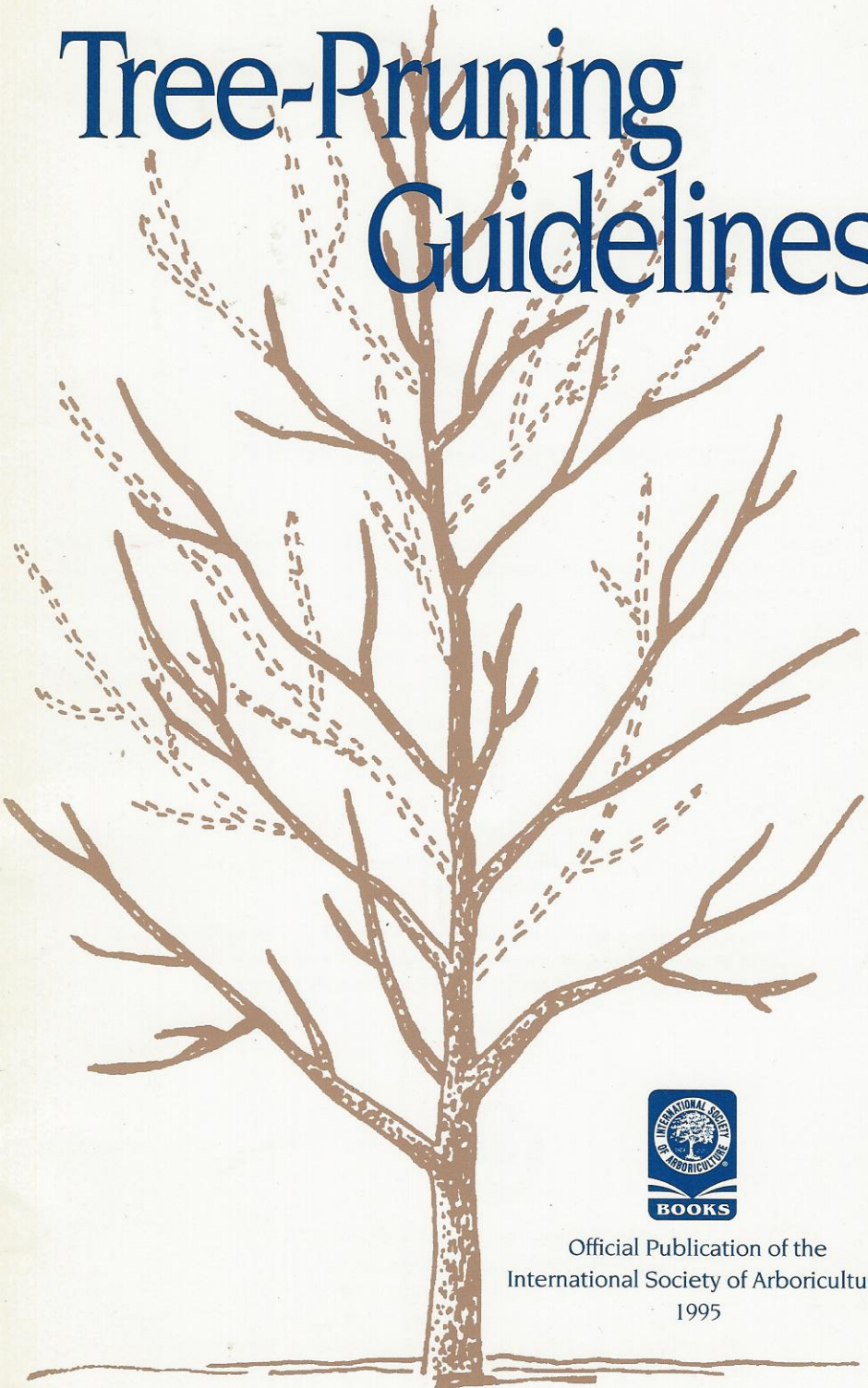


# Tree-Pruning Guidelines



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# PRUNING TECHNIQUES

A plant's responses to most techniques of pruning are universal to almost all trees and situations.

