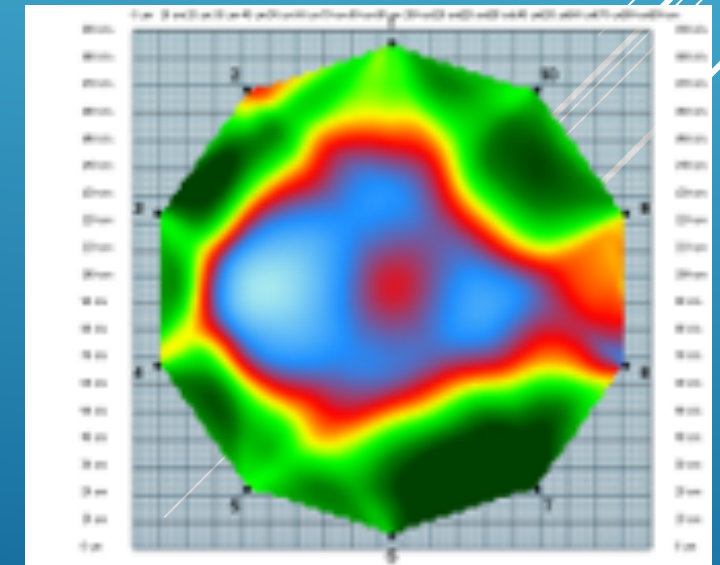


REGENERATING HOLLOW TREES, USING INTERNATIONAL PRUNING STANDARDS

ARBORICULTURAL ASSOCIATION, UNIVERSITY OF EXETER, SEPTEMBER 12, 2017

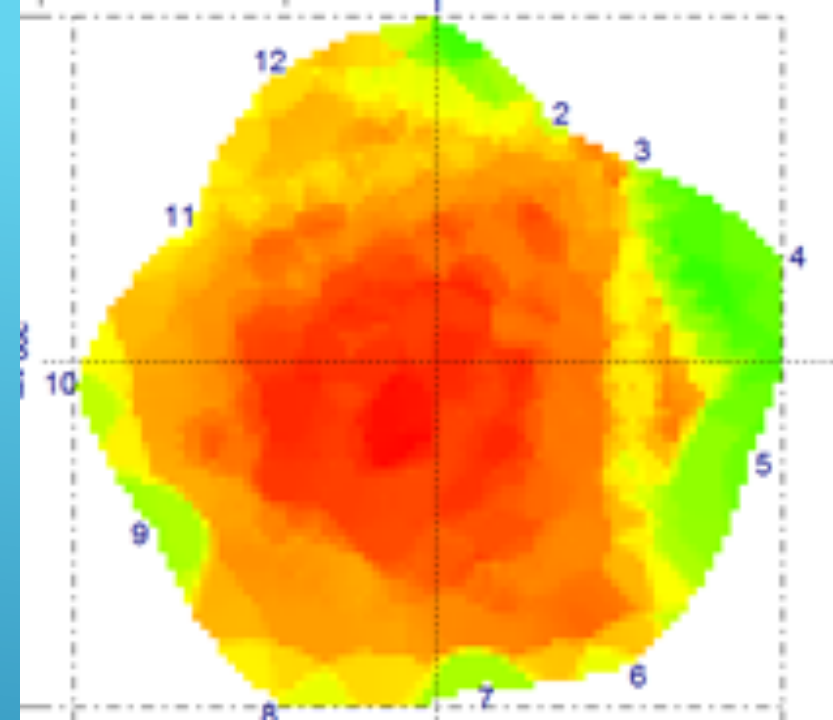
GUY MEILLEUR, ISA BOARD-CERTIFIED MASTER ARBORIST #SO-0284

WWW.HISTORICTREECARE.COM, HISTORICTREECARE@GMAIL.COM



▶ TODAY'S THEMES AND TOPICS

- ▶ MANAGING HOLLOW TREES WITHOUT ASSUMPTIONS
- ▶ DETECTIVE DENDRO AND FRIENDS; 3 CASES
- ▶ STANDARDS, SPECIFICATIONS, AND RESULTS—A CHRONOLOGY
- ▶ RECENT AND ONGOING RESEARCH—DOCUMENTING THE OBVIOUS



