



# Landscape Notes

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## Pruning Oak Trees in Southern California

Adapted from a presentation given at the Oaks in Urban Landscapes II meeting, October, 28, 2004 at the Los Angeles Arboretum.

When do you prune oaks? Simple answer—never! Oaks evolved in Southern California without the help of certified arborists or tree workers removing deadwood, crown thinning or crown cleaning them. Oaks do not need pruning. However, people may need to prune oaks to obtain specific pruning based objectives. Pruning should accomplish predetermined goals while striving to limit the formation of decay columns within the tree's major branches and stems. For most trees and especially oaks, decay limits the lifespan of the tree. When new wood production falls behind the rate of destruction by decay fungi, the tree loses structural integrity and starts to fall apart. Limb loss, and main stem (or bole) loss due to decay eventually kills large oak trees. Any pruning protocol for oaks should consider the ingress of decay and its long-term implications.

Because oaks are part of the urban environment and are often at the interface of wild or natural lands and urban landscapes, there are pruning needs. Since oaks attain great size and the wood is heavy, they can cause extreme damage should they fail. For large urban oaks, hazard reduction pruning is often a necessity. Removal of large dead branches is also necessary. Pruning for vehicular and pedestrian clearance is required for oaks used as street trees. Sometimes pruning is specifically for aesthetic purposes; to provide a new view, to expose the branch architecture of the tree or redirect growth of the tree. For young oak trees, pruning is used to train them and to impose a specific architecture that will ensure sound limb attachments to maintain the tree's structural integrity over its lifetime.



**Figure 1. Starch stored in healthy (top) but not in diseased (bottom) twigs**

Pruning is the removal of branches, shoots and buds to achieve specific goals. This usually means removal of oak wood. A few things need to be mentioned about wood and its importance to trees. Wood is a structural tissue. It provides the mechanical strength necessary for the support of large branches within a tree's architecture. Strength of a branch or trunk is proportional to the amount of sound wood (Harris et al., 2004). Wood is also a storage tissue. Trees store sugar as carbohydrate or starch in the wood of twigs and branches. When disease causing fungi are introduced into the wood system of a tree, these stored carbohydrates are depleted (Fig. 1). The concept of carbohydrate storage is also important when transplanting large trees. Although it is tempting to prune oaks to compensate for root loss during transplanting at least one study shows that compensatory pruning is detrimental to establishment of oaks (Dagit and Downer, 2002)

To understand how to prune oaks, two basic principles need to be reviewed. **First, pruning retards or slows the growth of whatever is pruned.** When leaves are removed, less energy will be captured by the tree and stored. The more you prune a branch or tree, the less its stem will grow, the less it will produce new wood and the less it will store the carbohydrate energy made by leaves. This is why pruning is a growth retarding process. Sometimes when a tree is heavily pruned, the regrowth is abundant. A pollarded mulberry or sycamore can make over ten feet of growth in a single season. Pruning hardly seems to have slowed the growth of these trees. However, an identical unpruned tree will make more growth on its main stem than a pruned one. I demonstrated this in a study of young oaks with codominant stems. Pairs of very similar size codominant stems were selected and measured. Various pruning treatments (heading, thinning, unpruned) were applied to one stem while the other was left unpruned. In all cases, pruning reduced the stem caliper of the pruned stem



Figure 2. Effect of heading cut on codominant stems

relative to its unpruned counterpart (figure 2). **The other basic pruning principle to remember is that pruning is a bud invigorating process.** When branches are removed from trees, buds on the remaining branches are invigorated. For preformed buds such as terminal or axillary buds, this will result in vigorous growth of desired branches. If pruning has been severe (say more than 50% canopy removal), it is possible to invigorate latent buds that will result in the development of epicormic, randomly spaced branches. Epicormic branches or water sprouts are often poorly attached and lead to poorly developed branch architecture in the tree that subjects it to failure at a later date if those branches are not carefully pruned.

Once we have a valid reason to prune, we need to understand how to remove the branches from trees. There have been many papers written in the last 25 years about a new form of pruning called natural target pruning. This style of branch removal was popularized by Dr. Alex Shigo (Shigo, 1983; Shigo, 2004). To use natural target pruning, it is necessary to understand the morphology of oak branches. Two areas of great concern are the branch bark ridge and the branch collar. The branch bark ridge can be found along the stem of the



Figure 4 Coast live oak branch bark ridge and branch collar

branch it is attached to at about a 45 degree angle. The uppermost edge of the branch bark ridge defines the area of the branch attachment called the branch collar. To make a good cut, a line is drawn flush along the trunk, outside the branch bark ridge (see figure 6). A branch cut is then made at least 30 degrees away from the flush line. Angles less than 30 degrees often result in cuts that are too close above or below the cut and will not close evenly.



Figure 3 Branch bark ridge and shoulder or collar rings on white alder

Sometimes the branch collar is defined by rings called shoulder or collar rings. The proper cut is made outside (up the branch) of these rings. Never cut into the shoulder rings, branch collar or branch bark ridge. Figure 3 shows a branch

attachment on white Alder, *Alnus rhombifolia* that has a well defined branch bark ridge, collar area and shoulder rings. Oaks have similar structures but they are subtle and become less defined as the size of the branch increases. Figure 4 shows similar structures on a young coast live oak.



