Storm Damage and Restoration Pruning: Latent Nodes as Natural Targets

By Guy Meilleur

"Pruning properly done is one of the most difficult tree treatments. Every branch will be different ... Learn to read trees, inside and out. It is always exciting to see the many many variations on a theme. It is much better to think of them as variations on a theme than exceptions to a rule. Rules are too absolute for mother nature." (Dr. Alex Shigo, A New Tree Biology)

The headed branches are aiming in the opposite direction from the uncut branches. As they regrow they will restore symmetry to the tree. Their mass at present balances the tree's structure, damping the effect of the wind on the crown over the house.

The central leader now ends in "stubs" with laterals much less than one-third their diameter. Retaining this leader keeps the tree's structural integrity.

Ice is not nice to trees. Neither is too much wind, rain or snow. When Mother Nature's storms do a ragged topping job on mature trees, how far back should the arborist cut the broken branches? Is it okay to leave a stub? The evidence supports leaving as much of the remaining canopy volume as possible.

For years we have all heard two rules repeated over and over:

1. For ordinary reduction pruning, cut back to a lateral branch able to assume the terminal role, at least one-third the diameter of the branch being cut.
2. Don't take off more than one-fourth of the canopy at a time.

Ice violation – following the standards

The question arborists are frequently called upon to answer is this: when an extraordinary storm has broken Rule 2, does Rule 1 still apply? Or was Dr. Shigo right about rules and nature? As the old saying goes, "When in doubt – read the directions!" The American National Standards Institute's 2001 edition of the A300 Pruning Standards gives directions all arborists should follow. Representatives of 15 different green industry organizations revise ANSI A300 National Standards every five years, updating them according to the latest arboricultural research and

Note the two small laterals arising just before the branch abruptly narrows; a clear natural target at which to aim the saw.

With no side branches to aim at, this node characterized by swelling and the old branch scar becomes the natural target. The cut is slanted to avoid trapping water and spores, and oriented to the north to lessen cracking.

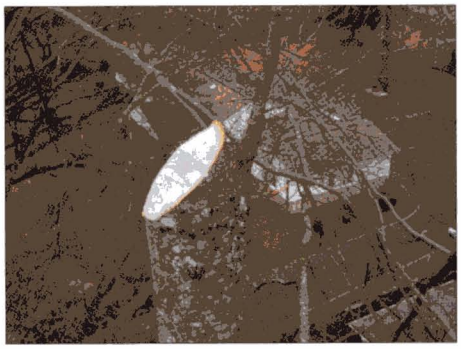
experience.

Since we are dealing with severely damaged trees, let's look at the A300 Standard under 5.7, Specialty Pruning Standards. 5.7.4.1, "Restoration shall consist of selective pruning to improve structure, form, and appearance of trees that have been severely headed, vandalized or damaged."

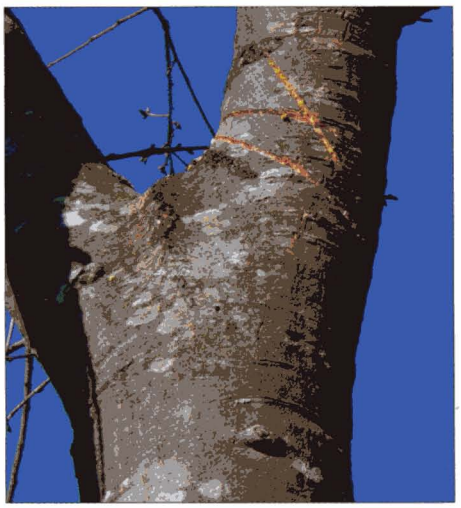
Section 4.20, reads "heading: 2. Cutting an older branch or stem back to a stub in order to meet a defined structural objective ... Heading may or may not be an acceptable pruning practice, depending on the application."

(Contrast this with 4.46, "topping: The

The crack ends at the point where a small upright lateral arises.



The face of the wound shows no evidence of the crack. This lateral's upright direction may give it the terminal role despite its small diameter.



A typical reduction cut is made on a line which bisects the angle between a line perpendicular to the branch being removed and the angle of attachment.

reduction of a tree's size using heading cuts that shorten limbs or branches back to a predetermined crown limit. Topping is not an acceptable pruning practice.")

There are a several other types of specialty pruning that properly use heading cuts in situations the arborist does not see every day.

