Replacing the American Elm: Twelve Stately Trees

by GARY KOLLER and RICHARD E. WEAVER, JR.

The majesty of the American elm begins with its straight, simple, relatively slender bole rising 30 feet or more before diverging into major upswung branches; it climaxes in the great, full, arching canopy that reaches across wide lawns or streets, allowing one tree to touch its neighbor, thus forming a continuous ceiling. Two secondary characteristics enhance the vaulted, noble impression of mature trees. One is the visual effect of the tall, thin stems of trees planted in lines or groves; they seem to gain stature from each other. The other is due to the way the trunk branches with the secondary limbs first rising upward and then in many cases drooping downward at the outer perimeter. Beneath the lower canopy, they enclose a spacious, inviting and often spiritually uplifting green.

Adding to the aesthetic considerations of the American elm are its relatively rapid growth, longevity, structural strength, and adaptability to a wide range of environmental conditions, soil types and soil conditions. It is hardly surprising that the American elm was the premier street and lawn tree until 50 years ago. Despite the relatively recent advent of Dutch elm disease, one can still find magnificent specimens.

However, in spite of the elm's desirable shape and stature, the tree

These silver maples (Acer saccharinum) *show the elmlike form and stature of this fine native tree Photograph by E. H Wilson.*

has drawbacks as a landscape plant. The elm has no ornamental flower, fruit, or bark. The foliage is unremarkable in its form, texture, and color. Unfortunately, the leaves are sought as food by a multitude of insects.

Many people seek a suitable tree that will duplicate the form and adaptability of *Ulmus americana* without its limitations. However, at present no single tree, including all the modern elm hybrids, has the positive architectural qualities and the environmental flexibility of this plant. Therefore, before we begin to look for substitutes, we should first consider if the elm is a lost cause as a plant for modern landscapes. The authors have discussed the status of *Ulmus americana* in relation to disease with several authories. It is our combined opinion that it would be unwise to cease planting American elms completely. However, prior to planting, we would recommend that the trees be planted singly rather than in masses or rows. The trees that survive tend to be lone or isolated specimens or those distant from sites of infection. Once a tree in a stand is infected, the disease spreads rapidly from tree to tree via root grafts, rather than above ground via insect vectors. Isolated trees can be sprayed to control the elm-bark beetle and the elm-leaf beetle. On large sites several elms could be planted, but they should be widely spaced so that at maturity there would be little likelihood of root grafting.

In selecting a site one should survey neighboring properties to determine if and where other elms exist. New plantings should be carefully sited and are best situated in locations where their loss

would have minimal impact on the total landscape. People who plant elms should take into account the future maintenance that will be required to protect the tree. One must be prepared for the cost of removing trees that die prematurely, and must clearly balance the aesthetic and architectural value of the tree against the costs of maintenance.

Those who fear the complete loss of the American elm as a species should take heart. It is still common as a wild plant because Dutch elm disease affects only the older specimens — specimens which have already produced multitudes of seeds annually before succumbing. Seedlings continue to sprout in great numbers in woodlands, at field edges, and in open city spaces. Therefore, whether we plant this tree or not, it will continue to invade our man-made landscapes and to flourish in natural ones.

However, any future landscape use of *Ulmus americana* will be limited because of the tree's susceptibility to disease. At present, modern science has no easy, effective, or reliable cure for Dutch elm disease or phloem necrosis, the two major afflictions of the American elm. Therefore, we are suggesting the following tree species as alternate plantings to the American elm. None is a substitute, but all have at least some of the major aesthetic characteristics that have made the American elm noteworthy.

Acer saccharinum
Silver maple

In many ways the silver maple comes closest in habit to the American elm among native trees. Typically, this species is characterized by a short, stout bole separating into several enormous, gradually ascending trunks. The result is a tall, somewhat narrow vase shape. Many individuals of the species will assume this shape naturally, without much remedial pruning.

