

APPENDIX B GUIDE FOR LANDSCAPING

B1 Introduction: Appendix B is a compilation of the latest accepted horticultural practices. It is meant to be used by North Carolina Landscape Contractors and Staff to help assure that installed landscape thrives once planted. It contains definitions, text descriptions and plant list. Sections within this Appendix provide information on tree protection, planting and pruning guidelines and suggested species. This Appendix is the guide that Staff uses to assess landscape installation. The information is designed to be used interchangeable with Article 31 Landscape Standards. All those who install landscape material subject to Staff approval towards a Certificate of Occupancy or landscape compliance are expected to follow these guidelines.

B2 Tree Preservation and Care During construction

B2.01 Tree Preservation

B2.01.01 Tree Protection Area

- A.** Install tree protection fencing before doing any grading or land disturbing activity.
- B.** Install tree protection fencing around the “Tree Protection Area”:
- C.** The size of the “Tree Protection Area” is the area within the drip line of the tree or group of trees.
- D.** Do not disturb the “Tree Protection Area.” In other words do not clear, grub, trench, remove soil, backfill, drive or park vehicles, equipment or materials, dump trash, oil, paint or any material harmful to the health and growth of the tree within the area marked by the drip line of any tree.
- E.** If authorized to clear within the TPA, cut any trees or shrubs flush with the grade or grind the stumps to a minimum twelve inches (12”) below surrounding grade. Backfill any holes with clean, dry soil the same day. Moisten the soil. Seed or mulch the remaining area depending on which landscaping treatments are stipulated on the plans.
- F.** If installing tree protection fencing for trees along a wood’s edge, locate the fence at the drip line of the outermost trees.
- G.** Call the Planning and Inspections Department (828-268-6960) to request that the Administrator visit the site to give approval of the placement of fencing before doing any other site work.
- H.** The Administrator may allow a Temporary Access (for 30 days only) across the “Tree Protection Area.” Get permission in writing from the Administrator and keep a copy on the construction site at all times. Mulch the access across the “Tree Protection Area” with a minimum 6” layer of large wood chips. No material storage, however, is allowed in the access area even on a temporary basis.
- I.** Some trees being saved may require root pruning. See Section B2.02 below for specific guidelines on root pruning.
- J.** Those trees requiring more than a third of their roots pruned/removed are unlikely to survive. Remove those trees.

B2.02 Care During Construction

- A.** Root pruning may be done on existing trees located near proposed construction using the following guidelines:
 - 1. Cut roots no more than six inches (6”) back from new construction, cut to a depth of two feet (2’) only.
 - 2. Backfill with clean, dry soil within hours of root pruning. Moisten soil the same day.
 - 3. Keep all tools sharp to ensure roots are not broken or torn.
- B.** Any clearing done in the TPA may only be done if specified on the approved site plan or with written permission from the Administrator and cannot disturb the roots. Cut any trees or shrubs flush with grade or use a stump grinder.
- C.** Do not use climbing irons, spurs or spikes on trees when pruning them.

B3 Requirements for Successful Groundcover, Shrub and Tree Installations

B3.02.01 Plant Material

Protect all plants at all times. Protect plants from sun and/or drying winds. Plants cannot be planted immediately upon delivery to the site must be kept in the shade or covered with burlap to prevent sun scorch. These plants need to be well watered. Plants which remain unplanted for longer than one day must be heeled in, i.e. covered with wet compost, soil, or other acceptable material and their root ball kept moist by watering. No plant may remain unplanted on site longer than three (3) days.

To protect surrounding turf that may be damaged from being driven over and upon which soil may be temporarily piled, cover with a tarp or sheets of plywood. Provide tree protection fencing to protected any existing trees, shrubbery, and beds in this area.

Supply all plants as specified in the Plant List as shown on the approved Site Plan. Determine from the plan the quantities of each species required. **If a discrepancy exists between the number of plants specified in the Plant List and the graphic representation on the plan, the installer is to use the number graphically represented on the plan.** Plants must be typical of their species and variety, have normal growth habit, have well developed branching, be densely foliated, and have healthy roots. Size of plants, spread of roots, and size of root ball must be in accordance with the American Standard for Nursery Stock (most current edition). Plants of each particular variety must be uniform in size, density, and configuration.

Container plants must have a root system dense enough to hold the soil intact when removed from the container. The root system however must not be root bound, or so dense in mass that it is excessively intertwined or has a circular growth pattern.

Balled and burlap (B & B) plants must be nursery grown, and dug within three (3) days of transplanting. The burlap used to secure the ball must be untreated and biodegradable. There can be no more than one inch (1") of fill over the original roots. B & B plants must have firm balls of earth in which the plant has been growing and of a diameter not less than specified in the American Standard for Nursery Stock.

All new trees must have straight trunks with an intact single central leader, unless a multi-stem tree is specified. Trees will not be accepted which have had their branches shortened, leaders cut, or have damaged leaders which require cutting. Unless otherwise specified, shade trees shall not have branches within six feet (6') of the top of the root ball.

B4.02.02 Soil Preparation:

Create plant beds the size and location shown on the approved Site Plan. All groundcovers and container shrubs must be planted in a shrub bed, B & B material or large container material may be planted in individual planting holes. The planting area must be wide enough to accommodate all roots without crowding, and must contain nutrient rich soil.

In order to ready the planting areas, prepare the soil by taking the following steps:

- A.** Remove all vegetation and topsoil from the top three inches (3") of the planting area for both planting beds and plant holes. Remove unwanted vegetation from the site, stockpile topsoil on site for future use or remove from site if specifically stated in the approved Site Plan.
- B.** Dig all shrub beds two (2) to three (3) times the width of the root mass and all tree planting holes 1.5 to 2 times the width of the root ball with a minimum nine inches (9") on each side of the mass or ball.
- C.** Install a sufficient quantity of planting mix to replace the removed topsoil, and to achieve positive drainage at a minimum of 1.5% slope.
 - 1. The replacement soil shall be the following planting mix: 10% - 30% sterile well pulverized red clay, 30% - 50% silt, 30% - 45% coarse sand, 1.0 mm to 0.5 mm in diameter, minimum 5% organic material such as completely decomposed compost/humus. The acidity range of the plant mix shall be ph 5.5 to ph 7.0. The planting mix shall have the following nutrients at the specified percent base saturation: calcium at 55% to 80%, magnesium at 10% to 30%, and potassium at 5% to 8%.
 - 2. If the quality of planting mix seems questionable to the Administrator, Staff may require the results of a soil test for analysis.
- D.** If no replacement planting mix is used, there is an acceptable alternative soil preparation. Thoroughly pulverize the soil, minus the sod, removed from the planting hole or plant bed. Amend with lime and fertilizer at the rates specified on the package.

B4.02.03 Plant Installation

- A. Soak with water all container plants before removing them from their containers to keep the plant moist and healthy during the planting process.
- B. Remove groundcover and shrubbery from their containers. If their root balls are pot bound, scarify the ball before installation.
- C. Set plants upright, plumb, and oriented to provide the best appearance and relationship to the viewer.
- D. Set trees and shrubs two to three inches (2"-3") above finished grade. Do not place backfill soil on top of the root ball, or up the stems or trunks of plant material.
- E. Backfill around the root ball being careful not to pack tightly. Form a two inch (2") high collar of soil around the drip zone of the individual shrub in all areas not irrigated.
- F. Take extra care to adequately backfill B & B plants. Backfill and compact bottom third (1/3) of the root ball. Cut away the ball ties, the top two thirds (2/3) of the wire basket, and the exposed burlap. Do not remove the burlap from under the root ball. Backfill one half (1/2) the remaining hole with the specified planting mix, and water thoroughly. Backfill the rest of the hole with the specified planting mix, firm down to eliminate air pockets, but do not pack tightly. Build a collar of soil four inches (4") in height around the edge of the root ball to form a basin for holding water. Form the bottom of the basin at surrounding finish grade.
- G. Mulch with two to three inches (2"-3") of hardwood mulch.
- H. Water all plants immediately after planting. See Subsection B4.02.05 for more on watering.

B4.02.04 Fertilizing and Liming Shrubs and Trees:

- A. Incorporate lime and fertilizer appropriately.
- B. The fertilizer analysis for shrubs shall be either 12-6-6 or 14-7-7 and shall be applied at a rate of 2 pounds per 100 square feet.
- C. For trees, apply fertilizer at a rate of 0.16 lb. to 0.20 lb. nitrogen per inch caliper of tree. Use a slow release fertilizer. Two possible fertilizer mixes are either 1 cup 31-7-7 or 2 cups 12-6-6 fertilizer per inch caliper.
- D. In addition to nitrogen, apply phosphorous and potassium at a rate of 0.05 lb. per inch caliper.

- E. Apply granulated fertilizer as a top dressing within the drip line of each individual plant. Immediately remove any fertilizer that comes in contact with the stem, trunk or foliage of a plant. Work the fertilizer into the top two inches (2") of the soil.
- F. Apply fertilizer and work into the soil before installing mulch.

B4.02.05 Watering Shrubs and Trees

- A. Be sure water is free from oil, acids, salts or any other substances that is toxic or harmful to vegetation.
- B. Water container plants thoroughly before removing from their containers to keep the plant moist and healthy during the planting process.
- C. Water all plants immediately after planting. To water thoroughly, saturate all backfill in beds during the same day of planting. Water only by open-end hose at very loose pressure to avoid erosion of soil, breaking the soil collars surrounding each plant, and/or injury to roots. Make sure plants are vertical and the top of the root ball is not below existing grade once they are watered and fully settled.

