Section 15. Urban Measurements and Sampling

15.1 OVERVIEW

The periodic assessment of forest resources conducted by the USDA Forest Service's Forest Inventory and Analysis units provides data on the amount, status, and character of forests. Historically, this information is summarized from general data collected on all plots and detailed tree measurements collected on all forested plots. Forested plots are defined by FIA as areas with at least 1 acre in size, at least 120 feet wide, and at least 10 percent stocked with trees. In additon, forested plots must have an understory undisturbed by another land use. A classification of 'non-forest' does not mean that an FIA plot location is devoid of trees rather that the plot location does not fully fit the forested definition. Many areas within a state have tree cover but plot locations within these areas do not meet the forested definition.

This manual describes supplemental data collection procedures for plots falling within an urban boundary. The urban boundary is defined by the U.S. Census Bureau in 2000 as all territory, population, and housing units in urbanized areas (UA) and urban clusters (UC).

- UA is a densely settled area with at least 500 people per square mile that has a census population of at least 50,000.
- UC is a densely settled area with at least 500 people per square mile that has a census population of 2,500 to 49,999.

The urban boundary is overlaid with the FIA grid and all plot falling within this boundary have both general data and detailed tree measurements collected whether or not they meet the definition of forested. Through this process data is collected that provides information on the amount, status, and character of the 'urban forest', and provides an assessment of the tree resource for which species, health, and biomass is not currently collected (the data gap).

15.2 WITNESS

Since pins are not placed on nonforest subplots, at least two witness objects must be identified (when available) for each subplot center so that it can be relocated for future remeasurements. Identify objects that are visible when standing at subplot center. Try to use objects that are likely to be present 5 to 15 years from now, e.g. street signs, utility poles, structures. Trees can be used but should not be used if there are other alternatives. Witness information for nonforest subplots should be recorded on the plot datasheet. If the subplot and the four offset points cannot be occupied (nonsampled condition or census water), then no reference is necessary.

15.2.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: All nonforest subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

15.2.2 SPECIES/OBJECT

Record the code to the specific witness object, or if a tree is being used, record the **TREE SPECIES CODE** or scientific name.

When collected: All witness objects
Tolerance: No errors
MQO: At least 99% of the time
Values:

C	Corner of House/Building
E	Electric Meter
F	Fire Hydrant
G	Gas Meter
M	Mailbox
P	Fence Post
S	Street Sign
U	Utility Pole
X	Sewer Cover
O	Other (specify)

15.2.3 WITNESS TREE DIAMETER

If a tree is used for the witness object, record diameter at 4.5'.

When Collected: All witnessed trees
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 in per 20.0 in increment of measured diameter on all live trees and dead trees
MQO: At least 95% of the time. For example: a tree with a diameter of 41.0 in would have a tolerance of plus or minus 0.3 in. (Note: the MQO for point of measurement is +/- 0.2 in when the tree is first measured and within 1 ft of the location established by the previous crew when the tree is remeasured.)
Values: 0001 to 9999

15.2.4 AZIMUTH

Record the azimuth from the subplot center to the **SPECIES/OBJECT**.

When collected: All witnessed objects/trees
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

15.2.5 HORIZONTAL DISTANCE

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center to the object or, when a tree is used, to the pith of the tree at the base.

When collected: All witnessed objects/trees
Field width: 4 digits
Tolerance: +/- 1 ft
MQO: At least 90% of the time
Values: 000.1 to 999.9

15.3 CONDITION LEVEL

15.3.1 LAND USE

Record this attribute when area sampled is classified as nonforest land.

When collected: CONDITION CLASS STATUS = 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

100 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide. Use the 100 code only for cases not better described by one of the following:

- 110 Cropland
- 120 Pasture (improved through cultural practices)
- 130 Idle farmland
- 140 Orchard
- 150 Christmas tree plantation

200 Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 acre in size and 120.0 feet wide.

300 Developed - Land used primarily by humans for purposes other than forestry or agriculture. Use the 300 code only for land not better described by one of the following:

- 311 Residential
- 312 Institutional
- 313 Commercial/Industrial
- 314 Cemetery
- 315 Multi-family residential
- 316 Vacant
- 320 Transportation: limited access roadway, railway or airport
- 321 Rights-of-way: improved road, maintained canal
- 322 Utility
- 330 Parks
- 331 Golf courses

400 Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, that do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow.

15.3.2 CONDITION DELINEATION BASED ON NONFOREST LAND USE

Further subdivide Nonforest Land by **LAND USE**:

Any condition class sampled as nonforest land may be further subdivided, into smaller condition classes if distinct, contrasting land use classes are present because of variation within the sampled area. Use the above described LAND USE codes to delineate between these smaller condition classes, regardless of size.

15.4 OFFSET POINT PROCEDURES

Because subplot locations are fixed and cannot be moved or rotated, the subplot center may fall in the middle of a tree, stream, building, or some other obstruction. Since it is impossible to occupy the point under these circumstances, distances and azimuths to boundaries and trees cannot be measured. Instead, four points can be established on the subplot perimeter, offset 24.0 ft (7.32 m) in the four cardinal directions from the subplot center. These serve as reference points for tree selection, instead of the subplot center. Offset points are used only on nonforest subplots (SUBPLOT STATUS = 2)

Procedure
When a subplot cannot be established because of an obstruction, any one of four subplot offset points can be used to reference boundaries or trees. That is, all distances and azimuths that would normally be taken from a subplot center are instead taken from one or more subplot offset points. Subplot offset points are located on the perimeter of the subplot in one of the four cardinal directions (360, 090, 180, and 270^{o}) from the subplot center (Figure 5-1).

15.4.1 OFFSET POINT

Record appropriate code for the offset point for each subplot, if needed. (See figure 15.1)

When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
0	Normal position (subplot center)
1	North offset point
2	East offset point
3	South offset point
4	West offset point

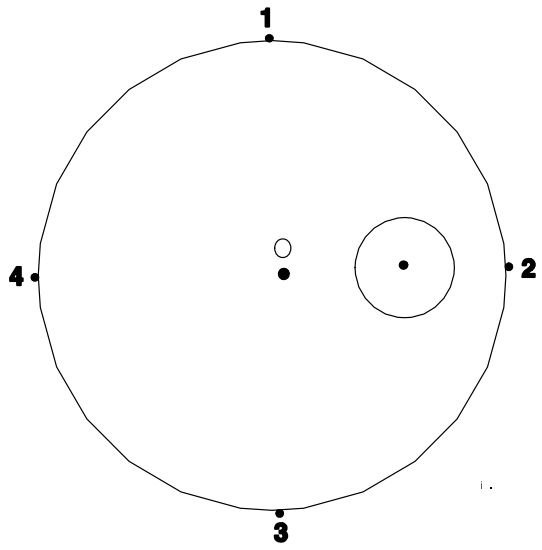


Figure 15.1 Location of four subplot offset points.

Obstructions that necessitate the use of offset points can also make travel to and around the plot difficult. The following illustrations provide information that facilitate plot establishment and measurement in such cases.

Case 1: An obstruction occurs at the center of Subplot 1.

If an obstruction prevents access to the center of Subplot 1, then stop at or before the obstruction, offset 24.0 ft in one of the cardinal directions (360, 090, 180, or 270°), and complete the course to arrive at one of the offset points. For example, say the course to plot center is 375 ft at 34°, the obstruction extends 17 ft from plot center, and the most convenient offset point is #3. Stop at 358.0 ft, proceed 24.0 ft at 180°, and then go 17.0 ft at 34°. This will position you at Offset Point 3 (Figure 15.2).

If Subplot 1 cannot be occupied, Subplot centers 2, 3, and 4 must be found by starting from one of Subplot 1's offset points. Travel 120.0 ft in the prescribed direction (360, 120, or 240°) to arrive at the same offset point at the next subplot 1. Then measure 24.0 ft back to subplot center.

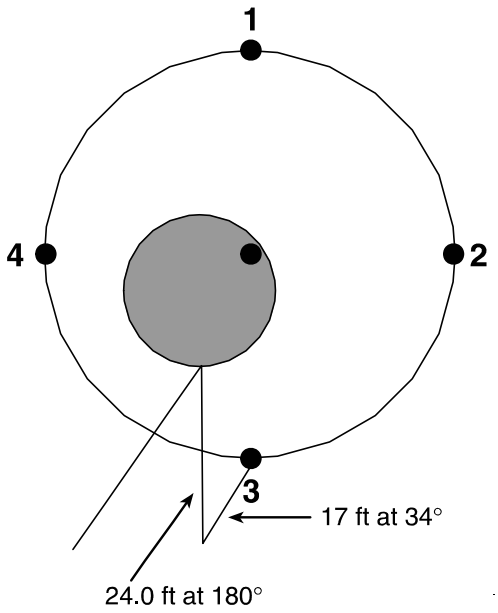


Figure 15.2 Locating offset point #3.

Case 2: An obstruction hinders travel from Subplot 1 to Subplots 2, 3, and 4.

If an obstruction occurs at the center of Subplot 1 or between Subplot 1 and Subplots 2, 3, or 4, then Subplots 2-4 can be reached from each other (e.g., travel from Point 2 to Point 3). The azimuths and distances between subplots are given in Table 15-1. If the direction is reversed from what is shown in the Table 15-1 (e.g., subplot 3 to subplot 2), then use the backsight for the azimuth.

Subplot Numbers		Azimuth	Backsight	----Distance---
From	To	----------degrees----------		feet
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

Table 15-1 Distances and Azimuths Between Subplots 2-4

Case 3: An obstruction occurs at the center of Subplot 2, 3, or 4.

This situation is handled the same as Case 1. Stop at or before the obstruction, proceed 24.0 ft in one of the cardinal directions, and then finish chaining to the subplot. This will position you at the targeted offset point.

Case 4: No portion of Subplot 1 can be occupied, not even the offset points.

This situation is handled similarly to Case 1 except that instead of proceeding to an offset point on Subplot 1, proceed directly to another subplot center. Stop at or before the obstruction, proceed 120 ft in

one of the prescribed directions (360, 120, or 240^{o}), and then finish chaining to the subplot. This will position you at the center of the selected subplot.

Case 5: Locating offset points from each other on the same subplot.

Once one offset point is determined, the location of other offset points can be found as indicated in Table 15-2 (Figure 15.3).

Table 15-2 Distances and Azimuths Between Offset Points

From Offset Point	To offset point							
	North (1)		East (2)		South (3)		West (4)	
	Azi deg	Dist ft	Azi deg	Dist ft	Azi deg	Dist ft	Azi deg	Dist ft
North (1)	-	-	135	33.9	180	48.0	225	33.9
East (2)	315	33.9	-	-	225	33.9	270	48.0
South (3)	360	48.0	045	33.9	-	-	315	33.9
West (4)	045	33.9	090	48.0	35	33.9	-	-

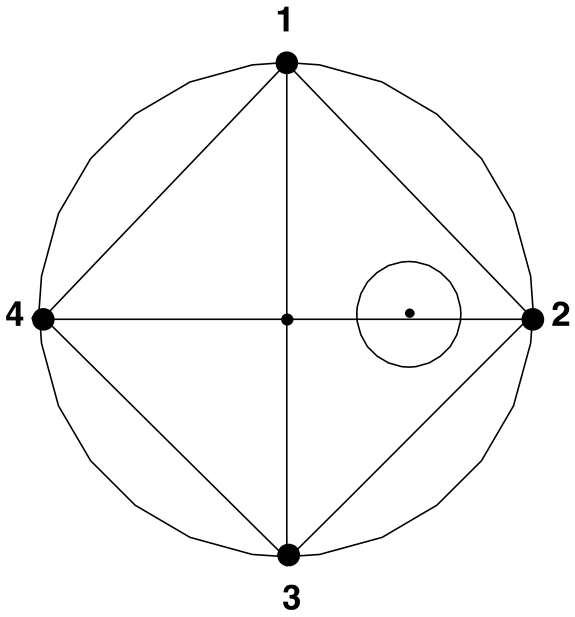


Figure 15.3 Locating offset points from each other on the same subplot

Case 6: Tallying trees from offset points.
Not all trees may be visible from the initial offset point. It is permissible to use more than one offset point to Tally trees. Subplot trees can be tallied from the subplot offset (Figure 15.4).

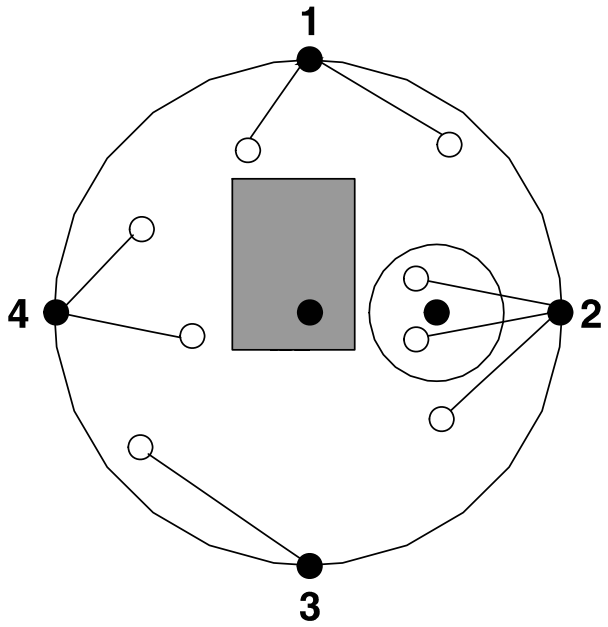


Figure 15.4 Referencing trees to offset points

Case 7: Recording boundaries from offset points.
Choose one offset point from which the left, right, and corner azimuths and distances can be measured. If possible, select an offset point which is on the same side of the boundary as the subplot center.

When referenced to an offset point, it is difficult to pinpoint where a boundary crosses the subplot perimeter. Left and right azimuths and distances from an offset point to the edge of the subplot will often have to be estimated and should be measured to points on the boundary that are close to the subplot perimeter (Figure 15.5). From the recorded data, the exact points of intersection will be computed at the time of data processing.

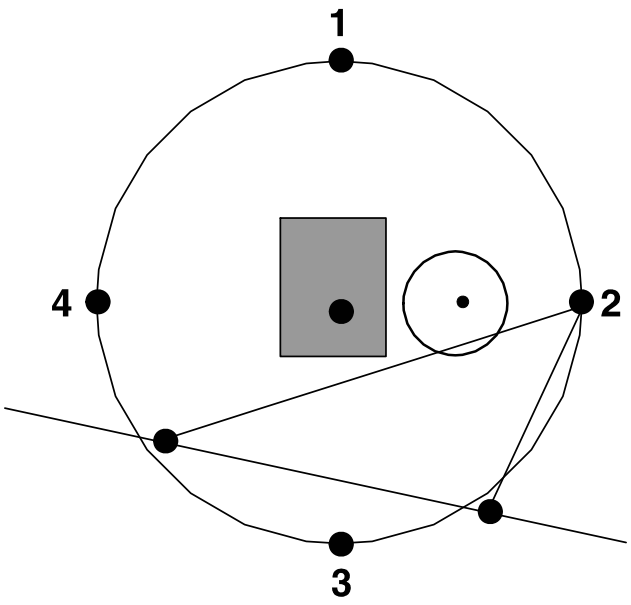


Figure 15.5. Estimating boundaries from offset points.

Case 8: Checking limiting distances from offset points without a PDR.

Table 15-3 lists the angle and limiting distance to 18 perimeter points on the subplot (Figure 15.6). The angle is the difference between the azimuth to subplot center (180, 270, 360, or 90°) and the azimuth to the tree. This angle should never be more than 90°. Borderline trees should be tallied and will be checked later during data processing.

Table 15-3 Limiting Distances to 18 Points on the Subplot

DEG	FT	DEG	FT	DEG	FT	DEG	FT
0	48.0	25	43.5	50	30.8	75	12.4
5	47.8	30	41.6	55	27.5	80	8.3
10	47.2	35	39.3	60	24.0	85	4.2
15	46.3	40	36.8	65	20.3	85	4.2
20	45.1	45	33.9	70	16.4		

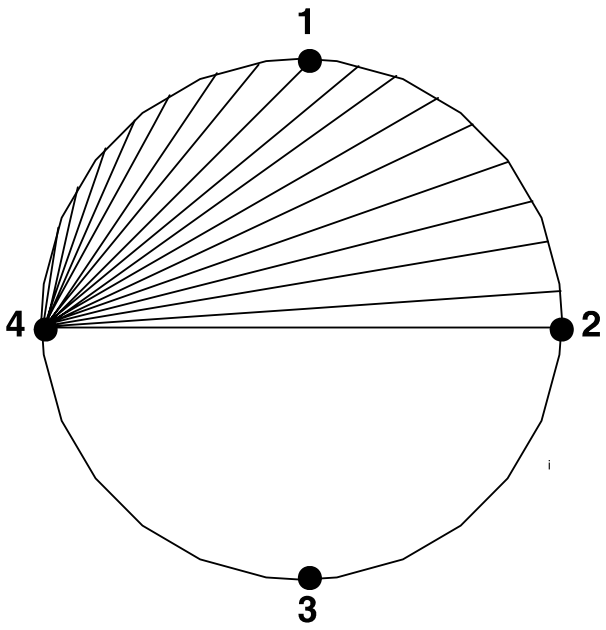


Figure 15.6 Subplot limiting distances from offset point #4.

15.5 SUBPLOT INFORMATION

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. If access (permission) to the subplot center is denied, do not collect data on the subplot except for **SUBPLOT NUMBER** and **SUBPLOT CENTER CONDITION.**

ALL SUBPLOT LEVEL DATA IS TO BE COLLECTED ON ACCESSIBLE FOREST LAND AND NONFOREST LAND (CONDITION STATUS CLASSES 1 AND 2)

15.5.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

15.5.2 PERCENT MAINTAINED

Record the percent of the subplot that is being maintained. Maintained areas are defined as those which are consistently being impacted by mowing, weeding, herbiciding, etc. Examples include, but are not limited to, lawns, rights-of-ways, and parks. Examples of unmaintained areas are overgrown lots, small wooded areas, and riverbanks, among others.

When Collected: All subplots
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.6 SUBPLOT COVER

Tree, shrub/seedling, and ground cover will be measured for each subplot.

