainage (10).

Associated Forest Cover

As river birch is primarily a streambank tree, a list of its associates includes practically all bottom-land plants in the eastern half of the United States. Published lists of associated plants from several states provide an east-to-west cross section of the range of river birch. Individual lists are from specific areas, however, and may not be representative of the state as a whole. Associates reported from more than one state are listed below (N = North Carolina, O = Ohio, I = Illinois, M = Missouri):

sycamore	<i>Platanus occidentalis</i> (N,O,I,M)
red maple	<i>Acer rubrum</i> (N,O,I)
silver maple	<i>Acer saccharinum</i> (O,I,M)
black willow	<i>Salix nigra</i> (N,O,I)
hazel alder	<i>Alnus serrulata</i> (N,O,I)
American hornbeam	<i>Carpinus caroliniana</i> (N,O)
honeylocust	<i>Gleditsia triacanthos</i> (O,I)
yellow-poplar	<i>Liriodendron tulipifera</i> (N,O)
black tupelo	<i>Nyssa sylvatica</i> (O,I)
black cherry	<i>Prunus serotina</i> (N,O)
American elm	<i>Ulmus americana</i> (O,I)

Other associated species include sugar maple (*Acer saccharum*), boxelder (*Acer negundo*), yellow buckeye (*Aesculus octandra*), water hickory (*Carya aquatica*),

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Figure 1-River birch in winter on a natural site in Illinois.

bitter-nut hickory (*C. cordiformis*), mocker-nut hickory (*C. tomentosa*), hackberry (*Celtis occidentalis*), buttonbush (*Cephalanthus occidentalis*), American beech (*Fagus grandifolia*), swamp-privet (*Forestiera acuminata*), ash (*Fraxinus* spp.), Carolina silverbell (*Halesia Carolina*), water-elm (*Planera aquatica*), eastern cottonwood (*Populus deltoides*), swamp cottonwood (*Populus heterophylla*), swamp white oak (*Quercus bicolor*), overcup oak (*Q. lyrata*), bur oak (*Q. macrocarpa*), swamp chestnut oak (*Q. michauxii*), pin oak (*Q. palustris*), northern red oak (*Q. rubra*),

baldcypress (*Taxodium distichum*), and American basswood (*Tilia americana*).

A forest cover type, River Birch-Sycamore (Society of American Foresters Type 61), has been described as growing along streams or lake shores with several of the associated species named above. River birch also is listed with associated vegetation in Cottonwood (Type 63) and Sycamore-Sweetgum-American Elm (Type 94) but undoubtedly occurs in most bottom-land types within its range (4).

Life History

Reproduction and Early Growth

Flowering and Fruiting-River birch is monoecious; separate male and female flowers are on the same plants. Clusters of pollen-producing male (staminate) catkins are formed at twig tips in fall and mature in April or May of the following year. Pollen production is abundant (birch pollen is a heavy contributor to the hay fever problem) (13). Female (pistillate) seed-producing catkins are borne on spur-shoots and appear with the leaves. The flowers open in early spring and the fruit matures in late spring or early summer. It is the only birch that does not produce seed in fall. Good seed crops occur almost every year.

Seed Production and Dissemination-Seeds of river birch are the largest of all the birches native to the United States, averaging 826,700/kg (375,000/lb). Each seed is about 4 mm (0.15 in) long by 3 mm (0.12 in) wide, excluding the wings. The small, winged seeds are transported by wind or by the streams along which river birch grows most abundantly. Seeds germinate rapidly in moist alluvial soil and often form thickets on sandbars.

Seeds can be collected by picking or stripping the "cones" (strobili) while they are still green enough to prevent shattering. Seeds are removed by flailing and screening or fanning.

