CHANGE IN STREET-TREE COMPOSITION OF TWO URBANA, ILLINOIS NEIGHBORHOODS AFTER FIFTY YEARS: 1932-1982

by Jeffrey O. Dawson and Mushtaq A. Khawaja

Abstract. Street-tree inventories from 1932 and 1982 for two Urbana, Illinois neighborhoods were compared. Tree species with the greatest, total stem basal areas at breast height in 1932 were American and red elms (*Ulmus americana* and *Ulmus rubra*), eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), and sugar maple (*Acer saccharum*). Tree species in the two neighborhoods with the greatest total basal areas in 1982 were silver maple, sugar maple, sycamore ((*Platanus occidentalis*), and hackberry (*Celtis occidentalis*). Trees that survived the fifty years included 24 silver maples, 24 sugar maples, 9 sycamores, and 8 hackberries. There were fewer but larger trees in these two Urbana neighborhoods after fifty years. The total basal area of trees decreased only 12% while the total number of trees decreased by 41%. Dominance of American and red elms along streets in these neighborhoods changed after fifty years to a more uniform distribution of basal areas and a greater variety of tree species. Between 1932 and 1982 Dutch elm disease, urban development, varying growth and mortality patterns of tree species, and changes in selections of tree species for planting probably resulted in the dramatic change in street-tree composition that occurred.

Detailed records of city street trees dating back 50 years or more are not common. We found street-tree inventory data from 1932 for two Urbana, Illinois neighborhoods (Figure 1). The 1932 inventory had been conducted by L. E. Sawyer, a former University of Illinois Extension Forester, and was contained in files of the Cooperative Extension Service. We became interested in comparing street trees of 1932 in these two neighborhoods with current street trees to determine 50-year changes.

The 1932 inventory consisted of hand-drawn maps illustrating the location of individual trees on city parkways. The genus and species or common name of each tree were listed as was the diameter at breast height (dbh). The 1982 street-tree inventory was provided by the Urbana Arbor Division. It included tree locations by street address, tree species and variety, and tree dbh. Only data from parkways of streets inventoried in 1932 were used to prepare the summary of corresponding 1982 street trees (Figure 2). The total basal area was calculated for each tree species by year. The 1932 maps were used to locate surviving trees in 1982, and the basal areas of surviving trees were calculated. Basal area measurements are intended as an approximate index of a tree

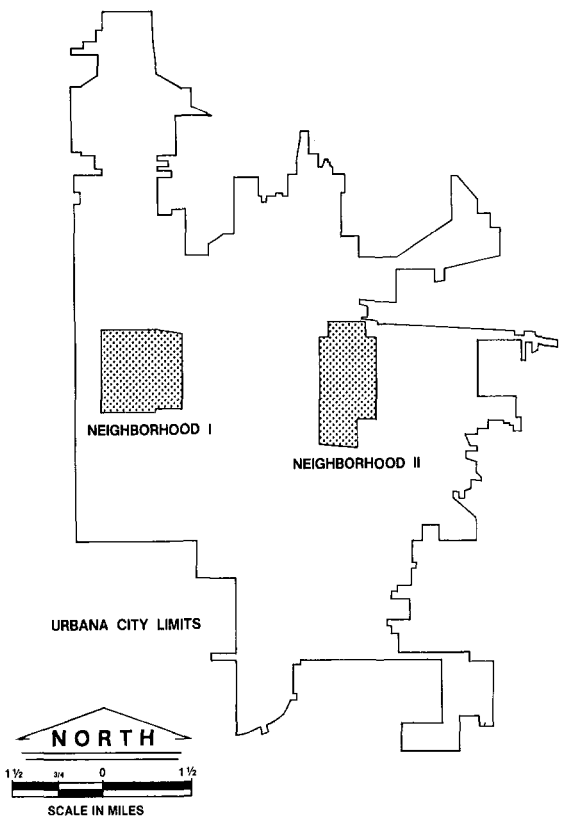

Figure 1

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species dominance of neighborhood parkways.