TREE, SHRUB/SEEDLING COVER (see 15.24) with DBH/DRC 1" or greater are considered TREES. Tree species (see 15.24) with stem diameter <1" are defined as SEEDLINGS. SHRUB species are never classified as a tree, no matter how large the stem diameter.

15.6.1 PERCENT TREE COVER

The amount of tree canopies (defined as all tree species with a diameter of at least 1" and ≥12" in height) covering the subplot. When looking upward from within the subplot, one will see tree canopies or open sky areas between the canopies. This data is the proportion of the sky that is obscured by tree crowns within the subplot and will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.6.2 PERCENT SHRUB/SEEDLING COVER

The amount of the subplot area covered by shrub/seedling canopies (defined as all shrubs >12" in height and all trees <1" diameter and ≥12" in height). Woody vines are included in as shrubs. Values will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.7 SUBPLOT GROUND COVER

Within the subplot, various materials will cover the ground (trees, shrubs/seedlings are considered separately; tree stems as a ground cover are ignored). The crew will measure and record what proportion of the subplot ground area is covered by the following materials:

- **BUILDINGS**
- **IMPERVIOUS**
- **PERMEABLE**
- **HERBACEOUS**
- **WATER**

A particular material must cover a minimum of 1% of the subplot area to be recorded. **The sum of the cover types listed above MUST sum to 100% for each subplot.** Objects that can be moved (not permanent) (e.g. picnic tables, sheet of metal on ground, inflatable swimming pool) are not considered ground cover. Cover goes to the **lowest** permanent cover type. **IMPERVIOUS** is defined as non-building material occupying at least 1% of the subplot that does not allow water to percolate through. (e.g. rock, tar, cement). Examples of **PERMEABLE** include soil and gravel. **HERBACEOUS** cover overrides **PERMEABLE**. **WATER** includes swimming pools.

15.7.1 PERCENT BUILDINGS

Record the percent of subplot area covered by buildings. Values will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.7.2 PERCENT IMPERVIOUS

Record the percent of subplot area covered by impervious materials (concrete, asphalt, tennis courts, etc.). Values will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.7.3 PERCENT PERMEABLE

Record the percent of subplot area covered by permeable materials (gravel, bare soil, sand, mulch, leaf litter, etc). Values will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.7.4 PERCENT LOW WOODY VEGETATION/HERBACEOUS

Record the percent of the subplot area covered by herbaceous materials (herbaceous ground cover, including agricultural crops, grass, low shrubs; also includes woody plants <12" in length)

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.7.5 PERCENT WATER

Record the percent of subplot area covered by water (swimming pools, canals, etc.). Values will range from 0 to 100 percent.

When collected: All subplots with an accessible forest land or nonforest land condition class (**CONDITION STATUS** = 1 and 2)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 100

15.8 CROWNS OVERVIEW

Crown indicators are designed to be used together. Each indicator comprises a piece of information that can be used individually or as a factor in combination with other indicators. Each variable, alone or in combination with others, adds to the overall rating given each tree. It is important to realize that models are designed to rate trees on how they look, from thriving to almost dead and to help predict future conditions of trees and forest ecosystems.

Crown evaluations, including UNCOMPACTED LIVE CROWN RATIO, LIGHT EXPOSURE, FOLIAGE ABSENT and DIEBACK are made on all trees. Trees with high scores for UNCOMPACTED LIVE CROWN RATIO and low scores for DIEBACK have increased potential for carbon fixation, nutrient storage and increased potential for survival and reproduction. Crown evaluations allow for the quantitative assessment of current tree conditions and provide an integrated measure of site conditions, stand density and influence of external stresses. All crown measurements are taken during plot establishment and whenever plot remeasurement occurs.

Two persons make all crown measurements. Individuals should be ½ to 1 tree length from the base of the tree to obtain a good view of the crown. Move away from each other at least 10 feet to take these measurements. A position of 90 degrees to each other from the tree base is ideal (Figure 15.9). When estimates made by two individuals disagree, they should discuss the reasons for their ratings until an agreement is reached, or use the methods below to resolve the situation. If the numbers for a crown measurement estimated by two crew members do not match, arrive at the final value by: (1) taking an average, if the numbers differ by 10 percent (2 classes) or less; (2) changing positions, if the numbers differ by 15 percent or more and attempting to narrow the range to 10 percent or less if crew members cannot agree; or (3) averaging the two estimates for those trees that actually have different ratings from the two viewing areas (ratings of 30 and 70 would be recorded as 50).

15.9 CROWN DEFINITIONS

Crown Shape
Crown shape is the silhouette of a tree, drawn from branch tip to branch tip, which contains all of a tree's foliage as it grows in a stand. Exclude abnormally long branches beyond the edge of the crown for this silhouette. Normally, silhouettes are derived from vigorous, open grown trees and tend to be species-specific. For Phase 3 purposes, silhouettes vary with age and spacing. Tree crowns tend to flatten out with age and be more slender when growing in crowded conditions. Crown shape is used as an outline for the sides of the tree.

Crown Top
The crown top is the highest point of a standing tree. Young trees usually have more conical-shaped crowns and the main terminal is the top. Older trees and many hardwoods have globose and flat-topped crowns, where a lateral branch is the highest point. For some measurements the highest live foliage is considered the live crown top. Other measurements include a dead top. Some crown measurements assess how much of the expected crown is present and include broken or missing tops.

Dieback
This is recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is only considered when it occurs in the upper and outer portions of the tree. When whole branches are dead in the upper crown, without obvious signs of damage such as breaks or animal injury, assume that the branches died from the terminal portion of the branch. Dead branches in the lower portion of the live crown are assumed to have died from competition and shading. Dead branches in the lower live crown are not considered as part of crown dieback, unless there is continuous dieback from the upper and outer crown down to those branches**.**

Epicormic
Shoot growth, from latent or suppressed buds, that arises from old branches, from the trunk or near large branch wounds or breaks. Epicormics remain epicormics until they regain the size of previous branches for trees with no branches 1.0 inch or larger in diameter at the base above the swelling. For trees that had 1.0 inch or larger branches when the epicormics formed, epicormics become branches once they reach 1.0 inch in diameter.

Live Branch
A live branch is any woody lateral growth supporting foliage, and is 1.0 inch or larger in diameter at the base above the swelling where it joins a main stem or larger branch. Small trees or certain tree species greater than 5.0 inches DBH/DRC may have only live twigs which have not yet reached 1.0 inch or larger at the point of attachment. If the death of larger branches is not the cause of these twigs, the twigs are considered branches for these smaller branched trees until the tree matures to a point where twigs have attained 1.0 inch or larger in diameter at the base above the swelling where it joins a main stem or larger branch.

Live Crown Base
The live crown base is an imaginary horizontal line drawn across the trunk from the bottom of the lowest live foliage of the "obvious live crown" for trees and from the lowest live foliage of the lowest twig for saplings. The "obvious live crown" is described as the point on the tree where most live branches/twigs above that point are continuous and typical for a tree species (and/or tree size) on a particular site. Include most crown branches/twigs, but exclude epicormic twigs/sprigs and straggler branches that usually do not contribute much to the tree's growth. The base of the live branch/twig bearing the lowest foliage may be above or below this line.

For trees 5.0 inches DBH/DRC or greater, if any live branch is within 5 feet below this "obvious live crown" line, a new horizontal line is established. Create the new line at the base of live foliage on that branch. Continue this evaluation process until no live branches are found within 5 feet of the foliage of the lowest qualifying branch (Figure 15-8).

Occasionally, all original major crown branches/twigs are dead or broken and many new twigs/sprigs develop. These situations are likely to occur in areas of heavy thinning, commercial clearcuts and severe weather damage:

- Trees that had an "obvious live crown" with live branches now have no crown to measure until the new live twigs become live branches. When these new live branches appear, draw the new live crown base to the live foliage of the lowest live branch that now meets the 5-foot rule.

- Saplings and small trees that had only live twigs should establish the crown base at the base of the live foliage on the new lowest live twig. If no live twigs are present, there is no crown to measure.

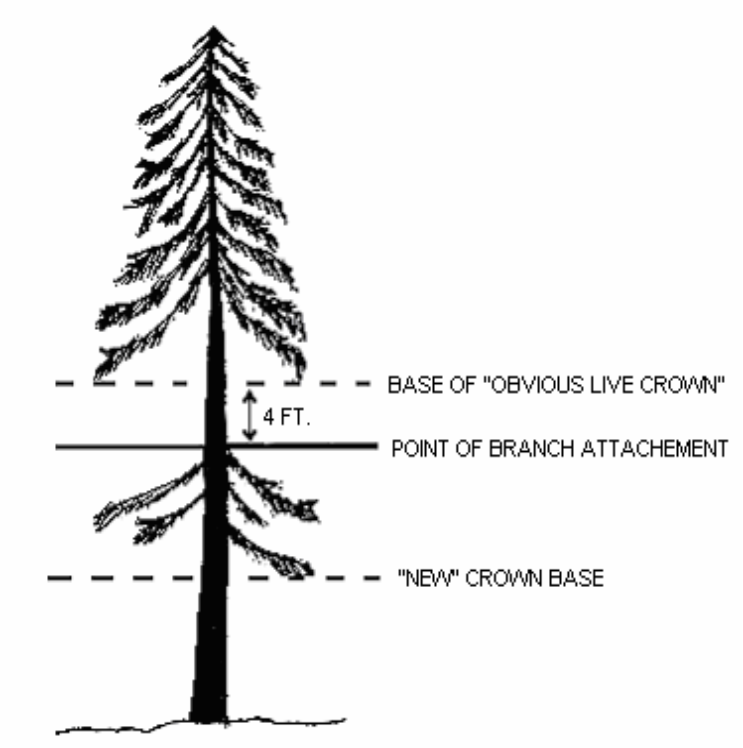


Figure 15-8 Determining the base of the live crown.

Overstory Canopy Zone
The area delineated by the average live crown height determined from the UNCOMPACTED LIVE CROWN RATIO of overstory trees. The bottom of the overstory canopy zone is the average height of the live crown bases. The top of the zone is the average height for the live crown tops.

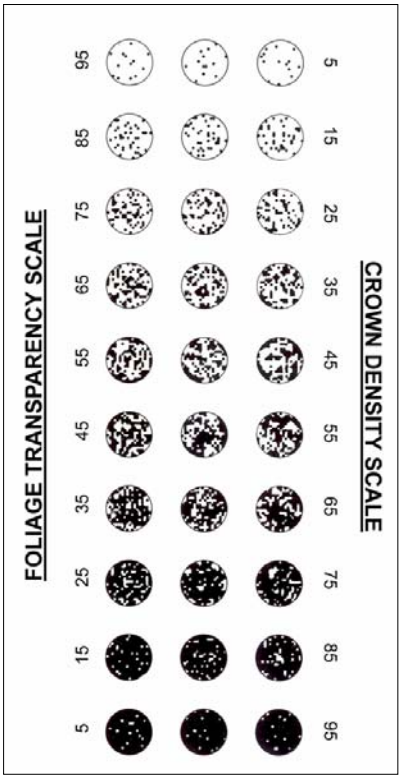
Snag Branch
A dead upper crown branch without twigs or sprigs attached to it. A lower branch on woodland trees such as juniper is not considered a snag branch unless the branch reaches into the upper crown, or reached into the upper crown when the branch was alive. A branch that died due to shading in any crown is not a snag branch.

Sprig
Any woody or non-woody lateral growth, without secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

Twig
Any woody lateral growth, with secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

15.10 CROWN DENSITY-FOLIAGE TRANSPARENCY CARD

Front



Back

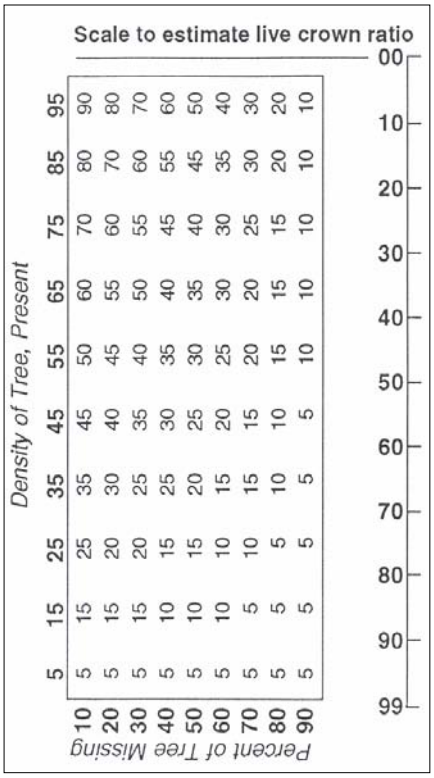


Figure 15-9. Density-Transparency card

The crown density - foliage transparency card (Figure 15-9) should be used as a training aid until crew personnel are comfortable with all ratings. White areas of the card represent skylight visible through the crown area and black areas represent a portion of the tree that is blocking skylight. After training, use the card to calibrate your eyes at the start of each day and rate those trees that do not fit into an obvious class. For CROWN DENSITY, hold the card so that "Crown Density" is right-side up ("Foliage Transparency" should be upside down). Use the numbers that are right-side up. Conversely, for FOLIAGE TRANSPARENCY, make sure that "Foliage Transparency" is right-side up. Crews should refer to specific CROWN DENSITY or FOLIAGE TRANSPARENCY sections for a definition of aspects that are included in the crown rating.

The back of the crown density - foliage transparency card has two uses: for CROWN DENSITY when a portion of the crown is missing and a general scale for estimating UNCOMPACTED LIVE CROWN RATIO. Crews should refer to the CROWN DENSITY and UNCOMPACTED LIVE CROWN RATIO sections for the use of this side of the card.

15.11 CROWN RATING PRECAUTIONS

Crews must be especially careful when making evaluations, and pay special attention to certain factors that may affect measurements in the field. These factors include:

- Distance and slope from the tree
- View of the crown
- Climatic conditions
- Heavy defoliation
- Leaning trees
- Trees with no “crown” by definition

Distance and slope from the tree -
Crews must attempt to stay at least 1/2 to 1 tree length from the tree being evaluated. Some ratings change with proximity to the tree. In some situations, it is impossible to satisfy this step, but the crew should do the best it can in each case. All evaluations are made at grade (same elevation as base of the tree) or up slope from the tree. This may not be possible in all cases but evaluating trees from the down slope side should be avoided.

View of the crown -
Crew members should evaluate trees when standing at an angle to each other, striving to obtain the best view of the crown. The ideal positions are at 90 degrees to each other on flat terrain (Figure 15-10). If possible, never evaluate the tree from the same position or at 180 degrees. In a thick canopy forest, getting a good perspective of the crown becomes difficult. Overlapping branches, background trees and lack of a good viewing area can cause problems when rating some trees. Crews need to move laterally to search for a good view. Take special care when rating such trees.

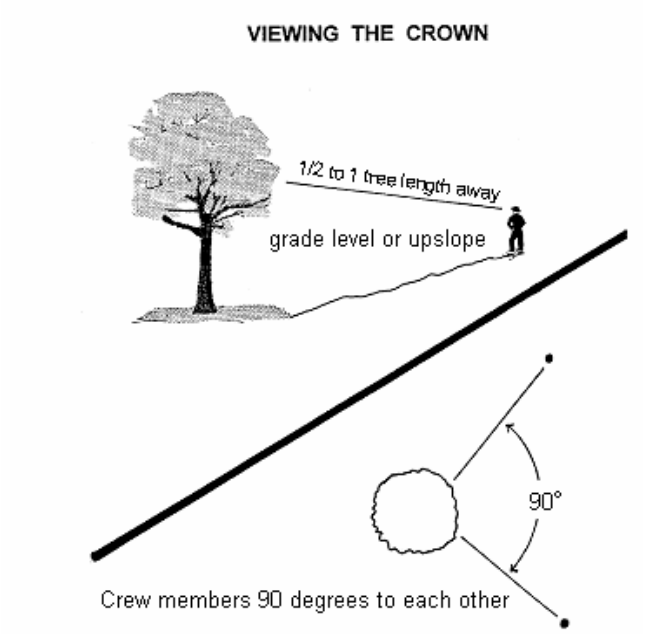


Figure 15-10. Crew positions for viewing crowns.

Climatic conditions -
Cloudy or overcast skies, fog, rain and poor sun angles may affect the accuracy of crown estimates. Crews need to be especially careful during poor lighting conditions to obtain the best possible view of the crown for the given climate conditions.

Heavy defoliation -
During heavy defoliation, CROWN DIEBACK may be overestimated due to the difficulty in differentiating dead twigs from defoliated twigs. The use of binoculars may help in separating dead twigs from defoliated twigs.

Leaning trees -
So that crown dimensions are measured consistently on both leaning and upright trees, UNCOMPACTED LIVE CROWN RATIO and CROWN DENSITY for leaning and down trees must be rated in relation to the actual length of the tree bole (as opposed to height above the ground). CROWN POSITION and CROWN LIGHT EXPOSURE should still be estimated relative to the tree's actual location in the canopy. FOLIAGE TRANSPARENCY will rarely be affected by lean angle. Place a note in the PDR TREE NOTES field that the tree is leaning if it is leaning more than 45 degrees from vertical.

Trees with no "crown" by definition (epicormics or sprigs only) -
After a sudden release or damage, a tree may have very dense foliage, but no crown. These situations are coded as follows: UNCOMPACTED LIVE CROWN RATIO = 00, CROWN LIGHT EXPOSURE = 0, CROWN POSITION = 3, CROWN DENSITY = 00, CROWN DIEBACK = 99 and FOLIAGE TRANSPARENCY = 99. This combination of codes is a flag for trees with no crowns.

After a sudden release or damage, a sapling may have very dense foliage, but no crown as it only has sprigs. These situations are coded as follows: UNCOMPACTED LIVE CROWN RATIO = 00, CROWN LIGHT EXPOSURE = 0 and CROWN POSITION = 3. This combination of codes is a flag for saplings with no crowns.

15.12 UNCOMPACTED LIVE CROWN RATIO

UNCOMPACTED LIVE CROWN RATIO is a percentage determined by dividing the live crown length by the actual tree length (Figure 15-12). Record the UNCOMPACTED LIVE CROWN RATIO to the nearest 1%.