Silver maples are handsome, rapidly growing trees, often reaching a height in excess of 100 feet. The silver-backed foliage is attractive during the growing season and typically turns a beautiful clear butter-yellow in the fall. Visual as well as textural variation can be obtained by using the laciniate-leaf forms of this tree.

Although the species was formerly widely planted as a shade tree, it has fallen into disfavor because of its supposedly brittle wood and its consequent susceptibility to injury in storms. Actually, in standard tests to determine the strength of wood, it compares favorably with the American elm. If judged from the specimens in the collections of the Arnold Arboretum, it is not particularly susceptible to storm damage. In fact, the collection as a whole fared much better during a snowstorm on May 10, 1979 (when many trees were well leafed-out), than did most other large tree collections. Not a single large branch was lost in a collection of silver maples averaging 95 years of age, with one individual standing 110 feet tall.

Left A fine specimen of the Ohio buckeye (Aesculus glabra) *in the Arnold Arboretum If the lower branches had been removed, the crown would have been narrowly vase shaped Right With its arching branches and twiggy crown, the river birch* (Betula nigra) *gives an elmlike effect, but on a smaller scale Photographs by H Howard*

Although relatively tolerant of city conditions, silver maples are not particularly good street trees because their shallow root systems wreak havoc with pavement. However, this tree remains a superb choice for parks, schools, or any landscape with sweeping, open spaces.

Acer saccharum
Sugar maple

Both in the wild and in cultivation, the sugar maple is a variable tree. In uncrowded situations it normally forms a relatively short bole, but the width, shape, and structure of the crown vary enormously. Many specimens develop a broad, rounded, regularly branched crown, while others have a crown that is narrower and oval in outline. Still others produce a dense crown of stiffly ascending branches. The first of these three types is the best to plant for an elmlike effect.

Unlike the American elm, the sugar maple has ornamental characteristics in addition to its form. In fact, it is one of the most beautiful large, native American trees It is difficult to imagine what the autumn landscape would be like without it. The tree itself is moderately fast growing; in cultivation it seldom exceeds 80 feet in height.

Although sugar maples are not particularly elmlike in form, in an avenue planting, if the lower branches have been carefully removed, they can give the same effect. Unfortunately, the trees cannot tolerate very dry soils or roadway salt so they cannot be recommended for planting along city streets, but they are excellent street trees in areas

where the roads are not regularly salted in the winter. In fact, in rural upstate New York and Pennsylvania they fill the same role as the American elm in New England.

Aesculus glabra
Ohio buckeye

Although it may grow taller in the wild, the Ohio buckeye seldom exceeds 50 feet in cultivation. The trees are distinctive in their form, with a moderately tall, thick bole, a slender, rounded crown, strongly down-curving branches, and thick twigs. If properly pruned, they will assume a vase shape, although a rather slender one.

This is a better all-around tree than the related and much more familiar horsechestnut (*Aesculus hippocastanum*), except for its relatively inconspicuous greenish white to yellowish flowers. The foliage is less coarse, and in most years it turns a good orange in the fall. The leaves also expand very early in the spring, and they are less susceptible to the scorch that so disfigures horsechestnuts. Although reasonably tolerant of city conditions, it is probably better not to plant them along busy streets because the large nuts could pose a hazard to traffic or pedestrians. However, the walls of the fruit lack the formidable prickles of horsechestnuts, so they do not pose a hazard to bare feet.

Betula nigra
River birch

As is the case with most birches, *Betula nigra* has a conical to pyramidal shape while young but develops a rounded crown with maturity. The bole is normally short, but the major branches arch gracefully upward, and the smaller branches and twigs at the end of the canopy tend to droop. The effect produced is vaselike, and this can be enhanced by removing the lower branches while the tree is still young.

River birches are graceful, fast-growing trees with relatively strong wood. Once established, annual growth rate can range from 3 to 4 feet. They have a moderate life span, and 100-year-old specimens at the Arnold Arboretum are beginning to show signs of decline. With a maximum height of 70 feet in cultivation, they bridge the gap between medium- and large-size trees.

