K-STATE Research and Extension

Ornamental Tree Evaluation

Trees enrich home, farm, and urban landscapes and provide significant benefits beyond aesthetic value. They screen objectionable views and create privacy, reduce traffic sounds, attract wildlife, moderate effects of wind, alter air temperature, and filter sunlight. In determining the value of individual trees, all of these attributes should be considered.

The most widely used method to assess ornamental tree value is a system developed by the Council of Tree and Landscape Appraisers, described in their handbook, *Guide for Plant Appraisal*. This method establishes a base value for a landscape tree, as determined by local tree replacement costs, factoring in ratings for tree species, condition, and location. Instructions for using this system are given following a brief introduction to appraisal methods.

Appraisal Methods

An appraisal may help a tree owner recapture a storm loss, substantiate a real estate transaction, or justify saving trees during construction. Most appraisals are initiated to assess damage, though many communities, arboreta, botanical gardens, and parks evaluate trees ahead of time, which is recommended.

Each appraisal is different and should follow appropriate procedures. It is best to work with your local horticulture agent or another professional with a background in tree structure, anatomy, maintenance, and health. This person can guide you through the process and help you to record results and conclusions to validate the appraisal.

The following are three main strategies used to establish the value of ornamental trees:

- The **market approach** assigns value based on a tree's contribution to total property value. The IRS and some state statutes or case law compensate for loss based on this percentage. This type of evaluation should be performed by a real estate appraiser. A plant appraiser typically is not qualified to judge property values.
- The **income approach** applies in situations involving lost income such as a landscape nursery, fruit orchard, or vineyard that incurs a crop or amenity-plant loss. Income statements and professional accounting services may be required.
- The **replacement cost approach**, appropriate for most ornamental landscape trees, considers cost to replace the lost or damaged tree with one from a local grower. Depending on tree size, use either the replacement cost method or the trunk formula method described here.

Replacement Cost Method

This method is appropriate for trees that can be replaced with one of comparable size and species, typically those with a 4-inch caliper or less. In the nursery industry, trees of this size are measured at 6 inches above grade, and trees larger than 4 inches are measured 12 inches from the ground (Figure 1). Trees that are too large to transplant are measured at 4½ feet above grade. This reference point is known as the diameter at breast height or DBH (Figure 2).

With this method, value is determined based on the cost to replace the tree with the largest *locally available* tree of the same or similar species. The total includes the price of the tree, transportation to the site, removal of damaged or dead tree(s); planting, pruning, and staking; insurance, overhead, and profit; post-transplant care; and survival guarantee costs, if offered. Costs must be obtained from a local grower.

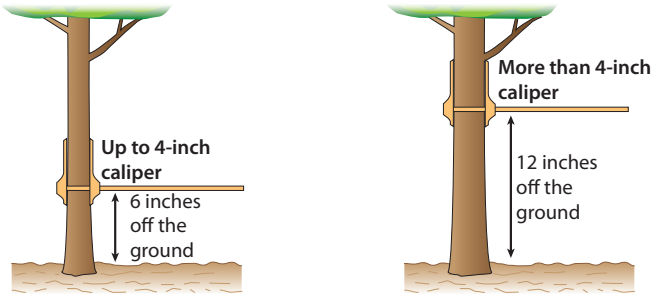

Figure 1. Measurements by tree size.

Trunk Formula Method

This method is recommended for trees that are too large to be replaced by nursery or field-grown stock. It considers species, condition, and location, in addition to base value. The following discussion addresses each of these factors.

$$\textit{Tree Value} = \textit{Base Value} \times \textit{Cross-Sectional Area} \times \textit{Species Classification (\%)} \times \textit{Condition (\%)} \times \textit{Location (\%)}$$

When using this formula, values based on trunks greater than 30 inches in circumference become unrealistically high. This is because the value of a mature tree does not increase as rapidly as its trunk size. In such cases, the *adjusted trunk area* formula is recommended. This method should be used for low-branching trees, trees with excessive trunk flare or multiple stems, or when the upper portion of a tree has been removed. (For details, see the *Guide for Plant Appraisal, 9th Edition,* referenced on page 3.)

Base value: This value is derived from the cost of the largest locally available tree of the same or similar species, including installation, divided by the trunk cross-sectional area as explained on page 2. For example, referring to Table 1, suppose a 2-inch caliper tree has a cross-sectional area of 3 square inches and a local replacement cost of $250. Dividing $250 by 3 results in a base value of $84.

Cross-sectional area: Tree size is expressed as cross-sectional area, which can be determined by measuring the trunk's circumference (c) 4½ feet (DBH) from the ground at the base of the tree (Figure 2). Trees with branches below 4½ feet should be measured at the point that best represents trunk size, recording this height location.