**Figure 5. Poor callus formation at the bottom of the cut where the branch collar was cut into.**

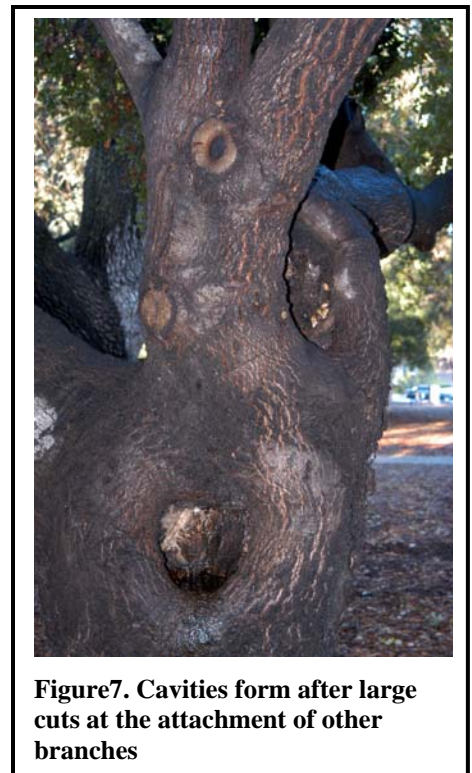
A flush cut often results in uneven callus development at the top, bottom or both ends of a cut (Figure 5). A properly made cut leaves the branch collar intact and tends to leave a projection of tissue just below the cut on the main stem. It is not flush (figure 6). Flush cuts tend to be oval in shape while natural target cuts leave a smaller, round wound. Published research on branch wound callus production suggests that flush cuts produce more wound tissue than NT cuts (Neely, 1988a & b). However, if the overriding goal of pruning is to achieve predetermined goals while limiting decay, less wound tissue forming over a smaller diameter cut better serves our objectives. This has been validated in a survey of arborists taken since the Neely/Shigo debate (Harris, et al, 1999).



**Figure 6. Projection of the branch collar after a good cut.**

We don't make cuts just to stimulate callus growth. Flush cuts certainly can produce more wound tissue; but, its development is irregular and ultimately a larger decay column will be created. The end result is a large central cavity in the tree. When cavity size increases to the point that the newly formed wood can't support the tree, the tree falls apart and its life is ended. To avoid decay columns that weaken trees, make many smaller cuts rather than fewer large cuts when pruning trees. A respect for the collar, branch bark ridge and an attempt to make the smallest pruning cuts possible will lengthen a tree's life.

There are two basic kinds of pruning cuts: heading cuts and thinning cuts. Heading cuts remove the terminal bud of a twig, branch or main stem. Thinning cuts remove a twig, branch or main stem back to a branch large enough to maintain apical dominance or control of the remaining buds. When leader branches are removed but the branch that they are cut back to does not maintain control of the remaining buds, epicormic shoots form and can result in the regrowth of poorly attached branches. Usually this happens on cuts 3 inches in size or greater and results in multiple branches arising from a single point with a wound that introduces decay at the point of attachment. This is pruning predisposed disaster in oaks (figure 7).



**Figure 7. Cavities form after large cuts at the attachment of other branches**

In many ways the best oak tree is the unpruned tree. It has fewer wounds and therefore less decay than a heavily pruned tree. Curiously, the more frequently a tree is pruned, the smaller the cuts will be so ideally, an oak is pruned frequently during its establishment period. Trained trees develop a good branch architecture that requires few if any large cuts later in the tree's life.

Training the young tree should accentuate the natural form inherent in the species being pruned. Form of the tree is determined by two key principles: Apical control and Apical dominance. Apical dominance is the complete suppression of buds on a twig or branch by the terminal bud during a growing season. Apical control is the ability of the terminal bud to stay ahead of all of the branches below it. In Southern California oak woodlands, the coast live oak (*Quercus agrifolia*) and the white oak or valley oak (*Quercus lobata*) are the dominant species. Each of these has its juvenile and adult forms. The coast live oak has high apical dominance and low apical control. It often loses its central leader and develops many competing leaders early in its life. The valley oak has greater apical control and seems to maintain a central leader without much training. Later in life, the valley oak loses its high apical control and a round headed or decurrent shape is established.

