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2. Broad leaf shade trees

These, along with the conifers (presented in a separate list), make up the landscape in our inhabited areas, and to a large degree the trees listed here are the backbone of the North Carolina landscape. In any region the cultivated shade trees, more so than any other horticultural grouping of plants, are usually species native to that region. Since it takes two or more human generations for many tree species to mature, the psychological investment in an established tree is so great exotic species that might not enjoy long term adaption are usually avoided. Note that only six species of shade trees not native to the eastern United States are included on the list of broad-leaved trees, and none of these are very common in cultivation. A summary of species discussed in this section is presented in Table 1.

A relatively unique situation is observed concerning some species in North Carolina as well as in some other parts of the United States. Many newer suburban areas have been carved from woodlands and native tree species persist and thrive, although these same species are rarely planted or volunteer in cultivation. Presumably these species will be seen much less frequently in cultivation as areas undergo long-term inhabitation.

The horticultural descriptions that follow are mostly based on my observations of these plants growing in the State of North Carolina. Numerous manuals (see list at the end of this article) have been consulted in preparing this listing, and it is clear from comparisons of the descriptions that a large number of species of woody plants vary greatly in size and habit as a function of climate; thus the description presented here may vary considerably from those prepared in the northeastern United States or England. Unless otherwise indicated, flowering dates are for the central piedmont area of the State of North Carolina.

Brief horticultural descriptions of broad leaf shade trees: The maples are among our most common native and planted trees. They are attractive in all seasons, and most species are well known for their fall coloration. They are not difficult to cultivate, but many species are sensitive to urban-related root disturbance and high salt concentrations. There are a large

Table 1. Parameters of cultivation of broad leaf shade trees grown in North Carolina

Species	Date brought into cultivation	Place of origin	Frequency* of cultivation
<i>Acer campestre</i>	long cultivated in U.S.A.	Europe, W. Asia	rare
<i>A. negundo</i>	native	North America	infrequent
<i>A. rubrum</i>	native	North America	common
<i>A. saccharum</i>			
ssp. <i>saccharum</i>	native	E. North America	occasional
ssp. <i>floridanum</i>	native	Southeastern U.S.A.	common
<i>A. saccharinum</i>	native	E. North America	occasional
<i>Betula nigra</i>	native	Eastern U.S.A.	occasional
<i>Carpinus caroliniana</i>	native	E. North America	rare
<i>Carya tomentosa</i>	native	Eastern U.S.A.	infrequent
<i>Celtis</i> species	native	Eastern U.S.A.	infrequent
<i>Fagus grandifolia</i>	native	E. North America	infrequent
<i>Fraxinus americana</i>	native	E. North America	common
<i>Ginkgo biloba</i>	1784	E. China	occasional
<i>Gleditsia triacanthos</i>	native	E. North America	rare
<i>Liquidambar styraciflua</i>	native	Eastern U.S.A., Mexico	common
<i>Liriodendron tulipifera</i>	native	Eastern U.S.A.	common
<i>Nyssa sylvatica</i>	native	E. North America	rare
<i>Ostrya virginiana</i>	native	E. North America	rare
<i>Platanus occidentalis</i>	native	E. North America	common
<i>Populus alba</i>	long cultivated in U.S.A.	Eurasia	occasional
<i>Quercus acutissima</i>	1862	Southeastern Asia	infrequent
<i>Q. alba</i>	native	E. North America	common
<i>Q. coccinea</i>	native	E. North America	occasional
<i>Q. falcata</i>	native	Southeastern U.S.A.	occasional
<i>Q. glauca</i>	about 1900	Japan	rare
<i>Q. laurifolia</i>	native	Southeastern U.S.A.	common
<i>Q. lyrata</i>	native	Southeastern U.S.A.	infrequent
<i>Q. phellos</i>	native	Eastern U.S.A.	very common
<i>Q. rubra</i>	native	E. North America	occasional
<i>Q. stellata</i>	native	E. North America	occasional
<i>Q. velutina</i>	native	E. North America	occasional
<i>Q. virginiana</i>	native	Southeastern U.S.A., Mexico	common
<i>Salix babylonica</i>	about 1730	China	occasional
<i>Tilia</i> species	native	E. North America	rare
<i>Ulmus alata</i>	native	Eastern U.S.A.	common
<i>U. americana</i>	native	E. North America	occasional

* Some of these species are more common than the frequency indicates because they are prone to volunteer.

number of potentially ornamental species which are very rarely grown in this area, and their increased use might add to the available horticultural fare.