Seedling Development-Germination of river birch seeds is best (about 35 percent) with unstratified seeds under artificial light (1). Germination is epigeal. During early stages, seedlings are fast-growing and have a high soil-moisture requirement. Because of abundant seed production, rapid germination, and vigorous early growth, river birch is one of the pioneer species of new forests growing on stream bank alluvium (17). Germination and development, as well as growth at all stages, is inhibited by even moderate shade (3). Despite the high moisture requirement of seedlings, river birch can tolerate flood-

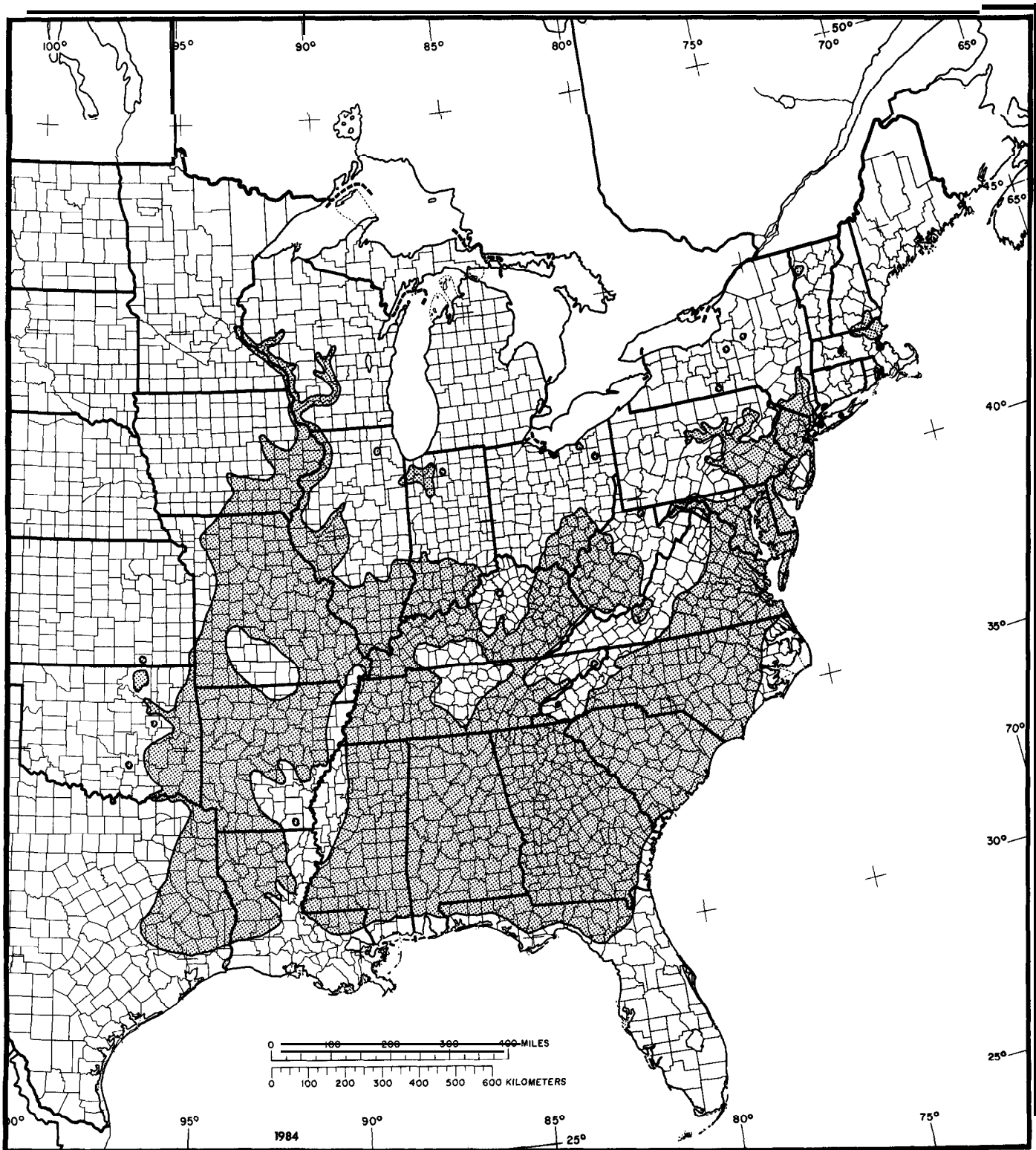


Figure 2—The native range of river birch.

ing no more than 3 months during the growing season (14). Stumps of young trees sprout vigorously (5).

Vegetative Reproduction—No information available.