B4.02.06 Mulching Shrubs and Trees

- A. Use shredded hardwood (triple or double cut) as a mulch. The mulch cannot contain any trash.
- B. Apply mulch in a two to three inch (2"-3") layer within two days of planting.
- C. Do not spread mulch closer than six inches (6") from the trunk of a tree.

B4.02.07 Staking Trees

- A. Generally for large caliper two and one-half inch (2 ½") caliper to six inch (6") caliper B & B trees, staking for support is not recommended, if the tree is planted using the methods described in this Appendix. However, because the trunks are exposed, it may be necessary to place 3 stakes around the tree at the edge of the rootball for protection of the trunk of the tree. Use stakes that are tall enough to be seen easily. Finally, when using stakes for protection, do not attach wire or rope to the trees.
- B. Trees less than two inch (2") caliper and shrubs less than eight feet (8') in height do not stake.
- C. In unusual conditions, staking may be used with the Administrator's approval. Stake trees using three (3) 1"x 2"x18" minimum size wood stakes per tree. Drive anchors into undisturbed soil. Use strapping or rope fed through a rubber hose at the trunk to prevent damage to the bark.
- D. The stakes should offer support, but also not bind or bend the tree, because flexibility of the trunk is essential for its future growth and development. Generally, after the first growing season the tree will be able to support itself.

B4.02.08 Turf

- A.** Prepare the soil and apply lime and fertilizer.
- B.** Incorporate lime and fertilizer in the top six to eight inches (6"-8") of the soil using a rototiller.
- C.** Use a rake to create a smooth and level bed free of hollows and depressions and with soil particles no larger than pea size.
- D.** Water to settle the soil, and rake again to break the crusty surface before seeding.
- E.** Sod installation:
 - 1. Spread four inches (4") of topsoil and cultivate entire area to four to six inch (4 "-6") depth.
 - 2. Spread lime and fertilizer over cultivated topsoil (as per specifications on package) and hand rake to smooth finish grade.
 - 3. Thoroughly water area to be sodded prior to installation.
 - 4. Lay sod, roll and water thoroughly.

B5 Plant List

LARGE DECIDUOUS TREES (40'+)		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	STREET TREE	NATIVE	BLOOMING
Scientific Name	Common Name						
Trees <25' mature height can be planted under power lines							
Trees 25'-40' mature height can be planted at least 20' from power lines							
Other species may be allowed with staff approval							
Scientific Name	Common Name	SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	STREET TREE	NATIVE	BLOOMING
Acer platanoides	Norway Maple				X		
Acer rubrum	Red Maple	X	X		X	X	
Acer saccharum	Sugar Maple	X	X		X	X	
Aesculus glabra	Ohio Buckeye	X				X	X
Aesculus flava	Yellow Buckeye	X				X	X
Betula alleghaniensis	Yellow Birch	X				X	
Betula lenta	Sweet Birch					X	
Betula papyrifera	Canoe Birch	X				X	
Betula nigra	River Birch	X	X		X	X	
Betula pendula	European White Birch				X		
Betula populifolia	Gray Birch			X		X	
Carya cordiformis	Bitternut Hickory	X				X	
Carya glabra	Pignut Hickory	X				X	
Carya illinoensis	Pecan	X				X	X
Carya laciniosa	Shellbark Hickory	X				X	
Carya ovata	Shagbark Hickory	X		X		X	
Celtis occidentalis	Common Hackberry		X			X	X
Cladrastis lutea	Yellowwood					X	X
Fagus grandiflora	American Beech	X				X	
Fraxinus americana	White Ash		X	X		X	X
Fraxinus nigra	Black Ash		X			X	X
Fraxinus pennsylvanica	Green Ash		X	X		X	
Ginkgo biloba	Maidenhair Tree		X		X		
Gleditsia triacanthos	Thornless Honeylocust		X	X	X		X
Gymnocladus dioicus	Kentucky Coffee Tree	X	X	X		X	X
Juglans cinerea	Butternut					X	
Juglans nigra	Black Walnut					X	
Liriodendron tulipifera	Tulip Poplar	X	X		X	X	X
Magnolia acuminata	Cucumber Tree					X	X
Magnolia macrophylla	Big Leaf Magnolia					X	X
Nyssa sylvatica	Black Gum					X	X
Platanus occidentalis	Sycamore	X				X	X

LARGE DECIDUOUS TREES (40'+)		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	STREET TREE	NATIVE	BLOOMING
Scientific Name	Common Name						
Trees <25' mature height can be planted under power lines							
Trees 25'-40' mature height can be planted at least 20' from power lines							
Other species may be allowed with staff approval							
Populus angustifolia	Balsam Cottonwood					x	x
Populus deltoids	Eastern Cottonwood					x	
Prunus serotina	Black Cherry					x	
Quercus alba	White Oak		x	x	x	x	
Quercus coccinea	Scarlet Oak					x	
Quercus imbricaria	Shingle Oak					x	
Quercus falcate	Southern Red Oak		x		x	x	
Quercus muehlenbergii	Chinkapin Oak					x	
Quercus michauxii	Swamp Chestnut					x	
Quercus phellos	Willow Oak		x		x	x	
Quercus palustris	Pin Oak		x		x	x	
Quercus rubra	Red Oak		x	x	x	x	
Quercus stellata	Post Oak		x		x	x	
Quercus velutina	Black Oak					x	
Salix babylonica	Weeping Willow	x					
Taxodium distichum	Bald Cypress		x	x	x	x	
Tilia americana	American Linden	x	x		x	x	
Ulmus americana	American Elm	x	x		x	x	
Ulmus parvifolia	Chinese Elm	x	x		x		
Zelkova serrata	Japanese Zelkova		x	x	x		

SMALL - MEDIUM DECIDUOUS TREES (up to 25')		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	STREET TREE	NATIVE	BLOOMING
Scientific Name	Common Name						
Trees <25' mature height can be planted under power lines							
Trees 25'-40' mature height can be planted at least 20' from power lines							
Other species may be allowed with staff approval							
Scientific Name	Common Name	SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	STREET TREE	NATIVE	BLOOMING
Acer buergeranum	Trident Maple	x	x	x	x		
Acer campestre	Hedge Maple	x	x	x			
Acer ginnala	Amur Maple	x	x	x	x		
Acer griseum	Paperbark Maple				x		
Acer leucoderme	Chalk Maple				x		
Acer palmatum	Japanese Maple	x			x		
Acer pensylvanicum	Striped Maple						
Aesculus pavia	Red Buckeye						
Alnus serrulata	Alder						x
Amelanchier arborea	Serviceberry		x	x	x	x	x
Aralia spinosa	Devil's Walking Stick					x	
Asimina triloba	PawPaw					x	
Carpinus caroliniana	Ironwood		x			x	
Celtis tenuifolia	Dwarf Hackberry						x
Cercis canadensis	Redbud	x	x		x	x	x
Chionanthus virginicus	Fringetree	x	x	x	x	x	x
Cornus spp.	Dogwood	x	x		x	x	x
Cotinus obovatus	American Smoke Tree		x	x			x
Crataegus spp.	Hawthorn		x	x	x	x	x
Diospyros virginiana	Persimmon	x	x			x	
Halesia carolina	Carolina Silverbell				x	x	x
Hamamelis virginiana	Witchhazel						
Ilex decidua	Possumhaw						
Magnolia fraseri	Mountain Magnolia		x				x
Malus spp.	Crabapple		x		x		x
Ostrya virginiana	Ironwood					x	
Oxydendrum arboretum	Sourwood	x			x	x	x
Prunus cerasifera	Purple-leaf Plum		x	x	x		x
Prunus spp.	Cherry		x		x		x
Rhus copallina	Winged Sumac						x
Sorbus americana	American Mountain Ash				x		
Vaccinium arboretum	Sparkleberry						x

EVERGREEN TREES		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	SCREENING	NATIVE
Trees <25' mature height can be planted under power lines						
Trees 25'-40' mature height can be planted at least 20' from power lines						
Other species may be allowed with staff approval						
Scientific Name	Common Name					
Abies balsamea	Balsam Fir	x			x	x
Abies concolor	White Fir	x			x	x
Abies fraseri	Frasier Fir	x			x	x
Cedrus atlantica	Atlas Cedar		x			
Ilex opaca	American Holly	x	x		x	x
Juniperus virginiana	Eastern Red Cedar		x	x	x	x
Picea abies	Norway Spruce	x		x	x	
Picea glauca	White Spruce	x	x	x	x	x
Picea orientalis	Oriental Spruce				x	
Picea pungens	Colorado Spruce		x	x	x	x
Pinus strobus	White Pine		x		x	x
Pinus sylvestris	Scotch Pine			x	x	
Pinus virginiana	Virginia Pine	x	x		x	x
Pseudotsuga menziesii	Douglas Fir				x	x
Thuja occidentalis	Arborvitae (White Cedar)				x	x
Thuja plicata	Arborvitae (Giant)	x			x	x
Tsuga canadensis	Eastern Hemlock		x		x	x
Tsuga caroliniana	Carolina Hemlock		x		x	x

