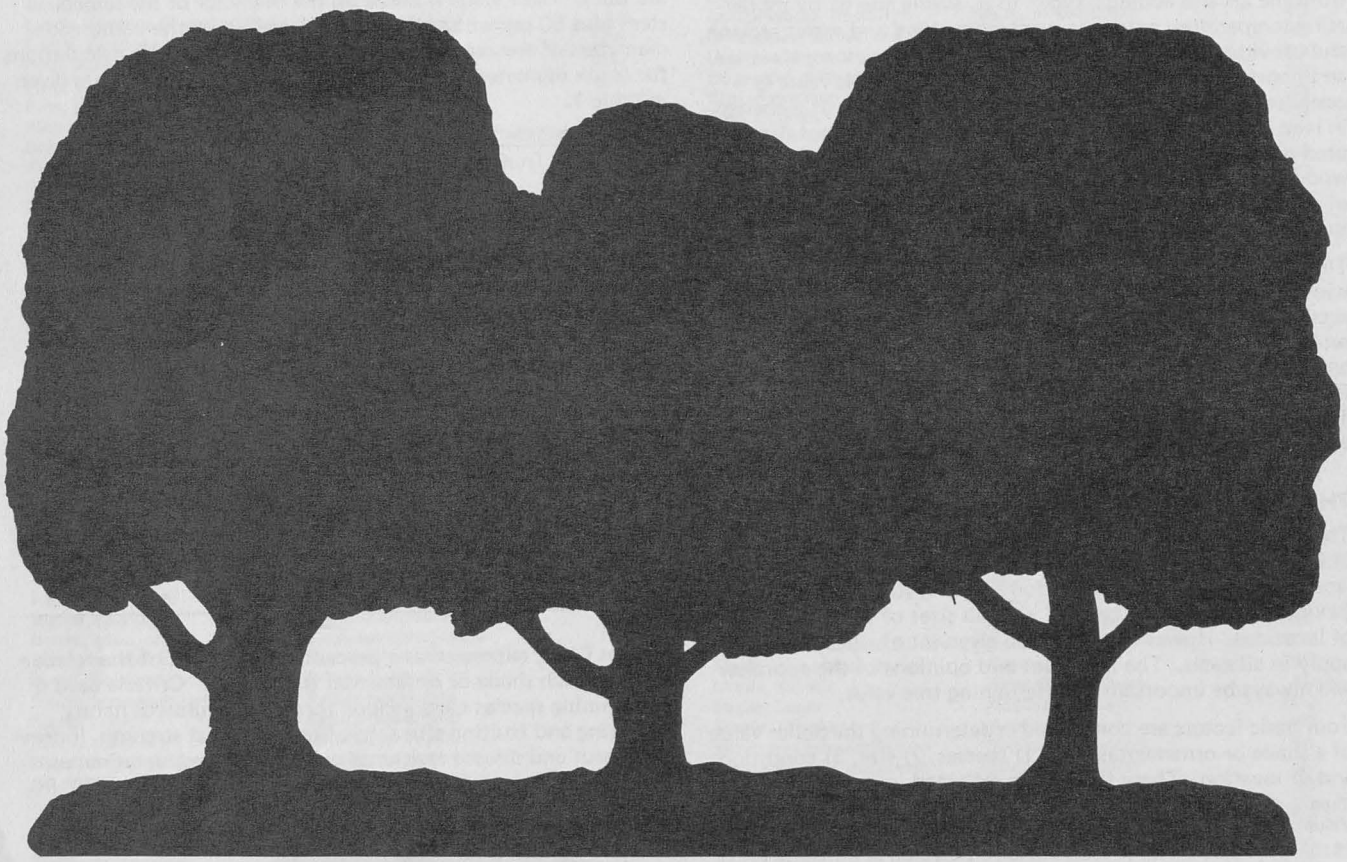
Extension Folder 445

Agricultural Extension Service
University of Minnesota



Shade Tree Evaluation

Shade Tree Evaluation

Patrick J. Weicherding

The charm and dignity of many communities rests in their shade tree environment. Beautiful cities are often remembered best for the many trees which line streets and beautify parks and lawns. Highway travel is more pleasant when roadside plantings blend the highway into scenic countryside. Our pride in public buildings, from a city hall to the nation's capitol, is as apparent in the beautiful parks around them as in the buildings themselves.