Saplings

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by actual tree length, then enter the appropriate code into the PDR. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live foliage on the lowest live twig for saplings. Be sure to eliminate vine foliage as best you can when determining the live crown. The live crown base for saplings is different from trees 5.0 inches DBH/DRC and larger. The 5-foot/1-inch rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 15-11).

When the two estimates do not agree, follow the guidelines listed at the end of section 15.6 *Overview*.

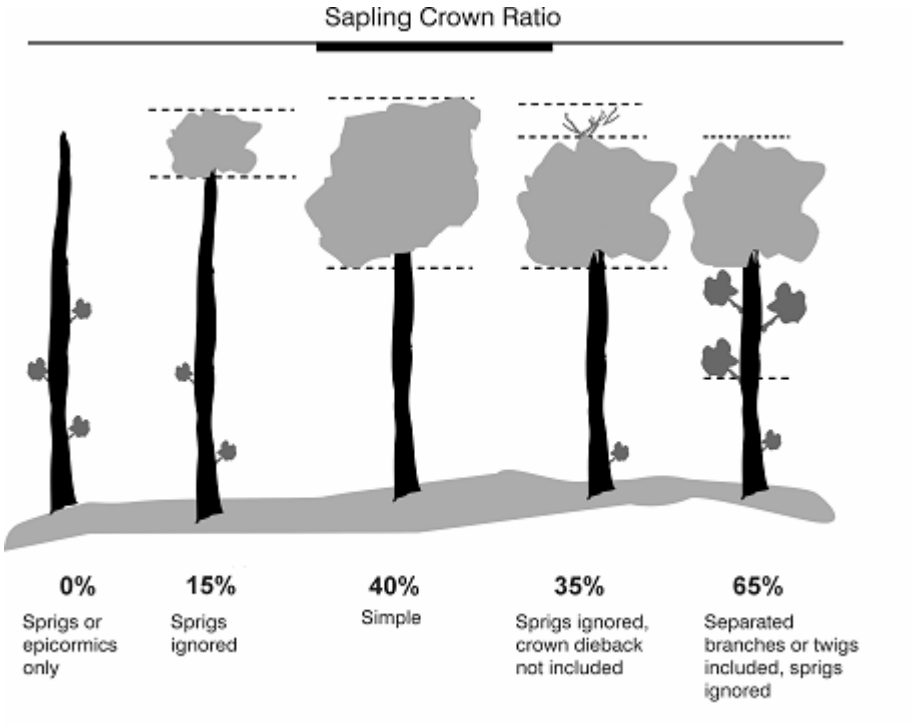


Figure15-11. Sapling UNCOMPACTED LIVE CROWN RATIO determination examples.

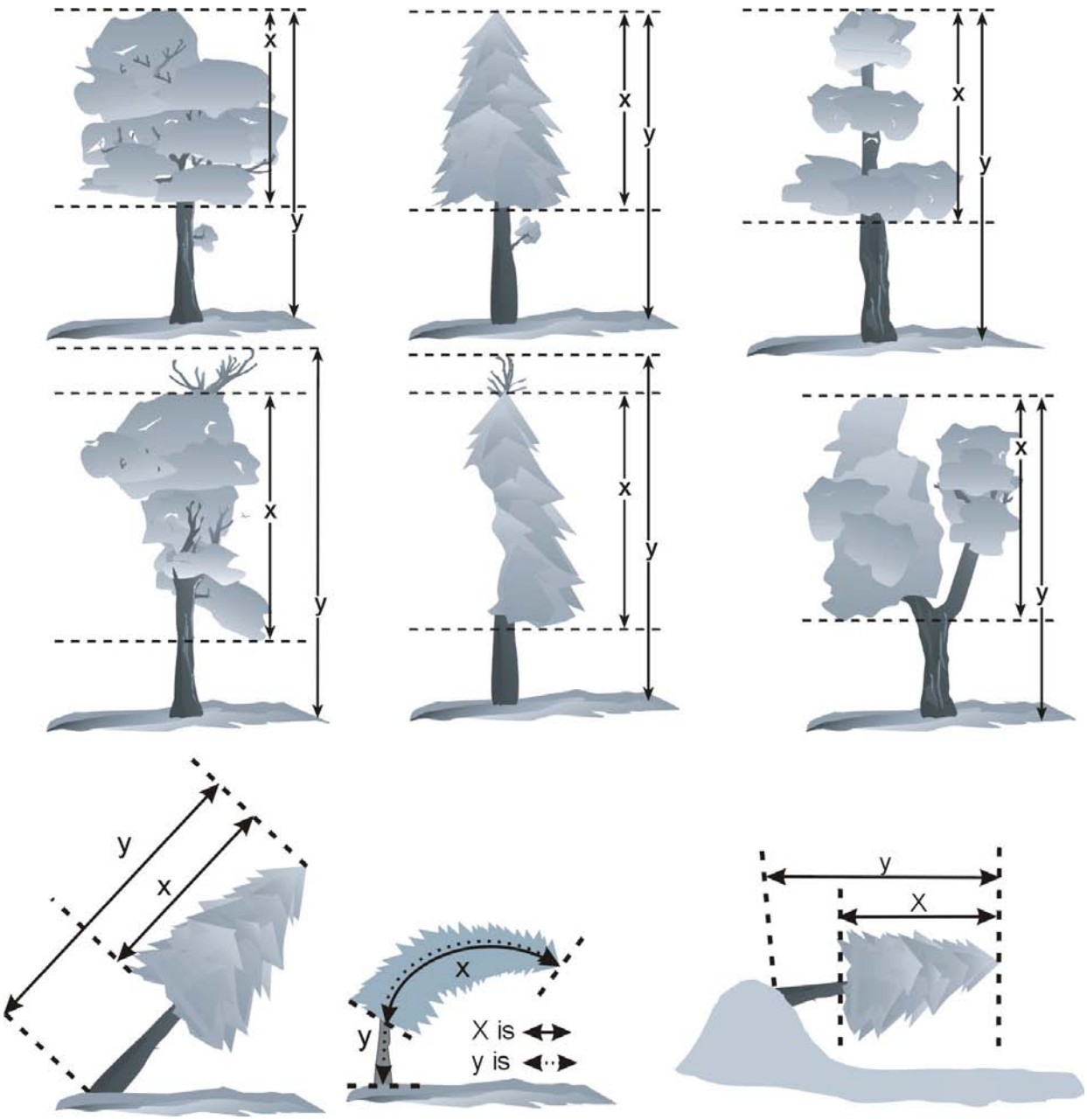


Figure 15-12. UNCOMPACTED LIVE CROWN RATIO examples.

Trees

Live crown length is the distance from the live crown top (dieback in the upper portion of the crown is not part of the live crown) to the "obvious live crown" base (Figure 15-12). Many times there are additional live branches below the "obvious live crown". These branches are only included if they have a basal diameter greater than 1.0 inch and are within 5.0 feet of the base of the obvious live crown (Figure 15-8). The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole. Occasionally, small trees or certain species may not have 1.0-inch diameter branches. If this occurs, use the 5.0-foot rule, and apply it to branches that you feel contribute significantly to tree growth.

An individual can use the UNCOMPACTED LIVE CROWN RATIO scale on the back of the crown density - foliage transparency card to help estimate ratios when the top of the tree and the top of the live crown are the same location (Figure 15-9). Hold the card in one hand, parallel to the trunk of the tree being

evaluated and move the card closer or farther from your eye until the 0 is at the live crown top and the 99 is at the base of the tree where it meets the ground. Then place your finger at the live crown base. A clinometer can also be used to verify the UNCOMPACTED LIVE CROWN RATIO by determining the values of both lengths and determining the ratio of the two values. If dieback or other crown abnormality affects the live crown length, align the card in such a way to place the 0 at the top of the ACTUAL LENGTH and the 99 at the base of the tree. Then place one finger at the live crown top and the other at the live crown base. Note the numbers at each finger location and subtract the lower number from the higher number. The result is the UNCOMPACTED LIVE CROWN RATIO.

When estimates between crew members do not agree, follow the guidelines listed at the end of section 15.7 *Overview*.

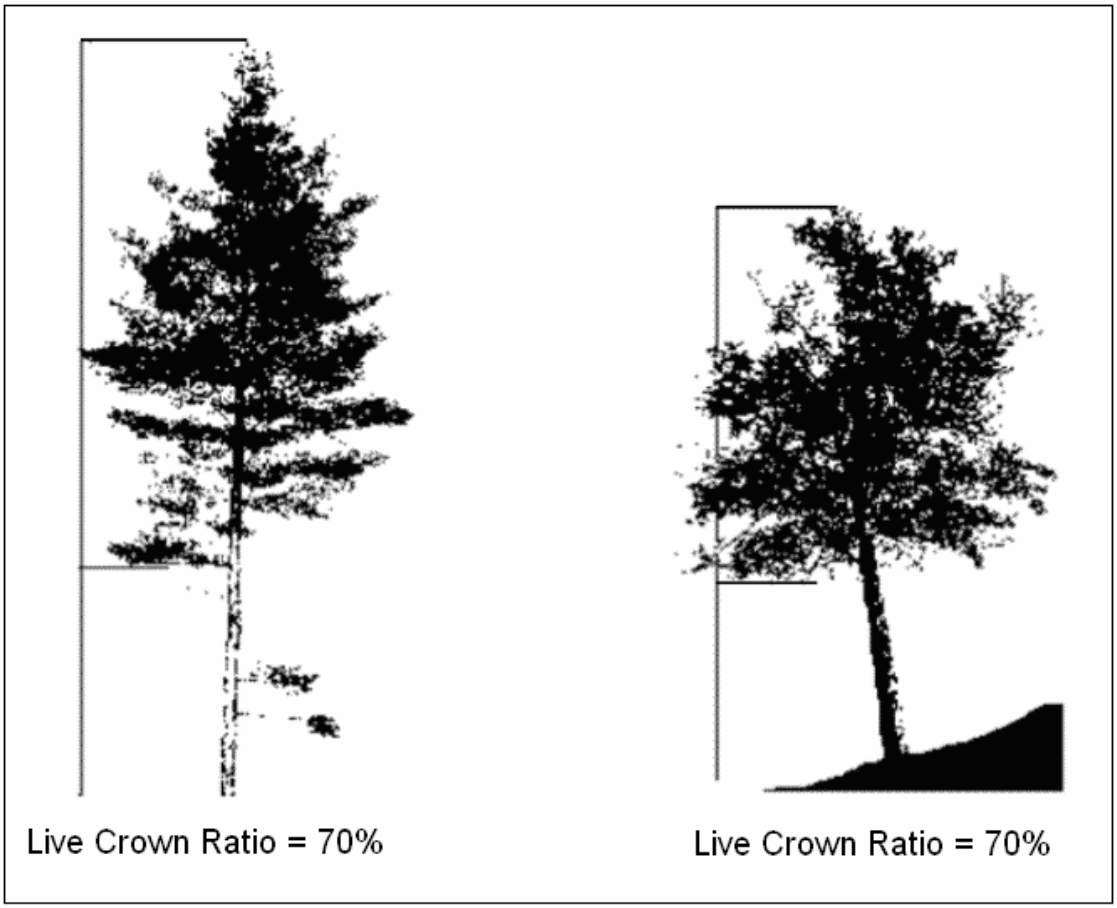


Figure 15-13. UNCOMPACTED LIVE CROWN RATIO outline and rating examples

When collected: All live trees ≥ 1.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 99 percent

15.13 CROWN LIGHT EXPOSURE

Rate the UNCOMPACTED LIVE CROWN RATIO for each side of the tree separately using the criteria for estimating total UNCOMPACTED LIVE CROWN RATIO. Visually divide the crown vertically into four equal sides. In order for a side to qualify for tally, the side must have an uncompacted live crown ratio of at least 35 percent. Additionally for a side to qualify, a continuous portion of live crown 35 percent or more in length must be completely exposed to direct light. For this measurement, a tree cannot shade itself (e.g., leaning trees or umbrella shaped trees). Try to divide the crown in such a way that as many sides as possible receive full light. Count the number of sides that would receive direct light if the sun were directly above the tree. Add one if the tree receives direct light from the top (Figure 15-14).

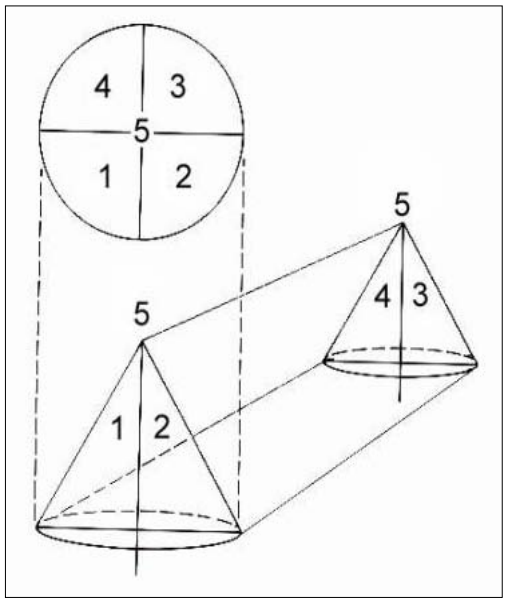


Figure 15-14. Dividing the crown.

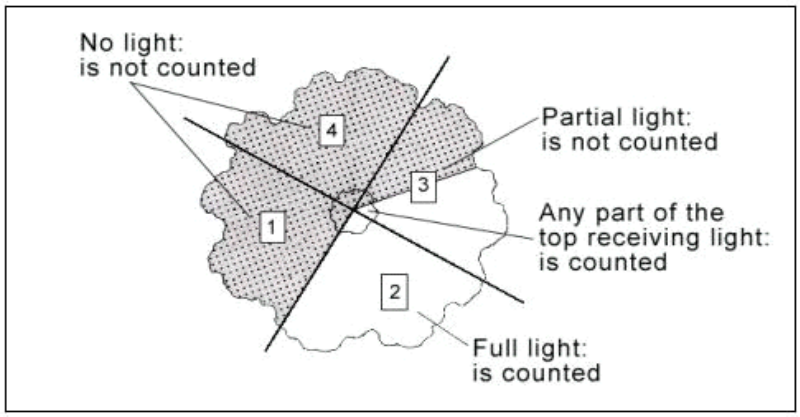


Figure 15-15. Crown light exposure.

Note: The entire side (25 percent of the crown circumference) must be receiving full light to qualify. A sliver of a side receiving light does not qualify. Trees with all sides having less than a 35 percent UNCOMPACTED LIVE CROWN RATIO can have a maximum crown exposure of one. Individual sides with less than 35 percent UNCOMPACTED LIVE CROWN RATIO should not be counted (Figure 15-15).

When collected: All live trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
Tolerance: within 1 if > 0
MQO: At least 85% of the time
Values:

Code	Definition
0	The tree receives no full light because it is shaded by trees, vines, or other vegetation; the tree has no crown by definition.
1	The tree receives full light from the top or 1 side.
2	The tree receives full light from the top and 1 side (or 2 sides without the top).
3	The tree receives full light from the top and 2 sides (or 3 sides without the top).
4	The tree receives full light from the top and 3 sides.
5	The tree receives full light from the top and 4 sides.

15.14 CROWN DENSITY

CROWN DENSITY estimates crown condition in relation to a typical tree for the site where it is found. CROWN DENSITY also serves as an indicator of expected growth in the near future. CROWN DENSITY is the amount of crown branches, foliage and reproductive structures that blocks light visibility through the crown. Each tree species has a normal crown that varies with the site, genetics, tree damage, etc.

To determine the crown shape, select the crown base on the stem used for UNCOMPACTED LIVE CROWN RATIO. Project a full "mirror image" crown based on that tree's shape. Include missing or dead tops. Project half-sided trees as full crowns by using the "mirror image" of the existing half of the crown. Foliage below the crown base is not included (Figure 15-9). Include CROWN DIEBACK and open areas in this outline (Figures 15-16 and 15-17).

After determining the crown shape, each person should use the crown density - foliage transparency card. Along the line of sight, estimate what percentage of the outlined area is blocking sunlight. In cases where portions of the tree may be missing, i.e., half-sided trees, it may be easier to determine the percent of the crown shape missing and the actual density of the tree's remaining portion. Then use the table on the back of the crown density - foliage transparency card to arrive at the final CROWN DENSITY. When two individuals disagree with their estimates, follow the guidelines listed at the end of section 15.7 *Overview*. The estimate is placed into one of 21 percentage classes.