DECIDUOUS SHRUBS		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	NATIVE	BLOOMING
Scientific Name	Common Name					
Other species may be allowed with staff approval						
Azalea hybrid 'Exbury"	Exbury Hybrid Azalea				X	X
Callicarpa americana	American Beautyberry	X	X		X	X
Calycanthus floridus	Sweetshrub	X			X	X
Chaenomeles speciosa	Common Flowering Quince		X			X
Clethra alnifolia	Sweet Pepperbush	X		X	X	X
Euonymus americanus	Hearts-a-burstin				X	
Forsythia x intermedia	Border Forsythia		X	X		X
Fothergilla major	Witchalder	X	X		X	X
Gaylussacia dumosa	Dwarf Huckleberry	X			X	X
Hibiscus syriacus	Rose of Sharon	X	X	X		X
Hydrangea arborescens	Wild Hydrangea	X			X	X
Hydrangea quercifolia	Oakleaf Hydrangea	X			X	X
Ilex verticillata	Winterberry			X	X	
Itea virginica	Virginia Sweetspire				X	X
Lindera benzoin	Spicebush	X			X	X
Lonicera fragrantissima	Winter Honeysuckle					
Magnolia stellata	Star Magnolia		X			X
Neviusia alabamensis	Snowwreath					X
Physocarpus opulifolius	Ninebark	X			X	X
Rhododendron arborescens	Sweet Azalea				X	X
Rhododendron austrinum	Yellow Azalea				X	X
Rhododendron calendulaceum	Flame Azalea	X			X	X
Rhododendron canadense	Rhodora	X			X	X
Rhododendron periclymenoides	Pinxter Bloom	X			X	X
Rhododendron viscosum	Swamp Azalea	X			X	X
Rosa palustris	Swamp Rose	X			X	X
Spirea prunifolia	Bridalwreath Spirea	X	X	X	X	X
Spirea x bumalda spp.	Spirea		X	X		X
Spirea x vanhouttei	Vanhoutte Spirea		X	X		X
Syringa vulgaris	Common Lilac		X			X
Styrax americana	American Snowbell	X			X	X
Viburnum spp.	Viburnum	X	X	X	X	X

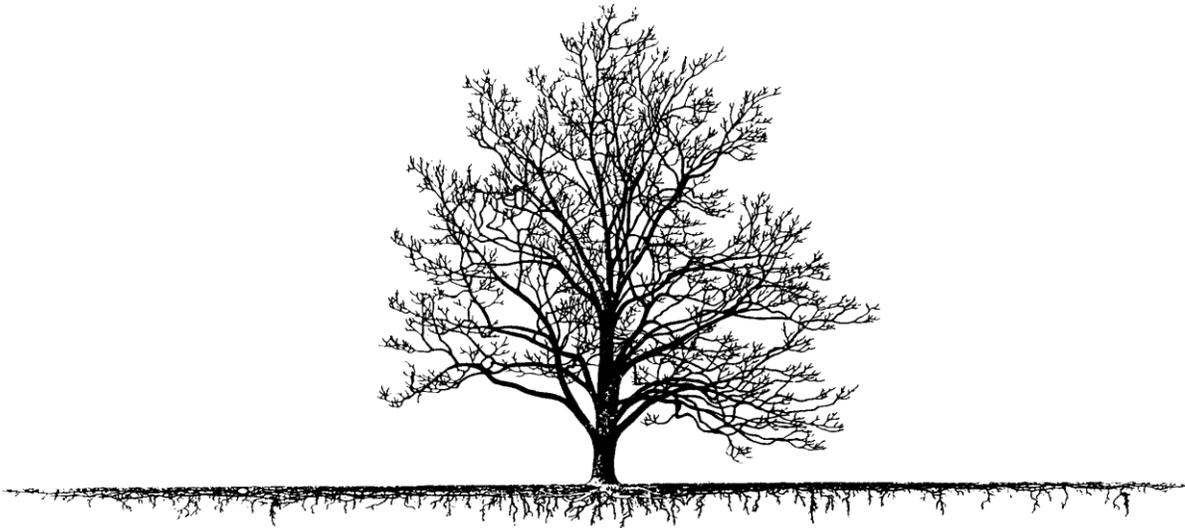
EVERGREEN SHRUBS		SHADE TOLERANT	XERISCAPING COMPATIBLE (DROUGHT TOLERANT)	SALT TOLERANT	NATIVE	BLOOMING
Scientific Name	Common Name					
Other species may be allowed with staff approval						
Abelia x grandiflora	Glossy Abelia		x	x		x
Azalea kaempferi	Kaempferi Azalea	x				x
Azalea hybrida	Satsuki Azalea	x				x
Azalea obtusum	Kurume Azalea	x			x	x
Buxus microphylla 'Koreana'	Korean Boxwood	x		x		
Buxus sempervirens 'Suffrutocosa	Dwarf Boxwood	x	x			
Chamaecyparis obtuse 'Nana Gracilis'	Dwarf Hinoki Cypress	x				
Cotoneaster horizontalis	Rockspray Cotoneaster		x	x		
Cotoneaster dammeri	Bearberry Cotoneaster		x	x		
Cotoneaster divaricatus	Spreading Cotoneaster		x	x		
Ilex aquifolium	English Holly	x				
Ilex crenata spp.	Japanese Holly		x			
Ilex glabra	Inkberry	x	x	x	x	
Ilex pernyi	Perny Holly		x			
Juniperus chinensis	Chinese Juniper		x	x		
Juniperus communis	Common Juniper		x	x		
Juniperus conferta	Shore Juniper		x	x		
Juniperus davurica 'Expansa'	Parsons Juniper		x	x		
Juniperus horizontalis	Creeping Juniper		x	x		
Juniperus procumbens	Japanese Garden Juniper		x	x		
Juniperus Sabina 'Tamariscifolia'	Tamarix Juniper		x			
Kalmia latifolia	Mountain Laurel	x	x			x
Kalmia polifolia	Bog Laurel	x			x	
Leucothoe axillaries	Doghobble	x	x	x	x	x
Leucothoe populifolia	Florida Leucothoe	x	x		x	x
Magnolia virginiana	Sweetbay	x	x		x	x
Pieris japonica	Pieris	x			x	x
Pinus Mugo 'Compacta'	Mugo Pine			x		
Rhododendron catawbiense	R. Catawba	x			x	x
Rhododendron maximum	Rosebay Rhododendron	x			x	x
Rhododendron minus	Carolina Rhododendron	x			x	x
Rhododendron spp.	Rhododendron spp.	x			x	x
Taxus x media	Intermediate Yew			x		
Thuja orientalis	Oriental Arborvitae					
Viburnum rhytidophyllum	Leatherleaf Viburnum					x

GROUND COVERS	
Other species may be allowed with staff approval	
Scientific Name	Common Name
Asarum canadense	Wild Ginger
Antennaria plantaginifolia	Pussy's Toes
Chrysoqonum virginianum	Green and Gold
Coreopsis auriculata	Mouse-Eared Coreopsis
Fraqaria virginiana	Wild Strawberry
Baultheria procumbens	Wintergreen
Hexastylis arifolia	Little Brown Jugs
Iris cristata	Dwarf Crested Iris
Mitchella repens	Partridge Berry
Pachysandra procumbens	Allegheny Spurge
Phacelia bipinnatifida	Phacelia
Phlox amoena	Chalice Phlox
Phlox divaricata	Wild Blue Phlox
Phlox stolonifera	Creeping Phlox
Pityopsis graminifolia	Golden Aster
Polystichum acrostichoides	Christmas Fern
Shortia qalacifolia	Oconee Bells
Sisyrinchium mucronatum	Blue-Eyed Grass
Tiarella cordifolia	Foamflower
Xanthorhiza simplicissima	Yellow-root

GRASSES & SEDGES	
Other species may be allowed with staff approval	
Scientific Name	Common Name
Andropogan gerardii	Big Bluestem
Andropogan virginicus	Broomsedge
Carex pennsylvanica	Pennsylvania sedge
Carex plantaginea	Plantain-leaved sedge
Chasmanthium latifolium	River Oats
Danthonia compressa	Oats Grass
Elymus bystrix	Bottle Brush
Panicum virgatum	Switch Grass
Schizachyrium scoparium	Little Bluestem
Sorghastrum nutans	Indian Grass
Tripsacum dactyloides	Eastern Gamma Grass

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B6 Tree Pruning Guidelines



Introduction

Pruning consists of *selectively* removing branches (living and dead) from woody plants, ranging from pinching off a bud at the end of a twig to removing large limbs.

Proper pruning benefits trees, shrubs, and vines, and the associates of woody plants (including humans). Pruning branches can be one of the most beneficial or the most damaging practices arborists do to trees.

A basic principle of pruning is that the removal of any live stems, branches, twigs, and buds affects growth of the plant. Proper pruning prevents and corrects defective form that could result in branch or stem failure. Thus, knowledge of plant biology is essential for the correct methods of pruning.

Most tree species evolved in competitive forest communities. Consequently, trees developed efficient branching systems to capture the energy of available light for photosynthesis.

Woody plants also evolved the ability to get rid of inefficient energy resources by *shedding* shaded branches (cladaptosis). A branch is naturally shed from its base. As natural shedding occurs, the wood tissue around the branch core within the stem protects against decay. Limb removal cuts imitate natural branch shedding (natural target pruning).

Many people equate woody plant pruning to amputation, but there should be no fear of wise and careful use of pruning equipment. A properly pruned tree, shrub, or vine is a combination of art, science, and skill.

In the arboriculture industry, the current standard approved by the ISA and the NAA is *The American National Standards Institute (ANSI) A300* issued in 19

Reasons for Pruning

The first rule in pruning is **do not cut without a reason**. Too often arborists tend to over prune to meet client expectations. Proper pruning is an effort to *direct* new growth rather than 'control' growth.

Most pruning cuts are of a *preventive* or a *corrective* nature to be beneficial to woody plant health.