This is rather different from other birches. Since it is widely distributed in flood plains and other lowland areas of the southern United States, it is tolerant of heat and oxygen-poor soils. The bark is pale creamy-brown on young trees, but it becomes dark and picturesquely scaly with age; the cultivar 'Heritage' has been selected for its attractive near-white bark color. The trees are seldom bothered by the bronze birch-borer.

Although this tree will never assume the proportions of a mature

Specimens of the black walnut (Juglans nigra) *Above An isolated specimen in the now-defunct Harvard College Botanical Garden. Below The group planting at the Arnold Arboretum. Photographs by A Rehder and H Howard*

Left With its tall, straight bole and massive, spreading crown, the tulip tree (Liriodendron tulipifera) *is one of the largest and most majestic of native American deciduous trees. Photograph by R Horsey Right An avenue of red oaks* (Quercus rubra) *at the Arnold Arboretum The clear trunks and the overlapping canopies give the same effect as would a group of American elms in a similar planting Photograph by E Gray.*

American elm, its shape and its graceful, twiggy crown make it an acceptable substitute for less grand landscapes.

Fraxinus americana
White ash

The white ash is one of the largest and most majestic of native American deciduous trees, and specimens nearly 100 feet tall are not uncommon. A mature specimen typically has a massive bole and a broad, rounded crown supported by a few very large branches.

The white ash is already extensively planted as a street tree for it has proved itself adaptable to urban conditions. One disadvantage is that it often seeds prolifically, becoming a nuisance. The species is dioecious, and several staminate (and therefore nonfruiting) clones are available. These include 'Autumn Purple', 'Autumn Applause', and 'Rose Hill'. Planting of these clones is recommended to avoid the abundant fruits and the numerous volunteer seedlings.

This is one of the finest trees at the Arnold Aboretum for autumn foliage color. Beside being one of the first trees to turn in the fall, the color is a beautiful blend of yellows, gold, reds and purples. It has been described as resembling a bed of glowing embers.

The green ash (*Fraxinus pennsylvanica*) is a similar species and one equally tolerant of urban conditions. It tends to be smaller in

stature than the white ash, and its fall color is generally yellow. Several staminate clones of this species are also available.

Gymnocladus dioica
Kentucky coffee tree

The open, picturesque crown of the Kentucky coffee tree casts a light dappled shade that is desirable in many garden settings. While this tree is substantially different in form from the American elm, it can be trained to create an unbranched stem rising 30 feet or more. The potentially tall trunk and the open, sparse canopy can be utilized in groups to create a lofty spatial enclosure reminiscent of the American elm. *Gymnocladus dioica* has bold, bipinnately compound leaves that are medium green in summer and pale yellow in autumn. Groups of this tree create a similar shade density to the honey locust.

The only notable disadvantage is that the pistillate plants produce a broad, lima-bean-like pod. These are light green in summer but at maturity turn dark, chocolate brown. When they fall from the tree, they can create a litter problem.

While growth rate can vary, the tree tends to be upright and rather slow growing. It may not be a good choice as a planting for an immediate effect, but for long-range planning for a future landscape, the Kentucky coffee tree deserves top consideration.

Juglans nigra
Black walnut

With its tall, straight bole and open, umbrellalike crown, a mature black walnut often strongly resembles an American elm in its form. However, some individuals branch close to the ground, and in these, pruning off the lower branches is necessary if a tall, straight bole is desired.

Black walnuts are magnificent, slow-growing trees, but they are best known for the edible nuts and beautiful lumber that they produce. They do have a number of drawbacks as ornamentals: the leaves appear late in the season and then fall off early before most other trees have assumed their autumnal coloration; the nuts, although pleasant to eat, have messy husks that stain sidewalks and roadways as they decay; and the trees develop a deep taproot, making them difficult to transplant. However, the allegation that their roots and litter are deleterious to the growth of other plants appears to be unfounded.

With all of these drawbacks, many would ask "why plant a black walnut?" To these we would suggest a look at the group of these trees in the Arnold Arboretum, where they are planted as an informal grove. We have few trees more beautiful in form, and few groupings that show the beautiful form of a tree so well.

