Acer negundo L. Boxelder

Aceraceae Maple family

Ronald P. Overton

Boxelder *(Acer **negundo**)* is one of the most widespread and best known of the maples. Its other common names include ashleaf maple, boxelder maple, Manitoba maple, California boxelder, and western boxelder. Best development of the species is in the bottom-land hardwood stands in the lower Ohio and Mississippi River valleys, although it is of limited commercial importance there. Its greatest value may be in shelterbelt and street plantings in the Great Plains and the West, where it is used because of its drought and cold tolerance.

Habitat

Native Range

Boxelder (figs. 1, 2) is the most widely distributed of all the North American maples, ranging from coast to coast and from Canada to Guatemala. In the United States, it is found from New York to central Florida; west to southern Texas; and northwest through the Plains region to eastern Alberta, central Saskatchewan and Manitoba; and east in southern Ontario. Further west, it is found along watercourses in the middle and southern Rocky Mountains and the Colorado Plateau. In California, boxelder grows in the Central Valley along the Sacramento and San Joaquin Rivers, in the interior valleys of the Coast Range, and on the western slopes of the San Bernardino Mountains. In Mexico and Guatemala, a variety is found in the mountains. Boxelder has been naturalized in New England, southern Quebec, New Brunswick, Nova Scotia, and Prince Edward Island; and in the Pacific Northwest in southeastern Washington and eastern Oregon.

Climate

Boxelder's wide range shows that it grows under a variety of climatic conditions. Its northward limits are in the extremely cold areas of the United States and Canada, and planted specimens have been reported as far north as Fort Simpson in the Canadian Northwest Territories *(2)*. Although boxelder is most commonly found on moist soil, it is drought tolerant and is frequently used in windbreaks and around homesteads throughout the Plains ***(21).*** It has also been known to survive inundation for as long as 30 days ***(15).***

The author is Geneticist, Northeastern Area, State and Private Forestry, Radnor, PA.

Soils and Topography

Boxelder has been found on virtually all types of soils, from heavy clays to pure sands of the orders Entisols, Inceptisols, Alfisols, Ultisols, and Mollisols. It is most common on deep alluvial soils near streams, but it also appears on upland sites and occasionally on poor, dry sites *(11,13)*. Through most of its range it grows in areas of little topographic relief, except for those features associated with stream valleys. In southern and central Arizona and New Mexico the species is found up to 2440 m (8,000 ft) (23) and in Mexico up to 2680 m (8,800 ft) *(18)*, but even at these elevations it is confined to stream bottoms and wet draws.

Associated Forest Cover

Boxelder is most commonly found in association with bottomland hardwoods. It is an associate species in the following cover types (Society of American Foresters) (8):

Eastern

42 Bur Oak
61 River Birch-Sycamore
62 Silver Map&American Elm
63 Cottonwood
87 Sweetgum-Yellow-poplar
93 Sugarberry-American Elm-Green Ash
94 Sycamore-Sweetgum-American Elm
95 Black Willow
109 Hawthorn

Western

235 Cottonwood-Willow
236 Bur Oak

Other associates in the eastern United States include red maple *(Acer rubrum)*, hackberry ***(Celtis occidentalis)***, slippery elm *(Ulmus **rubru),*** black walnut ***(Juglans nigra),*** basswood *(Tilia **americana),*** black cherry ***(Prunus serotina),*** blackgum *(Nyssa sylvatica)*, pecan *(Carya **illinoensis),*** Nuttall, water, willow, and overcup oak ***(Quercus** nuttallii, **Q. nigra, Q.** phellos,* and Q. ***lyrata),*** persimmon ***(Diospyros virginiana),*** and baldcypress ***(Taxodium distichum).*** In the Plains region, boxelder appears with green ash ***(Fraxinus pennsylvanica)***, bur oak ***(Quercus macrocarpa),***