1999: ISA Journal of Arb

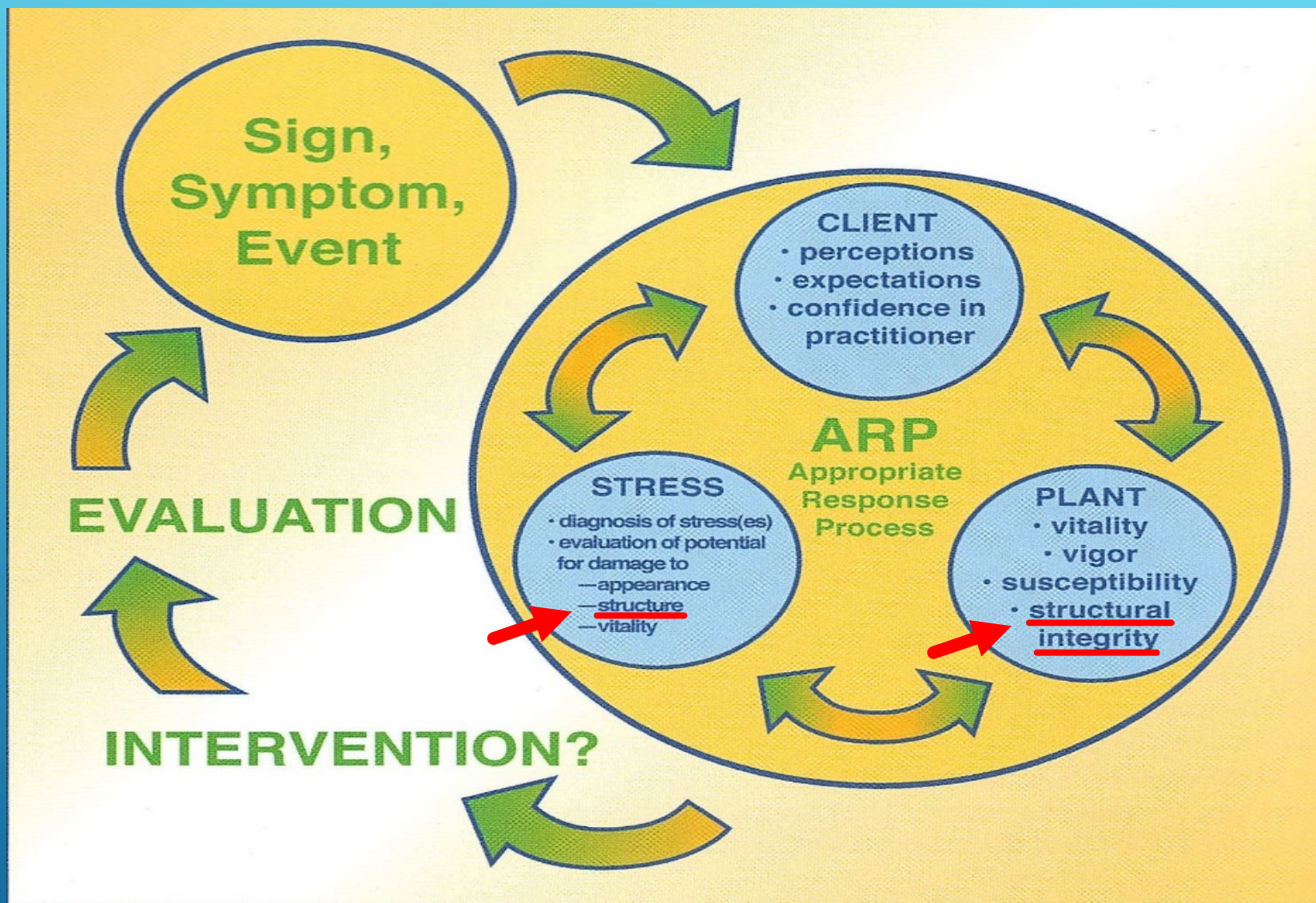
The appropriate response process (ARP) demonstrates decision-making in a PHC program.

After site changes or treatments, a follow-up evaluation is made.

Structure is one aspect of a comprehensive PHC program, an integral part of tree care.

Health and structure and risk are interdependent. They cannot be separated completely.

Ball, Marion, Lloyd



TREE RISK MANAGEMENT

↔ PLANT HEALTH CARE

Commonalities:

- ▶ Inspection and Diagnosis
- ▶ Regular Checkups
- ▶ Objective: Grow the Asset



A GUIDE TO THE
**PLANT
HEALTH
CARE**
MANAGEMENT
SYSTEM

THIRD EDITION

Old ISA Seal

- Science
- Research
- *Preservation*



Member since 1970's. 9/11/2001 out of ICU, Burning Planes in Burning Buildings.
USA--and ISA?-- Fear-Driven.

Make Arboriculture Great Again—MAGA?



NBC News

Storm Damage and Restoration Pruning: Latent Nodes as Natural Targets •

2002

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 first two images above are a before-and-after on a willow oak, *Quercus phellos*. The green branch broke, leaving a portion with no leaves or twigs remaining. I left a “stub” that violated the “ $\frac{1}{3}$ Rule”. Heeding that dogma would have put the total crown loss over the “50% Rule”, and condemned 100’s of trees to the woodpile. Rules ARE too absolute for Mother Nature!