Liriodendron tulipifera
Tulip tree, tulip poplar

This species is one of the largest native American deciduous trees, and individuals well in excess of 100 feet tall, with diameters of 7 feet or more, still survive in our southern mountains. Young trees are quite uniform in their narrowly conical shape, and many individuals mature with a tall, somewhat narrow crown. Others, however, develop a tall, massive bole with a broad, rounded crown, and these are the ones that give more of the effect of an American elm. Near the Arboretum are several specimens, grown on small residential lawns, that can be described as grand elements of outdoor architecture.

In many ways the tulip tree is the handsomest large tree native to the United States. The foliage is of excellent texture, and it is little bothered by insect pests. It turns bright yellow in the fall. The leaves are distinctively shaped and attractive. The beautiful orange and green flowers are unfortunately often borne too high to be fully appreciated. The tree is massive and substantial. It grows rapidly and soon forms a respectable specimen.

The species is intolerant of compacted soils, limiting its use as a street tree, and it cannot be recommended for small planting pockets in sidewalks. However, it would succeed along parkways or in similar situations that provide ample root space. Like its relatives the magnolias, the tulip tree should be transplanted in the spring.

Quercus rubra (Q. borealis)
Red oak

If left to grow naturally, a red oak will seldom assume anything resembling the vase shape of an American elm. However, if properly pruned it can give much the same effect in an avenue planting. In fact, it is one of the best large trees for avenue plantings in northern climates.

The red oak is a long-lived, moderately fast-growing tree, seldom exceeding a height of 75 feet in cultivation. If grown as a specimen tree in uncrowded situations, it branches relatively low to the ground from a massive, straight but short bole. The crown is dense and broad, often spreading as wide as it is tall. At maturity such a tree is magnificent. Although different in shape, it is comparable in scale to the American elm. If grown under more crowded conditions, the bole will grow taller without any management, but to insure an elmlike effect, the lower branches will have to be removed on a planned schedule for at least the first 15 years of growth.

Red oaks make excellent street trees. They are tolerant of poor, dry, compacted soils, salt and atmospheric pollution. The thick bark and strong wood are able to withstand the inevitable impact of vehicles. There is a particularly fine planting of this species along the Jamaicaway and the Arborway near the Arnold Arboretum. The black oak (*Quercus velutina*) is almost the equal of this species.

A specimen of the pendent silver linden (Tilia petiolaris) *that is exceptionally elmlike in form. Photograph by R Horsey*

Tilia petiolaris
Pendent silver linden

Most lindens have a tendency to branch low to the ground, so careful pruning is necessary while the trees are young to produce a specimen with a tall, straight bole. This species has a broad crown with somewhat pendent branches, and a mature specimen is majestic but still graceful.

An enormous, 75-foot-tall individual of this species, formerly at the edge of the *Aesculus* collection, was one of the most admired specimen trees in the Arnold Arboretum. Unfortunately, a serious, old cavity weakened the tree, and it was broken apart in a violent thunderstorm in 1981. Besides its form, the flowers and foliage of *T. petiolaris* are desirable ornamental characteristics. The blossoms are similar to others of this genus and are pleasantly fragrant. The foliage is outstanding, with leaves deep green above and covered with white hairs beneath. The slightest breeze causes them to rustle, producing a silvery effect. Unfortunately, the same white hairs collect dust and dirt, and the leaves may become somewhat unsightly on trees grown where there is a large amount of particulate matter in the air.

Ulmus parvifolia
Chinese elm

This is one of the smallest trees of those recommended here — it seldom grows more than 50 feet tall in cultivation in the Northeast. It

is an exceptionally neat and graceful tree with a somewhat slender bole and a rounded to vase-shaped crown of ascending branches.

If a congener must replace the American elm, this is about the only one to consider. It will never assume the stature of its American relative, but it is highly resistant to Dutch elm disease. The foliage, glossy and with a fine texture, remains on the tree well into the fall, and at least in warmer climates some clones are semi-evergreen. The bark exfoliates in small patches, producing an ornamental pattern of grays, greens and browns.