Acer campestre L., Hedge Maple. A rather slow growing tree that might reach (about) 30 feet at maturity. The habit is usually spreading, but some more erect-growing specimens can be found. The small, deeply lobed leaves give a medium-fine texture. The autumn coloration is pale yellow, and the bloom is conspicuous. Several older specimens on the University of North Carolina Campus have maintained good health under a variety of growing conditions.

Acer negundo L., Box Elder. A fast-growing, ultimately spreading tree, occasionally reaching 50 feet at maturity. In some older specimens the trunk often twists and curves far from the vertical. The leaflets of the large, pinnately compound leaves give a medium-fine texture. The deciduous leaves do not color conspicuously in the autumn, but the flower and seed tassels are attractive in some cultivated clones. Although rapid-growing and sometimes weedy, some older specimens have been observed to decline prematurely, possibly from over-shading by taller trees.

Acer rubrum L., Red Maple. A rapidly growing tree that is naturally subdivided into a wide range of ecological races differing considerably in ultimate size and texture (leaf size and shape). This species is said to occur in a wider range of habitats and climates than any other woody species in eastern North America. The upland forms that often are cultivated may reach about 80 feet at maturity, and usually maintain a more erect than spreading habit; however, some selections and wetland types seem to be typically more spreading. The deeply lobed, and often glaucous-backed, leaves of the commonly cultivated forms give a medium texture, but more finely textured specimens are often observed. The deciduous foliage is typically brilliant yellow, red or a mix of the two, and provides some of our best autumn scenery. Some clones have been selected and propagated for their particularly brilliant hues. Individually inconspicuous, the abundant deep red female flowers and young fruits are produced before foliation and can be very showy. Individual specimens may produce spectacular spring coloration while others produce only tan male flowers. (Technically monoecious, maples, particularly *A. rubrum* and *A. saccharinum*, are often, for all practical purposes, dioecious). The red maple

is fast-growing, soft-wooded, desirably shaped and often a very colorful tree in the spring and autumn. Old specimens are often seen in mature plantings, but it, like *A. saccharinum*, seems intolerant of highly disturbed urban conditions or root disturbance; consequently, it often declines prematurely in roadside plantings.

Acer saccharum Marshall ssp. *saccharum*, Sugar Maple. A large tree of moderate growth rate which, under favorable conditions, may reach 80 feet in height at maturity. Typically, it remains more erect than spreading and develops an oval outline in adult habit. The rather large, thin leaves are deeply lobed and give the tree a medium texture. The deciduous foliage typically colors in the autumn to a brilliant hue of orange or orange-yellow. The pale green and inconspicuous flowers occur at the time of foliation at the end of March.

Acer saccharum Marshall ssp. *floridanum* (Chapman) Desmarais, Southern Sugar Maple. This variety of the species is much like *A. s.* ssp. *saccharum* in all regards except that it is smaller in stature and has a slightly finer texture due to its smaller leaves. In practice, individual sugar maples planted in piedmont North Carolina are often variously intermediate between the two subspecies.

The sugar maples are strong-wooded, clean and well-shaped trees that are frequently planted for their famous fall coloration. They can usually be readily cultured except in excessively dry areas; however they are intolerant of root disturbance and sensitive to salt. In the colder parts of the United States one can see roads lined with rows of declining sugar maples, probably a result of over-salting of icy roads.

Acer saccharinum L., Silver Maple. Grows rapidly into a large specimen that may reach 100 feet in height in cooler parts of North Carolina. Perhaps the largest of the maples in cooler zones, but in warmer parts of the state it grows less rapidly and remains a small tree that appears at best to be poorly adapted. The habit is usually more erect than spreading, with occasional spreading individuals. The leaves are very deeply cut and more silvery-white beneath than the red maple. The texture is medium, but some named clones with several separated lobes have a distinctly finer texture than the

normal forms. The pale yellow autumn coloration of the deciduous foliage is not showy, but while the tan or reddish-tan flowers are relatively inconspicuous, they occur so early that they are the very earliest sign of spring where the tree is native. This species is native to deep alluvial soils on flood plains, and its problems in adapting to the North Carolina piedmont may be due as much to the heavy clay soils as to the milder climate, since it is used with some success for tree plantings in southern California.