Parkways, for our purposes, were the city-owned areas between curb and sidewalk along streets. Their dimensions were highly variable, ranging from about 1 to 20 ft in width and of various lengths with many intersections and driveways dissecting them. The total amount of parkway space has not decreased greatly since 1932, but sewer, gas, water, and in some cases, power and telephone utilities are buried beneath parkways resulting in frequent, localized disturbances of tree root systems. Records of planting prior to establishment of The Urbana Arbor Division in 1974 are lacking. Unregulated plantings by adjacent homeowners probably account for most of the existing trees on city parkways. Many of the soils were originally rich, prairie-derived, silty-clay loams, formed on glacial till, with a poor to moderately-poor internal drainage and a neutral pH. But street, utility, and residential excavations have greatly altered soil characteristics of Urbana's parkways. Urbana's climate is continental with cold winters and warm, occasionally droughty summers.

Results and Discussion

Between 1932 and 1982 American elm and short-lived trees such as eastern cottonwood and box elder virtually disappeared from the parkways (Tables 1 and 2). The disappearance of American elm is attributable to Dutch elm disease, which eliminated elms in Urbana during the 1950's and 1960's. Tables 1 and 2 reveal that the total number of trees decreased by 41% between 1932 and 1982, while the total basal area decreased by only 12% and the average tree's stem basal area increased by 76%. There were fewer but larger trees in these two Urbana neighborhoods fifty years after the original measurements. The dominance of elm trees was changed after fifty years to a more uniform distribution and a greater variety of tree species.

Silver maples, sugar maples, sycamores and hackberries survived the 50-year period in greatest numbers (Table 3). The rapid growth rate of silver maple relative to other survivors is evident in the greater increase in basal area of this species over fifty years (Table 3). The total proportion of silver maples that survived was greater

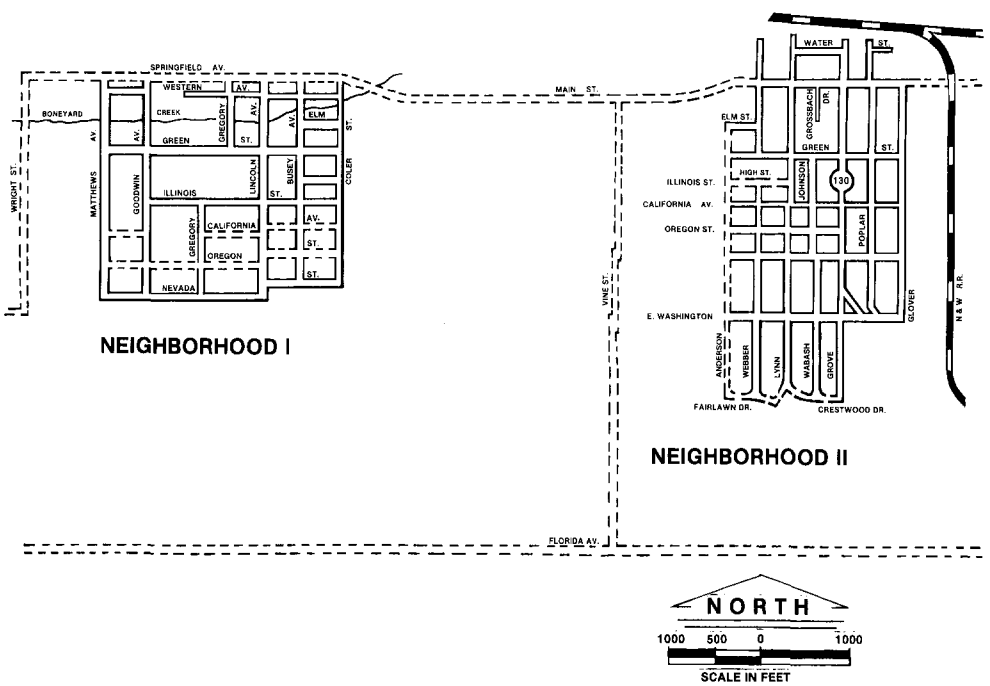

Figure 2

than that for sugar maple (Tables 1, 2, and 3). Sugar maples are long-lived and sturdy, and they are regarded as desirable parkway trees, while silver maples are highly susceptible to wind damage and considered undesirable.