- Orchardists have long used heading cuts to make strong branches capable of holding up under a heavy load of fruit. When the branches of fruit trees are pruned, the cuts are made to a weak lateral or at latent nodes. The objective of these cuts is to increase branch taper and therefore increase the load bearing capacity of the branch.
- Pollarding, described in ANSI A300 5.7.3, incorporates heading cuts, originally to allow another kind of harvest, not of fruit but of branches for fuel wood. In our modern age of fossil fuel use, pollarding is primarily used to limit tree size.
- Bonsai is actually a highly sophisticated form of structural pruning. Creating a miniature version of a forest tree requires close attention to the balance between root structure, crown structure, and environmental conditions.

Nodes as targets

The natural target for a heading cut is to a node, where wound closure will be optimal and re-growth will not result in a "crow's feet" tangle of weak sprouts, but a vigorous flush out of which strong new branches will eventually dominate. The locations of restorative nodal cuts are not predetermined (as topping cuts are), but selected by the arborist in the tree before each cut is made. To find out where, why and how these nodes should be selected, let's look again to the authorities.

In *A New Tree Biology Dictionar,* Shigo writes, "Pruning cuts that are made

at nodes cause less injury than cuts made at internodes ... A node is the position on a stem or trunk that was occupied by the terminal bud and its associated buds."

In *The Manual of Woody Landscape Plants*, Michael Dirr's definition, "node: a joint on a stem, represented by point of origin of a leaf or bud; sometimes represented by a swollen or constricted ring ..." agrees.

Shigo clearly acknowledges that proper cuts can be made at latent nodes, as opposed to the improper practice of topping. In *A New Tree Biology*, he writes, "Topping is done internodal; proper crown reduction is done at nodes, or at crotches. So the first separation must be nodes – good, internodes – bad."

The torn end will be reduced to the first good node. Cutting all the way back to the lateral might result in decay, instabilty and future failure.

In his *Illustrated Guide to Pruning*, Edward F. Gilman warns, "Reduction cuts cause injury to the cut stem or branch. This injury could extend down the cut stem on trees that compartmentalize decay poorly."

So we can leave relatively bigger wounds on, say, a healthy ash than a sick poplar. But he goes on to observe that "This disadvantage is often offset by the improved structure that results from appropriate reduction techniques."

Ultimately, the arborist must decide on the proper balance between cutting back the branch at its point of origin, cutting it back to a lateral, or cutting back to a "latent node." The arborist is cautioned by ANSI A300 standards to use his knowledge of the individual tree species and the local environment as guidance in making such decisions.

Why make heading cuts? Count the reasons!

After severe storm damage, there are at least five reasons to apply heading cuts that make them an acceptable practice:

1. Retain a safe branch structure
2. Reduce the risk of windthrow
3. Fend off fungus
4. Stop sunscald
5. Conserve our canopy

Any of these reasons may be enough to warrant leaving the bottom of a branch in a tree. If all five apply, there can be little question that heading cuts are proper for restoration pruning. In contrast, look at the practice of removing all damaged branches back to their origins or big laterals and ask what the reason is for it. Let's take a close look at the tree industry's standards, as well as conclusions drawn by its top researchers. We'll see that there is little support for gouging bigger holes in brutalized tree canopies by removing sound wood.

Though many will initially object to a stub left in the tree, it is important to think about what will grow from this branch that has been cut back to a healthy node. An arborist who is called upon to restore a damaged tree several years after the damage occurred will notice that there are already many sprouts originating from stubs. Some of these may have grown into branches. Some can be encouraged to grow into new branches or develop apical dominance through proper selection and management. We must think long and hard before deciding that a damaged tree has to be further damaged by cutting all damaged branches back toward the heart of the tree.

1. Retain a safe structure

Structure is the first reason to leave as much dynamic mass – as much moving, living bulk – as we possible in a severely damaged tree. If cutting back to laterals or the branch's origin will open up even bigger gaps in the crown and expose the remaining branches to higher stresses and strains, is it the proper technique?

Cornell University's Karl Niklas discussed this question in his keynote address at the Tree Structure and Mechanics Conference in October 2001 in Savannah, Ga. He said, "One important approach to describing adaptive tree morphology is to explore stem and root 'safety factors.' ... The 'safety factor' can be surprisingly instructive, even in terms of practical horticultural concerns such as the effects of pruning on mechanical stability."

Niklas also noted that "... most plants have a modular construction ... Stems growing in sheltered sites within the same tree canopy can have lower load-bearing capacities ... When exposed by the removal of neighboring stems, leaves or roots, previously sheltered and mechanically reliable body parts may deform or break even under wind conditions that are 'normal'."

So the "damping effect" of branches in a tree can prevent future breakage of branches that still have foliage on their ends. The weight of side branches can also reduce the movement of stems they are attached to by increasing overall mass. As a result, more force is required to overcome the inertia of the stems.