Betula nigra L., River Birch. A rapidly growing, medium-sized tree that may reach 50 feet at maturity. Young trunks or scaffolds in older trees are shaggy with interesting golden-tan, peeling bark. Usually specimens are taller than broad at maturity, but since trees with curving and multiple trunks are common, the overall effect of solitary mature specimens may be widely spreading. The rather small leaves give the tree a medium-fine texture. The deciduous foliage may take on a pleasing yellow coloration in favorable autumn seasons, while the flowers are inconspicuous except to the dedicated tree lover. Although a river bottom tree in the wild state, it adapts to a variety of situations in cultivation. Specimens are very susceptible to ice and storm damage, but trees regenerate after proper pruning.

The white-barked species from the cooler parts of the United States and Europe are rarely planted here, and those that have been observed on the piedmont are developing very slowly; however, well-formed adults occur in the mountains where these trees are more common. The common native Appalachian species, *Betula lenta* and *B. lutea*, are occasionally cultivated in the mountains, but they are never seen on the piedmont.

Carpinus caroliniana Walter, Iron Wood. A small, fine-textured tree that may persist in cultivation after an area is developed. While it is an attractive tree with some potential for the landscape, it is rarely cultivated.

Carya species. Mostly trees of medium to medium-fine texture that become large and reach 80 or more feet in height. The growth rate is moderate, and most species have a habit that is more erect than spreading. The deciduous, pinnately compound leaves may have from 3 to 21 leaflets depending on the species. Most of them produce an intense golden-yellow autumn coloration.

tion and have inconspicuous flowers. As an example of this genus the leaves of the Mockernut Hickory, *Carya tomentosa* (Poiret) Nuttall, are illustrated.

As was the case with *Carpinus*, the several native species of hickory may persist after an area is developed or volunteer in cultivated areas; however, with the exception of the pecan (see Chapter 4), a very small number of hickory trees are planted. Those seen in cultivation seem to perform well in a variety of situations.

Celtis species, Hackberries. Potentially very large trees of rapid growth rate and usually erect but sometimes spreading habit. Fine texture is coupled with interesting pale-gray scaffold branches. The autumn coloration of the deciduous foliage and the flowers are not conspicuous. In North Carolina the somewhat weedy and very easily grown hackberry is present in cultivation mostly as volunteer. Although it has many attributes that make it attractive and suitable for a shade tree, large specimens of hackberry occasionally break under the stress of wind or ice. As an example of this genus, the foliage of *Celtis occidentalis* L. is illustrated.

Fagus grandifolia Erhardt, American Beech. A large, but slow-growing tree that may attain 80 feet in cultivation after a long period. It is dome-shaped at maturity with specimens ranging from taller than broad to about as tall as broad. The small, serrate leaves and the lacy branch system give this species a relatively fine texture. The deciduous foliage takes on a gold to copper-gold color which can be very attractive in a favorable autumn season. The bloom is inconspicuous.

Both in Europe and America, the beech with its smooth gray limbs and tangled branches is one of our most beautiful trees. But while the American beech can be readily cultivated, particularly in rich moist sites, once established it is highly intolerant of any site disturbance. The European species, an even larger tree in favorable climates, is occasionally planted, but may decline before reaching maturity in central North Carolina.

Fraxinus americana L., American or White Ash. A tree of moderate growth rate, with a more erect than spreading habit, that may reach about 80 feet in height in cultivation. While the branch texture is coarse, the large, pinnately compound leaves have relatively small leaflets, and thus the texture

appears medium-fine. The autumn coloration of the deciduous foliage ranges from pale yellow on shade leaves to magenta-purple on the sun leaves, often producing an excellent display. The flowers are inconspicuous.

The white ash is our most commonly planted *Fraxinus* species, but the very similar green ash, *F. pennsylvanica* Marshall, is also planted and like other members of this genus freely volunteers. The two species are very similar in all respects and can only be distinguished by an experienced observer. The native ash species, particularly the white ash, are tolerant of a wide variety of growing conditions, but like most trees decline after severe root disturbance in urban environments.