The importance of shade and ornamental trees in community life comes not only from their aesthetic value but also from their functional value in reducing noise, filtering impurities from the air and adding oxygen to it, saving energy by moderating temperature extremes, controling wind and water erosion, and providing habitat for wildlife. For these reasons, trees are an important factor in real estate evaluation. This value is easily seen when replacement is necessary because of a change in land use, storm damage, injury, or disease. It is not measured simply in terms of the monetary value of the marketable wood products a tree could produce. Rather, the "real value" of a tree is determined by a combination of factors, including species, size, condition, and location.

The following method of evaluating shade and ornamental trees was developed for use by **qualified professionals** in Minnesota such as arborists and city foresters. It is based on *A guide to professional evaluation of landscape trees, specimen shrubs, and evergreens* developed and published by the International Society of Arboriculture, under the auspices of the Council of Tree and Landscape Appraisers. It is the best known and most widely accepted method of shade tree evaluation in use today.

THE METHOD

The method of evaluating shade and ornamental trees considers individual trees and is not intended for evaluating trees in woodland and forest areas. In addition to being standardized, it is flexible because it can be used with all sizes of trees in a variety of locations. However, there is no given set of rules that will apply in all cases. The iudgment and opinions of the appraiser will always be important in determining tree value.

Four basic factors are considered in determining the dollar value of a shade or ornamental tree: 1) species, 2) size, 3) condition, and 4) location. These factors are reflected in the formula:

$$\text{Tree Value} = \text{Cross Section Area} \times \text{\$15.00 per Square Inch*} \times \text{Species Class} \times \text{Condition Class} \times \text{Location Class}$$

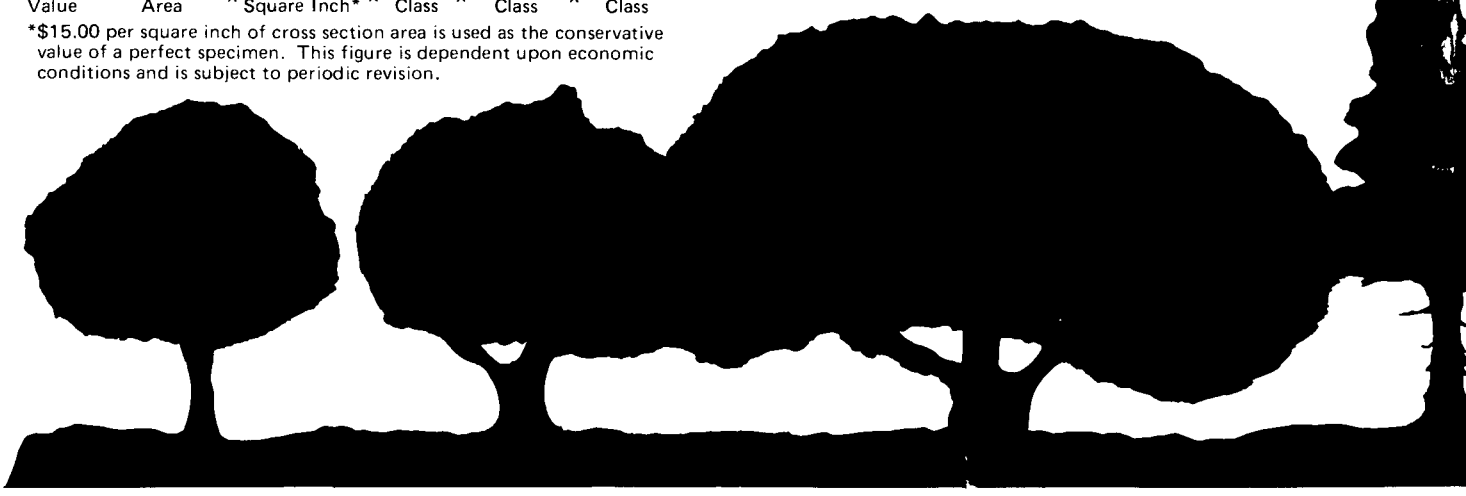
*$15.00 per square inch of cross section area is used as the conservative value of a perfect specimen. This figure is dependent upon economic conditions and is subject to periodic revision.