## Types of Pruning Cuts

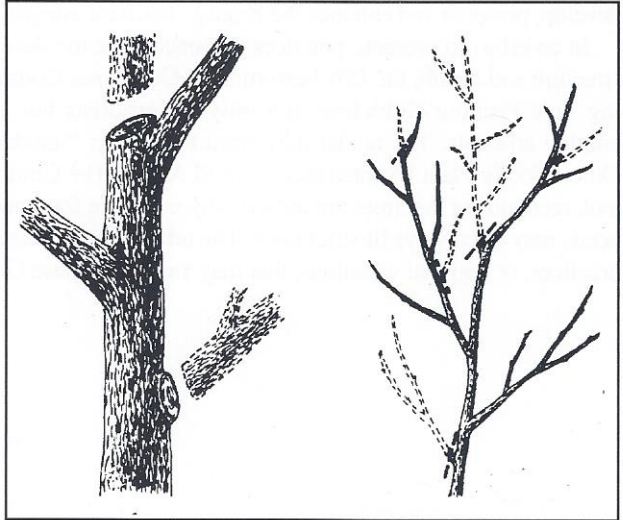
An understanding of tree responses to pruning cuts leads to a more reasoned approach to pruning.

A *thinning cut* removes a branch at its point of origin or to shorten it or the leader, to a lateral large enough to assume the terminal role (Figure 1). The use of thinning cuts opens the foliage of a tree, reduces the weight on heavy limbs, can reduce a tree's height, distribute ensuing invigoration throughout a tree and helps retain the tree's natural shape. Thinning cuts are usually the preferred method of tree pruning.

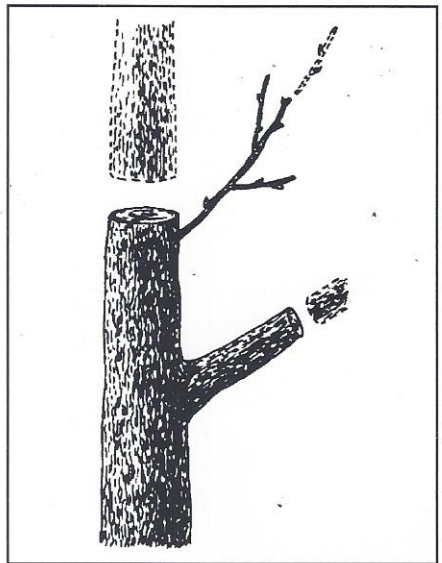
A *heading cut* removes a currently growing or one-year-old shoot back to a bud, or cuts an older branch or stem back to a stub or lateral branch not sufficiently large enough to assume the terminal role (Figure 2). Heading cuts are appropriate for specific purposes such as:

- Reducing leaf area on an unbranched shoot when training young trees.
- Pollarding trees.
- Shaping terminal flowering plants (lilac, privet, crape myrtle, roses).
- Shearing hedges.

A heading cut should rarely be used in mature trees, since it forces the growth of vigorous, weakly attached upright sprouts originating just below such cuts (Figure 7), and the tree's natural form is altered. In some situations, branch stubs die back or produce sprouts with low vigor.



**Figure 1.** A thinning cut removes a branch at its point of origin (lower cut on each) or shortens a branch or leader by cutting to a lateral large enough to assume the terminal role (upper cut on each).



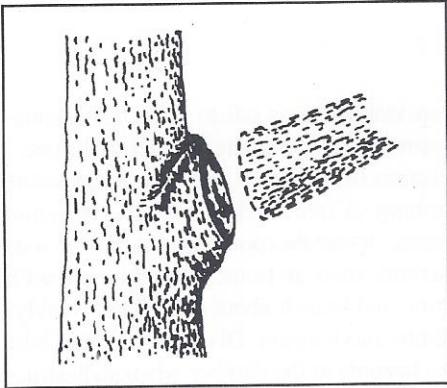
**Figure 2.** A heading cut is pruning to a stub (lower branch), a small lateral (trunk) or a bud (terminal on small lateral).