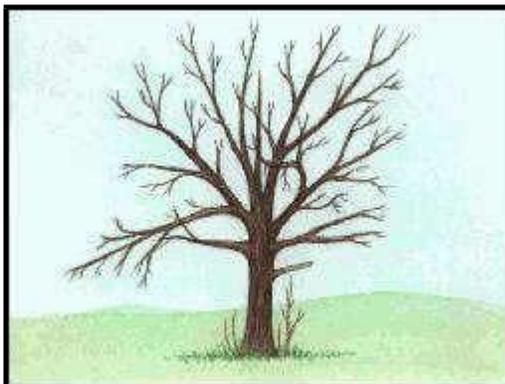
Health

- *Sanitation* by removing dead, broken, decayed, diseased or insect-infested wood (crown cleaning).
- *Thinning* to improve penetration of light and air, and to reduce wind resistance and potential storm damage.
- Reduction of the number of poorly attached *epicormic branches*.
- *Girdling root* removal.
- Correct and/or redirect *structural growth* that may cause future problems (weak crotches, branches growing out of proportion, etc.).



Appearance

- Shape for aesthetic purpose, natural forms, growth habit (training).
- Influence flowering, fruiting, promotion of shoots, canes, bark color.
- Direct new growth and/or correct improper prior pruning (crown restoration).



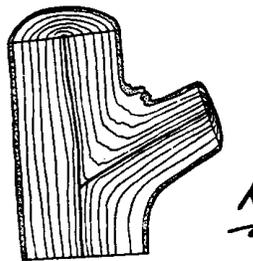
Convenience or Safety of Property and People

- Correct or modify storm-damaged, neglected, or poorly pruned woody plants.
- Identify and remove potential hazard limbs, stems, and deadwood (hazard reduction pruning).
- Line clearance (directional pruning).
- Raise or lower obstructive canopies over or near roads, sidewalks, playgrounds, buildings, pools, satellite dishes, etc. by removing interfering limbs (crown reduction and/or crown raising).
- Provide access to more light for understory plants and turf (crown thinning).
- Vista pruning (alter crowns to allow views of something beyond tree screens).



Pruning Methods and Techniques

Branch Attachment to Stems



New branch tissues generated by the vascular cambium usually start growth before trunk tissues. As current-year branch tissue develops from branch ends toward the trunk, it turns abruptly downward at the branch base to form a *collar*.

Trunk branch tissues grow later and form a trunk collar over the branch collar (trunk collars and branch collars are collectively called the *branch collar*).

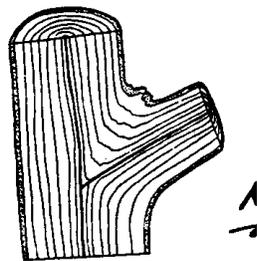
The collar is where wood and bark of the branch and the trunk come together, like an overlapping tissue 'switching zone'. All true branches on woody plants have branch collars.

The *branch bark ridge* (BBR) is raised bark developing in the branch crotch and shows the angle of the branch core in the tree.

If a branch dies or is removed, the trunk collar continues to grow over the thin belt of branch tissue below the collar junction. The wood core of the branch is walled off (compartmentalized) in the trunk.

Pruning Methods and Techniques

Branch Attachment to Stems



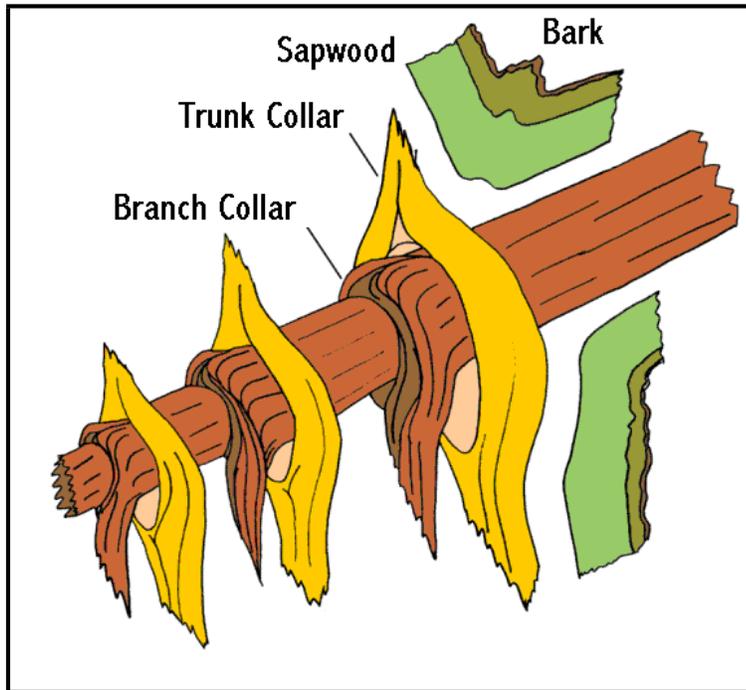
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Proper Pruning Cuts (Natural Target Pruning)

Location of *branch bark ridges* and *branch collars* determines the location of a pruning cut. Cuts must be made *outside* of the branch bark ridge, angling away from the trunk outward as close as possible to the collar.

- There is no set or standard angle for a proper collar cut.
- The proper angle depends on the shape of the collar.
- Conifers often have flat collars where a straight cut close to the collar is correct.
- Sometimes the angle of the cut will necessitate an *upstroke* cut with a handsaw or chainsaw.

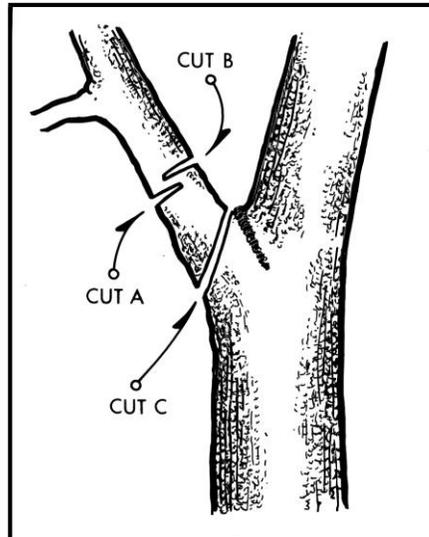
Do not cut into the collar to stimulate callus production and rapid closure. Although closure is desirable for appearance, such a cut promotes decay and future hazards. Never put a pruning tool behind the branch bark ridge.

Whether a branch collar is obvious or not, the position of the final or finish cut should:

- Minimize the branch stub that is an entryway for decay fungi.
- Retain the natural decay protection present in the branch core. The intact branch collar is the first line of defense in preventing decay within the trunk.
- Minimize the overall size of the pruning wound and direct damage to the stem.

Always **stub cut** the branch first. Limbs that cannot be controlled must be removed using at least **three** cuts. Roping of limbs may be necessary to prevent damage to other parts of the tree if they cannot be controlled by hand.

1. The first cut (Cut A) undercuts the limb one or two feet out from the parent branch or trunk. A properly made undercut will eliminate the chance of the branch 'peeling' or tearing bark as it is removed.
2. The second cut (Cut B) is the top cut which is usually made slightly further out on the limb than the undercut. This allows the limb to drop smoothly when the weight is released.
3. The third cut (Cut C) or finish cut is to remove the stub.



Each finish cut should be made carefully, outside of the branch bark ridge and the evident collar, leaving a smooth surface with no jagged edges or torn bark.

There are some situations where the cambium dies back beneath a branch collar after a correct cut:

- The trunk collar did not join the branch collar directly below the branch. Sunken spots under branches are a sign of this condition.
- Winter cuts may result in undercollar dieback.
- Problem tends to increase with size of branches removed.

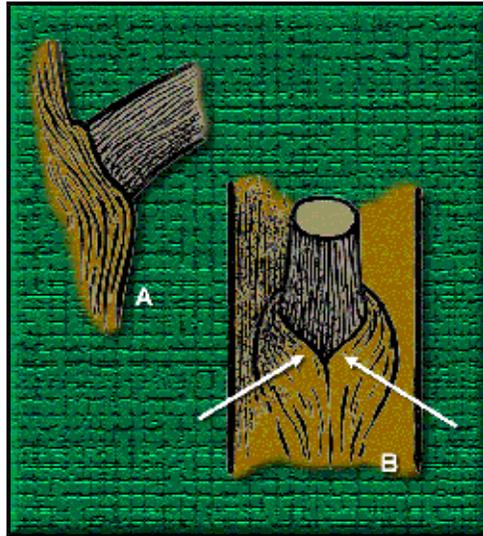
Callus and Woundwood

Callus is undifferentiated meristematic tissue that forms at wound margins from the cambium.

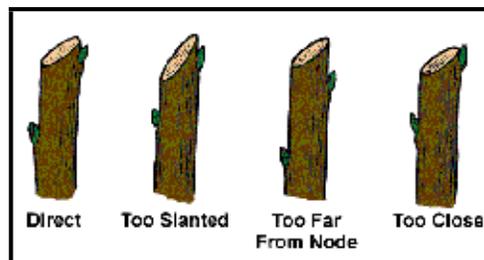
Callus differentiates into *woundwood* over time. Woundwood is 'new wood' and has the different cell components of periderm, cambium, phloem, and xylem.

A *complete* ring of callus and subsequent woundwood will develop around and eventually over proper cuts. Woundwood forms only to the sides of improper cuts (flush cuts), which means the collar and branch protection zone is damaged and the trunk is wounded.

A proper pruning cut results in a smaller wound area, and more rapid callus and woundwood movement over the wound. Cuts on dead limbs that have trunk collars moving up the dead branch wood must also be made just outside of the evident collar.