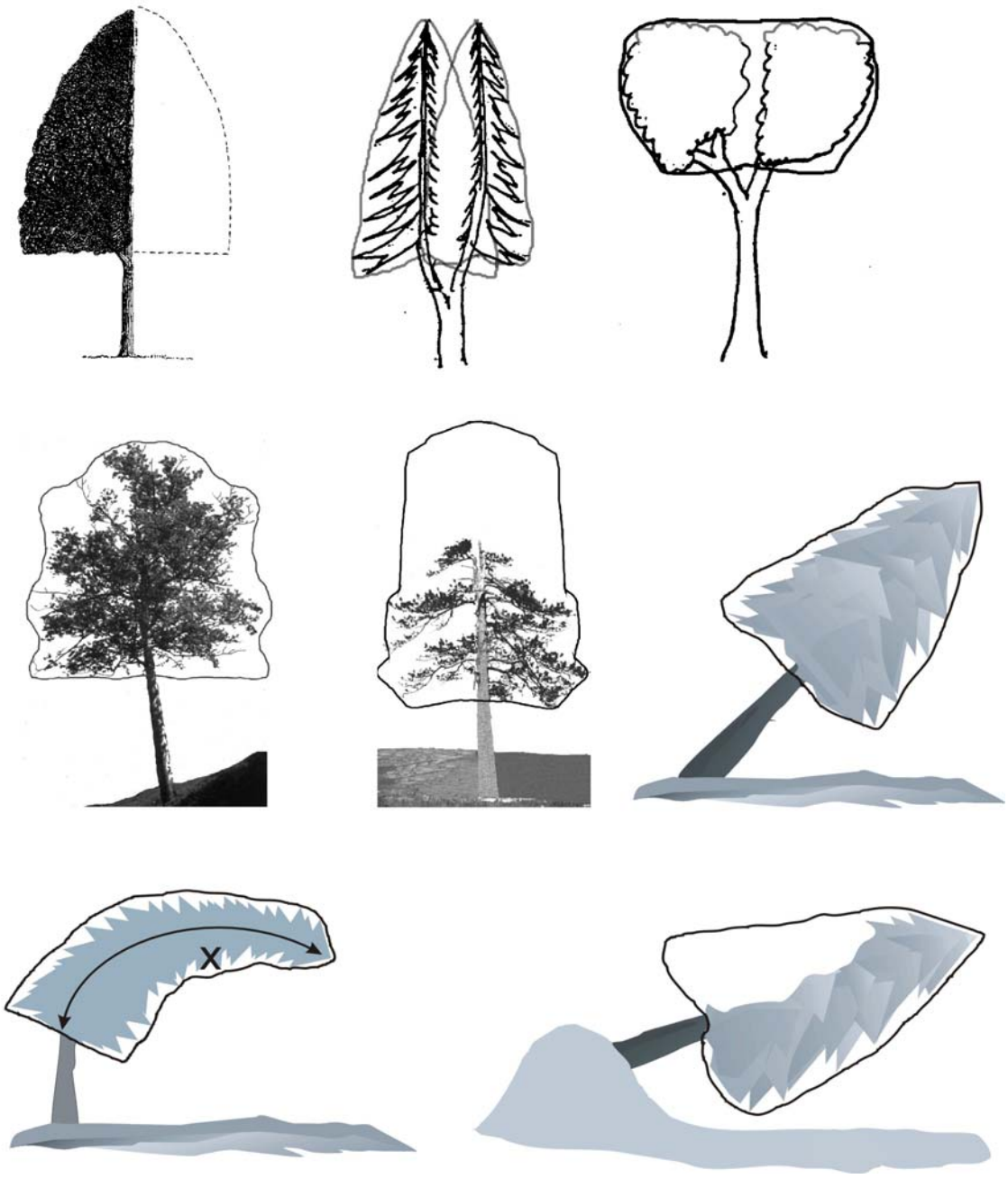


Figure 15-16. CROWN DENSITY rating outline examples.

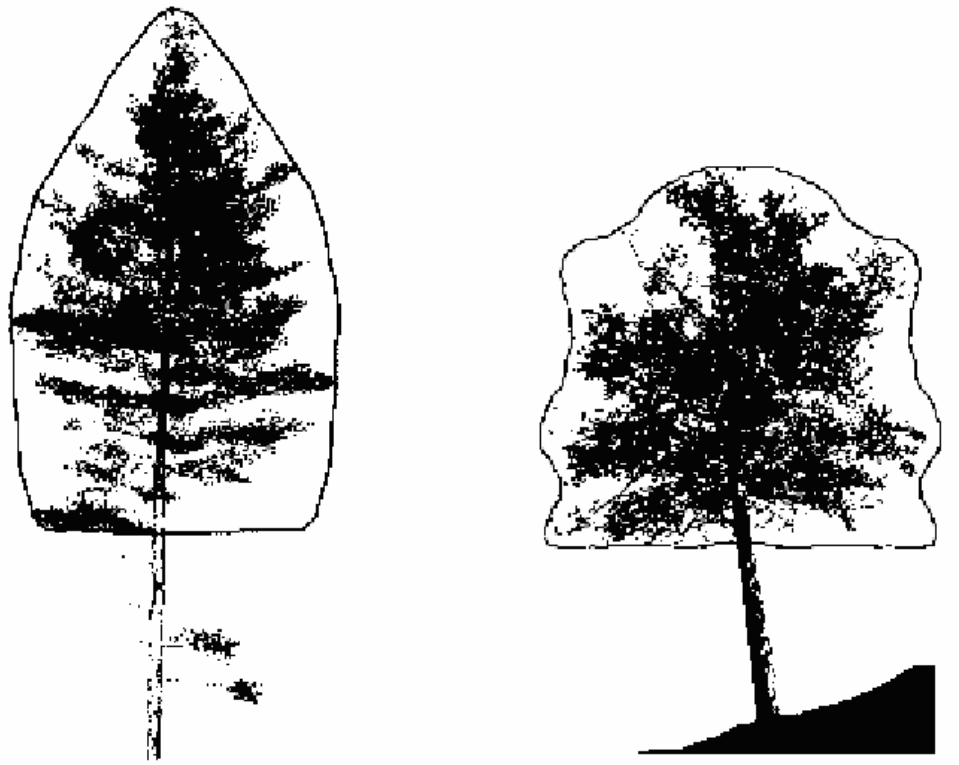


Figure 15-17. Crown density outline and rating examples

When collected: All live trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 90% of the time
Values: 00 to 99

Code	Definition	Code	Definition	Code	Definition
00	No crown	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

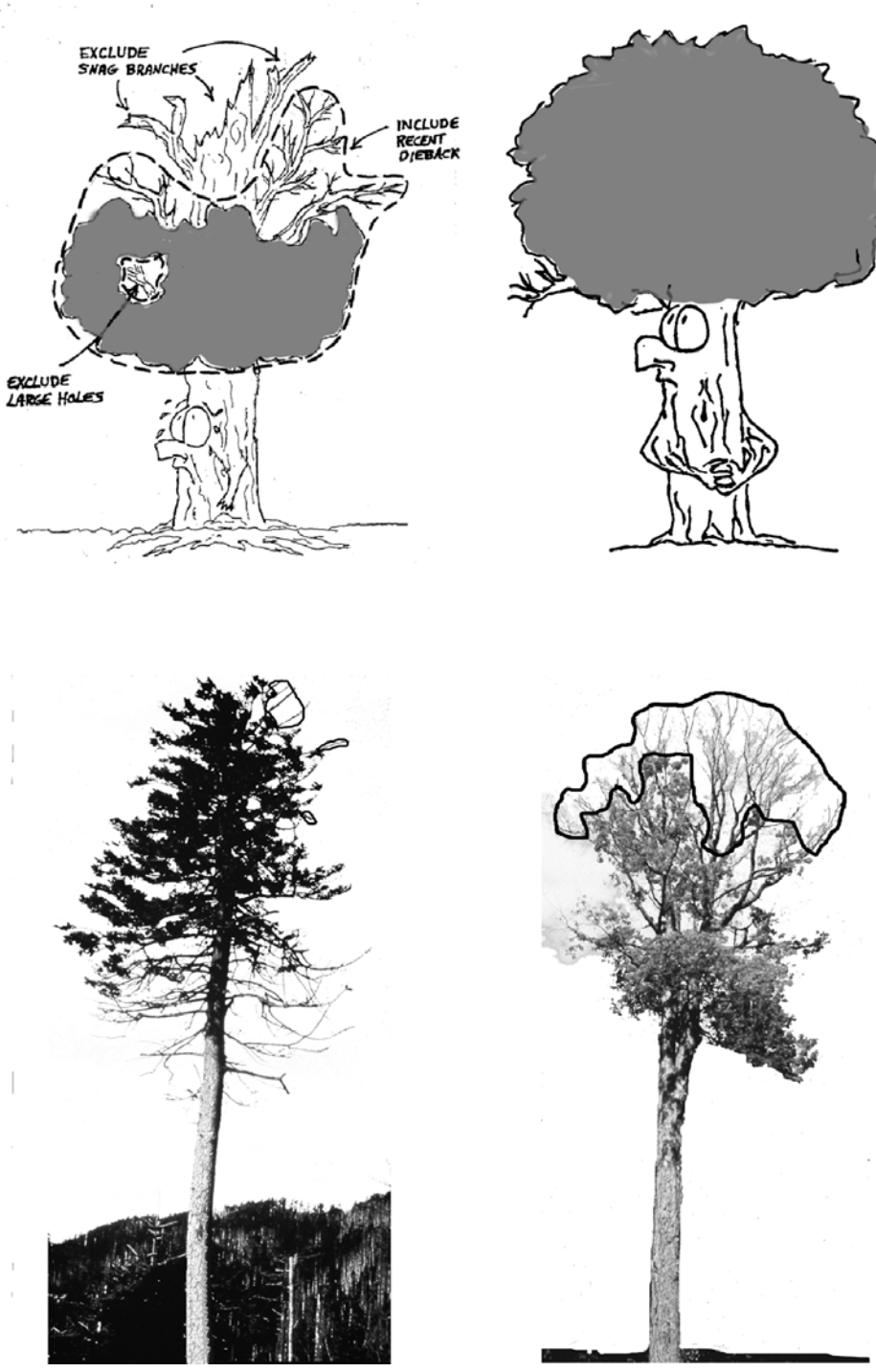
Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

15.15 CROWN DIEBACK

CROWN DIEBACK estimates reflect the severity of recent stresses on a tree. Estimate CROWN DIEBACK as a percentage of the live crown area, including the dieback area. The crown base should be the same as that used for the UNCOMPACTED LIVE CROWN RATIO estimate. Assume the perimeter of the crown is a two-dimensional outline from branch-tip to branch-tip, excluding snag branches and large holes or gaps in the crown (Figures 15-18 and 15-19).

Project a two-dimensional crown outline, block in the dieback and estimate the dieback area. When two individuals disagree with their estimates, follow the guidelines listed at the end of section 15.7 *Overview*. The estimate is placed into one of 21 percentage classes.

Figure 15-18. CROWN DIEBACK rating outline examples.



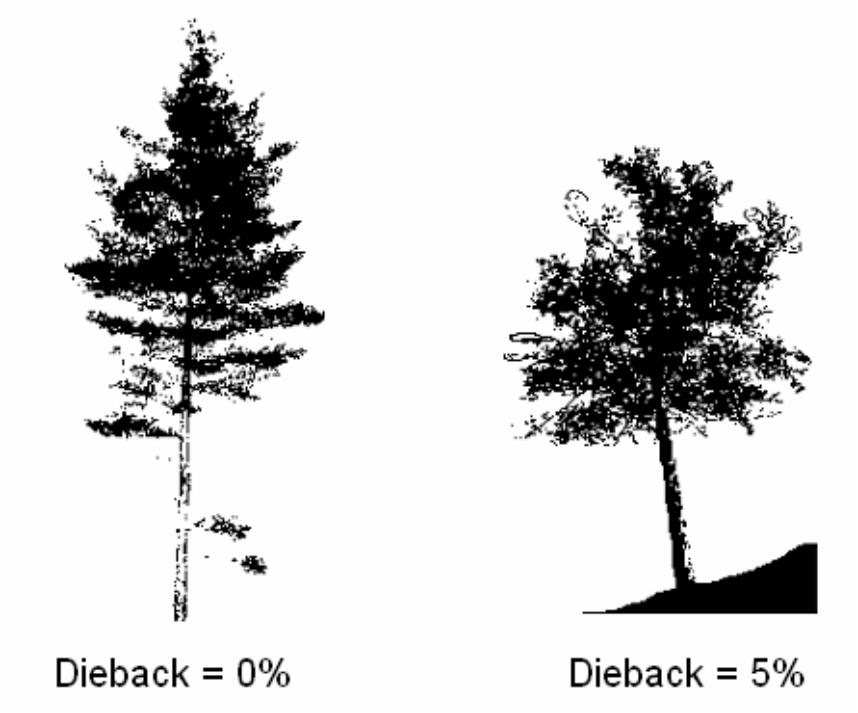


Figure 15-19. Dieback outline and rating examples.

When collected: All live trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 90% of the time
Values:

Code	Definition	Code	Definition	Code	Definition
00	No crown	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

15.16 FOLIAGE TRANSPARENCY

Foliage transparency is the amount of skylight visible through the live, normally foliated portion (where you see foliage, normal or damaged, or remnants of its recent presence) of the crown. A recently defoliated tree except for one or two live leaves should have a transparency rating of 99 not 0!! Check with binoculars to assess which branches are alive and should have foliage.

Different tree species have a normal range of foliage transparency, which may be more or less than that of other species. Changes in foliage transparency can also occur because of current defoliation or stresses during the current or preceding years.

Estimate FOLIAGE TRANSPARENCY using the crown density - foliage transparency card. Exclude vine foliage from the transparency estimate as best you can. Dead branches in the lower live crown, snag branches, crown dieback and missing branches or areas where foliage is expected to be missing are deleted from the estimate (Figure 15-20).

When defoliation is severe, branches alone will screen the light, but you should exclude the branches from the foliage outline and rate the area as if the light was penetrating those branches. For example, an almost completely defoliated dense spruce may have less than 20 percent skylight coming through the

crown, but it will be rated as highly transparent because of the missing foliage. Old trees and some hardwood species, have crowns with densely foliated branches that are widely spaced. These spaces between branches should not be included in the FOLIAGE TRANSPARENCY rating. When FOLIAGE TRANSPARENCY in one part of the crown differs from another part, the average FOLIAGE TRANSPARENCY is estimated.

Project a two-dimensional crown outline. Determine the foliated area within the crown outline and estimate the transparency of the normally foliated area.

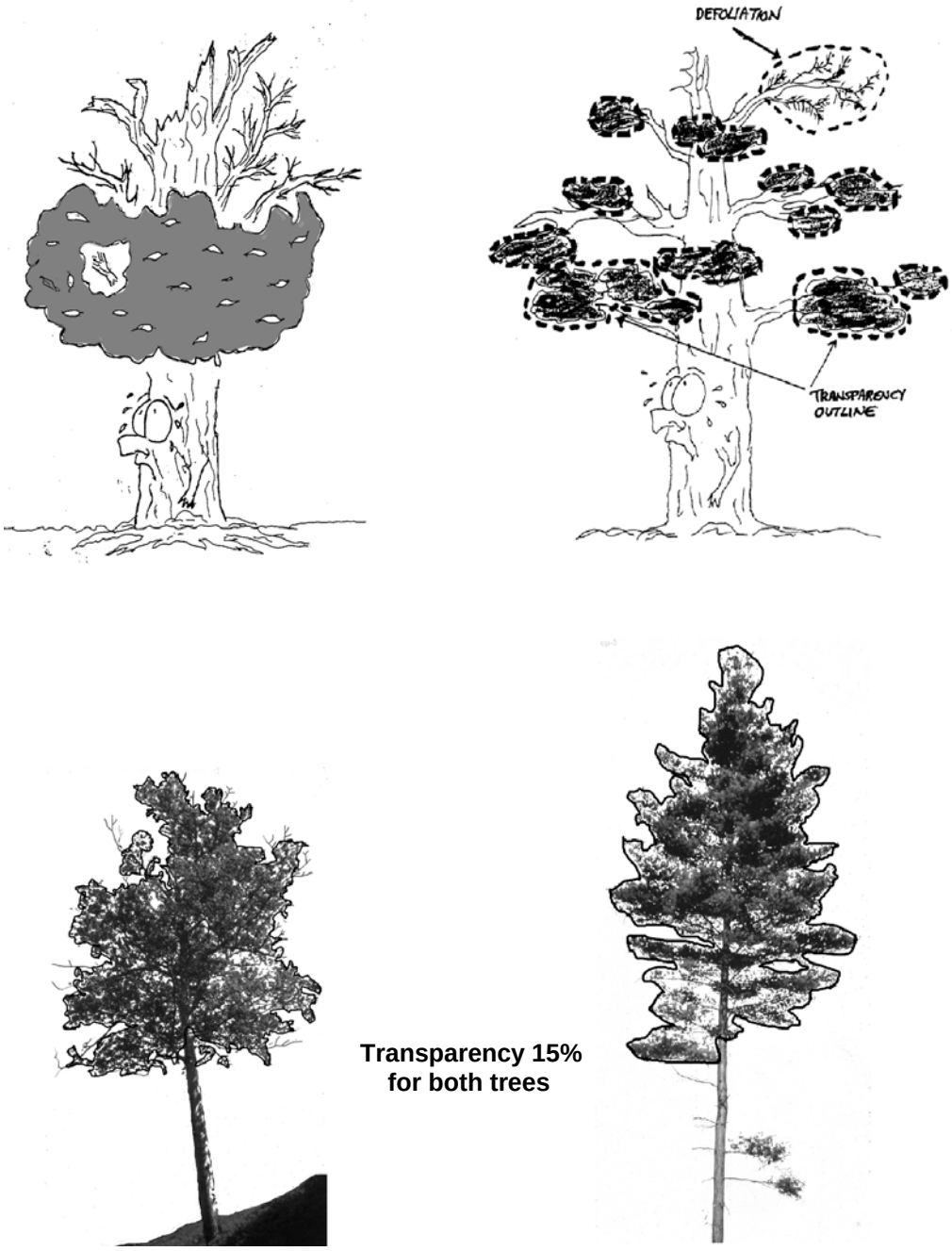


Figure 15-20. FOLIAGE TRANSPARENCY rating outline examples.

When collected: All live trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 90% of the time
Values:

Code	Definition	Code	Definition	Code	Definition
00	No crown	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

15.17 CROWN DIAMETER WIDE

Crown width estimated at the widest point. Record measurement to nearest 1 ft. Dead trees always have a crown width of 0. If tree is downed or leaning, take width measurements perpendicular to tree bole.

When Collected: All live ≥ 1.0 in DBH
Field width: 3 digits (xxx)
Tolerance: +/- 5 feet
MQO: At least 90% of the time
Values: 000 to 999

15.18 CROWN DIAMETER 90 DEGREES

Crown width estimated 90 degrees (perpendicular) to **CROWN DIAMETER WIDE** measurement. Record measurement to nearest 1 ft. If tree is downed or leaning, take width measurements perpendicular to tree bole.