## Making the Cut

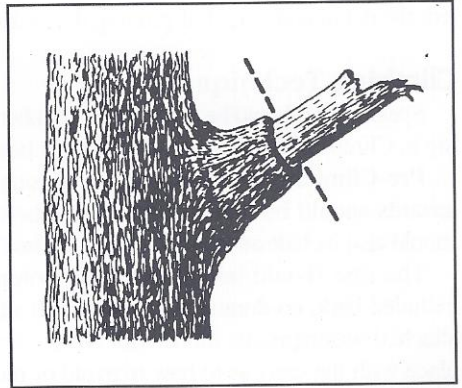
When removing a live branch, pruning cuts should be made just outside the branch bark ridge and collar (Figure 3). This location of cut is in contrast to a “flush cut” which is made inside the branch bark ridge and collar. Flush cuts should be avoided because they result in a larger wound and expose trunk tissues to the possibility of decay. If no collar is visible, the angle of the cut should approximate the angle formed by the branch bark ridge and the trunk.

When removing a dead branch, the final cut should be made outside the branch bark ridge and the collar of live callus or woundwood tissue. If the collar has grown out along the branch stub, only the dead stub should be removed; the live collar should remain intact (Figure 4).

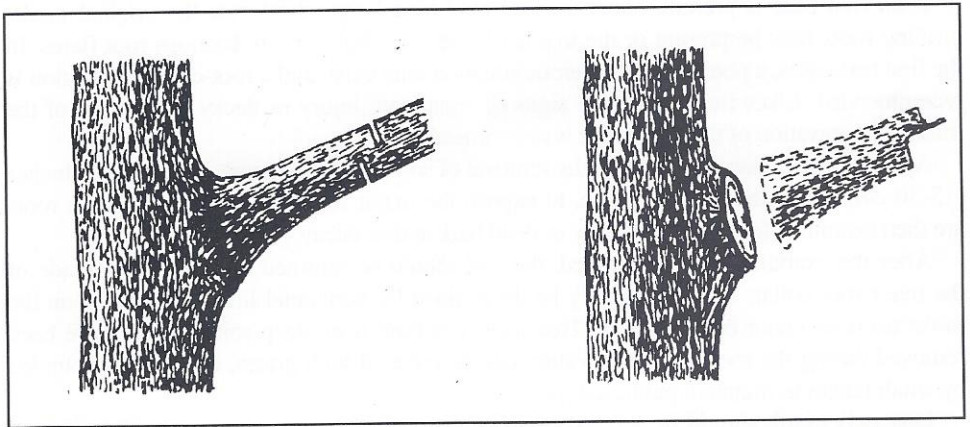
If it is necessary to reduce the length of a branch or the height of a leader, the final cut should be made just beyond (without violating) the branch bark ridge of the branch being cut to. The remaining branch should be no less than 1/3 (one third) the diameter of the branch being removed, and with enough foliage to assume the terminal role. On large trees this type of cut is commonly called drop crotching (Figure 1).



**Figure 3.** Pruning cuts should be made just outside the branch bark ridge (top of cut) and the collar (bottom of cut).



**Figure 4.** On a dead branch that has a collar of live wood, the final cut should be just beyond the outer edge of the collar.



**Figure 5.** Remove a large limb by making three cuts. First cut on the bottom of the limb about 12 inches (30 cm) from the branch attachment (left). Make the second cut on the top about 1 inch (2-3 cm) from the under cut. The final cut is just outside the branch bark ridge and the outer portion of the collar (right).

Pruning cuts should be clean and smooth, leaving the bark at the edge of the cut firmly attached to the wood. A three-cut process will reduce chances of injury when removing large limbs (Figure 5).

Large or heavy branches that cannot be safely thrown clear, should be lowered on ropes to prevent injury to the tree or other property.

Wound dressings and tree paints have not been shown to be effective in preventing or reducing decay. They are therefore not recommended for routine use on pruning cuts unless specified for disease, borer, mistletoe or sprout control.

## Size of Pruning Cuts

Pruning can be done to different levels of detail or refinement. The removal of many small branches rather than a few large branches requires more time, but produces a less-pruned appearance, forces fewer watersprouts, and helps to maintain the vitality and structure of the tree.

