UNIVERSITY OF GEORGIA
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Publication WSFNR-24-18C

February 2024

Young Tree Training Checklist

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The five components of life-long tree care are biology-first design, tree installation and establishment, young tree training, mature tree tune-ups, and risk management. A carefully prepared program of tree health care practices which effectively moves from tree life stage to life stage is critical to sustainable management. Through total quality tree care management, tree health care providers can generate a great quality of life for trees and tree owners.

One life stage management component which is most frequently overlooked is training young trees. Young trees can be pruned into biologically efficient forms minimizing potential for future problems. Many liability risks identified in mature trees could have been easily corrected when they were young trees. Tree health care providers are instrumental in training young trees.

Tree Health

Arborists assist trees to survive and thrive in their environment. Part of this assistance is development of biological efficiency and structural integrity while minimizing stress. Understanding tree growth and development is crucial. Internal and external tree resources must be cultivated and controlled. Tree health care providers can assist trees to maximize essential resource acquisitions which includes physical space and competition control.

Tree health care providers assure a long, useful tree life through development of proper form and management of structural components. Arborists have a long history of remedial and terminal care. The purpose of tree training is to guide young trees into acceptable forms and meet tree owner objectives. Tree training uses knowledge of mature tree problems to minimize young tree development of these problems.

Concerns

Tree training can not generate great trees from poor stock. Training can make good trees better. Through training, tree health care providers strive to provide tree owners with marginally better trees which will significantly out perform non-trained trees over the expected life-span of a species on a particular site. Poorly applied training techniques can damage the best stock, assuring loss of tree quality and increased liability risks.

Training is not considered to have major aesthetic objectives. Shaping, crown sculpting, propping, cabling for form, and architectural blending are not covered here. Training is concerned primarily with tree structure and prudent treatments. The image of a native tree on an average site is used to frame training concepts. A single, upright, well-tapered stem with no structural faults is ideal.

Training begins in the nursery or holding area where tree faults and growth form can be clearly seen and manipulated. Arborists and community foresters should work closely with tree producers to generate trees with natural forms for yards, streets and parks. After planting, allow trees to effectively control site resources before

starting a training program. Internal resource reorganization must be completed by the tree before externally modifing growth conditions. Give trees at least one full growing season after planting / establishment before training begins.

Training Concepts

There are seven main concepts in tree training: tree imaging, development of a dominant leader, use of transient branches, manipulating living crown area, controlling stem / branch attachments and conserving stem flange tissue, shallow not deep wounds, and assuring proper pruning with cuts which just miss tree established targets.

Tree Imaging

Trees which function well over long periods of time share a number of characteristics emphasized when training new trees. Characters that can be affected by cultural treatments and selection include identification of primary and secondary axies, leaf and branch density, branch attachments, and crown shape and extent in all dimensions. Before a tree is touched, a mental image should be developed representing views of the tree owner, experience of tree health care providers, and natural values of a tree on a specific site. Imagine what a tree should ideally look like in a particular situation, and then allow a tree to develop toward this ideal form over its life.

Imaging what a tree should look like considers the site and biological constraints present. Past damage, mismanagement, and neglect can yield a tree removal, even though young. Some trees will need little training to reach a biologically efficient form and structurally sound form. Develop an image of a tree though understanding how modular tree parts are connected and their interaction. Trees grow and develop in discretely formed units (nodes and internodes) and can be carefully dismantled in these same units. Selective and prescribed removal of these units or parts can be completed in an organized manner, which is the process of training.

Dominant Leader

Most trees have a strong growth regulation system which quickly and effectively reacts to environmental changes. Tree health care providers assist a tree to effectively react to changes. Minimizing stress components of the internal and external environment, while maximizing biological efficiency, can be attained by prescribed training of trees into a sustainable form. Form does impact how a tree reacts to changes in its environment.

A single primary axis or dominant leader is a form visible on many juvenile forest and landscape trees. This form is partially a result of strong growth control to effectively capture resources. Most trees in normal use should be developed into a single stem form with the primary axis being vertically, directly above the tree base position. The primary or dominant bud or bud group on the end of this axis, should be positioned in the most direct vertical line to the root plate. This primary bud group should be conserved because of its growth control / resource allocation role in a young tree.

Transient Branches

Depending upon species, past management history, site and chance, some branches will always be occupying inappropriate areas for a particular use or value objective. Risk management dictates out-of-place branches, or problem causing branches, be removed early. Remove branches which are too low, growing in the wrong direction, or prone to structural weakness due to position or form.

Most branches existing today on a small tree will have been removed by the time a tree reaches maturity. These transient branches still play a critical role in growth regulation, food production and allocation, and resource capture. Selective lower branch removal over time will be important, but must be carefully and slowly completed.

Treat lower branches as temporary food production and storage facilities allowing a tree to grow large quickly. If allowed by site use and risk assessment, keep temporary branches on a tree as long as possible if they represent no structural problem. Reduction (abridging) can be used to keep transient branches controlled. Green branches represent a great asset for a tree and should not be removed without serious consideration.