- Appropriate only for small woody plants or one- to two-year-old branches (twigs, branchlets) on trees.
- Cut back to a bud (lateral bud) or lateral branchlet, slanting at a 45° angle above the bud *node* on alternately arranged branches and stems.
- Two or more buds at a node (opposite, whorled) require a *transverse* cut just above the bud tips or a 45° angle cut, removing one of the buds and leaving the other(s) to elongate in a desired direction.
- Cut 1/8" higher above the bud tips when pruning in cold weather to prevent winter injury to the bud (tissue around a winter cut is more vulnerable to desiccation).



- Leaving a majority of *inward* facing buds produces growth towards center.
- Leaving a majority of *outward* facing buds results in more open growth.

Pruning Tools

Use well-sharpened tools for both your safety and to help reduce tearing of wood and cambial tissues. Wear specified protective equipment.

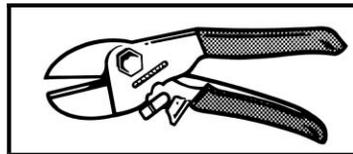
Pruning Shears

Hand shears, secateurs, hand pruners, one-hand shears:

- Remove branches, stems up to 1/2" diameter.
- By-pass (hook and blade, scissors, drop-forged, curve blade): make closer cuts than anvil-type.



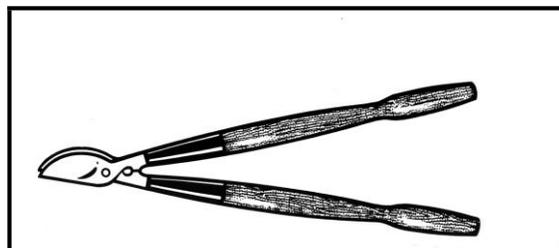
- Anvil (straight-blade): good for only soft-tissued wood; will crush harder wood (inappropriate per A300 standards).



Lopping shears

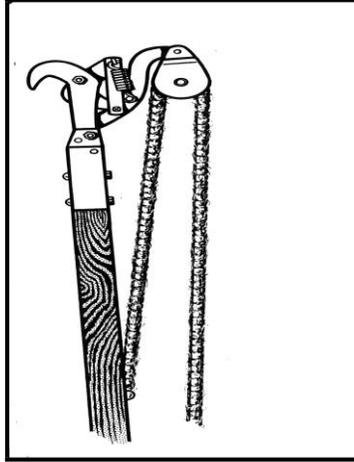
Two-hand shears:

- Remove branches, stems up to 1-3/4" diameter.
- Most useful in rejuvenation.
- By-pass, hook and blade, etc.
- Anvil, straight-blade.
- Ratcheting.



Pole Pruners

- Wood and insulated poles (round and squared).
- Cut like by-pass shears.
- Important to keep blade side in toward the cut.



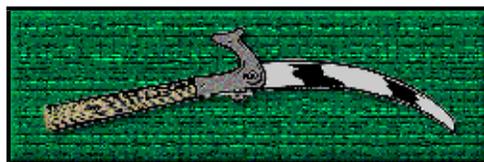
Cut at the outer side of the branch bark ridge at a slightly outward angle so as not to injure or remove the branch collar. Hook the pruner head around the limb to be cut with the blade side against the lateral branch or stem to remain. The arborist must be in a safe working position and the pruner handle positioned so the blade will not jam in the wood. You should not cut off a limb directly above yourself if there is any chance that it could fall and hit you.

Change your working position before completing the cut; place the hook so you have a straight pull on the rope and the lever arm can move far enough to complete the cut. An experienced tree surgeon can give a limb a flip with the side of the pruner head, just as the cut is completed, so that the limb will fall in the desired direction.

Saws

Pole saws:

- Hook cast onto pole-head.
- Wood poles (round and squared).
- Insulated poles (foam core).
- Difficult to make clean, accurate cuts.



Fine-tooth saw blades (more points per inch):

- On folding, rigid, and grip handles.
- *Needlepoint* teeth.
- Razor-tooth, Japanese, or *tri-edge*-style teeth (*Fanno™* 1311, *Felco™*, *Corona™*); narrow, curved blades facilitate getting into tight spots.



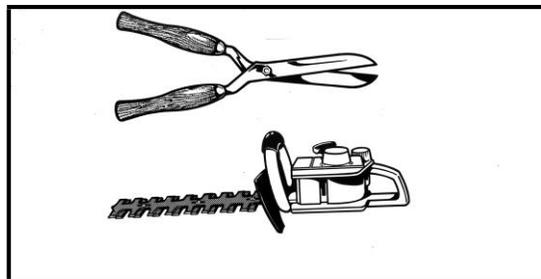
Arborist saws cut on the *pull* stroke:

- Davey-issue speed saw.
- Raker and gullet saws.
- Needle-tooth saws *Fanno™* series.
- Scabbards, blade lengths.
- Pole saw blades now available with tri-edge teeth.

Hedge Shears

Clippers/trimmers:

- Manual (sometimes called 'pruning' shears)



- Powered (electric, gasoline)
- Cut off growth 'in line' with no regard for node locations or branch bark ridges.
- Provide time and labor savings at expense of overall plant health.

- Dull blades compound problems and make you work harder!

Crown Thinning and Cleaning

A proper thinning cut removes a branch at its point of attachment, or back to a lateral branch large enough to assume a terminal role.

Learn to foresee the need for removing live branches while they are small. Avoid large cuts. Direction can be influenced by removal of short portions of growth or even by removal of individual buds.

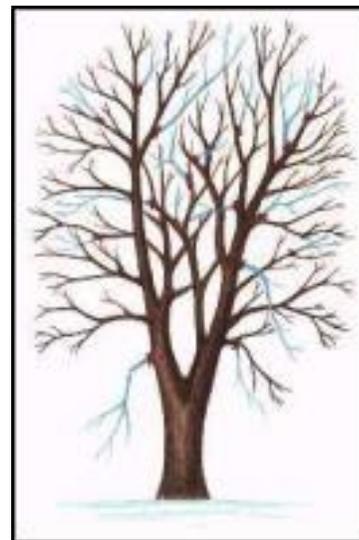
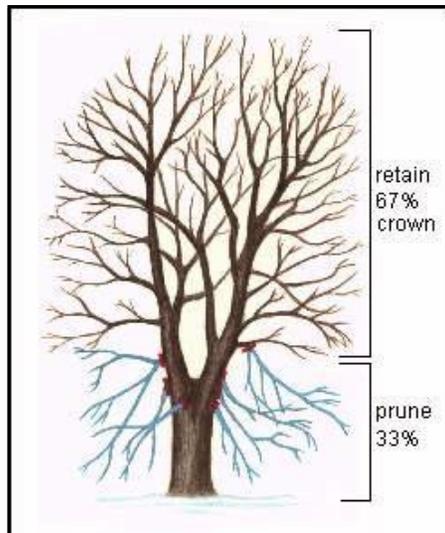
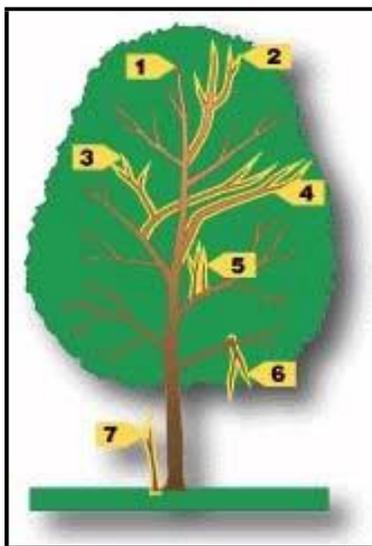
Thinning of lower branches can 'raise' a limb. If, after crown raising, the remaining leaf material is insufficient for limb size, consider complete removal. The client's opinion is important.

Never perform excessive thinning, which is stressful, especially on thin-barked or young trees prone to sunscald.

Avoid removing more than 1/4 of the live branches on a tree. Older or overmature trees should have an absolute minimum of living branches removed.

Always avoid 'skinning' or 'hollowing' out the center of a tree's canopy. The majority of thinning cuts should be made along the outer crown. Proper thinning requires a good deal of limb-walking and deft use of a pole-pruner when and where aerial lifts are not used.

When thinning laterals from a limb, maintain well-spaced inner branches to achieve more distribution of foliage along the branch.



Caution must be taken to avoid creating an effect known as *lion-tailing*:

- Caused by removing all of the inner laterals and foliage.
- Displaces foliar weight to the ends of the branches.
- May result in sunburned bark tissue, renewed and excessive epicormic branches, weakened branch structure and breakage.
- Wind whiplage.



Lion-tailing

Removal of Diseased or Insect-Infested Branches

Sanitation or 'eradivative' pruning (crown cleaning):

- Cut out diseased limbs back to collars, appropriate lateral branches, or a scaffold branch at least one foot below infected portion.
- Disinfect tools *during or after* pruning diseased branches with bleach solution (1 part bleach to 10 parts water) or Lysol.
- Do not use any form of alcohol to sterilize pruning tools *during* the work. Use alcohol to disinfect auger-bits, injection tees, or pruning tools *after* the job, especially plants with wetwood or fireblight bacterial infections.

Removal of Weak, Rubbing, or Competing Stems

Remove, if possible, but avoid large holes in the canopy.