Cross Section Area, expressed in square inches, is a measure of tree size. It is calculated from the trunk diameter using the formula .7854 D^2, where D^2 is the diameter measurement of the tree in inches, squared. Diameter measurements are taken at a point on the trunk one foot above ground level for trees up to 12 inches in diameter and 4½ feet above ground level (breast height) for larger trees. Abnormal trunk conditions, branch crotches or forked trunks may make it necessary to alter the position of the measurement. In these cases, diameter is usually measured at a point on the trunk 6 inches to 12 inches below the deformity. Multi-stemmed trees are counted as separate trees. Their value is based on the diameter of the largest stem plus 50 percent of the value derived from the combined diameters of the remaining stems. Cross section area calculations for trunk diameters ranging from 2 inches to 40 inches are given in table 1.

Table 1. Diameter and Cross-Section Area of Tree Trunks

Trunk Diameter (Inches)	Cross-Section Area (Square Inches)
2	3.1
4	12.6
6	20.3
8	50.3
10	78.5
12	113.1
14	153.9
16	201.1
18	254.5
20	314.2
22	380.1
24	452.4
26	530.9
28	615.8
30	706.9
32	804.3
34	907.9
36	1017.9
38	1134.1
40	1256.6

Species Class, expressed as a percent, is a measure of the relative value of each shade or ornamental tree species. Criteria used in determining species class include form, color, growth habits, flowering and fruiting characteristics, structural strength, longevity, insect and disease resistance and maintenance requirements. Each tree species is placed in 1 of 5 percentage classes (100, 80,



60, 40, 20). Table 2 lists a suggested percentage value for the most common species of shade and ornamental trees found in Minnesota.

Table 2. Species Class for Minnesota Shade and Ornamental Trees

Common Name	Botanical Name	Condition Class (Percent Value)
EVERGREEN TREES		
Arborvitae (white cedar)	*Thuja spp.*	80
Fir, balsam	*Abies balsamea*	40
Fir, Douglas	*Pseudotsuga menziesii glauca*	100
Fir, white	*Abies concolor*	80
Hemlock, Canada (Eastern)	*Tsuga canadensis*	80
Junipers	*Juniperus spp.*	80
Larch, Eastern (Tamarack)	*Larix laricina*	80
Larch, European	*Larix decidua*	100
Pine, Austrian	*Pinus nigra*	100
Pine, Eastern white	*Pinus strobus*	100
Pine, jack	*Pinus banksiana*	20
Pine, mugo	*Pinus montana*	80
Pine, ponderosa	*Pinus ponderosa*	80
Pine, red (Norway)	*Pinus resinosa*	80
Pine, scotch	*Pinus sylvestris*	60
Redcedar, Eastern	*Juniperus virginiana*	80
Redwood, dawn	*Metasequoia glyptostroboides*	80
Spruce, black	*Picea mariana*	20
Spruce, Blackhills	*Picea glauca densata*	80
Spruce, Colorado blue	*Picea pungens*	80
Spruce, Norway	*Picea abies*	80
Spruce, white	*Picea glauca*	80
Yew, Japanese	*Taxus cuspidata*	100
DECIDUOUS TREES		
Alder, Speckled	*Alnus rugosa*	20
Ash, black	*Fraxinus nigra*	40
Ash, blue	*Fraxinus quadrangulata*	80
Ash, green	*Fraxinus pennsylvanica*	60
Ash, Marshall seedless	*Fraxinus pennsylvanica subintegerrima 'Marshall seedless'*	80
Ash, Summit	*Fraxinus pennsylvanica subintegerrima 'Summit'*	80
Ash, white	*Fraxinus americana*	80
Aspen, bigtooth	*Populus grandidentata*	40
Aspen, quaking	*Populus tremuloides*	20
Beech, blue	*Carpinus caroliniana*	100
Birch, cutleaf European	*Betula pendulata gracilis*	60
Birch, European weeping	*Betula pendula*	60
Birch, European white	*Betula pendulata*	60
Birch, gray	*Betula populifoia*	60
Birch, heart-leaf	*Betula cordifolia*	60
Birch, paper (white)	*Betula papyrifera*	60
Birch, river	*Betula nigra*	80
Birch, yellow	*Betula alleghaniensis*	60
Boxelder	*Acer negundo*	20
Buckeye, Ohio	*Aesculus glabra*	60
Buckeye, painted	*Aesculus sylvatica*	40
Buckthorn, European	*Rhamnus cathartica*	40
Buckthorn, glossy	*Rhamnus frangula*	20