Ginkgo biloba L., Ginkgo, Maiden-hair Tree. A large tree of moderate growth rate under favorable conditions, eventually reaching 80 feet in height. The Ginkgo is usually an erect tree, and often has an irregular branch system. The unusual, small leaves are centrally cleft into two prominent lobes and give the tree a medium-fine texture. The deciduous foliage turns a brilliant yellow, and some clones have been selected that are particularly superior in this respect. The Ginkgo with its unique aspect is widely cultivated in both the West and the Orient. It tolerates a wide variety of growing conditions and climates and may live to a great age. Female trees produce smelly berry-like structures that offend the delicate gardener and fascinate the botanist; however, the seeds are edible. Most commercially available trees are male selections.

Gleditsia triacanthos L., Honey Locust. A rapidly growing tree reaching 80 or more feet in height; however, most locally observed specimens are much smaller, not more than 50 feet. The adult trees are usually taller than broad, with large, singly or doubly pinnately compound leaves giving a fine texture. The deciduous foliage does not produce an autumn display, but the large seed pods persist on the tree into the winter. The flowers are inconspicuous. The honey locust with its thorny armour is a very important shade tree in the center of the continent, but here it does not compete aesthetically with many other species. A number of cultivars are available that lack thorns and have golden leaf coloration in various patterns.

Liquidambar styraciflua L., Sweet Gum. A large, fast-growing tree that may reach 100 feet in height. It is distinctly columnar in youth, but the crown becomes dome-shaped with age; however, its form almost always remains taller than broad. The rather large and very characteristic star-shaped palmately lobed leaves give a medium texture to this tree. The deciduous autumn foliage ranges in color from yellow through red, to purple often on the same tree. The coloration is so striking and long-lasting that this species is often planted for its fall coloration in distant places like southern California. The flowers which occur at the time of foliation in March are inconspicuous. The sweet gum is one of the most common trees in the piedmont section of North Carolina, and it is widely planted across the North American continent. As a short-lived specimen it thrives in a great diversity of situations, but it only becomes a great tree in deep moist soils. It is somewhat weak-wooded and thus susceptible to wind and ice breakage, but younger specimens have great regenerative capacity.

Liriodendron tulipifera L., Tulip Tree. One of our largest and fastest growing trees, it may reach 100 feet in height in cultivation, and much more in the wild state. The habit is very distinctive with young trees having an erect conical shape that develops into a rounded crown with age. The erect habit is nearly always apparent, even trees grown in the open are taller than broad. The large four-lobed leaves of the *Liriodendron* which cannot be confused with those of any other tree provide a moderately coarse texture. Under favorable conditions the leaves turn a brilliant yellow, but unfortunately, the proper meteorological conditions do not develop every season. The large magnolia-like flowers are brightly marked and very showy individually, but their coloration blends with the foliage when the tree is viewed in full bloom. The tulip tree is one of our largest and most graceful trees. It tolerates a wide range of cultural conditions, but probably it is at its best in moist, rich soils. This is both one of our largest native species, and also one of the most frequently cultivated.

Nyssa sylvatica Marshall, Black Gum. Slowly growing into a large shrub, or developing more rapidly into a tree that may reach 80 feet in height. The shrub form produces long horizontal branches while the tree form

is usually more erect than spreading in habit (smaller branches may develop horizontally). The elongate entire leaves give a medium-fine texture to this tree. The deciduous foliage turns rich shades of red in the autumn. The flowers are inconspicuous. This common native tree is easily grown, despite the fact that it is not frequently cultivated. It is worthy of inclusion in a landscape for its excellent autumn coloration, and in fact, it is sometimes grown in Europe for this purpose.

Ostrya virginiana (Miller) K. Koch, Hop Hornbeam. A small fine-textured tree that occasionally persists from the wild state after an area has been developed. Although it is an attractive small tree with landscaping potential, there seem to be few cases where it has been deliberately planted.

Platanus occidentalis L., Sycamore. A fast-growing tree that may reach 100 feet in cultivation (more in the wild state). Young trees have an erect conical shape, but while overall habit remains distinctly erect the upper part of the tree broadens with age. The characteristic large acerifoliate leaves produce a coarse texture. The deciduous foliage does not produce an autumn display. The bloom is inconspicuous. This is one of the most widely planted and easily cultured tree genera in urban areas in both Europe and America. Its mottled trunk and nearly white limbs make this tree equally handsome in winter or summer stance. In central North Carolina many specimens gradually succumb to a fungal canker disease.