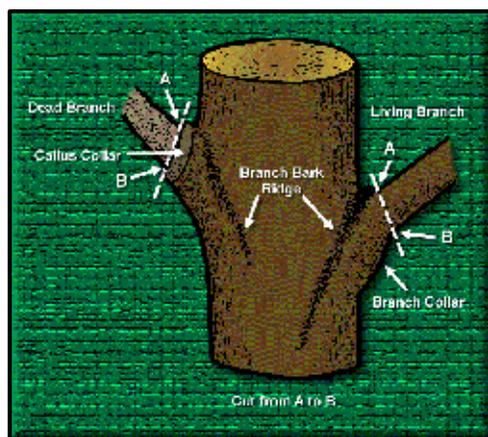
The life of large limbs, weakened by decay or cracks, can often be extended by "shortening" or weight removal using highly selective thinning cuts. Cabling and/or rigid bracing may be required to secure limbs or codominant stems if removal is not possible.

Deadwood Removal

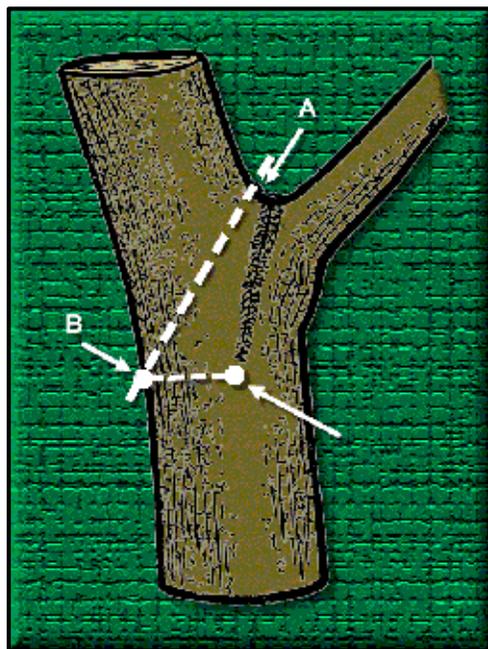
Sanitation and hazard reduction pruning:

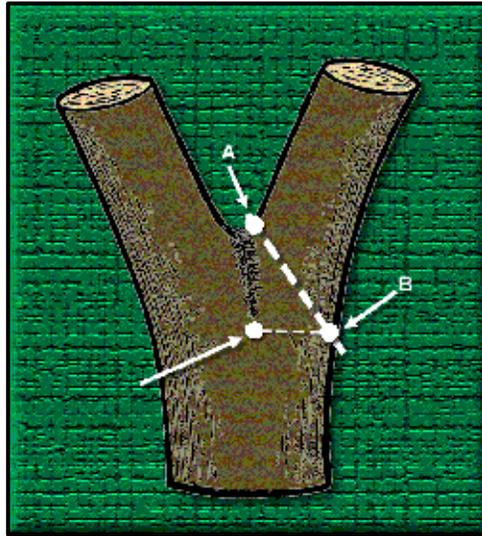
- Dead branches and stubs are an energy source (cellulose, glucose).
- Decay fungi.
- Boring insects.

Again, do not remove the branch collar around dead branches. Cut as close as possible to the collar of good wood surrounding the branch base.



Locate Target Points





Codominant Stem or Branch Removal

Always *stub cut* the stem to be removed, and then make the *finish* cut with care. Some defect (discoloration) will develop in the remnant stem 'core' in the main stem:

- Usually not attached like a true branch with protective collar.
- Barrier zone should develop and confine defect if correct cut is performed.
- Never remove both stems!

When the bark plates on the stem bark ridge turn upward, the union of the stems is usually *strong*.

When the bark between the stems turns inward, the union of the stems is *weak*.

It is the *union* of the stems or upright branches more than the *angle* that determines whether attachment is weak or strong.

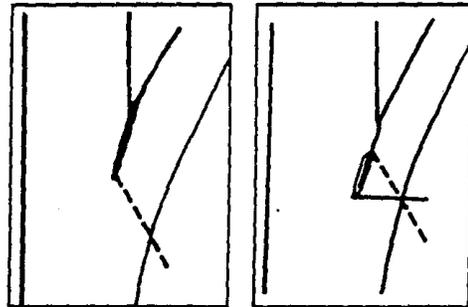
The stems have *included bark* squeezed or embedded *between* them.



Remedies:

To *remove*, stub cut the stem first and then cut where the dotted line is with care; avoid cutting into the remaining stem.

If the saw cannot complete this cut, tap a small wedge into the kerf and cut the remainder of the wood with a flat chisel and mallet.



To *strengthen* stem on older trees, a cable can be attached; place at a point approximately two-thirds of the distance from the crotch to the ends of the stems.

When a cable is used to strengthen stems, the cable and hardware must be checked regularly. When the risk of stem fracture becomes high, the weaker stem should be removed.

Davey Residential Operations employs four general classes of pruning. Classes 1, 2, and 3 are classified as maintenance pruning, which is recommended when the primary objective is to maintain or improve tree health and structure, including hazard reduction pruning:

- Class #1 - *Fine Pruning*: consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches (crown cleaning), as well as selective thinning to lessen wind resistance. Some deadwood up to ½ inch in diameter may remain within the main leaf area where it is not practical to remove such. Girdling roots will be monitored and removed where possible.
- Class #2 - *Medium Pruning*: consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches (crown cleaning). Some deadwood up to one inch in diameter may remain within the leaf canopy.
- Class #3 - *Hazard reduction*: pruning is recommended when the primary objective is to reduce the danger to a specific target, caused by visibly defined hazards in a tree, by removing dead, diseased, or obviously weak branches two inches in diameter or greater.
- Class #4 - *Crown Reduction Pruning*: consists of reducing canopy tops, sides, under branches, or individual limbs at appropriate lateral limbs and stems for purposes of clearance of storm damage repair. Some crown reduction pruning incorporates hazard reduction pruning.

Epicormic Branches

Epicormic branches may be needed to fill in the canopy where trees have been excessively thinned or storm damage has occurred (crown restoration). Epicormic branches (shoots, watersprouts, suckers) arise from two types of "buds":

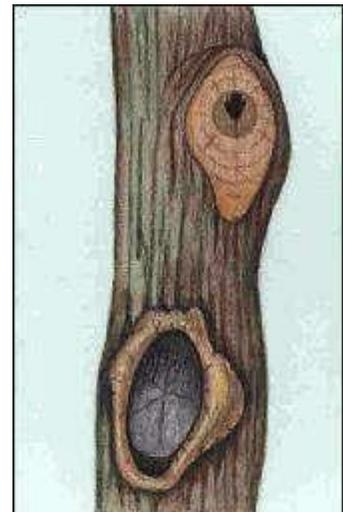
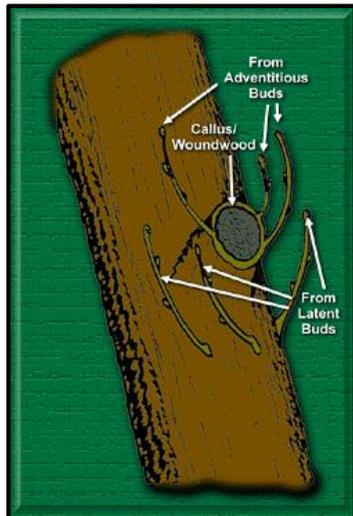
- Adventitious buds.
- Latent (dormant) buds or meristematic points.

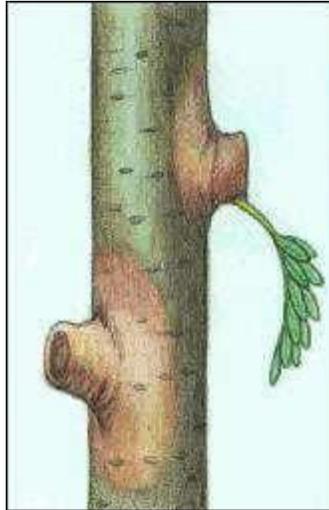
Adventitious epicormics come from meristematic tissue generated anew by the cambium. Most adventitious buds develop from callus tissues moving over a wound, or from root tissue.

Latent (dormant) buds or meristematic points are formed at an earlier time in the life of a woody plant but do not 'release' or grow. Latent buds are 'carried along' in rays in the cambial zone year after year, as the tree increases girth, and are usually released upon injury or stress. Epicormic sprouts from latent meristematic points are often found in the vicinity of pruning cuts, usually below the wound.

Epicormic branches are *stimulated* on a much larger scale by winter or early spring pruning rather than by late spring-summer pruning (desirable in shrub renewal or rejuvenation).

A *watersprout* is an epicormic branch growing from branch and stem parts, or above a graft union.





A *sucker* is an epicormic branch growing from root tissue or below a graft union.

Apical Dominance and Control

Woody plant natural shapes, forms, or habits are governed by species' inherent (genetic) determination of:

- Leaf and flower bud locations.
- Bud-break patterns along stems.
- Branching angles.
- How buds and branches elongate.

Apical dominance = terminal bud(s) suppress lateral buds along an elongating shoot

Excurrent and *decurent* branching patterns:

- Decurrent woody plants have overall weak apical control, but strong apical dominance while shoots are elongating.
- Random-branching excurrent plants have weak apical dominance and overall strong apical control.
- Whorl-branching excurrent trees have both strong apical dominance and control.



Decurrent.....



Excurrent

Plant growth regulators are substances that enhance or alter the growth and development process of a plant. In most cases, these chemicals either increase or decrease normal growth, flowering, and/or fruiting of plants.

Selective growth control and/or branch release by natural growth regulators:

- Auxins
- Abscisic acid (ABA)
- Cytokinins
- Gibberellins (gibberellic acid = GA)
- Ethylene

Branch terminals – auxin source Roots – cytokinin source

Low auxin = axillary bud release,

High cytokinin energy storage drain

High auxin = bud suppression,

Low cytokinin initiate new roots

Plant growth regulators are substances that enhance or alter the growth and development process of a plant. In most cases, these chemicals either increase or decrease normal growth, flowering, and/or fruiting of plants.