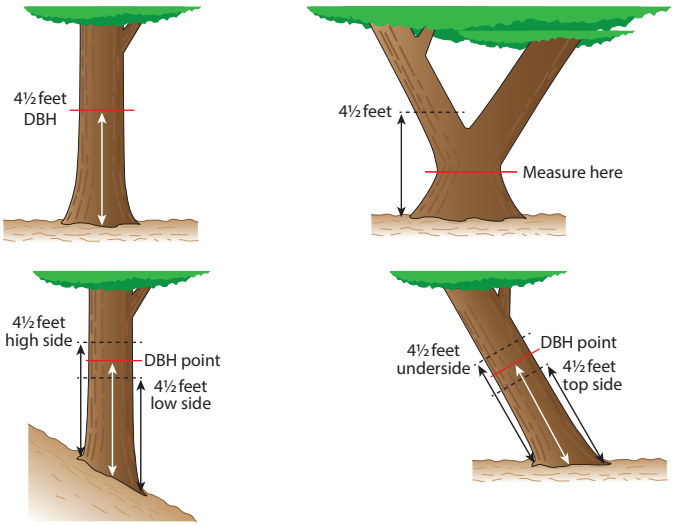

Figure 2. Common reference points for measuring tree diameter.

Trunk diameter converted to cross-sectional area is shown in Table 1. You can determine cross-sectional area without the table by measuring trunk circumference (c) at DBH, then calculating diameter:

$$c \div 3.14\ (\pi, pi) = d$$

Next, square the diameter (d), and then multiply by 0.7854 (pi ÷ 4) to determine cross-sectional area.

$$Cross\text{-}Sectional\ Area = d^2 \times 0.7854$$

Species classification: This number represents the value of an ornamental landscape tree *in Kansas* relative to other species. Values are based on climate adaptability, growth characteristics, soil adaptability, tolerance of insects and diseases, and general maintenance requirements, which vary across the state. This percentage is converted to a decimal for use in the formula so, for example, 70% becomes 0.70. Relative values of common Kansas tree species are listed on page 4.

Condition rating: A tree is assessed as being in excellent, good, fair, or poor condition based on structural integrity and health, vigor and life expectancy, as well as form quality relative to a "perfect specimen" of that species (Table 2). This rating is based on existing condition, with deductions for wounds, decay, storm damage, insect or disease damage, and poor form. Few trees are perfect specimens.

Proper assessment of tree condition requires specialized knowledge and experience. Trunk damage, for example, can significantly reduce life expectancy, or it may be superficial with little effect on condition or lifespan. Photographs taken before damage can be helpful. When in doubt, consult a Certified Professional Arborist or a member of the American Society of Consulting Arborists. Condition can be rated anywhere between 1% and 100%, but standard percentages are 100, 80, 60 to 40, 20, and 0. Expressed as a decimal, 60% becomes 0.60.

Location rating: A plant's location influences value. This rating is an average of the site, plant function or contribution, and placement in the landscape (Table 3).

Site is a primary factor in determining location class. Identical trees located on different sites may have different aesthetic values. A tree growing in an arboretum or park, for example, is of greater value than a street tree in a poorly maintained location. Rating: 10%–100%

Functional or contribution value describes benefits such as shade, screening, noise abatement, climate control, and aesthetic qualities for a particular situation. Rating: 10%–100%

Placement considerations include design symmetry, distance from other trees, interference with utilities, public safety, and potential damage to buildings, sidewalks, and other property with possible deductions for poor placement. Rating: 10%–100%

Calculate location rating as follows:

(Site + Contribution + Placement) ÷ 3 = Location Rating
Example: (0.70 + 0.80 + 0.65) ÷ 3 = 72%

Table 1. Trunk diameter to cross-sectional area.

Trunk diameter (inches)	Cross-sectional area (sq. in.) *	Trunk diameter (inches)	Cross-sectional area (sq. in.) *
2	3	17	227
3	7	18	254
4	13	19	283
5	20	20	314
6	28	21	346
7	38	22	380
8	50	23	415
9	64	24	452
10	79	25	491
11	95	26	531
12	113	27	572
13	133	28	615
14	154	29	660
15	177	30	707
16	201		

*Cross-sectional area = 0.7854 x d^2

Table 2. Condition rating: *Structure and health of roots, trunk, and scaffold branches combined.*

Condition Class	Condition Description	Value %	Formula Value
Excellent	Ideal specimen. Excellent form and vigor for species. No pest problems or mechanical injuries. No corrective work required. Minimum life expectancy 30 years.*	91-100	0.9-1.0
Good	Healthy and vigorous. No apparent signs of insect, disease, or mechanical injury. Little or no corrective work required. Form representative of species. Minimum life expectancy 20 years.*	70-90	0.7-0.9
Fair	Average condition and vigor. 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. *	40–60	0.4-0.6
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 or less	0.2-0.0