When Collected: All live tally trees ≥ 1.0 in DBH
Field width: 3 digits (xxx)
Tolerance: +/- 5 feet
MQO: At least 90% of the time
Values: 000 to 999

15.19 FOLIAGE ABSENT

Within the live crown outline (as defined by symmetrical silhouette created by live crown width, height, and height to base of live crown measurements), estimate percent foliage missing due to:
-Pruning
-Dieback
-Defoliation
-Uneven crown
-Dwarf or sparse leaves

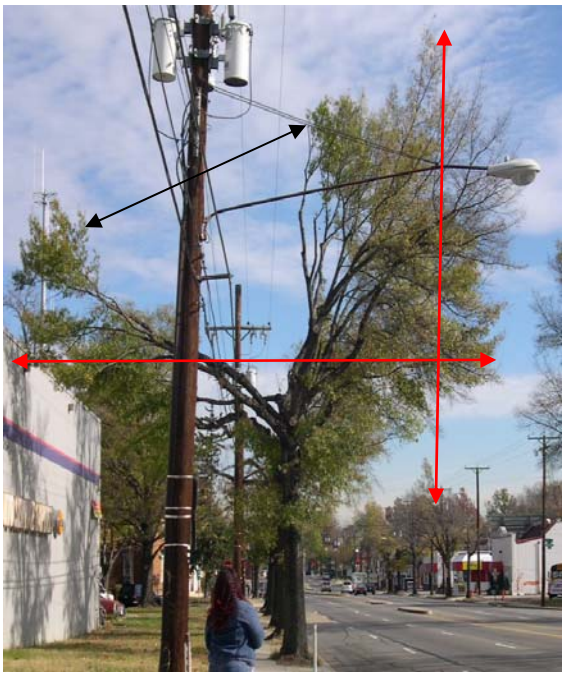
When collected: All live trees > 1.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 80% of the time
Values: 00 to 99

The UFORE model uses crown height and width, modified by foliage absent, to estimate leaf area. Note that thin or missing foliage due to “interior shading”, a characteristic of conifers or other trees with dense foliage, is not considered foliage absent.

Tops pruned: foliage absent = 55%
Crown is drawn as for foliage density, except dead or missing top is excluded.

Disease: foliage absent = 70%.
Draw crown as for foliage density, but do not include dead or missing tops.

Needle mortality (aphids): foliage absent = 99%
based on what would be in the live crown and assumes there are some live needles.



Utility Pruning: foliage absent = 25%. Red arrows show one width measurement and the height measure. Black arrow indicates foliage absent.

Utility Pruning: foliage absent = 20%. Width of crown includes an area where branches were pruned for utility clearance.

Uneven crowns: foliage absent = 5%. Use only the live crown that is present. In this example, utility pruning reduced the size of the crown width.

15.20 MORTALITY

Record a mortality code for all trees that have died since the previous survey or in the past five years for new locations, regardless of cause of death. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All standing dead trees 5.0 in DBH/DRC and larger
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:

0 No - tree does not qualify as mortality.
1 Yes – tree does qualify as mortality

15.21 MAINTAINED AREA

Record the code to indicate if the tree falls in the maintained area of the subplot (see 15.5.2 for definition of maintained area)

When Collected: All tally trees
Field width: 1 digits
Tolerance: No errors
MQO: At least 90% of the time
Values:

0 No -- tree is not in a maintained area
1 Yes -- tree is in a maintained area

15.22 URBAN DAMAGE AGENTS

Record the presence or absence of each urban damage agent for each tree measured on the subplot. Damage codes are assigned based on type of damage and its location on the tree. Severity thresholds are based on the point of occurrence for each damage. Record as many damages as occur.

When Collected: All live tally trees ≥ 1 inches DBH
Field width: 1 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

0 Damage absent
1 Damage present

Code	Location	Damage/Causal Agent	Severity Threshold
01	Bole or, when bole is absent, first 15' of stem from ground level	Canker or decay	Presence/Absence
02	Bole or, when bole is absent, first 15' of stem from ground level	Wound or crack	25% of circumference or over a 3 ft vertical section
03	Bole or, when bole is absent, first 15' of stem from ground level	Borers/Bark beetles	Presence/Absence
04	Roots	Stem Girdling	25% of circumference
05	Bole or, when bole is absent, first 15' of stem from ground level/Branches	Bark inclusion	Presence/Absence
06	Crown Stem or Branches	Severe Topping or Poor Pruning	30% or more of crown
07	Roots and stump	Excessive mulch	Presence/Absence
08	Branches	Dead or dying crown	30% or more of crown
09	Foliage	Chlorotic/necrotic	30% or more of crown
10	Foliage	Defoliation	30% or more of crown
11	Branches	Vines in crown	30% or more of crown volume
12	Main stem	Dead top	30% of tree height
13	Stump	Conflict with roots	Presence/Absence
14	Overhead wires	Conflict with tree crown	Presence/Absence
15	Roots and stump of trees ≤10" DBH	Improper plantin	Presence/Absence

DAMAGE DESCRIPTIONS:

Code 01

Location: Bole (tree trunk between base and live crown). When bole is absent, first 15 feet of stem from ground level.

Damage/Causal Agent: Presence of decay fungi; hollow areas, weak, rotten wood, bleeding cankers.

Severity Threshold: Present (1) or Absent (0)

Description: Decay is wood that is soft, punky, or crumbly, or a cavity with soft, punky wood inside. Wood decay begins with any injury that breaks through the bark and exposes the wood. The injury may be the result of a weed whip, animal damage, broken branch, etc. The damaged wood and vascular cells undergo chemical changes and become discolored.

This is both a canker and decay

A canker is a localized area on the stem or branch of a tree, where the bark is sunken or missing. Cankers are caused by wounding or disease. The presence of a canker increases the chance of the stem breaking near the canker. Some cankers are known as bleeding cankers. The fungus responsible for sudden oak death, for example, causes a bleeding canker with red-brown to black discoloration and seeping dark black to red sap. Often, it develops at about 1 to 3 feet off the ground.

Conks are fungal fruiting bodies. They can be fibrous, fleshy, or woody. Conks are indicative of decay.

Code 01: Canker or Decay
Present (1) or Absent (0)

Canker (aspen)

Bleeding canker (oak)

Conks

Hypoxylon canker

Code 02

Location: Bole (tree trunk between base and live crown). When bole is absent, first 15 feet of stem from ground level.

Damage/Causal Agent: Wound or crack causing physical damage to the main stem or stems of a tree.

Severity Threshold: 25 % of circumference or cumulatively over a 3 foot vertical section, multiple wounds or cracking have a width that, when added together, total at least 25% of the circumference. Present (1) or Absent (0)

Description: A crack is a deep split through the bark, extending into the wood of the main stem of the tree. Cracks can be caused by frost, lightning, or resulting from a "V" notch and included bark (see Damage Code 5).

Wounds are physical damage to the main stem as from a lawn mower or line trimmer without evidence of decay – bark is visibly damaged or absent. If decay is present, damage code is 01.

To be recorded, a wound should extend for at least 25% of the circumference of the portion of the stem where it is located. If multiple wounds are present, record when wounds over a 3 foot running section add up to 25% of the circumference.

Crack

Crack

Wound

Code 03

Location: Bole (tree trunk between base and live crown). When bole is absent, first 15 feet of stem from ground level.

Damage/Causal Agent: Borers or Bark Beetles

Severity Threshold: Present (1) or Absent (0)

Description:
Bark Beetles
Adult bark beetles bore through the outer bark to the inner cambial layer, where they channel out galleries in which to lay eggs. Larvae hatch in these galleries and may excavate additional channels as they feed.

Pine trees infested by bark beetles such as southern pine beetle (loblolly, slash, Virginia pines), and mountain pine beetle (lodgepole), may be recognized at a distance by fading foliage. Close inspection may show a fine reddish-brown boring dust in bark cervices and at the base of the tree. In pines small pitch tubes, or globules of pitch, may be seen on the tree trunk. Successful bark beetle attacks are indicated by the presence of pitch tubes. Pitch tubes are resins mixed with boring dust, between ¼" to ½" in diameter and range in color from cream to dark red and are insect entrance holes. In some cases where the number of attacking bark beetles is low, the tree may have sufficient resin available to eject the attacking bark beetles by extruding resin at the attack site ("pitching out"). Pitch tubes of whitish resin ¾" or more in diameter are evidence of an attack successfully resisted. Exit holes caused by bark beetles leaving the tree do not have pitch or resin. Other evidence of bark beetle infestation includes galleries discovered under the bark, sapwood discolored by blue-stain fungi, woodpecker feeding holes and bark removal by woodpeckers, though sapsucker damage itself, is not indicative of borers or bark beetles.

For hardwoods, bark beetle entrance holes are generally not seen. Exit holes, however, are apparent. These may appear as if the bark of tree was peppered with tiny holes.

Borers
Borers are insects that develop underneath the bark of woody plants. Most of these insects can attack only dying trees or trees under stress. Stress to trees may be the result of mechanical injury, recent transplanting, over-watering or drought.
Certain borers, in particular the "clear-wing borers," are capable of damaging apparently healthy trees. Signs of borer presence include: exit holes (as the adult emerges from under the bark), frass or wood shavings at the base of the tree, or sparse foliage. Borer exit holes are generally about one quarter inch in diameter.

Code 03: Borers and Bark Beetles
Present (1) or Absent (0)

Southern pine beetle, pitch tubes and entrance hole

Bark beetle exit holes

Asian longhorned beetle exit hole (maple)

Asian longhorned beetle, egg niche.

Bronze birch borer and exit hole

Emerald ash borer exit hole (ash)

Continued…

Code 03: Borers and Beetles – con't
Present (1) or Absent (0)

Wood wasp exit holes (pine)

Wood wasp egg laying sites with resin flow

Woodpeckers and sapsuckers can cause damage similar in appearance to wood borer exit holes. One key field identifier is that sapsucker holes are generally in a line whereas borer exit holes appear random. Urban FHM damage is **not** recorded for woodpeckers or sapsuckers.

Sapsucker damage can result in resin flow similar to insect borers such as Sirex woodwasp. In the case of the sapsucker, the resin flow is always associated with a definite large hole. Resin flow caused by the woodwasp is in response to egg laying.

Code 04

Location: Roots

Damage/Causal Agent: Stem Girdling

Severity Threshold: 25% of circumference. Present (1) or Absent (0)

Description:. Roots begin to grow around the main stem of the tree and cut off or restrict the movement of water, plant nutrients and stored food reserves.
Certain trees are more prone to this problem than others. Lindens, magnolias, pines, and maples (other than the silver maple) are susceptible to root girdling. On the other hand, silver maple, oaks, ash, and elm are well known for their ability to form functional root grafts and are rarely adversely affected by girdling roots.
The picture below illustrates a root crossing root, and is not considered a girdling root.

The pictures below illustrate a girdling root that is encircling the stem, though on the right, these girdling roots would probably not be apparent from above. The illustration on the left is the recordable damage. The photograph on the right shows below ground stem girdling.

Code 05

Location: Bole (tree trunk between stump and live crown). When bole is absent, first 15 feet of stem from ground level.

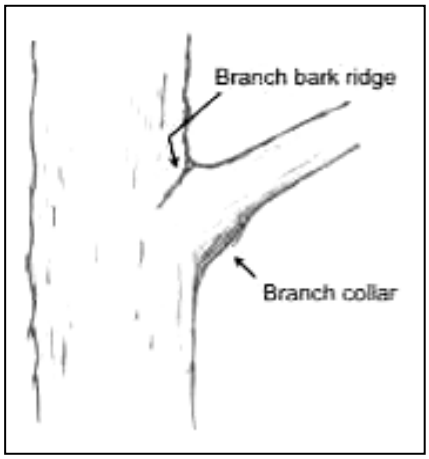
Damage/Causal Agent: "V" branching pattern.

Severity Threshold: Present (1) or Absent (0)

Description: Weak branch unions are places where branches are not strongly attached to the tree. A weak union occurs when two or more branches grow so closely together that bark grows between the branches and inside the union. This ingrown, or included, bark does not have the structural strength of wood and the union can become very weak. The inside bark may also act as a wedge and force the branch union to split apart. Trees with a tendency to form upright branches, such as elm and maple, often produce weak branch unions

The photo below illustrates a strong branch union (left) and a weak branch union with the characteristic "V" branching pattern (right).

Strong branch union vs. "V" notch. The branching pattern on the right is recordable because the two branches have grown closely together and contains included bark. Notice the easily identifiable branch bark ridge and "U" shape of the strong union of the left.



A strong branch union has a conspicuous branch bark ridge.

Code 05: Included Bark

Present (1) or Absent (0)

"V" Notch with included bark resulting in a split tree

"V" Notch

This is a "V" Notch and recordable. There is no branch bark ridge between the two branches.

Normal Branching:
These branch unions are okay and are **not** considered a "V" branching pattern.

Code 06

Location: Crown Stem or Branches

Damage/Causal Agent: Severe Topping or Poor Pruning

Severity Threshold: 30% or more of crown or branches. Present (1) or Absent (0)

Description: A tree is considered to have been severely topped when it has been reduced to a single "pole" due to severe over-pruning and branch removal. "Topping" is the cutting of branches to stubs, or, if 30% or more at the main stem has been cut to reduce tree height. Topping usually results in a profusion of shoots rendering the tree more susceptible to wind damage.
Poor pruning techniques include leaving stubs outside the branch collar, or cutting into the branch collar. A tree with proper pruning will still maintain the look and shape of the tree, just shorter.

Poor pruning

Poor pruning

Code 06: Severe Topping or Poor Pruning
30% or more of crown. Present (1) or Absent (0)

Severe topping

An example of severe topping, showing the weakly attached sprouts regenerating from the cut limb.

Code 07

Location: Roots and Stump

Damage/Causal Agent: Excessive Mulch

Severity Threshold: Present (1) or Absent (0)

Description: Root flare is not visible at base of trunk because of mulch. Mulch piled high around stem and mulch depth greater than 8 inches.

Over mulching of landscape plants, sometimes to the extent of creating mountainous mulch "volcanoes," can result in disease of death of the tree.

Over mulching can:

- promote excessive soil moisture and subsequent root rots
- cause inner bark tissue (phloem) death of aboveground stem flares
- cause fungal and bacterial diseases, and root, crown, and butt rots
- lead to rodent chewing on phloem tissue and subsequent stem girdling
- lead to the production of toxic organic acids (alcohols and volatile gases such as ammonia) by anaerobic microorganisms
- promote nutrient deficiencies and imbalances and possible allelopathic toxicities (allelopathy)
- lower soil temperatures during critical root growth periods, which may suppress overall root and plant growth
- prevent moisture penetration due to dry fungal masses becoming hydrophobic and actually repelling water

Code 07: Excessive Mulch
Present (1) or Absent (0)

Examples of excessive mulch:

Code 08

Location: Branches

Damage/Causal Agent: Dead or Dying Crown

Severity Threshold: 30% or more of crown. Present (1) or Absent (0)

Description: Dead branches in crown. At least 30% of the main branches on the tree must be dead – no foliage. If foliage is present, even if it is dead foliage, this damage code does not apply. Main branches are the entire branch (from tips to where the branch meets the main stem) as opposed to dieback which is branch tips. Branch mortality can be caused by disease or insect presence. Diseases that cause branch mortality are Dutch elm disease, bacterial leaf scorch (oaks), mimosa wilt, and *Diploida* blight (pines).

Bacterial leaf scorch

Mimosa wilt

Diplodia

Code 09

Location: Foliage

Damage/Causal Agent: Chlorosis/Necrosis

Severity Threshold: 30% or more of crown. Present (1) or Absent (0)

Description: Leaves are chlorotic, necrotic, wilted, or abnormal size/shape. Chlorosis is a yellowing of leaf tissue due to a lack of chlorophyll. Possible causes of chlorosis include poor drainage, damaged roots, compacted roots, high alkalinity, and nutrient deficiencies in the plant. Necrotic foliage has the appearance of dead areas often caused by disease or abiotic factors. Abnormal foliage are leaves that are small or have a deformed shape. Abnormal foliage can also be caused by disease or insect feeding.

Chlorosis

Dutch elm disease

Chlorosis

Abnormal leaves (*Anthracnose)*

Code 09: Chlorotic or Necrotic Foliage

Pine wilt necrosis

Chlorosis due to nutrient deficiency (iron).

Code 10

Location: Foliage

Damage/Causal Agent: Defoliation

Severity Threshold: 30% or more of crown. Present (1) or Absent (0)

Description: Defoliation, or the absence of foliage, is often caused by insect feeding, especially caterpillars. Other insects such as aphids and needleminers also can cause defoliation. Defoliation applies specifically to missing (eaten) foliage.

Discolored, necrotic, or abnormal foliage falling from the tree is Damage Code 09. For sucking insects, such as aphids, the foliage may be brown or yellow and falling from the tree.

If the **insect is present**, then the damage code is Defoliation.

Walnut caterpillar defoliation

Bagworm defoliation

Hemlock woolly adelgid causing defoliation

Hemlock woolly adelgid: cottony woolly masses indicate presence of adelgids.

Code 10: Defoliation
30% or more of crown. Present (1) or Absent (0)

Gypsy moth defoliation

Eastern tent caterpillar defoliation

Forest tent caterpillar defoliation

Code 11

Location: Branches

Damage/Causal Agent: Vines present in tree, including parasitic vines.

Severity Threshold: 30% or more of crown volume.
Present (1) or Absent (0)

Description: Vines in trees can be detrimental to tree health. In the foliage, vines reach out beyond the tree leaves and grab the sunlight. With sunlight cut down, photosynthesis is reduced and tree health suffers causing branch dieback and eventually tree mortality. Only vines in the crown should be considered.

Grapevine in tree.

Kudzu draped throughout and between tree crowns.

Parasitic mistletoe creating brooms in a crown. To be recorded as a damage, 30% or more of the crown volume must be affected.

Code 12

Location: Main Stem

Damage/Causal Agent: Dead Top

Severity Threshold: 30% or more of tree height.
Present (1) or Absent (0)

Description: Main stem dead or missing. If main stem missing due to topping or severe pruning, use DAMAGE CODE 06.

Dead tops are commonly caused by insect or disease presence. In some cases, the dead top may snap and result in a missing top. Missing tops can also be caused by wind or ice damage.

Dead top caused by white pine weevil infestation. In order to record this as a damage, 30% or more of the tree height must be dead.

More than half of this Norway spruce crown is dead.