Over time, branch clearances will be important for a landscape. Different clearance heights are required for safety and risk aversion. Walking, skating, or bike riding beneath a tree requires 9-12 feet in clearance, while trees bordering roadways may need 18-24 feet clearance. Some clearances are set by ordinances or regulations.

Trees which normally maintain branches down to ground level (skirted) should, at a minimum, be pruned-up so rain-burdened branches do not have contact with soil. Assure tree crowns are not raised too quickly which can cause long term structural issues and make them more susceptible to stress problems. Only remove a small proportion of the live crown every other year until a specificed clearance is reached.

Live Crown

Young trees require as much leaf area as possible to maximize growth rates and minimize stress problems. Young trees with plenty of leaf area will be highly reactive to changes in their environment. Leaves produce food, and the last few annual increments within twigs and branchlets immediately behind leaves store food in the form of starch. Excessive living branch removal disrupts food production, allocation, and storage. Excessive pruning, especially on young trees will stunt root growth and decrease ability of a tree to effectively react to changes in the environment.

Living crown ratio (height of living crown over total height of tree) can be used to manage tree response to change and gauge health. Roughly two-thirds of live crown ratio should be maintained on a young tree. Live crown ratios of less than 25% can be debilitating for a tree. For young trees with 2/3 live crown ratio, never remove more than 12% of the living crown in any pruning cycle. For young trees with smaller live crown ratios, less live crown should be removed in any pruning cycle. Always leave two full growing seasons between major pruning treatments to enable tree adjustments to tissue loss.

Pruning the lowest branches (crown raising) should commense late in young tree management. Raising the base of the live crown too quickly is abusive, and leads to loss of valuable taper development as well as causing new sprout generation along the stem. Crown raising should always be limited to only a small amount of live crown ratio in young trees.

Stem / Branch Attachments

Branch connection areas are structurally weak zones which can concentrate many mature tree problems. To minimize this effect, proper training focuses upon branch location and attachment. In broad-leaved or hardwood trees, branches should be attached alternately along the main stem.

Do not allow two or more branches to survive attached across from each other at the same horizontal position on a stem (on the same nodal torus). Branches should alternate from one side of the stem to the other as height increases. Distance between major, alternately placed branches on the primary axis should minimally be 5% of total height.

Trees that normally develop branches in an opposite pattern should be corrected back to alternate branching for as high as possible. Thereafter, a tree can be allowed to revert to natural branching patterns. The key is to develop an inherently strong stem and bury compartmented weak zones deep in the center of a tree as it ages.

Do not alternately train whorled branched trees, which develop many branches per whorl separated by a long internode (like in some gymnosperms). Thinning the number of branches on each whorl to 3 or 4 around the stem should be completed. Stagger branch locations on adjacent whorls so one branch is not directly over the top or in-line (fiber or grain line) of another. Training generates a natural looking tree which can safely and efficiently develops over time.

Flange Conservation

Training involves different types of pruning and branch cutting. Training should remove a branch without damaging the stem flange or branch collar. Disruption of the flange area initiates incomplete defensive reactions (as well as structural damage) which is then grown over by stem expansion. This process of "flush cutting" damages young trees for life and can be compounded into major structural faults.

Proper pruning minimizes potential structural problems by allowing a flange area at the stem-branch confluence, to establish defensive barriers and be as structurally isolated as possible from the primary mechanical stress columns and cross sections in a tree. Biological efficiency and structural integrity can be managed to generate a long-lived, stable, and healthy tree that meets its owner's objectives

Most landscape trees could benefit from training of branches and crowns using proper pruning techniques. Unwanted, damaged or mis-placed branches can be removed early before too many resources are wasted or before structural adjustments are made within a tree. Begin training when a tree is young with branches and branchlets for removal less than 1/2 inch basal diameter. The larger the branch, the greater chance of collateral damage, externally and internally over growing seasons to come. It will be more cost effective and biologically efficient to train young trees with small branches, than manipulate and severely damage large branches on large trees in order to reach owner objectives.

Cut Shallow / Not Deep

Small, shallow wounds are much easier for trees to effectively react to and effectively seal than wounds small in area but deep. Depth of injury is not about the number of inches into the tree which damage extends. A deep wound is one that reaches into heartwood, whether a stem is three inches in diameter or thirty inches. Depth of injury in a tree concerns the number of annual growth increments breached and the ability of the surrounding cells to react to injury. Shallow wounds remain entirely surrounded by sapwood. Always make cuts which cross 100% sapwood. Do not make cuts into or across heartwood, as this would be a deep injury and difficult for a tree to react to effectively.

Missing Targets

Remember, a tree provides clear delineation of stem and branch tissues. Prune just outside the stem flange within branch tissue only. A branch is meant to be disposable. The stem establishes a flange around the branch base to hold it onto a tree. In pruning, remove the branch and do not nick the stem flange at the branch base.

At the other extreme from flush cutting is stub cutting. Leaving a stub, or making an internodal cut, prevents effective defense and sealing-off of the area, which accentuates major structural problems. In addition,

internodal cuts provide an avenue of entry and a energy source for pests in the area. Trees are put together in units or modules, and should only be taken apart in modules. Internodal cutting should be completely avoided.