Designating the minimum size of undesirable branches to be removed from the tree crown, such as one-half inch, one inch or two inches (1, 2.5 or 5 cm) basal diameter, will establish the detail and extent of pruning desired.

## Climbing Techniques

Special care should be taken by the climber to ensure that the tree is safe to climb before entering it. Climbing techniques can affect tree health by preventing, or creating, injuries to the tree.

**Pre-Climbing Examination.** A thorough inspection of the tree's structure for possible hazards should be made of every tree before climbing. A tree worker's safety inspection should also include an examination of the tree's root collar, where the roots flare out into the soil.

The tree should be inspected for potential hazards such as branch attachments with included bark, co-dominant (equal-sized) stems, trunk and branch about equal size, weakly-attached watersprouts, limbs with cracks, broken limbs and hangers. Discussion should take place with the crew as to how to avoid or reduce the hazards to the climber when such structural defects are present in the tree. Hazards of the work site should also be reviewed, such as the presence and location of all electrical conductors, especially high voltage conductors. Check for property that might be damaged by falling branches.

If no root flare is present, either the soil may have been raised over the original grade, girdling roots may be present or the tree is of a species that seldom develops root flares. In the first two cases, a potentially dangerous situation may exist, and a root-collar excavation is recommended. Likewise, if there are signs of significant injury or decay at the base of the trunk, an excavation of the root collar is recommended.

A root-collar excavation includes the removal of soil around the trunk, six to twelve inches (15-30 cm) below the original grade, to expose the major roots for inspection. These roots are then examined for signs of healthy or dead bark and/or decay.

After the examination is completed, the soil should be returned to the original grade of the tree's root collar. This can usually be determined by horizontal lines or wrinkles on the lower trunk or major buttress roots. Tree wells resulting from deep soil fills that have been removed during the root collar excavation can be covered with grates, decks or surrounded by small fences to maintain public safety.

Diseased tissue should be left exposed for one or more years, or until callus is well formed and the progress of the disease has stopped. Roots should be protected in winter months from freezing temperatures by recovering them with mulch or soil, and exposing them again the next spring.

**Climbing Practices.** Climbing and pruning practices, except for pruning cuts, should not injure the tree.

Climbing spurs or gaffs should not be used when pruning a tree, however, they may be used to enter the tree where the lowest branch cannot be reached with a throw line and/or the branches are more than throwline distance apart. In such cases the spurs should be removed once the climber is tied in.

Spurs may be used to reach an injured climber or when climbing to remove a tree.

Rope injury to thin-barked trees from loading out heavy limbs should be avoided by installing a block in the tree to carry the load. A block or rope guard may also be used to reduce injury to the bark from the climber's line.

# TRAINING YOUNG TREES

Properly trained trees will develop into structurally strong trees well suited to the site and their intended landscape function. These trees will fulfill their intended function sooner and should require little corrective pruning as they mature. Young trees that reach large mature size should have a sturdy, tapered trunk with well-spaced branches that are smaller in diameter than the trunk.

These guidelines apply primarily to decurrent (round-headed) large-growing trees which often develop low, closely-shaped scaffold branches unless properly trained. Decurrent trees usually can be identified at a young age by their characteristic lack of lateral shoots on current-season's growth.

Trees of excurrent (central leader) growth habit usually need little or no training except to remove laterals that are too low or to control laterals that may compete with the leader.

## Trunk Development

For most trees, maintain a single, straight trunk or central leader. Do not head the leader except:

- to correctly position the lowest main branch;
- to space other main branches at least 18 inches apart vertically;
- to remove a tight grouping of terminal twigs so that a more vigorous shoot will develop as the leader.

At least one half of the foliage should be on branches (temporary and permanent) arising in the lower two-thirds of a tree. Similarly, branches should have a like distribution of foliage along their lengths. This will increase trunk taper and more uniformly distribute branch weight and wind stress along the trunk.

## Permanent Branch Selection

The height of the lowest permanent branch will depend on the function of the tree and local ordinance; e.g.: screen an unsightly view, provide a wind break, shade a patio or be a street tree.

Unless they are too close together, too vigorous, or weakly attached, or the tree may not receive adequate water, remove or cut back few or no branches on a newly-planted tree. This will ensure a better selection for permanent main branches in subsequent years, promote trunk taper and early rapid growth of a tree.