Code 13

Location: Stump

Damage/Causal Agent: Conflict with roots

Severity Threshold: Present (1) or Absent (0)

Description: Damage to sidewalk, driveway, road, or other hardscape directly caused by roots. Tree roots grow under sidewalks and asphalt. They do this in many instances because that is where the soil oxygen and moisture are located. Conflicts with curbs, driveways, or roads are all considered conflicts with roots. To be recorded, the conflict should be readily apparent (i.e. damage to sidewalk or hardscape is occurring). Or, as in the illustration below, tree roots are being cut to avoid the damage.

Shown below are examples of sidewalk conflicts.

Trees roots have been cut to avoid sidewalk damage. This is a recordable damage.

Code 14

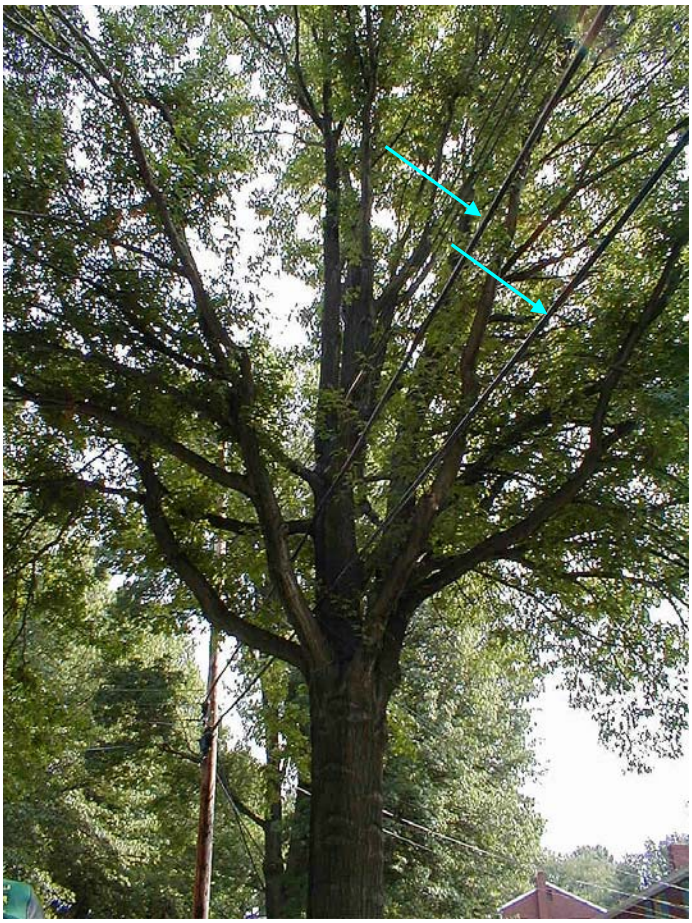
Location: Overhead wires

Damage/Causal Agent: Conflict with tree crown

Severity Threshold: Present (1) or Absent (0)

Description: Tree crown (branches or leaves) are within 5 feet of any utility wires.

Conflict with overhead wires can cause problems for both trees and wires creating maintenance problems and hazard situations. Conflict with overhead power, cable, and telephone wires is common along streets, yards, parking lots, and in commercial areas. Conflict is present when utility wires (electric, telephone, and/or cable) are within 5 feet of tree branches or foliage.



Utility wires, marked with blue arrows, going through a tree crown.

Code 15

Location: Roots and Stump of trees less than or equal to 10 " DBH

Damage/Causal Agent: Improper Planting

Description: Evidence that burlap, twine or root ball wire were not removed prior to planting. Any of the following are visible at the soil surface: burlap, twine, or cage/wire.

Severity Threshold: Present (1) or Absent (0)

Burlap showing from original root ball.

Burlap from original root ball has not decomposed and is girdling stem.

Rope that held the root ball together was not removed at time of planting. 15 years later it is girdling the base of the tree.

15.23 BUILDING ENERGY DATA

Data is collected for trees greater 20 feet in vertical height (Figure 15-21) within 60 feet of buildings. Buildings are defined as space conditioned structures (heated and perhaps cooled) that are no more than 3 stories (2 stories + attic) in height above ground level. The UFORE model utilizes an algorithm for single standing structures no larger than 4000 square feet in total inhabitable space, although larger single-family homes or duplexes should be included regardless of size. Do not count unheated garages, sheds, etc.

The building the tree affects does not have to be on the plot.

Distance is measured from the point where the pith of the tree enters the ground. The shortest distance to the building measured in feet. Measure to closest wall or to corner of building (for tree planted on corner).

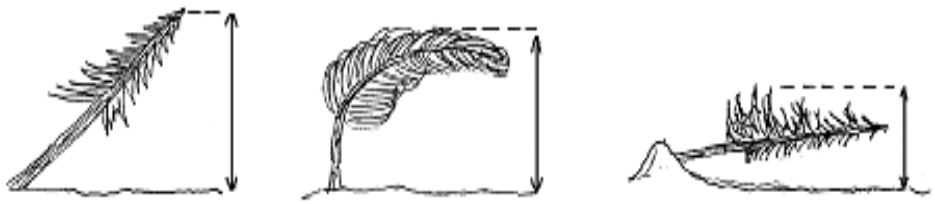


Figure 15-21 Vertical height measurement.

15.23.1 BUILDING DISTANCE 1

The shortest distance to the building measured in feet. Measure to closest wall or to corner of building (for tree planted on corner)

When Collected: All trees ≥20 ft. in height
Field width: 1 digits
Tolerance: No errors
MQO: At least 90% of the time
Values:

0 No building within 60 feet
1 Less than 20 feet
2 21 to 40 feet
3 41 to 60 feet

15.23.2 BUILDING AZIMUTH 1

Direction to building, measured in degrees. Note: some trees may be within 60 feet of more than one building; in this case; add data to BUILDING 2 for second building, BUILDING 3 for third building, etc. The building the tree affects does not have to be on the plot.

When Collected: All trees ≥20 ft. in height
Field width: 3 digits
Tolerance: 5 degrees
MQO: At least 90% of the time
Values: 001 to 360

15.23.3 BUILDING DISTANCE 2

Follow same procedures as BUILDING DISTANCE 1

15.23.4 BUILDING AZIMUTH 2

Follow same procedures as BUILDING AZIMUTH 1

15.23.5 BUILDING DISTANCE 3

Follow same procedures as BUILDING DISTANCE 1

15.23.6 BUILDING AZIMUTH 3

Follow same procedures as BUILDING AZIMUTH 1

15.23.7 BUILDING DISTANCE 4

Follow same procedures as BUILDING DISTANCE 1

15.23.8 BUILDING AZIMUTH 4

Follow same procedures as BUILDING AZIMUTH 1

15.24 TREE SPECIES LIST

Core	East	West	Woodland	Urban	FIA Code	PLANTS Code	Common Name	Genus	Species
X		W			11	ABAM	Pacific silver fir	Abies	amabilis
X	E	W			12	ABBA	balsam fir	Abies	balsamea
X		W			14	ABBR	Santa Lucia fir, bristlecone fir	Abies	bracteata
X		W			15	ABCO	white fir	Abies	concolor
X	E				16	ABFR	Fraser fir	Abies	fraseri
X		W			17	ABGR	grand fir	Abies	grandis
X		W			19	ABLA	subalpine fir	Abies	lasiocarpa
X		W			18	ABLAA	corkbark fir	Abies	lasiocarpa var. arizonica
X		W			20	ABMA	California red fir	Abies	magnifica
X		W			22	ABPR	noble fir	Abies	procera
X		W			21	ABSH	Shasta red fir	Abies	shastensis
	E	W			10	ABIES	Fir spp.	Abies	spp.
	E	W	w		303	ACFA	sweet acacia	Acacia	farnesiana
	E	W	w		304	ACGR	catclaw acacia	Acacia	greggii
	E	W	w		300	ACACI	acacia spp.	Acacia	spp.
X	E				311	ACBA3	Florida maple	Acer	barbatum
				U	5145	ACCA	Hedge maple	Acer	campestre
				U	5146	ACCI	Vine maple	Acer	circinatum
				U	5147	ACGI	amur	Acer	ginnala
		W	w		321	ACGL	Rocky Mountain maple	Acer	glabrum
		W	w		322	ACGR3	bigtooth maple	Acer	grandidentatum
				U	5148	ACGR	Paperbark maple	Acer	griseum
X	E				323	ACLE	chalk maple	Acer	leucoderme
X		W			312	ACMA3	bigleaf maple	Acer	macrophyllum
				U	5149	ACMO	Painted maple	Acer	mono
X	E	W			313	ACNE2	boxelder	Acer	negundo
X	E				314	ACNI5	black maple	Acer	nigrum
				U	5150	ACPA	Japanese maple	Acer	palmatum
X	E				315	ACPE	striped maple	Acer	pensylvanicum
	E				320	ACPL	Norway maple	Acer	platanoides
				U	5151	ACPS	Sycamore maple	Acer	pseudoplatanus
X	E				316	ACRU	red maple	Acer	rubrum
X	E				317	ACSA2	silver maple	Acer	saccharinum
X	E				318	ACSA3	sugar maple	Acer	saccharum
	E				319	ACSP2	mountain maple	Acer	spicatum
	E	W			310	ACER	maple spp.	Acer	spp.
				U	5152	ACTA	Tatar maple	Acer	tataricum
				U	5154	ACFR	Freeman maple	Acer	x freemanii
	E				906	ACWR4	paurotis palm	Acoelorraphe	wrightii

Core	East	West	Woodland	Urban	FIA Code	PLANTS Code	Common Name	Genus	Species
		W			333	AECA	California buckeye	Aesculus	californica
X	E				332	AEFL	yellow buckeye	Aesculus	flava
X	E				331	AEGL	Ohio buckeye	Aesculus	glabra
	E				334	AEGLA	Texas buckeye	Aesculus	glabra var. arguta
				U	5163	AEHI	Horsechestnut	Aesculus	hippocastanum
				U	5164	AEPA2	Bottlebrush buckeye	Aesculus	parviflora
	E				336	AEPA	red buckeye	Aesculus	pavia
	E	W			330	AESCU	buckeye, horsechestnut spp.	Aesculus	spp.
X	E				337	AESY	painted buckeye	Aesculus	sylvatica
X	E				341	AIAL	ailanthus	Ailanthus	altissima
X	E	W			345	ALJU	mimosa/silktree	Albizia	julibrissin
X	E				355	ALGL2	European alder	Alnus	glutinosa
				U	5188	ALIN	Grey alder	Alnus	incana
				U	5189	ALNE2	Nepal alder	Alnus	nepalensis
X		W			353	ALOB2	Arizona alder	Alnus	oblongifolia
X		W			352	ALRH2	white alder	Alnus	rhombifolia
X		W			351	ALRU2	red alder	Alnus	rubra
				U	5190	ALSE	Hazel alder	Alnus	serrulata
		W			350	ALNUS	alder spp.	Alnus	spp.
				U	5192	ALVI5	Green alder	Alnus	viridis
				U	5193	ALFA4	Alder	Alnus	x fallacina
	E	W			357	AMAR3	common serviceberry	Amelanchier	arborea
				U	5203	AMLA	Smooth service berry	Amelanchier	laevis
	E	W			358	AMSA	roundleaf serviceberry	Amelanchier	sanguinea
	E	W			356	AMELA	serviceberry spp.	Amelanchier	spp.
	E				852	AMEL	torchwood	Amyris	elemifera
	E				853	ANGL4	pond apple	Annona	glabra
				U	5232	AREL8	Japanese angelica tree	Aralia	elata
				U	5233	ARSP	Devils walking stick	Aralia	spinosa
X		W			362	ARAR2	Arizona madrone	Arbutus	arizonica
X		W			361	ARME	Pacific madrone	Arbutus	menziesii
		W			360	ARBUT	Madrone spp.	Arbutus	spp.
				U	5256	ASPA18	Smallflower pawpaw	Asimina	parviflora
X	E				367	ASTR	Pawpaw	Asimina	triloba
	E				986	AVGE	black mangrove	Avicennia	germinans
				U	5259	BAGL	Silverling	Baccharis	glomeruliflora
				U	5260	BAHA	Eastern baccharis	Baccharis	halimifolia
				U	5261	BAVU2	Common bamboo	Bambusa	vulgaris
X		W			378	BEUT	northwestern paper birch	Betula	X utahensis
X	E				371	BEAL2	yellow birch	Betula	alleghaniensis
X	E				372	BELE	sweet birch	Betula	lenta
X	E				373	BENI	river birch	Betula	nigra
X	E				374	BEOC2	water birch	Betula	occidentalis
X	E	W			375	BEPA	paper birch	Betula	papyrifera
				U	5279	BEPE	European white birch	Betula	pendula
				U	5280	BEPL2	Asian white birch	Betula	platyphylla
X	E				379	BEPO	gray birch	Betula	populifolia
				U	5281	BEAL1	Cut leaved birch	Betula	pubescens
	E	W			370	BETUL	birch spp.	Betula	spp.
X	E				377	BEUB	Virginia roundleaf birch	Betula	uber
				U	5308	BRPA	Paper mulberry	Broussonetia	papyrifera
				U	5322	BUAL	Fountain butterflybush	Buddleja	alternifolia
	E				854	BUSI	gumbo limbo	Bursera	simaruba
				U	5329	BUSE2	Common box	Buxus	sempervirens
X		W			81	CADE27	incense-cedar	Calocedrus	decurrens

Core	East	West	Woodland	Urban	FIA Code	PLANTS Code	Common Name	Genus	Species
				U	5363	CAJA9	Camellia	Camellia	japonica
				U	5364	CASI16	Tea	Camellia	sinensis
				U	5375	CAAR	Siberian pea tree	Caragana	arborescens
				U	5378	CABE	European hornbeam	Carpinus	betulus
X	E				391	CACA18	American hornbeam, musclewood	Carpinus	caroliniana
X	E				409	CAAL27	mockernut hickory	Carya	alba
X	E				401	CAAQ2	water hickory	Carya	aquatica
X	E				413	CACA38	southern shagbark hickory	Carya	carolinae-septentrionalis
X	E				402	CACO15	bitternut hickory	Carya	cordiformis
X	E				411	CAFL6	scrub hickory	Carya	floridana
X	E				403	CAGL8	pignut hickory	Carya	glabra
X	E				404	CAIL2	pecan	Carya	illinoinensis
X	E				405	CALA21	shellbark hickory	Carya	laciniosa
X	E				406	CAMY	nutmeg hickory	Carya	myristiciformis
X	E				412	CAOV3	red hickory	Carya	ovalis
X	E				407	CAOV2	shagbark hickory	Carya	ovata
X	E				410	CAPA24	sand hickory	Carya	pallida
				U	5379	CAPU2	Carya	Carya	pumilia
	E				400	CARYA	hickory spp.	Carya	spp.
X	E				408	CATE9	black hickory	Carya	texana
				U	5401	CACR27	Japanese chestnut	Castanea	crenata
	E				421	CADE12	American chestnut	Castanea	dentata
X	E	W			424	CAMO83	Chinese chestnut	Castanea	mollissima
X	E				422	CAPU9	Allegheny chinkapin	Castanea	pumila
	E				423	CAPUO	Ozark chinkapin	Castanea	pumila var. ozarkensis
				U	5402	CASA2	Eurpean chestnut	Castanea	sativa
	E	W			420	CASTA	chestnut spp.	Castanea	spp.
X	E				856	CAGL11	gray sheoak	Casuarina	glauca
X	E				857	CALE28	Australian pine	Casuarina	lepidophloia
	E				855	CASUA	sheoak spp.	Casuarina	spp.
X	E				451	CABI8	southern catalpa	Catalpa	bignonioides
				U	5411	CAOV3	Chinese catalpa	Catalpa	ovata
X	E				452	CASP8	northern catalpa	Catalpa	speciosa
	E				450	CATAL	catalpa spp.	Catalpa	spp.
				U	5415	CEVE	Snowbrush ceanothus	Ceanothus	velutinus
				U	5423	CEDE	Deodar cedar	Cedrus	deodara
X	E	W			461	CELA	sugarberry	Celtis	laevigata
	E	W			463	CELAR	netleaf hackberry	Celtis	laevigata var. reticulata
X	E	W			462	CEOC	hackberry	Celtis	occidentalis
	E	W			460	CELTI	hackberry spp.	Celtis	spp.
				U	5432	CEOC2	Button bush	Cephalanthus	occidentalis
				U	5434	CESI3	Algarrobo europeo	Ceratonia	siliqua
				U	5435	CEJA	Katsura tree	Cercidiphyllum	japonicum
X	E				471	CECA4	eastern redbud	Cercis	canadensis
				U	5436	CEOR9	California redbud	Cercis	orbiculata
		W	w		475	CELE3	curlleaf mountain-mahogany	Cercocarpus	ledifolius
X		W			41	CHLA	Port-Orford-cedar	Chamaecyparis	lawsoniana
X		W			42	CHNO	Alaska yellow-cedar	Chamaecyparis	nootkatensis
				U	5443	CHOB	Hinoki cypress	Chamaecyparis	obtusa
	E	W			40	CHAMA4	cedar spp.	Chamaecyparis	spp.
X	E				43	CHTH2	Atlantic white-cedar	Chamaecyparis	thyoides
				U	5462	CHLI	Desertwillow	Chilopsis	linearis
		W			431	CHCHC4	giant chinkapin, golden chinkapin	Chrysolepis	chrysophylla var. chrysophylla
	E				858	CICA	camphor tree	Cinnamomum	camphora