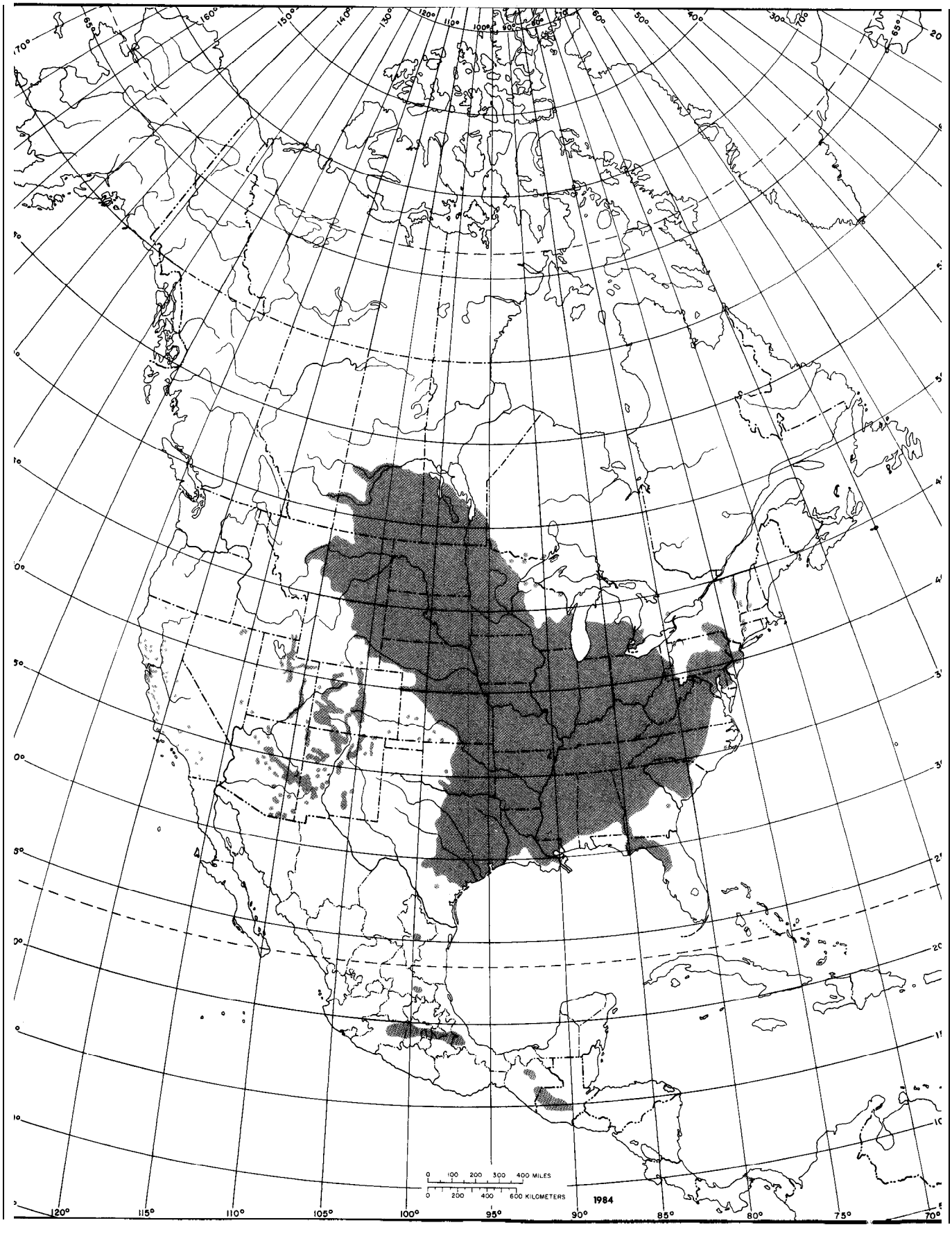

Figure *of boxelder.*

Figure 2—*Boxelder.*

plains cottonwood *(Populus deltoides* var. *occidentalis),* willow *(Salix* spp.), and hackberry. In the Rocky Mountains and the Colorado Plateau, associates include several species of willow and cottonwood, netleaf hackberry *(Celtis reticulata),* and Arizona sycamore *(Platanus wrightii).*

Life History

Reproduction and Early Growth

Flowering and Fruiting-Boxelder is dioecious with imperfect flowers, although perfect flowers that appeared to be functional have been reported *(12).* The staminate flowers are fascicled, the pistillate flowers are drooping racemes and are wind pollinated *(21,23).* Flowers appear with or before the leaves from March to May, depending on the geographic location *(13,28).*

Seed Production and Dissemination-Seed crops are produced each year on individual boxelder trees beginning at 8 to 11 years of age. The samaras are borne on drooping racemes and average 29 500/kg (13,400/lb) (26). Ripening takes place from August to October and seeds are wind distributed continuously until spring. This extended period provides a variety of germination sites, moisture, and temperature combinations and may account for the prolific reproduction from seed that is common for the species *(11).*

Seedling Development-Boxelder is capable of establishing itself on a variety of seedbeds. On southern Illinois bottom lands, it is among the most abundant species seeding in under cottonwood-willow and "soft" hardwood stands and invading old fields. On these sites, overstory density is apparently not a factor in early germination and survival, but seedlings begin to die off after 1 or 2 years unless openings are provided. The 1- and 2-year-old boxelder seedlings are also abundant in areas of ground vegetation ranging from light to heavy and in hardwood litter as much as 5 cm (2 in) deep *(16).*

Methods of collecting, handling, storing, and testing boxelder seeds have been described *(3,4,26).* Germination is epigeal.

Vegetative Reproduction-Reproduction by stump and root sprouts is common in boxelder from young, vigorous trees *(8,18).* Reports on propagation by cuttings indicate that best results are obtained from cuttings taken during the period of transition from softwood to greenwood and treated with an 8,000 ppm IBA-talc mixture (7). European nurserymen propagate some ornamental cultivars of boxelder using side grafts, whip and tongue grafts, or chip budding (7).