In 1932, more than half of the total basal area for all street trees in the two neighborhoods was attributed to elm and cottonwood, with elms accounting for most of the basal area. After 50 years the neighborhoods had become less dominated by a single street-tree species. Tree species with the greatest total stem basal areas in 1932 were, in decreasing order, American and red elms, eastern cottonwood, silver maple, and sugar maple. By 1982 silver maple followed in order by sugar maple, sycamore, hackberry, and Siberian elm, which is resistant to Dutch elm disease, dominated the parkways within the boundaries of the two neighborhoods. Siberian elm and silver maple are both susceptible to wind damage, mak-

Table 1. Trees along 8.25 linear miles of streets in two Urbana, Illinois neighorhoods in 1932.

Tree species	*Total basal area (ft^2)*	*Total number*	*Range in dbh (in)*
Ulmus americana (American elm) and *Ulmus rubra* (Red elm)	659.54	864	1 - 50
Populus deltoides (Cottonwood)	188.83	97	2 - 37
Acer saccharinum (Silver maple)	141.46	71	2 - 32
Acer saccharinum (Sugar maple)	104.12	96	1 - 23
Acer negundo (Box elder)	77.14	77	1 - 23
Acer nigrum (Black maple)	65.67	58	6 - 46
Celtis occidentalis (Common hackberry)	58.34	40	1 - 30
Fraxinus pennsylvanica (Green ash)	40.22	51	2 - 22
Juglans nigra (Black walnut)	33.68	24	2 - 45
Platanus occidentalis (Sycamore)	20.81	17	4 - 35
Catalpa speciosa (Western catalpa)	17.22	22	3 - 33
Malus spp. (Apple)	12.88	20	2 - 20
Prunus serotina (Black cherry)	11.21	18	2 - 22
Ailanthus altissima (Tree of heaven)	9.64	88	1 - 15
Subtotal	1440.76*	1527	
Others (41 taxons)	100.85	241	1 - 27
Total	1541.61	1768	

*For dominant tree species that accounted for 93% of the total basal area of street trees in 1932, there were 185 trees per linear mile of street, 15 per block (both sides), with an average cross-sectional area at breast height of 0.94 square foot per tree.

Table 2. Trees along 8.25 linear miles of streets in two Urbana, Illinois neighborhoods in 1982.

Tree species	*Total basal area (ft^2)*	*Total number*	*Range in dbh (in)*
Acer saccharinum (Silver maple)	347.16	163	1 - 46
Acer saccharum (Sugar maple)	193.47	109	3 - 35
Platanus occidentalis (Sycamore)	149.27	57	3 - 35
Celtis occidentalis (Common hackberry)	121.79	63	5 - 42
Ulmus pumila (Siberian elm)	116.70	37	14 - 33
Fraxinus americana (White ash)	48.63	29	2 - 29
Liriodendron tulipifera (Tulip tree)	43.88	39	4 - 23
Gleditsia triacanthos (Honey locust)	40.33	111	4 - 23
Acer rubrum (Red maple)	36.12	44	2 - 38
Liquidambar styraciflua (Sweetgum)	28.71	32	4 - 19
Acer platanoides (Norway maple)	27.59	33	1 - 21
Quercus palustris (Pin oak)	20.90	14	10 - 25
Quercus rubra (Red oak)	18.40	32	2 - 37
Catalpa speciosa (Western catalpa)	14.66	4	9 - 38
Fraxinus pennsylvanica (Green ash)	12.64	3	15 - 28
Subtotal	1220.25*	738	
Others (65 taxons)	141.49	297	1 - 34
Total	1361.74	1035	

*For dominant tree species that accounted for 90% of the total basal area of street trees in 1982, there were 89 trees per linear mile of street, 7 per block (both sides) with an average cross-sectional area at breast height of 1.65 square feet per tree.