Populus alba L., White Poplar. A fast-growing, small tree that may reach 50 feet in height. The habit is erect-conical in youth, but may become more spreading with maturity. The rather small ovate leaves are conspicuously white underneath, and the texture is medium-fine. The autumn coloration of the deciduous foliage and the bloom are not conspicuous. Once established, this species rapidly reproduces from root suckers, producing a thicket, and older specimens often decline prematurely.

Species of *Populus* are native to North Carolina, but are only cultivated occasionally in the mountain region of the state. The Lombardy poplar (*P. nigra italica* Muench.) is occasionally planted on the piedmont, but it becomes infested with canker dieback at an early age, declines, and dies before reaching maturity.

The oaks are one of the most widely planted woody genera over much of the temperate zone with each region having its own local species. North Carolina has a very rich collection of native oaks, and a large number of these species are commonly cultivated. In the higher elevations of our mountains red and white oaks are usually planted, while on the piedmont a number of drought-tolerant species are added to the standard fare of white and willow oak. On the coastal plain the evergreen live oaks are important, as they are in all mild coastal and Mediterranean zones in the United States. We will consider several species seen in cultivation in North Carolina.

Quercus acutissima Carruth. A tree of moderate growth rate and a generally erect habit. (I have not observed the final height and form of a mature specimen.) A medium texture is produced by the long, glossy, chestnut-like leaves. The autumn coloration of this deciduous species is yellowish-brown, and a proportion of the dead leaves persist on the twigs throughout the winter. Like all the oaks, the bloom is relatively inconspicuous. The youthful specimens of this species seem to be adapting well to a variety of sites, so this species shows promise of enriching the cultivated oak flora of the Carolinas.

Quercus alba L., White Oak. A large tree of moderate growth rate that may reach a height of up to 80 feet in cultivation. In youth, its shape can be strikingly symmetrical, and it matures into great spreading individuals. The foliage, like that of all the large-leaved oaks, is moderate to moderately coarse. The white oak leaf with its linear arrangement of rounded lobes cannot be confused with those from any other local tree species. The autumn coloration of the deciduous foliage is highly variable, with some individuals turning an inconspicuous yellow-brown and others turning a spectacular purple-red color. Generally, this species provides an autumn show if the weather conditions are favorable. The bloom is inconspicuous. The white oak is one of North America's grandest trees. With pale gray scaffolds in the winter and excellent foliage in the summer and autumn, it is a tree for all seasons. It is one of the most common native and cultivated trees on the piedmont, and it is tolerant of a wide range of conditions in cultivation. It needs room to develop and, like most oaks, is intolerant of root disturbance, thus not

fully suitable for confined street plantings.

Quercus coccinia Muench., Scarlet Oak. A large tree of moderate growth rate that is usually more erect than spreading, becoming dome-shaped at maturity, and reaching about 80 feet in height. Moderately coarse texture and deeply dissected leaves are characteristic of this species, but the leaves of the scarlet oak are somewhat similar to those of several other species, and thus experience in identification is necessary. At its best the deciduous foliage of the scarlet oak provides a late autumn show in deep red and red-brown. The flowers are inconspicuous. In nature, the common scarlet oak occurs in a variety of sites, and as might be anticipated, it is easily cultivated, but like the other adult oaks, it is intolerant of root disturbance.

Quercus falcata Michaux, Southern Red Oak. A large tree of moderate growth rate that may reach about 80 feet in cultivation. The habit is usually more erect than spreading, but old specimens in the open may develop great size and branch spread greater than the height of the tree. The texture is much like the scarlet oak, but the fall coloration is not showy. As with most of the oaks, the bloom is not conspicuous. This species is easily grown and may be slightly more tolerant of disturbance than the previous two species. Under favorable circumstances, it may become very large.

Quercus glauca Thundberg, Japanese Evergreen Oak. A small tree of moderately slow growth rate that takes on a somewhat erect to globe-shaped habit and reaches 40 or more feet in height. (No aged specimens are available in our area for observation). The rather small, evergreen, chestnut-like leaves impart a moderately fine texture. The bloom is inconspicuous. Although only occasionally planted, this very beautiful small evergreen tree is easily grown and deserves to be used more widely.