Sapling and Pole Stages to Maturity

Growth and Yield—Information on growth and yield of river birch is scarce because most commercial use of the tree comes from natural stands, and wood of river birch is combined with that of other birches, beech, and maples (3). The clear bole is relatively short, with several ascending major branches arising from 4.6 to 6.1 m (15 to 20 ft) above the ground. Multiple stems, probably originating from stump sprouts, are common and tend to have basal sweep. In the lower Mississippi River Valley, isolated trees attain heights of 30.5 m (100 ft) and diameters of 150 cm (60 in). Average merchantable size, however, is 15.2 to 24.4 m (50 to 80 ft) tall and 61 to 91 cm (24 to 36 in) in d.b.h. In Ohio, 58-year-old river birches grown in plantations average 23 to 41 cm (9 to 16 in) in d.b.h. and 15.5 m (51 ft) tall. Trees of the same age grown in the open with no competition from other trees are 58 to 76 cm (23 to 30 in) in d.b.h. and 15.2 to 19.8 m (50 to 65 ft) tall (11).

Rooting Habit—No information available.

Reaction to Competition—River birch is most commonly classed as intolerant of shade. This characteristic precludes uneven-aged management of the species, although no record has been found of commercial planting for wood production. Thick natural stands often stagnate at an early age; nearly 20,000 3-month-old seedlings were counted in a 3.3 m² (36 ft²) plot on a Mississippi River bottom in Wisconsin (7).

Damaging Agents—Floods and floating ice periodically destroy or damage young riverbank stands of river birch, but young trees are usually free of serious disease. Anthracnose leaf blight caused by the fungus *Gloeosporium betularum* is the principal leaf disease. Christmas mistletoe (*Phorudendron serotinum*) is a common pest in the South because of the tree's preference for low, wet sites. It is usually disease-free unless old or damaged (5). Although river birch is host to several species of insects, it has no serious insect pests.

Special Uses

River birch is used mainly for local enterprises such as the manufacture of inexpensive furniture, basket hoops, and turned articles. Experiments in North Carolina did not indicate that it is desirable for commercial pulpwood production, but naturally occurring merchantable-sized trees are often harvested for pulpwood when mixed with other bottom-land hardwoods. Strength of the wood makes it suitable for the manufacture of artificial limbs and children's toys. As the wood weighs about 560 kg/m³ (35 lb/ft³), it is somewhat lighter than commercially important birches (3). Because of its tolerance to acid soils, river birch has been used successfully in strip mine reclamation. It has also been used in erosion control (13). Its graceful form, attractive bark, and high resistance to the bronze birch borer (*Agrilus anxius*) make it desirable for ornamental planting, especially in the Northeastern and Midwestern States. Young bark varies in color from silvery gray to light reddish brown or cinnamon colored and is lustrous with darker, narrow, longitudinal lenticels. Bark on fast-growing young trees may peel into papery strips. On older trees, bark on branches may be gray, smooth, and shiny; on the main trunk it may vary from dark reddish brown to gray or almost black with inch-thick irregular scales (fig. 3). Seeds are sometimes eaten by birds and the foliage is browsed by white-tailed deer (15).

Genetics

Population Differences

There are few genetic studies of river birch but parent trees from Illinois, Indiana, and Kentucky varied randomly in leaf and seed characteristics. Their progenies also varied in leaf traits, and first-year seedling height was correlated with annual diameter growth of the parent trees (12). Texas stands varied significantly in wood specific gravity, and the variation was correlated with diameter growth. Single-tree progenies also varied significantly in height growth (6). Thus, it appears possible to increase both growth and specific gravity of river birch by selecting for fast diameter growth.

Hybrids

Natural hybrids between river birch and paper birch (*Betula papyrifera*) have been reported but have never been verified and appear unlikely because interspecific hybridization involving river birch is very difficult. River birch has been crossed with



Figure 3—Bark of a large river birch at the Secrest Arboretum in northern Ohio.

sweet birch (*B. lenta*), gray birch (*B. populifolia*), paper birch (*B. papyrifera*), resin birch (*B. glandulosa*), and low birch (*B. pumila* var. *glandulifera*) and with the following introduced species: *B. ermani* Cham., *B. raddeana* Trautv., *B. pendula* Roth, *B. pubescens* Ehrh., *B. platyphylla* Sukachev, and *B. maximowicziana* Regel. Seed yield and viability have been low and growth has been poor. In general, crossing attempts are more likely to succeed if river birch is the female parent (2).

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