Utility arborists use synthetic growth regulators to *control* the growth of trees and other vegetation beneath utility lines. Growth *inhibitors* can be:

- Sprayed on the foliage.
- Painted on pruning wounds.
- Banded on the bark.

- Soil applied.
- Injected into trees.

Antigibberellins are growth regulators that counter the effects of naturally occurring *cell- elongation* hormones (gibberellin). Ideal formulations are being sought that would minimize phytotoxicity while reducing utilities' pruning expenses.

- Another use of growth inhibitors is to suppress epicormic branch production on trees:
- Not yet widely used by arborists.
- Must be applied annually.
- Client concern over the use of chemicals.
- Applicator safety concerns.
- Epicormic branch growth can be minimized with proper cuts.
- Retarded woundwood development.

Painting of Cuts

Proper cuts negate the "need" for wound dressings. Wound dressings will not *prevent* decay; wound dressings have been evaluated to often *promote* wood decay or cause cambium damage.

Cuts or wounds in certain species during the growing season may attract insects that carry diseases or allow fungus invasion. Native oaks or elms and European elms should be pruned during dormant periods in regions where wilt disease conditions are known to exist.

If pruned in summer, pruning wounds on wilt-susceptible oaks and elms should be treated with the current wound dressing recommended by The Davey Institute.

Pruning Phenology

The ideal or optimal times to prune most woody plants are:

- Late in the dormant season.
- After leaves are fully formed and expanded.

Client concerns with excessive *sap flow* (birches, maples):

- Avoid pruning during height of sap flow (just before growing season) if possible.
- Sap flow may be unsightly but does not cause definite injury.
- Prune immediately after leaves are fully expanded if client cannot be convinced.

Avoid pruning birches after leaf expansion, as the wounds may be attractive to boring insects.

Dead, broken, or weak limbs may be removed at any time with little effect, except in wilt-susceptible oaks and elms.

Pruning before the spring leaf bud-break period can enhance stimulated growth and rapid wound closure. Pruning during the period after leaf expansion will result in suppressed growth and maximum 'dwarfing'.

Avoid pruning those woody plants undergoing bud break and early leaf expansion, especially in the period where bark 'slips' (cambial development of unlignified wood).

Flowering can be reduced or enhanced by pruning at the appropriate time of the year. Woody plants that bloom on current season's growth ('summer-flowering' such as crapemyrtle or butterfly-bush) are best pruned to enhance flowering:

- During the dormant season.
- Just prior to or immediately after leaf expansion.
- In late summer (post-bloom).

Plants that bloom on last season's wood ('spring-flowering') should be pruned *just after bloom*.

- Fruit trees are often pruned during the dormant season to enhance structure and distribute fruiting wood, and after bloom to thin fruit-load.

Pruning Selection

Ideal pruning technique begins with planting the right tree in the right place (PHC selection).

Maintaining tree size or allowing for limited crown growth is possible with a regular pruning schedule begun early in the tree's life.

- Consider the extent of mature branches and crown.
- Select good stock with proper growth form.
- Imagine how form will continue to develop; there is no way to turn a large tree back into a small tree.
- Don't expect to improve form with future prunings.

Avoid obtaining saplings with included bark; the stem union becomes weaker rather than stronger as the plant grows. Failure of one or both stems of the fork frequently occurs when the tree is mature, especially during snow and ice storms (loading events).

Structural Pruning

Structural pruning principles are used when training young woody plants or working with a tree that has not been pruned in many years. Properly trained shrubs and young trees will develop into structurally strong plants that should require little corrective pruning as they mature.

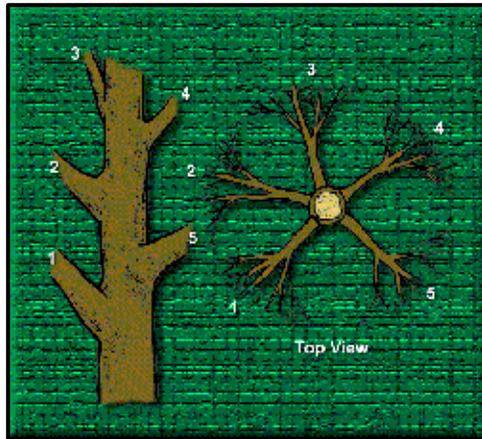
Trees that will be large at maturity should have a sturdy, tapered trunk, with well-spaced branches smaller in diameter than the trunk.

If two branches develop from apical buds at the tip of the same stem, they will form *codominant* branches or, eventually, codominant stems. Each codominant branch is a direct extension of the stem. It is best if one is removed when the tree is young.

Branches with narrow angles of attachment and codominant branches may tend to break if there is *included bark* that gets enclosed inside the crotch as the two branches develop girth and length.

The relative *size* of a branch in relation to the trunk is usually more important for strength of branch attachment than is the *angle* of attachment. Scaffold branches' diameters should not be more than 1/2 the stem or trunk diameter.

Select main branches to give *radial distribution*. Discourage branches growing directly over another unless spaced well apart.



On large-growing trees, except whorl-branching conifers, branches that are more than $\frac{1}{3}$ the diameter of the trunk in size should be well spaced along the trunk (at least 18 inches apart).

Maintain one-half the foliage on branches arising in the lower $\frac{2}{3}$ of younger trees.

- Increases trunk taper.
- More uniformly distributes weight and wind stress along the trunk.

This rule of thumb also holds true for an individual limb:

- Leave lower and inside branches along the limb.
- Limb can develop taper and strength.
- Stress and weight can be evenly distributed along the length.

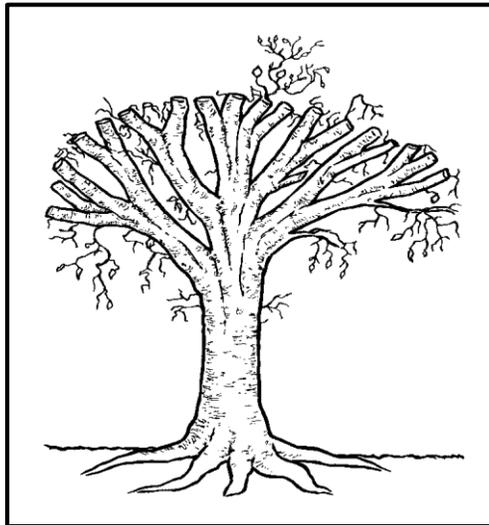
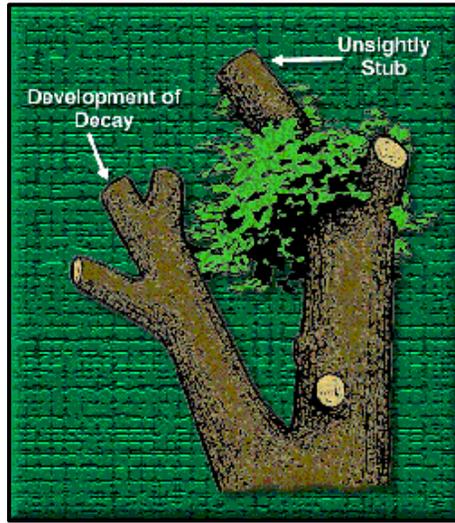
The height of the lowest scaffold branch will depend on the intended function of the tree: screen an unsightly view, provide a windbreak, shade a patio, installed as a walkway or street tree.

Pruning at Planting

For years, the conventional wisdom was that trees should be severely pruned at time of transplant to compensate for root loss and to "balance" the crown with the root system (especially bareroot trees). This practice has since been discovered to prolong *transplant shock*.

- Transplant pruning should be limited to removal of dead, broken, diseased, or interfering branches.
- Leave small shoots along the trunk for later removal.
- Protect the trunk from 'sunburn'.
- Aid in development of proper trunk taper.
- Leave as many terminal buds as possible.
- Stimulate root growth triggered by hormones in these buds.

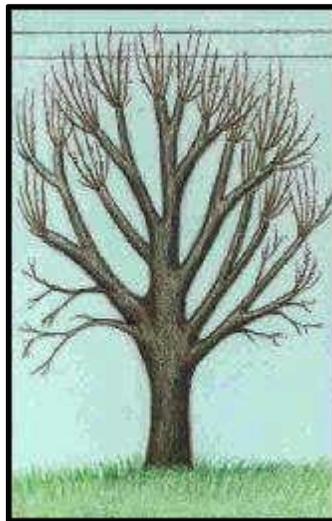
Topping, Tipping, and Roundover



Topping: cutting vertical branches and stems back to inadequate nodes (heading) or to internodes (stubbing).



Tipping: heading side or horizontal branches to stubs or weak laterals.



Roundover: topping + tipping.

Many people have the misconception that cutting or heading the main branches of a tree back to stubs to 'reduce the height' is the proper way to prune.

Apparently, a short tree is thought to be safer and healthier than a tall tree regardless of how the result is attained. Heading back to stubs or inadequate laterals permanently disfigures and weakens a tree. Topping is one of the worst things humans do to trees.