Quercus laurifolia Michaux, Laurel and Darlington Oak. The laurel oak is very similar in growth rate, general appearance and adaptation to the willow oak (see entry for *Q. phellos*), except that the foliage of the laurel oak is somewhat larger, giving it a medium-fine texture rather than the fine texture of willow oak. The Darlington oak is a finer-textured selection of the laurel oak with a bushier branch system and smaller leaves. In central North Carolina the typical form of *Q. laurifolia* is deciduous without conspicuous

autumn coloration, while the Darlington oak is semi-evergreen. The forms of the laurel oak have the capacity to withstand urban conditions better than most oaks, and they grow fairly rapidly to rather great size.

Quercus lyrata Walter, Overcup Oak. A medium-sized tree with some mature specimens about 70 feet in height and slightly taller than broad in habit. The growth rate seems to be similar to that of the white oak. Although the specific arrangement of the foliar lobes are somewhat different from that of the white oak, the texture is similar. The deciduous foliage takes on shades of yellow and brown in the autumn, and the flowers are inconspicuous. Although only occasionally planted, the overcup oak with its large cup covering most of the acorn is a handsome, well-shaped tree that deserves to be more widely planted.

Quercus phellos L., Willow Oak. A large tree that is one of the fastest growing oaks, reaching up to 80 or more feet in height in cultivation. Often slightly more erect than spreading, in the open the total maximum lateral branch extension may approximately equal the height. This is a fine-textured tree with small willow-like leaves. The deciduous foliage is often inconspicuous or at best yellowish in the late autumn, and the bloom is inconspicuous. The fast-growing and ultimately massive willow oak is our most widely planted street tree because of its rapid growth and its tolerance of a wide variety of cultural conditions and disturbances. Its massive dark grey limbs contrast with the fine willowy foliage making it a very attractive tree.

Quercus rubra L., Red Oak. A large tree of moderate growth rate with a mature habit that is usually taller than broad; however, occasionally specimens in the open may have a total branch spread that may equal the height of the tree. Old specimens may reach 80 to occasionally 100 feet in height. Although the specific lobe pattern of the leaves is characteristic of this species, the overall texture and appearance of the red oak is similar to the southern red oak, the scarlet oak and the black oak. Autumn colors of the deciduous foliage include yellow, yellow-orange and orange-brown shades. The bloom, as with most of the oaks, is not showy. Further north and in our mountains the red oak is widely planted; however, while it is rarely planted here,

our local red oak is readily cultivated and grows into a handsome tree.

Quercus stellata Wang., Post Oak. Normally a medium-sized tree with occasional large specimens. It is similar in many respects to the white oak although the post oak usually has more erect habit, and the autumn coloration of the deciduous foliage is only a golden-brown. This species is very common in the wild conditions and persists or volunteers in cultivation; and thus, while it is probably rarely planted, it is nevertheless common in cultivation. Also it is easily cultured, it is intolerant of disturbance at maturity; and it fails as a specimen to match the grandeur of white oak.

Quercus velutina Lam., Black Oak. Normally a medium-sized tree similar to, and in some cases difficult to distinguish from, the red oak. It has a moderate growth rate, and its habit is usually distinctly erect, rarely widely spreading, and it may reach the height of about 70 feet. It rarely grows as large as the red oak at maturity. The leaf size, shape, and texture of the foliage closely resemble that of the red oak. The deciduous foliage is golden-brown or orange-brown in the autumn, and the bloom is inconspicuous. Like the post oak this is common on dry sites on the North Carolina piedmont, and it persists and volunteers in cultivated areas; however, it is only very occasionally planted. It is easily grown and moderately tolerant of disturbance when compared to some other oak species.

Quercus virginiana Miller, Live Oak. A great spreading tree that has a moderate growth rate and may reach a height of about 70 feet. The habit at maturity is characteristically spreading, such that the branch spread of an-

Figure 1a. Typical leaves of broadleaf shade trees listed in chapter 2.