The species has been more widely planted in recent years, and it shows promising tolerance of urban conditions. Chinese elms have been planted along streets of Philadelphia's Society Hill area. Here they have exhibited exceptional tolerance of repeated and severe damage to their trunks from automobiles and snow-removal equipment.

Zelkova serrata
Japanese zelkova

The Japanese zelkova is one of the trees being actively promoted as a substitute for the American elm. In fact, it was a rather rare tree in this country until Dutch elm disease became a serious problem. Although quite elmlike in basic form, it is not very elmlike in character. The bole is short and separates into numerous, rather small, stiffly ascending branches. In extreme cases, these branches are so numerous as to make the tree resemble an upturned broom. Judicious pruning, of course, can reduce the number of these branches.

The Japanese zelkova seldom grows to more than 60 feet in the northern United States, so the scale of the tree does not approximate that of the American elm. And it is only moderately resistant to Dutch elm disease. Two cultivars have been selected and are becoming widely planted: 'Village Green', for its straight trunk; and 'Parkview', for a better vase shape than the type. Both are tolerant of city conditions and make excellent street trees.

One disadvantage of this tree is its susceptibility to branch damage from ice and snow. New plantings along Commonwealth Avenue in Boston suffered significant structural damage during a recent early-winter snowstorm. This was in part due to the fact that the leaves had not yet fallen and, therefore, accumulated snow until the flux strength of the woody tissue was exceeded.

If you are familiar with the foregoing trees, you will know that all are different in stature than *Ulmus americana*. One characteristic that can make them more closely approximate the form of the American elm is a tall, straight, unbranched bole. Generally the trees discussed branch rather low to the ground, but where specialized maintenance can be supplied, the canopy can be "pushed" up.

Several techniques can be used to promote or force a higher branching system. The first technique involves annual pruning. As the tree

The Chinese elm (Ulmus parvifolia) *is one of the few species of its genus that is relatively resistant to the Dutch elm disease. Photograph by M Dirr*

grows, the lower limbs should be pruned off. As an example of "limbing up" pruning, we cite a specimen of turkey oak (*Quercus cerris*). This tree, grown *in situ* from an acorn, is 20 years of age and 35 feet tall. Each winter the owner of the tree removed the lower one quarter of its branches, pushing the bottom branch level ever higher. Today, the lowermost branch arises at 20 feet. While the owner wishes no additional branch clearage, the bottom branches could be pruned up to 25 feet with no damage to the tree. In pushing the branches up, two factors must be kept in mind. First, removal of the lower branches should be started when the tree is young, and continued annually thereafter, so the limbs do not become large in size, necessitating huge pruning cuts. Second, the side or secondary branches produce chemicals or food materials that contribute to increasing the diameter of the main trunk. If one forces the head of the tree up too rapidly, one creates the danger of a thin or weak stem. A thin stem may not adequately support the top growth, especially in the event of ice, snow, or wind storms.

The second method involves close spacing at planting time. The crowding and shading will cause the trees to become more open in the center and to grow taller as they reach for light. Some pruning might be employed to remove branches central to the mass, as well as twigs in undesirable locations.

The third means is to surround the tree with a rapid-growing but short-lived tall shrub, or small tree. For example, one could use a mass of *Elaeagnus angustifolia* or *Salix caprea* that would generate a

mass of foliage quickly and provide a more immediate — but short-term — landscape effect. The shading from these smaller plants will stretch the tree up to overtop the ground. Once the tree is stretched, the nurse planting can be either removed or allowed to decline and disappear as part of a natural cycle.

Let us reiterate that no existing plant can duplicate the form of the American elm. However, the trees suggested above can achieve a similar effect in a variety of situations if planted and pruned properly.

Erratum — On page 248 of the November/December, 1981, issue of *Arnoldia*, the name of the donor for the arcto-tertiary garden should read Mr. Philip Hofer.