Potential permanent branches can be spaced 6 to 12 inches (15-30 cm) apart by thinning. By the fifth year or before, these branches should be spaced to at least 18 inches (50 cm) apart, if at maturity the trunk diameter is expected to be greater than 18 inches (50 cm). Spacing can be less with an expected trunk diameter of less than 12 inches (30 cm) at maturity.

Select permanent branches to maintain an even radial distribution. Where branches are growing one directly above another, maintain at least 15-36 inches (40-100 cm) above the lower branch on small to medium-size trees, and 60 inches (150 cm) on large-growing trees.

## Temporary Branches

Retain small branches along the trunk for 1 to 5 years to increase lower-trunk size and taper and to protect the trunk from injury by the sun and vandals. It is more important to have temporary branches below the lowest permanent branch than above.

Preferred vertical spacing of temporary branches is 4 to 6 inches (10-15 cm), with none within 6 inches (15 cm) of potential main branches. Select the least vigorous shoots for temporary branches. If larger-than-desired branches need to be kept as temporaries, head them

back to 2 or 3 buds. It is important to have some on the side of the trunk facing the afternoon sun. Attachment angle of temporary branches is not important since they will be removed.

Temporary branches should be kept short to provide clearance for paths, etc. and to increase height growth of the leader. These branches may need more than one pruning during a growing season, depending on tree vigor.

During the first dormant season, prune to thin the temporary branches. Leave about  $\frac{3}{4}$  (three fourths) of those left the first year. Leave them uniformly spaced, remove the largest or cut them back 2 or 3 buds.

During the next dormant season, reduce the number of temporary branches by  $\frac{1}{5}$  (one fifth) to  $\frac{1}{4}$  (one fourth) of those present the first year. In most situations, by the fifth dormant season, all of the temporary branches should be removed.

## **Developing Strong-Branch Structure**

The relative size of a branch in relation to the trunk is more important for strength of branch attachment than is the angle of attachment. Branches should be  $\frac{1}{2}$  (one half) or less of the diameter of the trunk immediately above the branch.

No permanent branch attachments should have included bark.

Retain lateral branches along limbs, but each should be less than  $\frac{1}{2}$  (one half) the diameter of the limb at its attachment. Permanent lateral branches along limbs should be at least 2 feet (60 cm) out from the trunk.

As trees grow to maturity, pruning should focus on maintaining or improving structure, and directing the tree's growth.

A goal of structural pruning is to maintain the size of permanent lateral branches to less than  $\frac{1}{2}$  (one half) the diameter of the parent branch or trunk. If a scaffold branch is too large in relation to the leader or another scaffold, thin the competing scaffold's laterals particularly near its terminal. Thin the leader and other scaffolds less, if at all. Thinning laterals from a branch will reduce the weight of the branch, slow its total growth and develop a stronger branch attachment. If pruning the competing scaffold is not appropriate, it should be removed.

On large-growing trees, except for whorl-branching conifers, branches that are more than one-third the diameter of the trunk should be spaced along the trunk at least 18 inches (50 cm) apart, on center. If this is not possible, because of the present size of the tree, such branches should have their foliage thinned, particularly near their terminals.

# PRUNING MATURE TREES (MAINTENANCE PRUNING)

As trees mature, their need for structural pruning should decrease. Pruning should then focus on maintaining tree structure, form, health and appearance by:

- removing dead branches
- thinning to reduce weight and/or the windsail effect of large laterals, and
- maintaining inner branches.

Pruning such as crown reduction, or shaping, is sometimes necessary if tree branches of foliage begin to interfere with surrounding improvements, such as buildings, utility wires or paths. The types of pruning generally used in the industry are described below.

## **Crown Cleaning**

Crown cleaning, or cleaning out, is the removal of dead, dying, diseased, crowded, weakly attached, low-vigor branches, and waterspouts from a tree's crown.