- | | |
|---|------------------------------------|
| 1. <i>Acer campestre</i> | 13. <i>Ginkgo biloba</i> |
| 2. <i>A. negundo</i> | 14. <i>Gleditsia triacanthos</i> |
| 3. <i>A. rubrum</i> | 15. <i>Liquidambar styraciflua</i> |
| 4. <i>A. saccharum</i> ssp. <i>saccharum</i> | 16. <i>Liriodendron tulipifera</i> |
| 5. <i>A. saccharum</i> ssp. <i>floridanum</i> | 17. <i>Nyssa sylvatica</i> |
| 6. <i>A. saccharinum</i> | 18. <i>Ostrya virginiana</i> |
| 7. <i>Betula nigra</i> | 19. <i>Platanus occidentalis</i> |
| 8. <i>Carpinus caroliniana</i> | 20. <i>Populus alba</i> |
| 9. <i>Carya tomentosa</i> | 21. <i>Salix babylonica</i> |
| 10. <i>Celtis occidentalis</i> | 22. <i>Tilia</i> |
| 11. <i>Fagus grandifolia</i> | 23. <i>Ulmus alata</i> |
| 12. <i>Fraxinus americana</i> | 24. <i>U. americana</i> |



cient specimens is far greater than the height. The small, entire evergreen leaves are responsible for a fine textural aspect. The bloom is inconspicuous. Although live oaks are not frequently cultivated on the piedmont, there seems to be no difficulty in their cultivation. They have not been severely damaged in recent severe winter storms. Considering the appeal of evergreen trees in the winter landscape, the live oak might be more extensively planted. A member of this species is the largest broad-leafed tree in the United States.

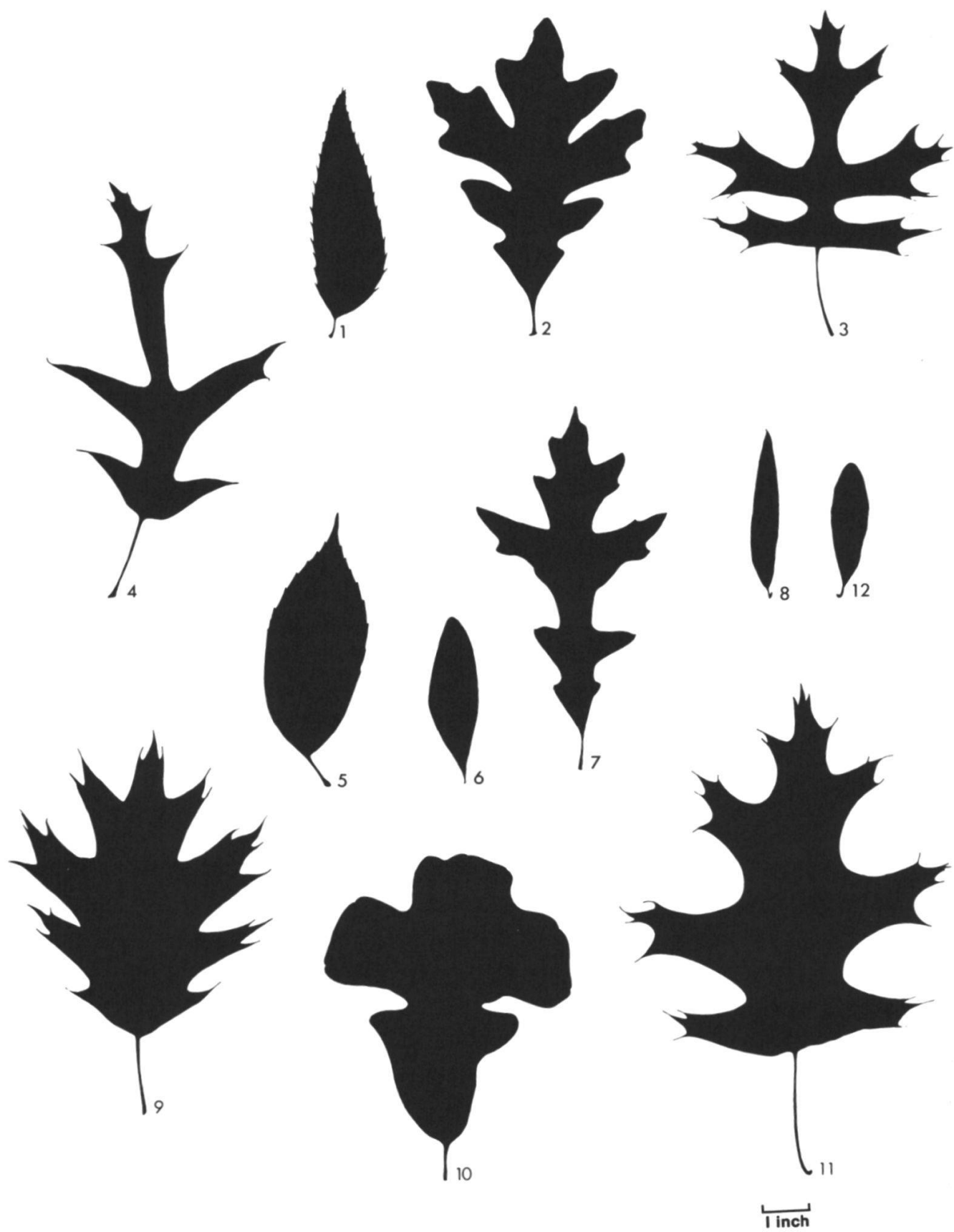
Salix babylonica L., Weeping Willow. A very fast-growing tree with pendulous branchlets that takes on a globular to slightly spreading habit at maturity and reaches heights of 60 to 70 feet in favorable habitats in the North Carolina mountains. The small elongate leaves give a fine texture to the appearance of the plant. The deciduous foliage remains green until early winter and then fades yellowish as it is torn by the winter winds. The bloom is inconspicuous. Large weeping willows are commonly seen in the foothills and in the mountains of North Carolina, but on the piedmont this species often declines prematurely after a few years of initial vigorous growth. This decline may be due, at least in part, to an intolerance of the heavy clay soils that characterize the Piedmont Plateau.