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	E				859	CIFR	fiddlewood	Citharexylum	fruticosum
	E				860	CITRU2	citrus spp.	Citrus	spp.
X	E				481	CLKE	yellowwood	Cladrastis	kentukea
				U	5523	CLBU	Rose glorybower	Clerodendrum	bungei
				U	5529	CLAC3	Mountain sweetpepperbush	Clethra	acuminata
	E				863	CODI8	pigeon plum, tietongue	Coccoloba	diversifolia
	E				907	COAR	silver palm	Coccothrinax	argentata
	E				908	CONU	coconut palm	Cocos	nucifera
	E				864	COEL2	soldierwood	Colubrina	elliptica
				U	5559	COAR6	Bladder senna	Colutea	arborescens
	E				987	COER2	buttonwood mangrove	Conocarpus	erectus
	E				865	COSE2	geiger tree	Cordia	sebestena
X	E				491	COFL2	flowering dogwood	Cornus	florida
				U	5591	COKO	Kousa Dogwood	Cornus	kousa
X		W			492	CONU4	Pacific dogwood	Cornus	nuttallii
	E	W			490	CORNU	dogwood spp.	Cornus	spp.
				U	5599	COAM	American hazlenut	Corylus	americana
				U	5600	COCO2	Turkish hazelnut	Corylus	colurna
				U	5603	COCO1	Smoke tree	Cotinus	coggygria
X	E				996	COOB2	smoketree	Cotinus	obovatus
	E				503	CRBR3	Brainerd hawthorn	Crataegus	brainerdii
	E				504	CRCA	pear hawthorn	Crataegus	calpodendron
	E				505	CRCH	fireberry hawthorn	Crataegus	chrysocarpa
	E				501	CRCR2	cockspur hawthorn	Crataegus	crus-galli
	E				506	CRDI	broadleaf hawthorn	Crataegus	dilatata
	E				507	CRFL	fanleaf hawthorn	Crataegus	flabellata
	E				502	CRMO2	downy hawthorn	Crataegus	mollis
	E				508	CRMO3	oneseed hawthorn	Crataegus	monogyna
	E				509	CRPE	scarlet hawthorn	Crataegus	pedicellata
	E				5091	CRPH	Washington hawthorn	Crataegus	phaenopyrum
	E				500	CRATA	hawthorn spp.	Crataegus	spp.
	E				5092	CRSU5	fleshy hawthorn	Crataegus	succulenta
	E				5093	CRUN	dwarf hawthorn	Crataegus	uniflora
				U	5775	CRJA	Japanese red cedar	Cryptomeria	japonica
				U	5776	CUTR2	Storehousebush	Cudrania	tricuspidata
	E				866	CUAN4	carrotwood	Cupaniopsis	anacardioides
				U	5800	CULE2	Dallimore	Cupressocyparis	leylandii
X		W			53	CUFO2	tecate cypress	Cupressus	forbesii
X		W			51	CUAR	Arizona cypress	Cupressus	arizonica
X		W			52	CUBA	Baker cypress, Modoc cypress	Cupressus	bakeri
X		W			56	CUMA	MacNab’s cypress	Cupressus	macnabiana
X		W			54	CUMA2	Monterey cypress	Cupressus	macrocarpa
		W			55	CUSA3	Sargent’s cypress	Cupressus	sargentii
		W			50	CUPRE	cypress	Cupressus	spp.
				U	5818	CYOB	Quince	Cydonia	oblonga
				U	5821	CYRA	Swamp cypress, swamp titi	Cyrilla	racemiflora
	E				520	DIOSP	persimmon spp.	Diospyros	spp.
X	E				522	DITE3	Texas persimmon	Diospyros	texana
X	E				521	DIVI5	common persimmon	Diospyros	virginiana
	E	W			997	ELAN	Russian-olive	Elaeagnus	angustifolia
				U	5877	ERJA	Loquat tree	Eriobotrya	japonica
X	E				512	EUCA2	river redgum	Eucalyptus	camaldulensis
X		W			511	EUGL	Tasmanian bluegum	Eucalyptus	globulus
X	E				513	EUGR12	grand eucalyptus	Eucalyptus	grandis
X	E				514	EURO2	swamp mahogany	Eucalyptus	robusta

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	E	W			510	EUCAL	eucalyptus spp.	Eucalyptus	spp.
	E				873	EURH	red stopper	Eugenia	rhombea
				U	5965	EUAL8	Winged burning bush	Euonymus	alata
	E				874	EXPA	Inkwood, butterbough	Exothea	paniculata
X	E				531	FAGR	American beech	Fagus	grandifolia
				U	5983	FASY	European beech	Fagus	sylvatica
	E				915	ARECA	other palms	Family Arecaceae	not listed above
				U	5990	FICA	Common fig	Ficus	carica
	E				876	FIAU	strangler fig	Ficus	aurea
	E				877	FICI	shortleaf fig, wild banyantree	Ficus	citrifolia
				U	6004	FISI	Chinese parasoltree	Firmiana	simplex
				U	6018	FRCA12	California buckthorn	Frangula	californica
				U	6021	FRAL	Franklin tree	Franklinia	alatamaha
X	E				541	FRAM2	white ash	Fraxinus	americana
				U	6025	FREX	European ash	Fraxinus	excelsior
X		W			542	FRLA	Oregon ash	Fraxinus	latifolia
X	E				543	FRNI	black ash	Fraxinus	nigra
				U	6030	FROX	Caucasian ash	Fraxinus	oxycarpa
X	E				544	FRPE	green ash	Fraxinus	pennsylvanica
X	E				545	FRPR	pumpkin ash	Fraxinus	profunda
X	E				546	FRQU	blue ash	Fraxinus	quadrangulata
	E	W			540	FRAXI	ash spp.	Fraxinus	spp.
X	E				549	FRTE	Texas ash	Fraxinus	texensis
X		W			547	FRVE2	velvet ash	Fraxinus	velutina
X	E				548	FRCA3	Carolina ash	Fraxinus	caroliniana
X	E	W			561	GIBI2	Ginkgo, maidenhair tree	Ginkgo	biloba
X	E				551	GLAQ	waterlocust	Gleditsia	aquatica
	E				550	GLEDI	locust spp.	Gleditsia	spp.
X	E				552	GLTR	honeylocust	Gleditsia	triacanthos
				U	6057	GLPA4	Flower axistree	Glycosmis	parviflora
X	E				555	GOLA	loblolly bay	Gordonia	lasianthus
	E				882	GUDI	Blolly, beeftree	Guapira	discolor
X	E				571	GYDI	Kentucky coffeetree	Gymnocladus	dioicus
X	E				581	HACA3	Carolina silverbell	Halesia	carolina
X	E				582	HADI3	two-wing silverbell	Halesia	diptera
X	E				583	HACA3	little silverbell	Halesia	parviflora
	E				580	HALES	silverbell spp.	Halesia	spp.
				U	6083	HATE3	Mountain silverbell	Halesia	tetraptera
				U	6084	HAVE2	Ozark witchhazel	Hamamelis	vernalis
				U	6085	HAVI	Witch hazel	Hamamelis	virginiana
	E				883	HIMA2	manchineel	Hippomane	mancinella
				U	6130	HODU	Japanese raisin tree	Hovenia	dulcis
				U	6134	HYTR	Inkwood	Hypelate	trifoliata
				U	6141	ILCA	Dahoon	Ilex	cassine
X	E				591	ILOP	American holly	Ilex	opaca
				U	6140	ILEX	Ilex spp.	Ilex	spp.
				U	6156	ILVO	Yaupon	Ilex	vomitoria
X		W			604	JUCA	Southern California black walnut	Juglans	californica
X	E				601	JUCI	butternut	Juglans	cinerea
		W			603	JUHI	Northern California black walnut	Juglans	hindsii
X		W			606	JUMA	Arizona walnut	Juglans	major
	E	W			605	JUMI	Texas walnut	Juglans	microcarpa
X	E	W			602	JUNI	black walnut	Juglans	nigra
				U	6177	JURE	English walnut	Juglans	regia

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	E	W			600	JUGLA	walnut spp.	Juglans	spp.
X	E				61	JUAS	Ashe juniper	Juniperus	ashei
X		W	w		62	JUCA7	California juniper	Juniperus	californica
X		W	w		59	JUCO11	redberry juniper	Juniperus	coahuilensis
X		W	w		63	JUDE2	alligator juniper	Juniperus	deppeana
X		W	w		69	JUMO	oneseed juniper	Juniperus	monosperma
X		W			64	JUOC	western juniper	Juniperus	occidentalis
X		W	w		65	JUOS	Utah juniper	Juniperus	osteosperma
X		W	w		58	JUPI	Pinchot juniper	Juniperus	pinchotii
X	E	W	w		66	JUSC2	Rocky Mountain juniper	Juniperus	scopulorum
	E	W			57	JUNIP	redcedar, juniper spp.	Juniperus	spp.
X	E				68	JUVI	eastern redcedar	Juniperus	virginiana
	E				67	JUVIS	southern redcedar	Juniperus	virginiana var. silicicola
				U	6193	KOPA	Goldenrain tree	Koelreuteria	paniculata
				U	6205	LAAN2	Golden chain tree	Laburnum	anagyroides
			w	U	6208	LAIN	Common crapemyrtle	Lagerstroemia	indica
	E				988	LARA2	white mangrove	Laguncularia	racemosa
				U	6212	LADE	European larch	Larix	decidua
X	E	W			71	LALA	tamarack (native)	Larix	laricina
X		W			72	LALY	subalpine larch	Larix	lyallii
X		W			73	LAOC	western larch	Larix	occidentalis
	E	W			70	LARIX	larch spp.	Larix	spp.
				U	6223	LEPU3	Great leadtree	Leucaena	pulverulenta
				U	6224	LERE5	Littleleaf leadtree	Leucaena	retusa
			w	U	6228	LIJA	Japanese privet, Ligustro	Ligustrum	japonicum
			w	U	6229	LILU	Glossy privet	Ligustrum	lucidum
			w	U	6230	LIOV	California privet	Ligustrum	ovalifolium
			w	U	6231	LISI	Chinese privet	Ligustrum	sinense
				U	6233	LIME7	Southern spicebush	Lindera	melissifolia
				U	6234	LISU8	Bog spicebush	Lindera	subcoriacea
X	E				611	LIST2	sweetgum	Liquidambar	styraciflua
X	E				621	LITU	yellow-poplar	Liriodendron	tulipifera
X		W			631	LIDE3	tanoak	Lithocarpus	densiflorus
				U	6239	LIMO4	Aroeira blanca	Lithrea	molleoides
			w	U	6244	LOMA6	Amur honeysuckle, Bush honeysuckle	Lonicera	maackii
	E				884	LYLA3	false tamarind	Lysiloma	latisiliquum
X	E				641	MAPO	Osage-orange	Maclura	pomifera
X	E				651	MAAC	cucumbertree	Magnolia	acuminata
X	E				655	MAFR	mountain magnolia, Fraser magnolia	Magnolia	fraseri
X	E				652	MAGR4	southern magnolia	Magnolia	grandiflora
X	E				654	MAMA2	bigleaf magnolia	Magnolia	macrophylla
X	E				657	MAPY	pyramid magnolia	Magnolia	pyramidata
	E				650	MAGNO	magnolia spp.	Magnolia	spp.
X	E				658	MATR	umbrella magnolia	Magnolia	tripetala
X	E				653	MAVI2	sweetbay	Magnolia	virginiana
X	E				662	MAAN3	southern crabapple	Malus	angustifolia
				U	6274	PYBA	Siberian crabapple	Malus	baccata
				U	6278	MAPU	paradise apple	Malus	communis
X	E				663	MACO5	sweet crabapple	Malus	coronaria
				U	6275	MAFL80	Japanese flowering crabapple	Malus	floribunda
X		W			661	MAFU	Oregon crabapple	Malus	fusca
X	E				664	MAIO	prairie crabapple	Malus	ioensis
	E	W			660	MALUS	apple spp.	Malus	spp.
	E				885	MAIN3	mango	Mangifera	indica

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X	E				992	MEQU	melaleuca	Melaleuca	quinquenervia
X	E				993	MEAZ	chinaberry	Melia	azedarach
				U	6354	MEGL	Dawn redwood	Metasequoia	glyptostroboi
	E				886	METO3	poisonwood	Metopium	toxiferum
X	E				681	MOAL	white mulberry	Morus	alba
	E	W			683	MOMI	Texas mulberry	Morus	microphylla
X	E				684	MONI	black mulberry	Morus	nigra
X	E				682	MORU2	red mulberry	Morus	rubra
	E				680	MORUS	mulberry spp.	Morus	spp.
				U	6438	NEMU2	Catberry	Nemopanthus	mucronatus
				U	6444	NIGL	Tree tobacco	Nicotiana	glauca
X	E				691	NYAQ2	water tupelo	Nyssa	aquatica
X	E				694	NYBI	swamp tupelo	Nyssa	biflora
X	E				692	NYOG	Ogeechee tupelo	Nyssa	ogeche
	E				690	NYSSA	tupelo spp.	Nyssa	spp.
X	E				693	NYSY	blackgum	Nyssa	sylvatica
		W	w		990	OLTE	desert ironwood	Olneya	tesota
				U	6479	OSKN	Knowlton hophornbeam	Ostrya	knowltonii
X	E				701	OSVI	eastern hophornbeam	Ostrya	virginiana
X	E				711	OXAR	sourwood	Oxydendrum	arboreum
X	E				712	PATO2	paulownia, empress-tree	Paulownia	tomentosa
X		W			7211	PEAM3	avocado	Persea	americana
X	E				721	PEBO	redbay	Persea	borbonia
				U	6511	PEPA37	Swamp bay	Persea	palustris
	E	W			720	PERSE	bay spp.	Persea	spp.
				U	6516	PHAM	Amur corktree	Phellodendron	amurense
X	E				91	PIAB	Norway spruce	Picea	abies
X		W			92	PIBR	Brewer spruce	Picea	breweriana
X		W			93	PIEN	Engelmann spruce	Picea	engelmannii
X	E	W			94	PIGL	white spruce	Picea	glauca
				U	6533	PIGL3	Sagholia spruce	Picea	glehnii
X	E	W			95	PIMA	black spruce	Picea	mariana
				U	6538	PIOM	Serbian spruce	Picea	omorika
X	E	W			96	PIPU	blue spruce	Picea	pungens
X	E				97	PIRU	red spruce	Picea	rubens
X		W			98	PISI	Sitka spruce	Picea	sitchensis
	E	W			90	PICEA	spruce spp.	Picea	spp.
X		W			101	PIAL	whitebark pine	Pinus	albicaulis
X		W			102	PIAR	Rocky Mountain bristlecone pine	Pinus	aristata
X		W			135	PIAR5	Arizona pine	Pinus	arizonica
X		W			103	PIAT	knobcone pine	Pinus	attenuata
X		W			104	PIBA	foxtail pine	Pinus	balfouriana
X	E				105	PIBA2	jack pine	Pinus	banksiana
X		W	w		140	PICE	Mexican pinyon pine	Pinus	cembroides
X	E				107	PICL	sand pine	Pinus	clausa
X		W			108	PICO	lodgepole pine	Pinus	contorta
X		W			109	PICO3	Coulter pine	Pinus	coulteri
				U	6552	PIDE	Japanese red pine	Pinus	densiflora
X		W	w		134	PIDI3	border pinyon	Pinus	discolor
X	E				110	PIEC2	shortleaf pine	Pinus	echinata
X		W	w		106	PIED	Common pinyon, two-needle pinyon	Pinus	edulis
X	E				111	PIEL	slash pine	Pinus	elliottii
X	E				144	PIELE2	Carribean pine	Pinus	elliottii var. elliottii
X		W			112	PIEN2	Apache pine	Pinus	engelmannii

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X		W			113	PIFL2	limber pine	Pinus	flexilis
X	E				115	PIGL2	spruce pine	Pinus	glabra
X		W			116	PIJE	Jeffrey pine	Pinus	jeffreyi
X		W			117	PILA	sugar pine	Pinus	lambertiana
X		W			118	PILE	Chihuahua pine	Pinus	leiophylla
X		W			142	PILO	Great Basin bristlecone pine	Pinus	longaeva
X		W	w		133	PIMO	singleleaf pinyon	Pinus	monophylla
X		W	w		143	PIMOF	Arizona pinyon pine	Pinus	monophylla var. fallax
X		W			119	PIMO3	western white pine	Pinus	monticola
X		W			120	PIMU	bishop pine	Pinus	muricata
X	E				136	PINI	Austrian pine	Pinus	nigra
X	E				121	PIPA2	longleaf pine	Pinus	palustris
				U	6562	PIPA2	Japanese white pine	Pinus	parviflora
X	E	W			122	PIPO	ponderosa pine	Pinus	ponderosa
X	E				123	PIPU5	Table Mountain pine	Pinus	pungens
X		W			138	PIQU	four-leaf pine, Parry pinyon pine	Pinus	quadrifolia
X		W			124	PIRA2	Monterey pine	Pinus	radiata
X	E				125	PIRE	red pine	Pinus	resinosa
X	E				126	PIRI	pitch pine	Pinus	rigida
X		W			127	PISA2	gray pine, California foothill pine	Pinus	sabiniana
X	E				128	PISE	pond pine	Pinus	serotina
	E	W			100	PINUS	pine spp.	Pinus	spp.
X		W			114	PIST3	southwestern white pine	Pinus	strobiformis
X	E				129	PIST	eastern white pine	Pinus	strobus
X	E				130	PISY	Scotch pine	Pinus	sylvestris
X	E				131	PITA	loblolly pine	Pinus	taeda
				U	6569	PITH	Japansese Black pine	Pinus	thunbergiana
X		W			139	PITO	Torrey pine	Pinus	torreyana
X	E				132	PIVI2	Virginia pine	Pinus	virginiana
X		W			137	PIWA	Washoe pine	Pinus	washoensis
	E				887	PIPI3	fishpoison tree	Piscidia	piscipula
				U	6594	PICH	Chinese pistache	Pistacia	chinensis
X	E				722	PLAQ	water-elm, planertree	Planera	aquatica
				U	6615	PLAC	London planetree; platanus x acerfolia	Platanus	hybrida
X	E				731	PLOC	American sycamore	Platanus	occidentalis
				U	6616	PLOR	Oriental planetree	Platanus	orientalis
X		W			730	PLRA	California sycamore	Platanus	racemosa
	E	W			729	PLATA	sycamore spp.	Platanus	spp.
X		W			732	PLWR2	Arizona sycamore	Platanus	wrightii
				U	6617	THOR	Oriental arbor vitae	Platycladus	orientalis
				U	6633	POTR4	Hardy orange	Poncirus	trifoliata
X	E				752	POAL7	silver poplar	Populus	alba
X		W			749	POAN3	narrowleaf cottonwood	Populus	angustifolia
X	E	W			741	POBA2	balsam poplar	Populus	balsamifera
X		W			747	POBAT	black cottonwood	Populus	balsamifera ssp. trichocarpa
X	E				742	PODE3	eastern cottonwood	Populus	deltoides
X	E	W			745	PODEM	plains cottonwood	Populus	deltoides ssp. monilifera
X		W			748	POFR2	Fremont's cottonwood	Populus	fremontii
X	E				743	POGR4	bigtooth aspen	Populus	grandidentata
X	E				744	POHE4	swamp cottonwood	Populus	heterophylla
X	E				753	PONI	Lombardy poplar	Populus	nigra
	E	W			740	POPUL	cottonwood and poplar spp.	Populus	spp.
X	E	W			746	POTR5	quaking aspen	Populus	tremuloides
				U	6640	POBR7	Hybrid balsam poplar	Populus	x brayshawii