Table 2. Continued

Common Name	Botanical Name	Condition Class (Percent Value)
Butternut	*Juglans cinerea*	40
Catalpa, Northern	*Catalpa speciosa*	40
Catalpa, Southern	*Catalpa bignonioides*	20
Cherry, black	*Prunus serotina*	40
Cherry, pin	*Prunus pennsylvanica*	60
Chestnut, American	*Castanea dentata*	20
Chokecherry	*Prunus virginiana*	40
Chokecherry, amur	*Prunus maacki*	80
Chokecherry, Shubert's	*Prunus virginiana 'Shubert'*	80
Coffee-tree, Kentucky	*Gymnocladus dioicus*	80
Corktree, amur	*Phellodendron amurense*	80
Cottonwood, Eastern	*Populus deltoides*	40
Crabapples (ornamental)	*Malus spp.*	80
Cucumbertree	*Magnolia acuminata*	60
Dogwood, alternate-leaved	*Cornus alternifolia*	80
Elm, American	*Ulmus americana*	20
Elm, English	*Ulmus procera*	40
Elm, Siberian	*Ulmus pumila*	20
Elm, Slippery (red)	*Ulmus rubra*	40
Elm, rock	*Ulmus thomasii*	40
Ginko (male trees)	*Ginko biloba*	100
Hackberry	*Celtis occidentalis*	80
Hawthorns	*Crataegus spp.*	80
Hickory, bitternut	*Carya cordiformis*	80
Hickory, Stagbark	*Carya ovata*	40
Honeylocust, common	*Gleditsia triacanthos*	40
Honeylocust, Imperial	*Gleditsia triacanthos 'Imperial'*	80
Honeylocust, Skyline	*Gleditsia triacanthus 'Skyline'*	80
Honeylocust, thornless and cultivars	*Gleditsia tracanthos inermis*	60
Hoptree, common	*Ptelea trifoliata*	20
Horsechestnut, common	*Aesculus hippocastanum*	60
Ironwood	*Ostrya virginiana*	100
Lilac, Japanese tree	*Syringa amurensis japonica*	80
Linden, American (Basswood)	*Tilia americana*	60
Linden, Greenspire	*Tilia cordata 'Greenspire'*	100
Linden, littleleaf	*Tilia cordata*	80
Linden, Redmond	*Tilia x euchlora 'Redmond'*	100
Locust, black	*Robinia pseudoacacia*	20
Maple, amur	*Acer ginnala*	100
Maple, black	*Acer nigra*	100
Maple, mountain	*Acer spicatum*	80
Maple, Norway and cultivars	*Acer platanoides*	100
Maple, red and cultivars	*Acer rubrum*	100
Maple, silver	*Acer saccharinum*	40
Maple, sugar	*Acer saccharum*	100
Maple, tatarian	*Acer tatarica*	80
Mountain ash, American	*Sorbus americana*	60
Mountain ash, European	*Sorbus aucuparia*	80
Mountain ash, showy	*Sorbus decora*	80
Mulberry, red	*Morus rubra*	80
Nannyberry	*Viburnum lentago*	80
Oak, Black	*Quercus velutina*	60
Oak, bur	*Quercus macrocarpa*	100
Oak, chestnut	*Quercus muhlenbergii*	100
Oak, Northern pin	*Quercus ellipsoidalis*	100
Oak, Northern red	*Quercus rubra var. borealis*	100
Oak, pin	*Quercus palustris*	100
Oak, red	*Quercus rubra*	100
Oak, Scarlet	*Quercus coccinea*	80