## **Crown Thinning**

Crown thinning is the selective removal of branches and/or pruning back to large laterals to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, distributes ensuing invigoration throughout a tree and helps retain the tree's natural shape. Thinning cuts are usually the preferred method of tree pruning. When thinning the crown of mature trees you should seldom remove more than 1/4 (one fourth) of the live foliage.

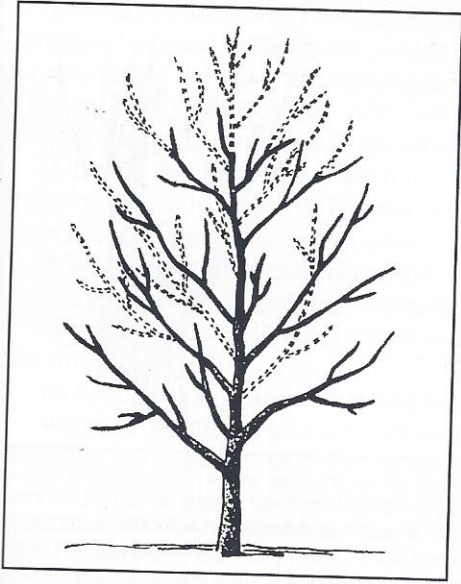
At least 1/2 (one half) of the foliage should be on branches that arise in the lower 2/3 (two thirds) of the tree. Likewise, when thinning laterals from a limb, an effort should be made to retain well-spaced inner lateral branches with foliage. Trees and branches so pruned will have mechanical stress more evenly distributed along a branch and throughout the tree.

Caution must be taken not to create "lion-tailing," which is caused by removing all or most of the inner foliage. This places foliar weight at the ends of the branches and may result in sunburn, watersprouts, weakened branch structure and limb breakage.

## **Crown Raising**

Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians and vistas. It is important that a developing tree has at least 1/2 (one half) of its foliage on branches that originate in the lower 2/3 (two thirds) of the tree. Similarly, branches should have even distribution of foliage along their lengths. This will ensure a well-formed, tapered structure and to uniformly distribute stress within a tree. In some cases, this may not be possible because local ordinances require removal of low branches for clearance.

When pruning for view, it is preferable to develop spaces between branches, or "windows" through the foliage of the tree, rather than to severely raise or reduce the crown.



**Figure 6.** The height and spread of a tree can usually be reduced and still maintain its natural shape. Branches that have been removed by thinning cuts are outlined by broken lines.

A tree pruned by the crown reduction method appears more natural and lasts longer if confined to relatively small thinning cuts. This is the preferred method of crown reduction. The removal of a large limb or leader to a large lateral, or shorter vertical, is sometimes referred to as drop crotching or drop-crotch pruning. Pruning the leader of a central-leader tree to a large lateral is inappropriate. Even though large wounds may lead to decay, drop-crotch pruning is preferred to making heading cuts.

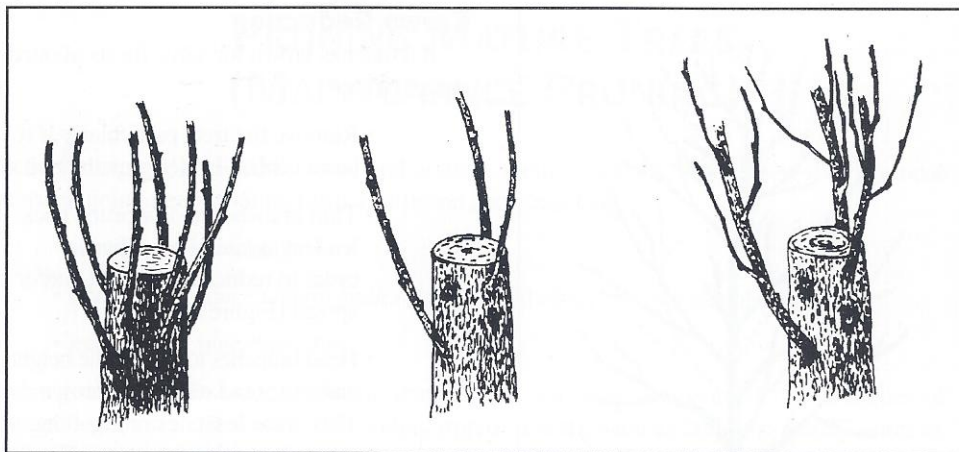
Heading cuts to control size and flowering are appropriate on small-growing trees which flower terminally on current-season's growth (crape myrtle). One-year-old shoots usually need to be reduced in number and the remaining shoots cut back to 3 or 4 buds. This pruning is best done on an annual basis.