Salix, other species. The native willows are common large shrubs to small trees that only occur in cultivation as persistents from the wild condition or volunteers in wet areas.

The pussywillow, *Salix discolor* Muhl., is rarely planted in our area, and observed specimens have slowly developed into large shrubs (no mature specimens observed in this area). Although the specimens seen appear in good health, the slow growth rate and lower vigor prevent a conspicuous show of male catkins for which the species is cultivated in colder areas.

Figure 1b. Typical leaves of broadleaf shade trees listed in chapter 2
(continued from Figure 1a).

- | | |
|------------------------------|--------------------------|
| 1. <i>Quercus acutissima</i> | 7. <i>Q. lyrata</i> |
| 2. <i>Q. alba</i> | 8. <i>Q. phellos</i> |
| 3. <i>Q. coccinea</i> | 9. <i>Q. rubra</i> |
| 4. <i>Q. falcata</i> | 10. <i>Q. stellata</i> |
| 5. <i>Q. glauca</i> | 11. <i>Q. velutina</i> |
| 6. <i>Q. laurifolia</i> | 12. <i>Q. virginiana</i> |



Tilia species. Native species of basswood planted in the Coker Arboretum on the campus of the University of North Carolina have matured into medium-large, erect-growing trees. While in the mountains basswoods are occasionally seen in cultivated plantings, very few specimens have been observed in plantings on the piedmont. In recent years some individuals of the European basswood have been planted; however, it is too soon to comment in performance of these trees.

Ulmus alata Michaux, Winged Elm. A tree of medium size and rapid growth rate that typically is erect in habit in youth but becomes somewhat more spreading with age. While it is usually not more than about 60 feet in height, larger specimens are occasionally seen. Fine texture is provided by the small serrate leaves. When weather conditions are favorable the deciduous leaves uniformly turn yellow, but in some years there is little display. The bloom, which occurs in late February, is not showy, but it is one of our first signs of spring locally. This is one of our common weed-trees; however, with its fine texture and well-shaped crown, it often develops into a handsome tree. The winged elm is weak-wooded and is often damaged in wind or ice storms; however, it may have some resistance to the diseases which are ruining the grander white elm. Younger specimens have conspicuous corky outgrowths (wings) on the twigs, thus the common name.

Ulmus americana L., White or American Elm. Rapid-growing, in our area usually a medium-sized tree reaching a height of up to about 80 feet but often much less. Specimens growing on the piedmont often have a branch spread equalling their height, but overall, the highly variable American elm may take on any of the basic tree shapes ranging from fastigiate to broadly spreading. The medium-sized serrate leaves give a medium-fine texture. In favorable seasons the deciduous foliage changes to gold. As with the other spring-blooming elms, the relatively inconspicuous bloom occurs so early in the season (February-March) that it is a conspicuous sign of spring. This species is widely tolerant of a variety of conditions in urban cultivation, but unfortunately it is virtually being removed from some localities by the Dutch elm disease. Since the disease is spread by a small bark beetle, the disease spreads less rapidly where individuals are less frequent; consequently, the disease is moving less rapidly in our area than it has in the eastern or mid-western parts of the United States.