Timing is critical for training trees. Avoid pruning living branches and foliage during the Spring period between the beginning of bud swell and full leaf expansion. From the tree's standpoint, always prune after full leaf expansion if there are no pest related concerns. Late dormant season pruning is also acceptable. The key is pruning when a tree can react effectively to wounding and still maintain normal growth processes. Badly stressed trees should only be pruned after full leaf expansion when temperatures are below 80°F. .

Pruning BMPs

Best management practices for young tree pruning include this list of NEVERS:

NEVER trim, hedge, tip, top, or roundover a tree utilizing internodal cuts;
NEVER leave a stub;
NEVER flush cut;
NEVER leave tattered and raged periderm (bark) tears around pruning wounds; and,
NEVER remove living branch tissue without a strong structure or health reason.

Always cleanly prune trees at the nodes or structural unit lines. Assist a tree to effectively and efficiently react to changes in its environment by properly assessing, timing, targeting, and carefully completing pruning cuts.

Correctable Faults

Forks -- There are a number of correctable tree faults which training can modify. Correcting double stems or forks is a major training concern. Within a forked stem, periderm can be included or grown around. This periderm associated with a branch-stem confluence has reduced strength and tends to split. Forks should be corrected early in the life of a tree before large amounts of stress and strain are concentrated around the confluence. In a fork, retain the stem which is largest, more fully crowned, more vigorous, and/or in a more direct vertical line along the primary axis to the top of the roots. Trees with naturally opposite branching should have any forks removed for at least the first 30 feet up and out to provide a strong and sustainable supporting structure.

Branches with narrow or small angled confluences are similar to stem forks in potential for structural weakness. The narrower a confluence angle, or the more upright a branch grows against the main axis, the weaker the connection and the greater the chance of branch failure. Depending upon its length, an average branch should occur with >75° branch angle to the stem.

Side Branch Control -- Tree growth control is formulated by meristem areas using growth regulators as messengers. Disruption of growth control patterns can lead to many structural and stress related problems. One of the most noticeable negative impacts seen in young trees is a side branch being taller than the main axis. Training should maintain a single main stem in the most direct vertical line to the roots. Significantly reduce (i.e. abridge) side branches attempting to control a tree. With a vigorous main terminal, tall side branches do not need to be removed, but can be reduced below main axis height (reduced 33%).

An associated problem is rapid growth and expansion of side branches in extent and leaf volume, compared to the rest of a tree. Controlling these "renegade" branches by reduction (abridging) is essential for proper young tree development. These branches can be abridged back into the crown where the pruning cut is

shaded by the crown. Do not allow branch diameters to exceed 33% (50% at most) of stem size at the confluence point (i.e. become codominant). Branch and crown control are managed through abridging cuts (small, shortening, reduction cuts), not whole branch removal cuts.

Crown Base Raising -- Patience must be used in how gradual crown raising progresses. For trees with small live crown ratios, the maximum per year raising which can be effectively adjusted to is quite small. The less live crown, the less food and growth regulators generated, reducing the ability of a tree to react to change. Slow crown raising over many years builds strong stem taper. Stem taper development is essential for allowing trees to withstand lateral wind loads and control sway.

Young tree stem diameter must continue to grow at a much greater rate in proportion to height growth to maintain stem strength resisting bending and twist. Key is the live crown base must be allowed to develop a strong tree by building diameter and a well-tapered shape. Do not push crown raising too fast. Ideally, a healthy young tree with a live crown ratio of 66% should be able to sustain up to 1/8 (~12%) of live crown removal in any pruning cycle. The larger the crown (and everything else being equal), the more accepting a tree is physiologically to productive crown loss.

Checklist of Correctable Faults -- A litany of tree faults can be corrected with training. A few educated pruning cuts made early will lead to a long, healthy and structurally sound life for a tree and an improved quality of life for the tree owner. Correctable faults which can be, at least partially, trained away include:

multiple leaders;
tall and expanding side branches;
flat tops;
large side branches (codominant branches);
forks;
long branches with foilage concentrated near end (lion-tailed);
clumps of branches generated close to each other / from same node;
mechanical or chemical damage to the circumference of the stem or main roots;
sprouts on the main stem;
sprouts around the base of the tree;
new sprouts from woundwood areas;
any confluences with included periderm;
branches that rub, cross, or heavily shade each other;
opposite branching;
rapidly growing, vertical growing sprouts within a crown;
excessively crooked, swept, or bent branches; and,
excessively drooping or weeping branches (creeping branches).

Conclusions

Tree training can be a cost-effective and biologically efficient means for guiding young trees into acceptable growth patterns minimizing future liability problems. Tree health care providers must assure tree owners can appreciate caring for trees from “cradle to grave” or “planting to removal,” not just during major crisis periods, is much better for them and their trees.

Citation:

Coder, Kim D. 2024. Young Tree Training Checklist. University of Georgia, Warnell School of Forestry & Natural Resources Outreach Publication WSFNR-24-18C. Pp.7.