## Crown Reduction

If a tree has grown too large for its allotted space, either:

- Remove the tree, particularly if it has a central-leader growth habit;
- Thin branches and/or prune back leaders to lateral branches in order to reduce tree height and/or spread (Figure 6), or
- Head branches to reduce the height and/or spread of the tree crown. This is the least desirable of the three alternatives.

Thinning cuts to reduce the size of the crown results in fewer sprouts and can maintain the structural integrity and natural form of the tree, delaying the need to re-prune. The lateral to which a branch or leader is cut should be at least  $\frac{1}{3}$  (one third) the diameter of the branch being removed.



**Figure 7.** Numerous watersprouts resulted from the heading cut the previous winter of this leader or large upright branch (left). The one-year-old watersprouts have been thinned to three to begin to rebuild the tree (center). The number of sprouts left depends on the size of the branch and number of branches in the tree. Laterals on the sprouts the following season (right) may need to be thinned to reduce weight and wind-sail effects that could break sprout attachment. If such a heading cut is made, it is preferable to cut at an angle with the high side towards the afternoon sun. (The full length of the sprouts and laterals are not shown.)

## Crown Restoration

Crown restoration is intended to improve the structure and appearance of trees that have sprouted vigorously after being broken, topped or severely pruned using heading cuts. One to three sprouts, on main branch stubs, should be selected to form a natural appearing crown. The more vigorous sprouts may need to be thinned, cut to a lateral, or even headed, to control length growth or ensure adequate attachment for the size of the sprout. Crown restoration may require several prunings over a number of years (Figure 7).

## Utility Pruning

Utility pruning is used to maintain the required clearance of trees from high voltage transmission lines with a minimum of resprouting and fewer pruning cycles. The guidelines are based on known tree responses to various pruning techniques. In no sense should the guidelines take precedence over safe work practices. Line-clearance tree workers should be trained to work safely around high voltage conductors. The United States Occupational Safety and Health Act (O.S.H.A.) and The American National Standards Institute (A.N.S.I.) have established minimum distances to be maintained by tree workers from electrical conductors.

Utility pruning may vary in urban and rural areas. The quality of care given a tree should balance with the landscape setting. The pruning of high-value trees in urban landscaped areas should more closely follow the preceding Tree Pruning Guidelines. Public pressure in some areas may require leaving more branches inside the canopy, which may potentially contact the conductor. This practice will be more costly as it requires more frequent pruning cycles.

It is important to prevent bark injuries on large and high-value trees by controlled lowering of heavy limbs being removed and by not climbing with gaffs. Urban trees often sustain injuries to the lower bole which open sites for decay. All trees should be carefully examined for structural problems before climbing.

**Lateral or Directional Pruning.** A tree's growth under utility lines is most economically managed by lateral or directional pruning (thinning cuts). Directional pruning is the removal of a branch to the trunk or a significant lateral branch growing away from the conductor. Heading cuts (topping), on the other hand, encourage vigorous sprouting and increases the frequency of pruning cycles and the cost of maintenance.

All trees should be examined for hazards before climbing. Hangers and large dead branches should be removed. The root collar should be examined for signs of decay or root rot which would make the tree unstable.

Where possible, the tree should be allowed to attain normal height, with crown development maturing away from high-voltage conductors.

To achieve clearance, pruning should be restricted to removal of branches at crotches within the crown.

As few cuts as are reasonable should be used to achieve the required clearances.

When the pruning of a branch will result in the loss of more than 1/2 (one half) of the foliage on the branch, it should be removed to the parent stem.

Precautions shall be taken to pre-cut large limbs to avoid stripping or tearing the bark, and minimize unnecessary wounding. Heavy limbs should be lowered on ropes to avoid damaging bark on limbs and trunks below.