The trunks and scaffolds of trees also contain reaction wood that has formed over many years of bearing the load of their canopies. Removal of too much weight will change the tension and compression forces in the trunk and scaffolds. The tree can adapt by adding more wood in areas under load stress but will be more vulnerable to additional storm damage while this process takes place.

Nelda Matheny and James R. Clark point out in their book, *Evaluation of Hazard Trees in Urban Areas*, that maintaining a strong central leader is also important to the structure of many species, especially in trees with excurrent growth forms, those that exhibit strong apical dominance. Excurrent trees act to replace a damaged central stem with a new one. This may result in multiple leaders with weak branch attachments. Retaining as much of a broken central stem as possible and managing the resulting sprouts to control apical dominance can promote good tree structure.

The goal is to leave the tree as safe as possible, even if some see the immediate effect of nodal cuts as "topping" or improperly leaving stubs. It's nature's storms that did the topping job and left the stubs; the conservative arborist further reduces the crown as little as possible.

2. Reduce the risk of windthrow

If removing the damaged branches back to the center of the tree will remove large amounts of weight from one side, this could increase the potential for uprooting of the tree. According to Claus Mattheck and Helge Breloer in *The Body Language of Trees*, a lopsided crown reduces the soil friction with the tree's roots on the side where weight has been removed. If the weight has been removed from the windward side, "The crown shape and the wind then combine forces to lift the pruned side of the crown, so reducing the normal stress and indeed perhaps transforming it into tensile stresses (i.e., lift!). When this happens, the effective sliding surface between the root-ball and the ground is so severely reduced that the tree blows over far more easily."

Since storm damage from wind often occurs on the windward side of the crown, the weight conserved by cutting at a node could increase the stability of the tree's root system in the soil.

3. Fend off fungus

Decay is another good reason to make nodal cuts just below the storm-caused wounds. As Schwarze, Engels and Mattheck remind us in 2001's *Fungal Strategies of Wood Decay in Trees*, large wounds on trunks are unlikely to close before they start cracking and become "motorways for decay-causing fungi and bacteria" racing into the heart of the tree. Trees rely on suberin (a fungus-inhibiting corky material) formed in the cell walls of the cambium to form a barrier zone. With the increasing acidification of our atmosphere, some of that suberin is washed off. Callusing cambium can be exposed to infection, just as desuberized dogwood leaves are exposed to lethal anthracnose. Now more than ever, our strategy must be to minimize the size of wounds, the infection courts that we must leave behind.

4. Stop sunscald

Another reason for retaining branches that nature topped is sun injury. Bark loss from sun injury exposes the wood to cracking and decay pathogens. These injuries are slow to heal because the bark in the tree's interior is thin to begin with, and the sun also dries the tissue at the edge of the visible injury so it can not form callus tissue effectively. Like a big pruning cut on a stem, sun-damaged bark is a slow-sealing type of infection court we must avoid creating.

5. Conserve our canopy

Canopy conservation is the ultimate reason for minimizing crown losses. When nature radically removes portions of our tree canopy, it's up to the arborist to be as conservative as possible. Trees are a living system. When a tree is damaged by storms, the balance between roots and canopy is altered. The tree will respond by sending up watersprouts in an effort to restore the balance. The more material is removed from the tree, the greater the imbalance becomes. At a certain point there will no longer enough photosynthesis to support growth, nutrient storage, and defense, and the tree will decline. Diameter growth may suffer if the live crown ratio – the relative proportion of green crown to overall tree height – is reduced to 40 percent or less. Reduction in diameter growth slows down wood production and the closure of wounds. The more of the tree we leave, the more benefits, such as clean air and water, we conserve. If we look to the A300 Standards and the tree industry's leading scientists for guidance in dealing with damaged trees, we see that restoration pruning calls for leaving as much canopy as we can to benefit the tree, the tree owner and the community.

In the years to come

Aftercare is often very easy, but it is important to communicate to the client that the restoration process will take several phases to complete. From most heading cuts a flush of sprouts will grow. Branches in the upper canopy that have been headed back are now more likely to support the weight of a climber since the extra weight of their tips has been removed by the storm. The strongest sprouts can be trained to become your new branches. Simply remove the weaker and more poorly placed sprouts to make room for the best. These can be shortened if they are too rangy, and side branches can be thinned if they are too crowded. On mature oaks, every three years is about right. Some branches that were headed back in 1996 after Hurricane Fran just got their second thinning. They now have three strongly attached, natural-looking branch ends to carry on the growth of the tree. What once looked like stubs have grown into attractive, symmetrical portions of our valuable tree canopy.

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