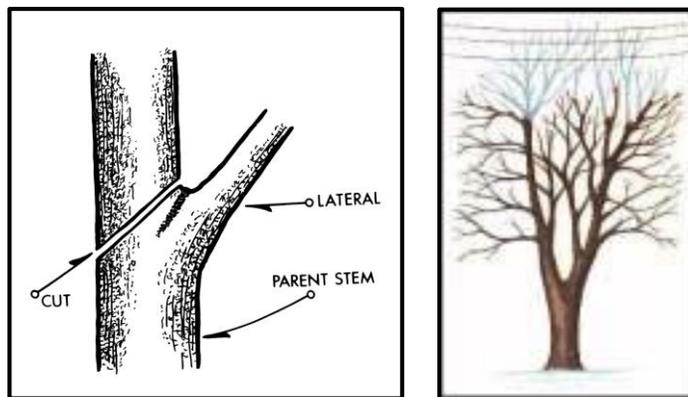
The International Society of Arboriculture (ISA) and the National Arborist Association (NAA) consider heading-back to stubs an unacceptable arboricultural practice. Modern pruning standards do not include heading-back as any sort of a recommended technique.

- Topping removes a major portion of a tree's leaves that are necessary for the production of carbohydrates.
- Stimulation of epicormic branches at or just below an internodal stub cut causes a topped tree to grow back to its original height faster and denser than a properly pruned tree. The sprouts are weakly attached and easily broken off in storms.
- Bark within the canopy can become scalded by sudden exposure to direct sunlight.
- Stubs attract wood-boring insects and sustain wood decay organisms.
- Topping, tipping, and roundover cuts permanently disfigure a tree.

Crown Reduction, Restoration, and Raising

If the height or width of a tree has to be reduced because of storm damage or interference with structures or utility lines, it is performed correctly by a method called *crown reduction* or *drop-crotch* pruning (NAA Class IV Crown Reduction). This procedure involves the removal of a main leader, scaffold, or branch at its point of attachment with a lateral branch large enough to assume a terminal or leader role.

The final cut should begin or end somewhat *parallel* to the remaining lateral branch and offset slightly above the branch bark ridge (without cutting into the bark ridge). The remaining lateral branch must be at least one-half to one-third the diameter of the branch or leader that is being removed.



If a tree has been topped previously and now has epicormic sprouts, *crown restoration* can improve its structure and appearance. Decayed, rotting stubs and tipped branches are cut back to appropriate laterals or entirely removed. One to three sprouts on main branch stubs are retained to become permanent branches and reform a more natural appearing crown. Selected epicormic branches may need to be thinned to a lateral to control length and ensure adequate attachment for the size of the sprout. Restoration usually requires several prunings over a number of years.

Trees in urban and landscape settings may need to have lower limbs removed. *Crown raising* or elevating removes the lower branches of a tree in order to provide clearance for buildings, vehicles,

pedestrians, and vistas. Excessive removal of lower limbs should be avoided so that the development of trunk taper is not affected and structural stability is maintained.

Definitions of Arboricultural Terms

Anvil-Type Pruning Tool – Pruning tool that has a straight sharp blade that cuts against a flat metal cutting surface (see *hook and blade-type pruning tool*).

Arborist – A professional who possesses the technical competence through experience and related training to provide for or supervise the management of trees and other woody plants in the residential, commercial, and public landscape.

Boundary Reaction Zone – A separating boundary between wood present at the time of wounding and wood that continues to form after wounding.

Branch – A secondary shoot or stem arising from one of the main axes (i.e. trunk or leader) of a tree or woody plant.

Branch Collar – Trunk tissue that forms around the base of a branch between the main stem and the branch or a branch and a lateral. As a branch decreases in vigor or begins to die, the branch collar becomes more pronounced.

Branch Bark Ridge – Raised area of bark in the branch crotch that marks where the branch wood and trunk wood meet.

Callus – Undifferentiated tissue formed by the cambium layer around a wound.

Cambium – Dividing layer of cells that forms sapwood (xylem) to the inside and bark (phloem) to the outside.

Climbing Spurs – Sharp, pointed devices affixed to the climber's leg used to assist in climbing trees (also known as *gaffs, hooks, spurs, spikes, climbers*).

Closure – The process of woundwood covering a cut or other tree injury.

Crotch – The angle formed at the attachment between a branch and another branch, leader, or trunk of a woody plant.

Crown – The leaves and branches of a tree or shrub; the upper portion of a tree from the lowest branch on the trunk to the top.

Crown Cleaning – The removal of dead, dying, diseased, crowded, weakly attached, low-vigor branches, and watersprouts from a tree's crown.

Crown Raising – The removal of the lower branches of a tree in order to provide clearance.

Crown Reduction – The reduction of the top, sides, or individual limbs by the means of removal of the leader or longest portion of a limb to a lateral no less than one-third of the total diameter of the original limb removing no more than one-quarter of the leaf surface.

Crown Thinning – The selective removal of branches to increase light penetration and air movement, and to reduce weight.

Cut – The exposed wood area resulting from the removal of a branch or portion thereof.

Decay – Degradation of woody tissue caused by biological organisms.

Espalier Pruning – A combination of cutting and training branches that are oriented in one plane, formally or informally arranged, and usually supported on a wall, fence, or trellis. The patterns can be simple or complex, but the cutting and training is precise. Ties should be replaced every few years to prevent girdling the branches at the attachment site.

Facility – Equipment or structure used to deliver or provide protection for the delivery of an essential service such as electricity.

Girdling Roots – Roots located above or below ground whose circular growth around the base of the trunk or over individual roots applies pressure to the bark area, ultimately restricting sap flow and trunk/root growth. Frequently results in reduced vitality or stability of the plant.

Heading – Cutting a currently growing or one-year-old shoot back to a bud, or cutting an older branch or stem back to a stub or lateral branch not sufficiently large enough to assume the terminal role. Heading should rarely be used on mature trees.

Heartwood – The inactive xylem (wood) toward the center of a stem or root that provides structural support.

Hook and Blade Pruning Tool – A hand pruner that has a curved, sharpened blade that overlaps a supporting hook (in contrast to *an anvil-type pruning tool*).

Horizontal Plane (palms) – An imaginary level line that begins at the base of live frond petioles.

Lateral – A branch or twig growing from a parent branch or stem.

Leader – A dominant upright stem, usually the main trunk. There can be several leaders in one tree.

Limb – Same as *Branch*, but larger and more prominent.

Lopping – See *Heading*.

Mycellum – Growth mass of fungus tissue found under bark or in rotted wood.

Obstructing – To hinder, block, close off, or be in the way of; to hinder or retard a desired effect or shape.

Parent Branch or Stem – The tree trunk or a large limb from which lateral branches grow.

Petiole – The stalk of a leaf.

Phloem – Inner bark tissue through which primarily carbohydrates and other organic compounds move from regions of high concentration to low.

Pollarding – Pollarding is a training system used on some large-growing deciduous trees that are severely headed annually or every few years to hold them to modest size or to give them and

the landscape a formal appearance. Pollarding is not synonymous with topping, lopping, or stubbing. Pollarding is severely heading some and removing other vigorous water sprouts back to a definite head or knob of latent buds at the branch ends.

Precut or Precutting – The two-step process to remove a branch before the finished cut is made so as to prevent splitting or bark tearing into the parent stem. The branch is first undercut, and then cut from the top before the final cut.

Pruning – Removal of plant parts.

Qualified Line Clearance Tree Trimmer – A tree worker who, through related training and on-the-job experience, is familiar with the techniques in line clearance and has demonstrated his/her ability in the performance of the special techniques involved. This qualified person may or may not be currently employed by a line clearance contractor.

Qualified Line Clearance Tree Trimmer Trainee – Any worker undergoing line-clearance tree trimming training, who, in the course of such training, is familiar with the techniques in line clearance and has demonstrated his/her ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Qualified Person or Personnel – Workers who, through related training or on-the-job experience, or both, are familiar with the techniques and hazards of arboriculture work including training, trimming, maintaining, repairing, or removing trees, and the equipment used in such operations.

Qualified Tree Worker, Person, or Personnel – A person who, through related training and on-the-job experience, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees and with the equipment used in such operations and has demonstrated ability in the performance of the special techniques involved.

Qualified Tree Worker Trainee – Any worker undergoing on-the-job training who, in the course of such training, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees, with the equipment used in such operations and has demonstrated ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Remote/Rural – Areas associated with very little human activity, land improvement, or development.

Sapwood – The active xylem (wood) that stores water and carbohydrates, and transports water and nutrients; a wood layer of variable thickness found immediately inside the cambium, comprised of water-conducting vessels or tracheids and living plant cells.

Shall – As used in this standard, denotes a mandatory requirement.

Should – As used in this standard, denotes an advisory recommendation.

Stub – An undesirable short length of a branch remaining after a break or incorrect pruning cut is made.

Stubbing – See *Heading*.

Target – A person, structure, or object that could sustain damage from the failure of a tree or portion of a tree.

Terminal Role – Branch that assumes the dominant vertical position on the top of a tree.

Thinning – The removal of a lateral branch at its point of origin or the shortening of a branch or stem by cutting to a lateral large enough to assume the terminal role.

Throwline – A small, lightweight line with a weighted end used to position a climber's rope in a tree.

Topping – See *Heading*.

Tracing – Shaping a wound by removing loose bark from in and around a wound.

Urban/Residential – Locations normally associated with human activity such as populated areas including public and private property.

Utility – An entity that delivers a public service such as electricity or communication.

Utility Space – The physical area occupied by the utility's facilities and the additional space required ensuring its operation.

Wound – An opening that is created any time the tree's protective bark covering is penetrated, cut, or removed, injuring or destroying living tissue. Pruning a live branch creates a wound, even when the cut is properly made.

Woundwood – Differentiated woody tissue that forms after the initial callus has formed around the margins of a wound. Wounds are closed primarily by woundwood.

Xylem – Wood tissue; active xylem is called *sapwood* and inactive xylem is called *heartwood*.

Young Tree – A tree young in age or a newly installed tree.

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