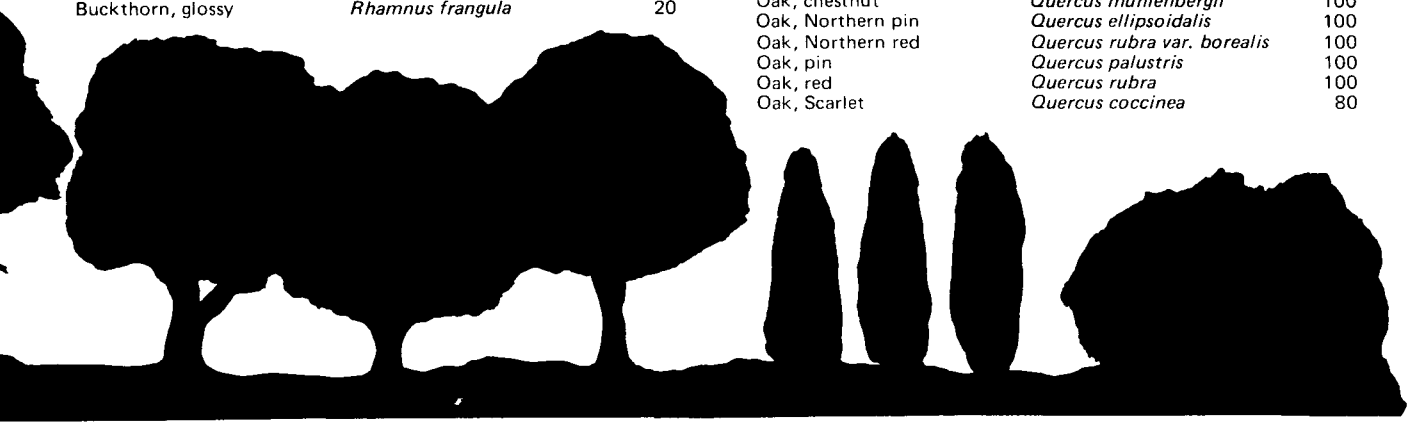


Table 2. Continued

Common Name	Botanical Name	Condition Class (Percent Value)
Oak, swamp white	*Quercus bicolor*	80
Oak, white	*Quercus alba*	100
Plum, American	*Prunus americana*	80
Plum, Canada	*Prunus nigra*	80
Poplar, balsam	*Populus balsamifera*	60
Poplar, Bolleana	*Populus alba 'Bolleana'*	40
Poplar, Lombardy	*Populus nigra 'Italica'*	20
Poplar, white	*Populus alba*	40
Redbud, Eastern	*Cercis canadensis*	80
Russian-olive	*Elaegnus angustifolia*	40
Serviceberry	*Amelanchier spp.*	80
Sumac, staghorn	*Rhus typhina*	60
Sycamore, American	*Platanus occidentalis*	40
Tulip-tree	*Liriodendron tulipifera*	80
Walnut, black	*Juglans nigra*	60
Willows	*Salix spp.*	20

Condition Class, expressed as a percent, is a measure of an individual tree's relative physical condition as compared to a specimen tree of the same species which exhibits perfect health and form. The expertise of the appraiser is critical to an accurate judgment of condition, particularly in cases where there is partial loss of a tree due to casualty, such as fire or windstorm. Tree condition is expressed in 5 percentage classes (100, 80, 60, 40, 20) with a perfect specimen valued at 100 percent. Very few shade or ornamental trees are perfect specimens. Deductions are made for defects, such as poor form, wounds, decay, storm damage, and insect or disease damage. Trees should be evaluated in the condition in which they are found. Improvements may be made and condition class improved through proper cultural treatment. Table 3 is presented as a basic guide for determining condition class.