** Life expectancy values represent years beyond time of inspection.*

Table 3. Location rating: *Site, plus contribution and placement.*

Site Location	Value %	Formula Value
Arboretum, specimen or historical tree	100	1.00
Average residential, landscape trees	80–90	0.80-0.90
Park and recreation trees	70–80	0.70-0.80
Golf course trees	60–80	0.60-0.80
City street trees, shopping malls	60–80	0.60-0.80
Homestead/farmstead	60–80	0.60-0.80
Industrial area trees	50–60	0.50-0.60
Out-of-city highway trees	40–50	0.40-0.50
Undesirable location	0–20	0.0-0.20

Tree evaluation procedures presented were adapted from the *Guide for Plant Appraisal, 9th Edition* by the Council of Tree and Landscape Appraisers. For a copy of the handbook, contact the International Society of Arboriculture, Champaign, Illinois.

Trunk Formula Calculation Examples

Sycamore, 23-inch DBH, in fair condition with good form, located in a city park in eastern Kansas. Cost estimate for replacement and installation of a 2-inch caliper tree, the largest available from a local nursery, is $150.

Base value: 2-inch caliper tree = cross-sectional area of 3 sq. in. (Table 1) $150 ÷ 3 sq. in. = $50 per sq. in.

Cross-sectional area (DBH): 23 in. = 415 sq. in. (Table 1) or [$d^2 = 23^2 \times 0.7854 = 415.48$ sq. in.]

Species classification: 60% (0.6)

Condition rating: 60% (0.6)

Location rating: 70% (0.7)

Computation: $50 x 415.48 sq. in. x 0.6 x 0.6 x 0.7 = $5,235.04

Sugar maple, 10-inch DBH, in good health and form, specimen tree on a golf course. Cost estimate for replacement and installation of a 2-inch caliper tree, the largest available from a local nursery, is $250.

Base value: 2-inch tree = 3 sq. in. cross-sectional area (Table 1) $250 ÷ 3 sq. in. = $83.33 per sq. in. (Round to $84.)

Cross-sectional area (DBH): 10 inches = 79 sq. in. (Table 1) or [$d^2 = 100 \times 0.7854 = 78.5$ or 79 sq. in.]

Species classification: 100% (1.0)

Condition rating: 80% (0.8)

Location rating: 70% (0.7)