Sapling and Pole Stages to Maturity

Growth and Yield-Boxelder is a small to medium-size tree reaching 15 to 23 m (50 to 75 ft) in height and 60 to 120 cm (24 to 48 in) in d.b.h. The species is short-lived, attaining an average age of 60 years but rarely 100 years. Growth during the first 15 to 20 years is very rapid and may be as much as 2.5 cm (1 in) a year in d.b.h. *(11).* Poor sites bring a corresponding reduction in growth. In western Min-

nesota windbreaks, diameter growth averaged less than 5 mm (0.2 in) per year and height growth averaged less than 0.37 m (1.2 ft) per year during the first 13 years after planting (25). Boxelder typically forms a short, tapering bole and bushy, spreading crown.

Because boxelder usually appears in mixed stands and has limited commercial value, no information is available about its potential yield. Equations are available, however, to predict volume of boxelder stems, and green and dry weights of stems, limbs, and leaves (24). After trees reach 15 cm (5.9 in) in d.b.h., the proportion of aboveground green components is relatively constant, with bole wood, 63 percent; bole bark, 8 percent; limbs, 22 percent; and leaves, 7 percent.

Rooting Habit-Boxelder usually develops a shallow, fibrous root system. On deep soils it may form a short taproot with strong laterals *(11).*

Reaction to Competition-In the area of its best development, the lower Ohio and Mississippi River valleys, boxelder usually follows the pioneer species of cottonwood and willow in colonizing new ground in alluvial bottoms. In some instances it is a pioneer species in the invasion of old fields (16). Boxelder may persist into the oak-hickory type but then begins to be eliminated, probably due to shading (18). The species is generally classed as tolerant of shade, although less so than the other soft maples (13).

Damaging Agents-The chief rot-causing fungi attacking boxelder are *Fomitopsis fruxinus, Perreniporia fraxinophilus, Fomes geotropus, Fomitopsis scutellata, Inonotus glomeratus,* and *Ustulina vulgaris.* Root rots caused by *Rhizoctonia crocorum* and *Phymatotrichum omnivorum* have been identified on boxelder, but *Armillaria mellea* has not been reported on the species, although it is common on other maples *(14).*

Verticillium wilt *(Verticillium albo-atrum)* is the only notable killing disease of boxelder. The species is also susceptible to a stem canker caused by *Eutypella parasitica.*

A red stain in the wood of living trees caused by *Fusarium reticulatum* var. *negundinis* apparently is specific to boxelder. The stain regularly is associated with Cerambycid beetles and the galleries of other insects, but itself does no damage to the wood *(14).*

Insect damage to boxelder is relatively unimportant, but a number of leaf-feeding and scale insects and borers attack it *(1).* The boxelder bug, *Leptocoris trivittatus* is a common associate of boxelder throughout most of its range. The nymphs feed mainly on pistillate trees in leaves, fruits, and soft seeds. Although the trees are not greatly damaged, the insect's habits of invading houses in large numbers with the onset of cold weather makes it an important pest. The boxelder aphid, *Periphyllus negundinis,* and the boxelder gall midge, *Contarinia negundifolia,* are also common. Other leaf feeders include the Asiatic garden beetle, *Maladera castanea,* the greenstriped mapleworm, *Anisota rubicunda,* a leafroller, *Archips negundana,* and the boxelder leafroller, *Caloptilia negundella.* The scale insects include cottony maple scale, *Pulvinaria innumerabilis,* and terrapin scale, *Mesolecanium nigrofasciatum.* Borers include the boxelder twig borer, *Proteoteras willingana,* and the flatheaded apple tree borer, *Chrysobothris femorata.*

Ice and wind damage is common in older trees *(11)* and boxelder is quite susceptible to fire and mechanical damage due to its thin bark.

Boxelder is highly sensitive to 2,4-D. In the northern Great Plains, drift from agricultural spraying operations produced distorted, blighted foliage up to 16 km (10 mi) from the source *(20).*

Special Uses

Because of its drought and cold resistance, boxelder has been widely planted in the Great Plains and at lower elevations in the West as a street tree and in windbreaks. Although the species is not an ideal ornamental, being "trashy," poorly formed, and short-lived, numerous ornamental cultivars of boxelder are propagated in Europe (7). Its fibrous root system and prolific seeding habit have led to its use in erosion control in some parts of the world (32).

Seeds and other portions of boxelder are utilized by many species of birds and mammals as food *(19).* Because of the species delayed seeding habit, some seeds are available throughout most of the winter. The sap of boxelder has been used to a limited extent for syrup (9).

Genetics

Population differences in boxelder have been noted in response to photoperiod *(6,28),* in seed germination and stratification requirements *(29),* seed weight *(30),* tracheid length *(31),* frost tolerance *(5),* and in chlorophyll levels *(10).*

Some 8 to 14 varieties and forms have been described for boxelder, several relating to variegated patterns of the foliage or some other morphological character *(2,17,21,23,28).* At least two varieties appear to be confined to a definite geographic range:

var. *arizonicum* Sarg. to central and southern Arizona and New Mexico and var. *californicum* (Torr. and Gray) Sarg. to the Central Valley, Coast Range, and San Bernardino Mountains of California (23).

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