Table 3. Trees surviving 50 years after 1932 in two Urbana, Illinois neighborhoods.

Tree species	*Number of surviving trees*	*Total basal area in 1932 (ft^2)*	*Total basal area in 1982 (ft^2)*
Acer saccharinum (Silver maple)	24	13.20	158.27
Acer saccharum (Sugar maple)	24	30.17	101.51
Platanus occidentalis (Sycamore)	9	10.61	43.44
Celtis occidentalis (Common hackberry)	8	10.53	42.13
Acer rubrum (Red maple)	3	0.06	42.13
Catalpa speciosa (Western catalpa)	2	1.77	13.20
Fraxinus pennsylvanica (Green ash)	2	1.76	11.38
Ailanthus altissima (Tree of heaven)	1	0.23	7.30
Ulmus pumila (Siberian elm)	1	0.68	6.13
Ulmus americana (American elm)	1	0.11	4.41
Quercus rubra (Red oak)	1	<0.01	7.71
Morus alba (Mulberry)	1	<0.01	9.01

ing them undesirable street-tree selections for Urbana. New plantings of both species are banned from city property by current ordinance.

The tree species found on Urbana parkways in 1932 were rapidly-growing, easily propagated species, many of which were locally available as forest wildings or volunteers on disturbed land. The trend, as illustrated in tables and appendices, is toward a greater diversity of trees, with a larger number of native and exotic species selections, and more cultivated varieties selected for special attributes. This emerging trend seems to be, in part, the result of city ordinances establishing street-tree planting and maintenance policies and an Arbor Division established in 1974 that is empowered to implement street-tree plans and regulations.

Dramatic changes in street tree composition occurred in these two Urbana neighborhoods over 50 years. Dutch elm disease, construction and utility company activities, different growth rates of trees, different mortality patterns of tree species, and changing selections of tree species for planting probably account for the changes, though historical planting and mortality data are almost completely lacking. Insofar as these neighborhood parkways are representative of street tree populations in general, parkway "forests" must be regarded as very dynamic ecosystems. Much can be done to produce stability and lower maintenance costs of urban parkway forests by more judicious selection of tree species for planting. This seems to be the trend in Urbana.

Appendix 1. Additional street tree species in 1932, in descending order of basal area.

Prunus serotina (Black cherry)
Fraxinus americana (White ash)
Magnolia tripetala (Umbrella magnolia)
Pinus nigra (Austrian pine)
Tilia americana (American linden)
Aesculus hippocastanum (Common horsechestnut)
Prunus cerasus (Sour cherry)
Catalpa bungei (Catalpa)
Rhus typhina (Staghorn sumac)
Juglans cinerea (Butternut)
Sassafras albidum (Sassafras)
Prunus avium (Mazzard cherry)
Cercis canadensis (Red bud)
Magnolia accuminata (Cucumber tree)
Rhus glabra (Smooth sumac)
Crataegus coccinea (Scarlet hawthorn)
Picea spp. (Spruce)
Malus pumila (Common apple)
Ulmus laevis (European white elm)
Salix caprea (Goat willow)
Pyrus communis (Common peach)
Ulmus carpinifolia (Smooth-leaved elm)
Pinus sylvestris (Scots pine)
Prunus spp. (Plum)
Fraxinus quadrangulata (Blue ash)
Morus alba (White mulberry)
Castanea dentata (American chestnut)
Populus alba (White poplar)
Hydrangea spp. (Tree hydrangea)
Cornus mas (Dogwood)
Syringa x japonica (Lilac)
Juniperus virginiana (Eastern red cedar)
Picea glauca (White spruce)
Aralia spinosa (Hercule's club)
Sorbus americana (American mountain ash)
Chamaecyparis pisifera (Sawara cedar)
Pyrus spp. (Pear)
Prunus serotina (Black cherry)
Juniperus communis (Common juniper)
Prunus persica (Peach)
Tsuga canadensis (Common hemlock)

Appendix 2. Additional street tree species and varieties in 1982, in descending order of basal area.