Table 3. Condition Class for Minnesota Shade and Ornamental Trees

Condition	Description	Condition Class (Percent Value)
Excellent	Perfect specimen. Excellent form and vigor for species. No pest problems or mechanical injuries. No corrective work required. Minimum life expectancy 30 years beyond the time of inspection.	100
Good	Healthy and vigorus. No apparent signs of insect, disease or mechanical injury. Little or no corrective work required. Form representative of species. Minimum life expectancy 20 years.	80
Fair	Average condition and vigor for area. May be in need of some corrective pruning or repair. May lack desirable form characteristics of species. May show minor insect, disease or physiological problems. Minimum life expectancy 10 years.	60 or 40
Poor	General state of decline. May show severe mechanical, insect or disease injury, but death not imminent. May require major repair or renovation. Minimum life expectancy 5 years.	20
Dead or Dying	Dead, or death imminent within 5 years.	0

Location Class, expressed as a percent, is a measure of the benefits derived from an individual tree. Each tree is placed in 1 of 5 percentage classes (100, 80, 60, 40, 20) based on an evaluation of the site location, functional value, and tree placement.

1. *Site location*—The site is a major factor in determining location class. Identical trees located on different sites may have different aesthetic values. For example, street trees have a completely separate set of aesthetic values than trees growing on residential property. Table 4 represents basic guidelines for evaluating site location.

Table 4. Site Location Values for Minnesota Shade and Ornamental Trees

Site Location	Percent Value*
Specimen or historical trees	100
Average residential, landscape trees	80-90
Malls and public area trees	70-80
Arboretum, park and recreation trees	60-80
Golf course trees	60-80
City street trees	60-80
Environmental screen trees	60-80
Industrial area trees	50-70
Out-of-city highway trees	40-60
Native, open woods trees	20-40

*Functional or placement deficiencies will reduce site location values.

2. *Functional value*—How well the tree satisfies functional uses such as for shade, screening for privacy, noise abatement, climate control and aesthetic requirements should be assessed for each situation.
3. *Tree placement*—Deductions in location class are made for poor placement. Design symmetry, crowding from other trees, interference with utilities, public safety and potential damage to buildings, sidewalks, and other property are placement factors which should be considered.

EXAMPLES

The following examples illustrate the formula method for evaluating shade and ornamental trees. Tree value is rounded to the nearest dollar.

Example 1. 20-inch diameter northern red oak, excellent health and form, specimen location.

Example 2. 20-inch diameter northern red oak, excellent form and health, residential location, beneath utility lines.

Example 3. 20-inch diameter northern red oak, healthy, leaning and lopsided crown, street tree, located one foot from the sidewalk.

Example 4. 20-inch diameter eastern cottonwood, park tree, broken top as a result of an ice storm.

Example 5. 10-inch diameter Siberian elm, poor form, large trunk wound, street tree.

Example 6. 5-inch diameter Norway maple, excellent health and form, residential landscape tree.

The formula method is not perfect. It gives low values for small trees and unrealistically high values for trees over 40 inches in diameter. Caution should be exercised when using this method for calculating shade and ornamental tree values for purposes of appraisal, casualties, condemnations, insurance claims and litigation.

Replacement cost might be more approrpiate for determining the value of small trees. It represents a realistic approach to tree value. Replacement cost includes all costs associated with replanting a tree of the same species and size plus a guarantee of survival.

Table 5. Examples of Shade Tree Values

Species	Diameter (in.)	Cross Section Area ($in.^2$)	Basic Value	Species Class (Percent)	Condition Class (Percent)	Location Class (Percent)	Tree Value
Example 1	20	314.2	$4713	100	100	100	$4713
Example 2	20	314.2	$4713	100	100	60	$2828
Example 3	20	314.2	$4713	100	60	40	$1131
Example 4	20	314.2	$4713	100	40	60	$452
Example 5	10	78.5	$1178	20	20	40	$19
Example 6	5	19.6	$294	100	100	80	$188

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap.

10¢