Some researchers recommend early development of a central leader system when training young trees (Costello, 2001) This allows even distribution of branches up and down and around the main stem of a tree. When training oaks, the coast live oak will often resist the selection of a central leader by constantly growing new leaders that out-compete the selected leader. Sometimes the selected leader will have to be staked to maintain an upright dominant position for the tree. Heading cuts are used to suppress competing leaders. The white oak due to its greater apical control naturally develops a central leader early in life that often leads to 12 to 20 feet of straight trunk in the mature tree. Training involves removal of co-dominant leaders that sometimes form and maintenance of temporary lateral branches. In both species, the next step in training is to select the first permanent branch. It is left un-pruned or lightly pruned while all other shoots around it are headed back to retard their growth. In subsequent years, competing leaders are removed along with temporary branches and new scaffold branches are selected. The well-trained young oak will have a defined central leader with well spaced scaffold branches. As the tree enters mid life and starts to attain size, pruning is used to remove codominant stems, closely spaced branches, branches that seem to arise from the same attachment, branches with included bark or

branches that have become diseased or damaged. Frequent light pruning will assure that cuts are not too large and that decay never enters the tree as large decay columns. At this point, the coast live oak will have lost a central leader and will have several leaders arising from the main scaffold branches. The white oak will have fewer leaders but will also start to assume a decurrent or broad domed shape as upper bole scaffold branches assume their dominant role in the canopy of these trees. Valley or white oaks have a tendency to develop co-dominant leaders and special attention should be given to prune heavily on one of these stems to decrease its size relative to the main stem to which it is attached. Ideally, co-dominant leaders are removed at an early age so later pruning is minimal and the wound closes rapidly.

Another reason to prune is for crown restoration. Crown restoration pruning seeks to solve some of the problems that have occurred in the canopy of a tree due to damage or disorganization caused by previous poor pruning practices. When a tree is located in an area where pedestrians travel under it, deadwood removal is necessary. However, deadwood removal for its own sake serves no purpose except to remove habitat for animals and insects that live on oaks.

Often crown restoration involves making large cuts to deal with poorly attached, diseased or broken branches. Although contrary to conventional wisdom, it may sometimes be advisable to leave a large branch as a stub rather than to cut it back to its attachment. Remember the larger the cut, the larger the potential decay column that will form. When a large branch must be removed, it may be better to leave the attachment alone and retain a lengthy stub (several feet) that will resprout and thus slow the entrance of decay near the branch attachment. However, there is another argument exists against this practice. This is: that if the large branch stub is left on the tree, it will provide energy for wood decay fungi to break through natural barrier zones that protect the main stem from decay. This may be true. The answer to the problem is probably decided by the ability of the remaining stem to sprout enough new growth that will maintain and support its cambial system and allow new wood to continue its formation at the attachment.

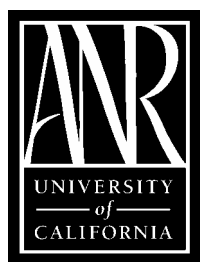
If the tree is vigorous and regrowth is plentiful, it may be best to leave the stub and organize the new branches as they grow onto the tree. Maintain them with pruning so they don't grow too fast and select a few branches to be permanent while the rest are headed back as temporaries. I have seen this strategy work in oaks but it must be initiated and maintained by trained arborists or tree workers with a clear objective in mind.

It is important to have clear goals when pruning oaks and not unnecessarily remove green foliage from the interior of the tree. There is evidence (Rundel, 1980) that coast live oak requires an inner canopy of foliage to photosynthesize during high stress summer drought periods. Removal of the inner canopy is thus an additional stress factor that urban oaks do not benefit from. Pruning should accomplish its goals with the least impact to the form, physiology or support (wood) system of the tree. If you are not sure of your motives for pruning an oak tree, don't do it.

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## References

- Costello, L. 2001. Training young trees for structure and form. *Arborist News* vol 10.no2. and, published online at :<http://flash.lakeheadu.ca/~forurban/monthly%20tip.html>
- Dagit, R. and A.J. Downer. 2002. To prune or not to prune: responses of coast live oaks (*Quercus agrifolia*) to canopy retention during transplanting. USDA Forest Service Gen Tech Rep. PSW-GTR-184: 369-380.
- Harris, R.W., J.R. Clark and N. Matheny. 2004 *Arboriculture: Integrated management of landscape trees, shrubs and vines*. Prentice Hall. Upper Saddle River NJ 4<sup>th</sup> ed.
- Harris, R.W., J.R. Clark and N. Matheny. 1999. *Arboriculture: Integrated management of landscape trees, shrubs and vines*. Prentice Hall. Upper Saddle River NJ 3<sup>rd</sup> ed.
- Neely, D. 1988a Tree Wound Closure. *J. Arboriculture* 14:148-152
- Neely, D. 1988b. Wound closure Rates on Trees. *J. Arboriculture* 14:250-254.
- Rundel, P.W. 1980. Adaptations of Mediterranean-climate oaks to environmental stress. IN: Plumb, T.R. technical coordinator. *Procs. of the symposium on the ecology, management and utilization of California oaks*. June 26-28, 1979 Claremont Ca publication of the Pacific Southwest Forest and Range Experiment Station USDA. PSW-GTR-RR: 43-54.
- Shigo, A. 1983. Targets for proper tree care. *J. Arboriculture* 9: 285-294
- Shigo, A. 2004. Guidelines for correct pruning. Published on the Pacific Northwest Chapter of the International Soc. Arboriculture web page at: <http://www.pnwisa.org/shigo.html>



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