Salix babylonica (Weeping willow)
Ailanthus altissima (Tree of heaven)
Prunus armenica (Apricot)
Taxodium distichum (Bald cypress)
Cercis canadensis (Eastern red bud)
Ginkgo biloba (Ginkgo)
Celtis laevigata (Sugar hackberry)
Prunus x *cistena* (Purple leaf plum)
Tilia cordata (Little leaf linden)
Picea glauca (White spruce)
Aesculus glabra (Buckeye)
Cladrastis kentukea (American yellowwood)
Pyrus calleryana (Red spire pear)
Acer platanoides (Crimson king maple)
Tilia corodata (Glenleven linden)
Ulmus americana (American elm)
Robinia pseudoacacia (Black locust)
Platanus x *acerifolia* (London plane tree)
Carya illinoensis (Pecan)
Juglans nigra (Black walnut)
Cornus florida (Flowering dogwood)
Quercus alba (White oak)
Juglans cinerea (Butternut)
Salix matsudana (Corkscrew willow)
Prunus serotina (Black cherry)
Malus coronaria (Crabapple)
Fagus sylvatica (European beech)
Magnolia virginiana (Sweetbay magnolia)
Pinus strobus (White pine)
Magnolia x *soulangiana* (Saucer magnolia)
Paulownia tomentosa (Royal paulownia)
Quercus velutina (Black oak)
Tilia americana (American linden)
Quercus macrocarpa (Bur oak)
Crataegus spp. (Hawthorn)
Juniperus communis (Common juniper)
Nyssa sylvatica (Black tupelo)
Maclura pomifera (Osage orange)
Pyrus coronaria (Crab apple)
Morus alba (White mulberry)
Picea pungens (Colorado spruce)
Tilia tomentosa (Silver linden)
Magnolia stellata (Star magnolia)
Malus spp. (Crab apple)
Acer rubrum (Columnare red maple)
Malus x *zumi* (Liset crab)
Betula papyrifera (Paper birch)
Acer rubrum (Sunset red maple)
Populus nigra (Lombardy poplar)
Ostrya virginiana (Hophorn beam)
Sorbus aucuparia (European mountain ash)
Quercus bicolor (Swamp white oak)
Tilia x *euchlora* (Crimean linden)
Diospyros virginiana (Persimmon)
Acer saccharum (Green mountain sugar maple)
Fraxinus americana (Autumn purple ash)
Gymnocladus dioicus (Kentucky coffee tree)
Cercidiphyllum japonicum (Katsura tree)
Pyrus calleryana (Bradford pear)
Acer rubrum (October glory red maple)
Hibiscus syriacus (Rose of sharon)
Quercus imbricaria (Shingle oak)
Malus hupenhensis (Tea crab)

Department of Forestry
University of Illinois
Urbana, Illinois 61801

ABSTRACT

HAMILTON, W. DOUGLAS. 1984. **Sidewalk/curb-breaking tree roots. 2. Management to minimize existing pavement problems by tree roots.** Arboric. J. 8: 223-234.

Improved watering practices and the reduction of the total amount of water applied is probably the most effective and cost-effective means of minimizing pavement distortion caused by tree roots. By covering the area around the base of a tree with mulch, to eliminate weed growth, surface root expansion can be reduced. Root pruning, using a large specially designed circular saw is expensive and provides only a temporary relief to the problem. While caustic materials like creosote or pentachlorophenol kills live tissue and possibly penetrates the bark of live roots, their action is difficult to control. Combined with reduced watering, the most practical solution is the redesign of the affected sidewalk. Unfortunately this approach is generally unacceptable and meets with considerable opposition. When a tree has become a safety hazard or outlived its aesthetic usefulness or has become an economic burden, cost/benefit analyses invariability conclude that the tree has to be removed.