Core	East	West	Woodland	Urban	FIA Code	PLANTS Code	Common Name	Genus	Species
				U	6634	POCA19	Carolina poplar/narrowleaf cottonwood	Populus	x canadensis Moench/anfustifolia
				U	6642	POCA	Gray poplar	Populus	x canescens
X	E	W	w		756	PRGL2	honey mesquite	Prosopis	glandulosa
X	E	W	w		758	PRPU	screwbean mesquite	Prosopis	pubescens
	E	W	w		755	PROSO	mesquite spp.	Prosopis	spp.
X	E	W	w		757	PRVE	velvet mesquite	Prosopis	velutina
	E				769	PRAL5	Allegheny plum	Prunus	alleghaniensis
X	E				766	PRAM	American plum	Prunus	americana
	E	W			770	PRAN3	Chickasaw plum	Prunus	angustifolia
X	E				771	PRAV	sweet cherry (domesticated)	Prunus	avium
				U	6691	PRCE	Cherry plum	Prunus	cerasifera
	E				772	PRCE	sour cherry (domesticated)	Prunus	cerasus
	E				773	PRDO	European plum (domesticated)	Prunus	domestica
		W			768	PREM	bitter cherry	Prunus	emarginata
				U	6696	PRLA	Common cherry laural	Prunus	laurocerasus
	E				774	PRMA	Mahaleb plum (domesticated)	Prunus	mahaleb
X	E				765	PRNI	Canada plum	Prunus	nigra
	E	W			761	PRPE2	pin cherry	Prunus	pensylvanica
	E				764	PRPE3	peach	Prunus	persica
X	E				762	PRSE2	black cherry	Prunus	serotina
				U	6707	PRSE2	Kwanzan cherry	Prunus	serrulata
	E	W			760	PRUNU	cherry and plum spp.	Prunus	spp.
	E	W			763	PRVI	common chokecherry	Prunus	virginiana
				U	6719	PRYE	Yoshino flowering cherry	Prunus	x yedoensis
X		W			201	PSMA	bigcone Douglas-fir	Pseudotsuga	macrocarpa
X		W			202	PSME	Douglas-fir	Pseudotsuga	menziesii
		W			200	PSEUD7	Douglas-fir spp.	Pseudotsuga	spp.
				U	6753	PTTR	Common hoptree	Ptelea	trifoliata
				U	6758	PTST	Chinese wingnut	Pterocarya	stenoptera
				U	6759	PUST	Stansbury cliffrose	Purshia	stansburiana
	E				782	PYCA80	Callery pear	Pyrus	calleryana
				U	6760	PYCA	Callery pear	Pyrus	calleryana
	E				781	PYCO	Common pear	Pyrus	communis
				U	6761	PYCO	Common pear	Pyrus	communis
				U	6763	PYPY2	Chinese pear	Pyrus	pyrifolia
	E				780	PYRUS	Pear spp.	Pyrus	spp.
				U	6767	QUAC	Sawtooth oak	Quercus	acutissima
X		W			801	QUAG	California live oak	Quercus	agrifolia
X	E				802	QUAL	white oak	Quercus	alba
X		W	w		803	QUAR	Arizona white oak	Quercus	arizonica
				U	6768	QUAR2	Arkansas oak	Quercus	arkansana
				U	6769	QUAU	Bluff oak	Quercus	austrina
X	E				804	QUBI	swamp white oak	Quercus	bicolor
X	E				828	QUBU2	Nuttall oak	Quercus	buckleyi
				U	6774	QUCE	Euopean turkey oak	Quercus	cerris
		W			805	QUCH2	canyon live oak	Quercus	chrysolepis
X	E				806	QUCO2	scarlet oak	Quercus	coccinea
X		W			807	QUDO	blue oak	Quercus	douglasii
X	E				809	QUEL	northern pin oak	Quercus	ellipsoidalis
X		W	w		810	QUEM	Emory oak	Quercus	emoryi
X		W			811	QUEN	Engelmann oak	Quercus	engelmannii
X	E				812	QUFA	southern red oak	Quercus	falcata
X		W	w		814	QUGA	Gambel oak	Quercus	gambelii
X		W			815	QUGA4	Oregon white oak	Quercus	garryana

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				U	6781	QUGE2	Sand live oak	Quercus	geminata
				U	6782	QUGE	Georgia oak	Quercus	georgiana
X		W	w		846	QUGR3	gray oak	Quercus	grisea
				U	6785	QUHA3	Havard oak	Quercus	havardii
				U	6786	QUHE	Laurel oak	Quercus	hemisphaerica
X		W	w		843	QUHY	silverleaf oak	Quercus	hypoleucoides
				U	6787	QUIL2	Roble negro	Quercus	ilex
X	E				816	QUIL	scrub oak	Quercus	ilicifolia
X	E				817	QUIM	shingle oak	Quercus	imbricaria
X	E				842	QUIN	bluejack oak	Quercus	incana
X		W			818	QUKE	California black oak	Quercus	kelloggii
X	E				819	QULA2	turkey oak	Quercus	laevis
X	E				820	QULA3	laurel oak	Quercus	laurifolia
X		W			821	QULO	California white oak	Quercus	lobata
X	E				822	QULY	overcup oak	Quercus	lyrata
X	E				823	QUMA2	bur oak	Quercus	macrocarpa
X	E				840	QUMA6	dwarf post oak	Quercus	margarettiae
X	E				824	QUMA3	blackjack oak	Quercus	marilandica
X	E				825	QUMI	swamp chestnut oak	Quercus	michauxii
X	E				841	QUMI2	dwarf live oak	Quercus	minima
X	E				826	QUMU	chinkapin oak	Quercus	muehlenbergii
				U	6791	QUMY	Myrtle oak	Quercus	myrtifolia
X	E				827	QUNI	water oak	Quercus	nigra
X		W	w		829	QUOB	Mexican blue oak	Quercus	oblongifolia
X	E				844	QUOG	Oglethorpe oak	Quercus	oglethorpensis
X	E				813	QUPA5	cherrybark oak	Quercus	pagoda
X	E				830	QUPA2	pin oak	Quercus	palustris
				U	6794	QUPE	Durmast oak	Quercus	petraea
X	E				831	QUPH	willow oak	Quercus	phellos
	E				845	QUPR	dwarf chinkapin oak	Quercus	prinoides
X	E				832	QUPR2	chestnut oak	Quercus	prinus
				U	6797	QURO	English Oak	Quercus	robur
X	E				833	QURU	northern red oak	Quercus	rubra
X		W	w		847	QURU4	netleaf oak	Quercus	rugosa
X	E				834	QUSH	Shumard’s oak	Quercus	shumardii
	E				836	QUSI2	Delta post oak	Quercus	similis
				U	6799	QUSI	Bastard oak	Quercus	sinuata
X	E				808	QUSIS	Durand oak	Quercus	sinuata var. sinuata
	E	W			800	QUERC	oak – deciduous spp.	Quercus	spp.
		W	w		850	QUERC	oak – evergreen spp.	Quercus	spp.
X	E				835	QUST	post oak	Quercus	stellata
				U	6802	QUNU	Buckley oak	Quercus	texana
				U	6805	QUTU2	Sonoran scrub oak	Quercus	turbinella
X	E				837	QUVE	black oak	Quercus	velutina
X	E				838	QUVI	live oak	Quercus	virginiana
X		W			839	QUWI2	interior live oak	Quercus	wislizeni
				U	6918	RHCA	European buckthorn	Rhamnus	cathartica
X	E				989	RHMA2	American mangrove	Rhizophora	mangle
				U	6923	RHCA8	Catawba rosebay	Rhododendron	catawbiense
				U	6924	RHHI2	staghorn sumac	Rhus	hirta
				U	6937	RICO3	Castorbean	Ricinus	communis
				U	6938	ROHI	Bristly locust	Robinia	hispida
		W	w		902	RONE	New Mexico locust	Robinia	neomexicana
X	E	W			901	ROPS	black locust	Robinia	pseudoacacia
	E				909	ROYST	royal palm spp.	Roystonea	spp.

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X	E				912	SAPA	cabbage palmetto	Sabal	palmetto
	E	W			927	SAAL2	white willow	Salix	alba
	E	W			921	SAAM2	peachleaf willow	Salix	amygdaloides
	E	W			923	SABE2	Bebb willow	Salix	bebbiana
		W			924	SABO	red willow	Salix	bonplandiana
X	E				925	SACA5	coastal plain willow	Salix	caroliniana
				U	6953	SADI	Pussy willow	Salix	discolor
				U	6954	SAEL	Elaeagnus willow	Salix	elaeagnos
				U	6959	SAGE2	Geyer's willow	Salix	geyeriana
				U	6961	SAGO	Goodding's willow	Salix	gooddingii
				U	6963	SALA3	Red willow	Salix	laevigata
				U	6965	SALU2	Yellow willow	Salix	lutea
				U	6967	SAMA	Corkscrew willow	Salix	matsudana
	E	W			922	SANI	black willow	Salix	nigra
				U	6975	SAPL2	Diamondleaf willow	Salix	planifolia
X	E				926	SAPY	balsam willow	Salix	pyrifolia
		W			928	SASC	Scouler’s willow	Salix	scouleriana
X	E				929	SASE10	weeping willow	Salix	sepulcralis
				U	6977	SASE	Silky willow	Salix	sericea
	E	W			920	SALIX	willow spp.	Salix	spp.
				U	6990	SANI4	European black elderberry	Sambucus	nigra
				U	6991	SARA2	Red elderberry	Sambucus	racemosa
				U	7000	SASA	Wingleaf soapberry	Sapindus	saponaria
	E	W			919	SASAD	western soapberry	Sapindus	saponaria var. drummondii
X	E				931	SAAL5	sassafras	Sassafras	albidum
	E				888	SCAC2	schefflera, octopus tree	Schefflera	actinophylla
				U	7023	SECO9	Argentine senna	Senna	corymbosa
X		W			211	SESE3	redwood	Sequoia	sempervirens
X		W			212	SEGI2	giant sequoia	Sequoiadendron	giganteum
	E				381	SILAL3	Chittamwood, gum bumelia	Sideroxylon	lanuginosum ssp. lanuginosum
				U	7043	SILY	Buckthorn bully	Sideroxylon	lycioides
				U	7046	SITE2	Tough bully	Sideroxylon	tenax
	E				890	SIFO	false mastic	Sideroxylon	foetidissimum
	E				891	SISA6	white bully, willow bustic	Sideroxylon	salicifolium
	E				895	SIGL3	paradise tree	Simarouba	glauca
				U	7058	SOAF	Texas sophora	Sophora	affinis
				U	7060	SOJA	Japanese pagoda tree	Sophora	japonica
				U	7062	SOSE	Mescalbean	Sophora	secundiflora
				U	7063	SORBA	false spiraea	Sorbaria	
	E				935	SOAM3	American mountain ash	Sorbus	americana
X	E				936	SOAU	European mountain ash	Sorbus	aucuparia
X	E				937	SODE3	northern mountain ash	Sorbus	decora
				U	7066	SOSC2	Greene's mountain ash	Sorbus	scopulina
				U	7067	SOSI2	Western mountain ash	Sorbus	sitchensis
	E				934	SORBU	mountain ash spp.	Sorbus	spp.
				U	7077	STKO	Stewartia	Stewartia	koreana
				U	7078	STMA	Silky camellia	Stewartia	malacodendron
				U	7079	STOV	Mountain stewartia	Stewartia	ovata
				U	7082	STAM4	American snowbell	Styrax	americanus
				U	7083	STGR4	Bigleaf snowbell	Styrax	grandifolius
	E				940	SWMA2	mahogany	Swietenia	mahagoni
				U	7092	SYRE	Japanese tree lilac	Syringa	reticulata
				U	7093	SYVU	common lilac	Syringa	vulgaris
	E				896	SYCU	Java plum	Syzygium	cumini

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	E				897	TAIN2	tamarind	Tamarindus	indica
				U	7112	TAAP	Athel tamarisk	Tamarix	aphylla
				U	7115	TACH2	Fivestamen tamarisk	Tamarix	chinensis
				U	7116	TARA	Saltcedar	Tamarix	ramosissima
	E	W			991	TAMAR2	saltcedar	Tamarix	spp.
X	E				222	TAAS	pondcypress	Taxodium	ascendens
X	E				221	TADI2	baldcypress	Taxodium	distichum
				U	7118	TAMU	Montezuma cypress	Taxodium	mucronatum
	E				220	TAXOD	cypress spp.	Taxodium	spp.
				U	7119	TABA	English yew	Taxus	baccata
		W			231	TABR2	Pacific yew	Taxus	brevifolia
				U	7120	TACU	Japanese yew	Taxus	cuspidata
X	E				232	TAFL	Florida yew	Taxus	floridana
	E	W			230	TAXUS	yew spp.	Taxus	spp.
	E				913	THMO4	key thatch palm	Thrinax	morrisii
	E				914	THRA2	Florida thatch palm	Thrinax	radiata
X	E				241	THOC2	northern white-cedar	Thuja	occidentalis
X		W			242	THPL	western redcedar	Thuja	plicata
	E	W			240	THUJA	Thuja spp.	Thuja	spp.
X	E				951	TIAM	American basswood	Tilia	americana
	E				953	TIAMC	Carolina basswood	Tilia	americana var. caroliniana
	E				952	TIAMH	white basswood	Tilia	americana var. heterophylla
				U	7154	TICO	littleleaf linden	Tilia	cordata
	E				950	TILIA	basswood spp.	Tilia	spp.
				U	7158	TITO	Silver linden	Tilia	tomentosa
X		W			251	TOCA	California torreya (nutmeg)	Torreya	californica
	E	W			250	TORRE	torreya (nutmeg) spp.	Torreya	spp.
X	E				252	TOTA	Florida torreya (nutmeg)	Torreya	taxifolia
				U	7166	TOVE	Poison sumac	Toxicodendron	vernix
X	E	W			998	2TB	unknown dead hardwood	Tree	broadleaf
X	E	W			299	2TE	unknown dead conifer	Tree	evergreen
X	E	W			999	2TREE	other, or unknown live tree	Tree	unknown
X	E				994	TRSE6	Chinese tallowtree	Triadica	sebifera
X	E				261	TSCA	eastern hemlock	Tsuga	canadensis
X	E				262	TSCA2	Carolina hemlock	Tsuga	caroliniana
X		W			263	TSHE	western hemlock	Tsuga	heterophylla
X		W			264	TSME	mountain hemlock	Tsuga	mertensiana
	E	W			260	TSUGA	hemlock spp.	Tsuga	spp.
X	E				971	ULAL	winged elm	Ulmus	alata
X	E				972	ULAM	American elm	Ulmus	americana
X	E				973	ULCR	cedar elm	Ulmus	crassifolia
				U	7178	ULPA	Chinese elm	Ulmus	parvifolia
				U	7179	ULPR	English elm	Ulmus	procera
X	E				974	ULPU	Siberian elm	Ulmus	pumila
X	E				975	ULRU	slippery elm	Ulmus	rubra
X	E				976	ULSE	September elm	Ulmus	serotina
	E				970	ULMUS	elm spp.	Ulmus	spp.
X	E				977	ULTH	rock elm	Ulmus	thomasii
X		W			981	UMCA	California-laurel	Umbellularia	californica
				U	7182	UNSP	Mexican buckeye	Ungnadia	speciosa
				U	7188	VAAR	Sparkleberry	Vaccinium	arboreum
X	E				995	VEFO	tungoil tree	Vernicia	fordii
				U	7192	VILE	Nannyberry	Viburnum	lentago
				U	7194	VIPR	Black haw	Viburnum	prunifolium
				U	7195	VIRU	Rusty blackhaw	Viburnum	rufidulum

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			U	7196	VISI	Siebold's arrowwood	Viburnum	sieboldii
			U	7197	VIAG	Chaste tree	Vitex	agnus-castus
			U	7199	VINE2	Negundo chastetree	Vitex	negundo
			U	7216	XYBI	Mission manzanita	Xylococcus	bicolor
	W			982	YUBR	Joshua tree	Yucca	brevifolia
			U	7224	ZAAM	Common prickly ash	Zanthoxylum	americanum
			U	7243	ZESE	Japanese zelkova	Zelkova	serrata
			U	7246	ZIOB	Lotebush	Ziziphus	obtusifolia
			U	7250	ZIZI	Common jujube	Ziziphus	zizyphus

Measurements required for urban plots		Urban-only			
		Live Sapling	Live Pole/sawtimber	Standing dead	
Subplot Number		X	X	X	Trees that qualify on both urban and remeasure require all usually recorded items and all additional urban-only variables, based on tree status
Tree Record Number		X	X	X	
Condition Class Number		X	X	X	
Offset Point Number		0-4	0-4	0-4	
Azimuth		X	X	X	
Horizontal Distance		X	X	X	
Tree Status	Present	8	8	9	
	Urban status	1	1	2	
Species		X	X	X	
Diameter	Present Diameter	X	X	X	
	Diameter Check	X	X	X	
	Length to Diameter Point	X	X	X	
Length	Total	X	X	X	
	Actual	X	X	X	
	Length Method	X	X	X	
Uncompacted Live crown ratio		X	X		
Crown Light Exposure		X	X		
Crown Density			X		
Crown Dieback			X		
Crown Transparency			X		
Crown Diameter Wide		X	X		
Crown Diameter 90 Degrees		X	X		
Foliage Absent		X	X		
Mortality?				X	
Maintained Area?		X	X	X	
Cause of Death				X	
Urban Damage		X	X		
Building Energy Data (Azimuth/Distance)		X	X		