The placement of pruning cuts shall be determined by anatomy, structure and branching habit. Limbs should not be arbitrarily cut off based on a pre-established clearing limit.

Final drop-crotch cuts should be made outside the branch bark ridge on the main stem or lateral branch. The remaining branch shall be no smaller than 1/3 (one third) the diameter of the portion being removed. The remaining branch should be pruned to direct the growth away from conductors.

The use of multiple, small-diameter shaping cuts to create an artificially uniform crown form, commonly known as a "roundover," or a hedged side-wall effect, is not cost effective nor consistent with proper pruning practice.

Severe crown reduction pruning should be practiced only where trees are located under lines. Topping of tall-growing species directly under utility lines should be discouraged in favor of the removal and replacement with a species that matures at a lower height.

Climbing spurs, gaffs, climbing irons or hooks shall not be used except for tree removal or where branches are more than a throw-line distance apart or for emergency rescue.

**Mechanical Utility Pruning.** Appropriate for remote sites where trees occur in wooded areas or forest stands.

To the extent possible, the placement of pruning cuts should be determined by crown structure and branching habit.

The minimum number of cuts should be utilized to achieve required clearances.

Cuts should be made as reasonably close to the main stem as possible or to a lateral branch 1/3 (one third) the diameter of the removed branch that will direct future growth away from conductors.

Pruning cuts are to be made outside the branch collar, leaving as small a stub as possible (see Figure 3).

Precautions shall be taken to avoid excessive wounding and stripping or tearing of bark.

Severed limbs shall be removed from the crown of the tree.

# GLOSSARY OF TERMS

(Page number corresponding with first use of term.)

**Arborist:** A person possessing 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. (pg. 1)

**Branch:** A secondary shoot or stem arising from the main stem or trunk. (pg. 2)

**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 collar usually becomes more pronounced and more completely encircles the branch. (pg. 3)

**Branch Bark Ridge:** A ridge of bark in a branch crotch that marks where branch and trunk tissues meet and often extends down the trunk. (pg. 3)

**Callus:** Undifferentiated tissue initially formed by the cambium around and over a wound. (See woundwood.) (pg. 3)

**Climbing Spurs:** Sharp-pointed devices affixed to a climber's legs used to assist in climbing trees (a.k.a. gaffs, hooks, spurs, spikes, climbers). (pg. 5)

**Crotch:** The angle formed at the attachment between a branch and another branch, leader or trunk of a woody plant. (pg. 10)

**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. (pg. 8)

**Decurrent:** Round-headed or spreading plant with no main leader to the top of the plant. (See excurrent.) (pg. 6)

**Drop-Crotch Pruning Cut:** A thinning cut which removes the terminal portion of a large branch or leader back to a lateral large enough to assume the terminal role. (pg. 2)

**Excurrent:** Tree with cone-shaped crown with a central leader that outgrows and subdues lateral branches. (See decurrent.) (pg. 6)

**Flush Cut:** A pruning cut made inside the branch collar and branch bark ridge. (pg. 3)

**Heading Cut:** Pruning 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. (pg. 2)

**Included Bark:** Bark that occurs in a crotch between branch and trunk or between codominant stems. Included bark usually prevents the trunk from growing around a branch. (pg. 4)

**Lateral:** A branch or twig growing from a parent branch or stem. (pg. 2)

**Leader:** A dominant upright stem, usually the main trunk. (pg. 2)

**Limb:** Same as branch, but usually larger and more prominent. (pg. 2)

**Parent Branch or Stem:** The tree trunk; or, the larger limb from which lateral branches are growing. (pg. 7)

**Root Collar:** The junction between the root of a plant and its stem, often indicated by the trunk flare. (pg. 4)

**Scaffold:** A large limb that is or will be part of the permanent branch structure of a tree. (pg. 7)

**Thinning Cut:** The removal of a branch at its origin or cutting it or the leader to a lateral large enough to assume the terminal role. (pg. 2)

**Wound:** An opening that is created when 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. (pg. 3)

**Woundwood:** Differentiated woody tissue which forms after initial callus has formed around the margins of a wound. Wounds are closed primarily by woundwood. (See callus.) (pg. 3)