Computation: $84 per sq. in.× 79 sq. in. × 1.0 × 0.8 × 0.7 = $3,716.16

Relative Shade Tree Values in Kansas

Deciduous Trees

Common Name	Botanical Name	Relative Value (%) Eastern	Central	Western
American Elm	*Ulmus americana*	40	50	50
Improved Elm	*Ulmus* sp.	75	75	80
American Holly	*Ilex opaca*	80	75	
American Hophornbeam	*Ostrya virginiana*	80	80	80
American Planetree	*Platanus occidentalis*	80	80	80
American Plum	*Prunus americana*	40	60	75
American Sweetgum	*Liquidambar styraciflua*	90	80	
American Yellowwood	*Cladrastis kentukea*	75	50	
Amur Maple	*Acer ginnala*	75	80	50
Autumn Blaze Maple	*Acer x freemanii*	75	80	50
Black Cherry	*Prunus serotina*	50	60	60
Black Locust	*Robinia pseudoacacia*	75	70	50
Blue Ash	*Fraxinus quadrangulata*	50	50	
Boxelder	*Acer negundo*	40	50	60
Bur Oak	*Quercus macrocarpa*	100	100	100
Chinese Pistache	*Pistacia chinensis*	90	90	60
Chinkapin Oak	*Quercus muehlenbergii*	100	100	90
Common Horsechestnut	*Aesculus hippocastanum*	80	80	
Cottonwood	*Populus deltoides*	40	50	50
Cottonwood (cottonless)	*Populus deltoides*	50	60	60
Crabapples	*Malus* spp.	90	90	90
Eastern Black Walnut	*Juglans nigra*	80	80	80
Eastern Redbud	*Cercis canadensis*	80	80	70
Eastern White Birch	*Betula pendula*	40	40	
English Oak	*Quercus robur*	100	100	90
European Mountain Ash	*Sorbus aucuparia*	40	20	
Flowering Dogwood	*Cornus florida*	70		
Freeman Maple	*Acer x freemanii*	60	60	60
Ginkgo (male)	*Ginkgo biloba*	100	100	90
Goldenraintree	*Koelreuteria paniculata*	90	90	90
Green Ash	*Fraxinus pennsylvanica*	40	40	50
Hackberry	*Celtis occidentalis*	50	60	70
Hawthorns	*Crataegus* spp.	80	75	75
Hedge Maple	*Acer campestre*	80	80	80
Hickories	*Carya* spp.	80	50	
Honeylocust (common)	*Gleditsia triacanthos*	40	40	40
Honeylocust (thornless)	*Gleditsia triacanthos* var. *inermis*	70	80	90
Japanese Maple	*Acer palmatum*	80	70	
Japanese Pagodatree	*Styphnolobium japonicum*	80	80	80
Japanese Tree Lilac	*Syringa reticulata*	80	80	75
Japanese Zelkova	*Zelkova serrata*	70	70	50
Kentucky Coffeetree	*Gymnocladus dioica*	90	90	90
Lacebark Elm	*Ulmus parvifolia*	80	80	80
Lindens	*Tilia* spp.	80	70	60
London Planetree	*Platanus x acerifolia*	80	90	90
Magnolia	*Magnolia* spp.	70	60	
Northern Catalpa	*Catalpa speciosa*	70	60	60
Norway Maple	*Acer platanoides*	80	60	50
Ohio Buckeye	*Aesculus glabra*	75	60	
Osageorange (common)	*Maclura pomifera*	50	50	75
Osageorange (thornless male)	*Maclura pomifera*	70	60	80
Pear (ornamental)	*Pyrus* spp.	70	70	70
Pecan	*Carya illinoinensis*	90	90	90
Persimmon	*Diospyros virginiana*	60	60	
Pin Oak	*Quercus palustris*	80	70	60
Post Oak	*Quercus stellata*	50	50	50
Red Maple	*Acer rubrum*	75	50	25
Red Oak	*Quercus rubra*	90	90	80
River Birch	*Betula nigra*	70	70	50
Royal Paulownia	*Paulownia tomentosa*	50	40	
Russian-olive	*Elaeagnus angustifolia*	40	50	70
Saucer Magnolia	*Magnolia x soulangeana*	90	90	
Sawtooth Oak	*Quercus acutissima*	80	80	50
Shantung Maple	*Acer truncatum*	100	90	80
Shumard Oak	*Quercus shumardii*	100	90	80
Shingle Oak	*Quercus imbricaria*	90	90	90
Siberian Elm	*Ulmus pumila*	20	40	60
Silver Maple	*Acer saccharinum*	30	40	50
Southern Catalpa	*Catalpa bignonioides*	70	60	40
Sugar Hackberry	*Celtis laevigata*	60	60	70
Sugar Maple	*Acer saccharum*	90	90	
Swamp White Oak	*Quercus bicolor*	100	90	80
Sycamore	*Platanus x occidentalis*	60	60	60
Tatarian Maple	*Acer tataricum*	70	70	80
Tree-of-Heaven	*Ailanthus altissima*	20	40	60
Tuliptree	*Liriodendron tulipifera*	70	60	
Western Soapberry	*Sapindus drummondii*	80	90	100
White Ash	*Fraxinus americana*	40	50	50
Mulberry	*Morus* spp.	40	50	80
White Oak	*Quercus alba*	90	70	60
Willows	*Salix* spp.	60	60	60
Willow Oak	*Quercus phellos*	80	80	
Yellow Buckeye	*Aesculus flava*	70	70	

Evergreens (Conifers)

Common Name	Botanical Name	Relative Value (%) Eastern	Central	Western
Austrian Pine	*Pinus nigra*	75	75	80
Chinese Juniper	*Juniperus chinensis*	80	80	80
Colorado Spruce	*Picea pungens*	90	75	75
Baldcypress	*Taxodium distichum*	90	80	70
Black Hills Spruce	*Picea glauca* var. *densata*	90	80	
Douglasfir	*Pseudotsuga menziesii*	90	70	50
Eastern Redcedar	*Juniperus virginiana*	80	80	100
Eastern White Pine	*Pinus strobus*	90	70	
European Larch	*Larix decidua*	80		
Green Giant Arborvitae	*Thuja standishii x plicata*	100	80	50
Jack Pine	*Pinus banksiana*	80	80	80
Limber Pine	*Pinus flexilis*	70	70	
Norway Spruce	*Picea abies*	90	60	50
Pinyon Pine	*Pinus edulis*	50	50	50
Pitch Pine	*Pinus rigida*	70	50	
Ponderosa Pine	*Pinus ponderosa*	90	70	70
Red Pine	*Pinus resinosa*	70	30	20
Rocky Mountain Juniper	*Juniperus scopulorum*	40	50	70
Scotch Pine	*Pinus sylvestris*	20	20	50
Southwestern White Pine	*Pinus strobiformis*	80	70	50
Virginia Pine (Scrub)	*Pinus virginiana*	70	50	50
White Spruce	*Picea glauca*	80	60	

*Trees and varieties not listed may be compared to similar species.

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