This branch was reduced to a node after an ice storm in 2002. 10" diameter at the base and ~10' long, this 'stub' had no lateral branches, twigs, or leaves.

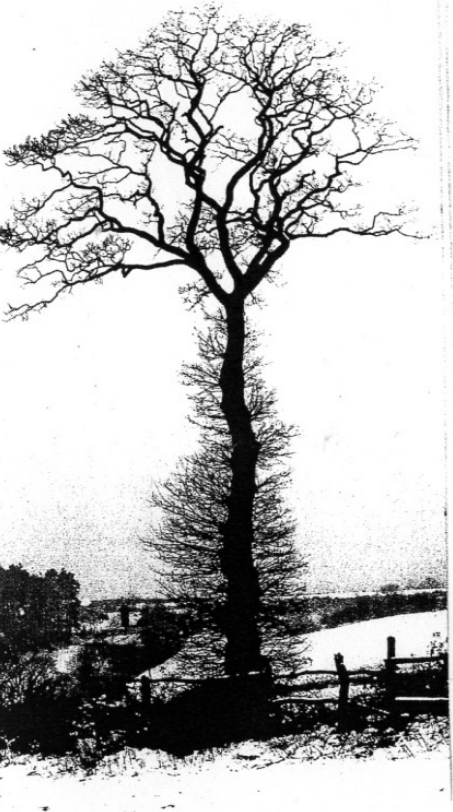
2003 Not a sign of life.

2004 Sprouts grew

2010 New lateral branches were filling in the hole in the crown. The terminal wound is closing well.

EPICORMIC = WEAK?

THE ARTHUR CLOUGH OAK



1910



1920s



c. 1950



1981



2009

Every scaffold limb on the 2009 picture was once a sprout.

But it does not take 100 years for sprouts to grow strong.

Acknowledgement for the above images, which have also appeared in numerous publications:

1910 – Henry Taunt (with acknowledgement to Oxford City Library); 1920s – Country Life magazine; 1950s – anonymous; 1981 – Paul Lack; 2009 – Philip Stewart,

2002 This branch was broken by ice, and reduced back to buds at the first growth point, 'node', behind the break.

These upright laterals sprouted after the storm, and helped compartmentalize that sapwood rot (sunscald is common on beech after sudden exposure).

2012 I climbed the tree. This was an easy shot with a throwline, and passed the 'bounce test'.

After ascending, it occurred to me that the limb I was hanging 100 kg on was a 10-year old sprout. Doh!

I wasted no time tying into another branch.



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)



On the beech, I just cut back to a node where it looked like there would be good compartmentalization and good regrowth. The tree to the right had 70%+ crown loss. The central leader was reduced to a very small lateral in 2002.

RESTORING TREES

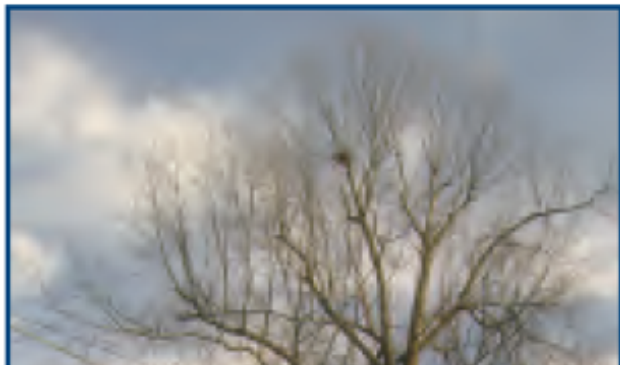
ONE BRANCH AT A TIME

By Guy Meilleur

2010



Six years after heading, the 6-inch wound on this central leader is fully closed. One of the six large sprouts were removed, and two subordinated. The less dominant leaders were slower to close their wounds.



Six years after heading, form is restored. Pruning was conservative out of concern for biomechanical stability, resource loss, and sunscald. One more treatment is scheduled five years later.

Reduction of tree crowns is largely misunderstood, due in large part to confusion with reckless and internodal topping. Reduction does remove some photosynthetic potential, but the remaining leaves can increase their energy production, and new leaves are formed per need. Formal research on crown reduction is almost impossible due to the large number of variables, so one trend has been to repeat simple criteria, like the one-third rules applied to stem walls and branch diameter ratios. Research on structural pruning shows the removal of a large codominant stem will introduce decay into the other, so subordination is preferred. Reduction slows its growth rate, subordinating the stem into a branch. Discoloration and decay is farther from the fork, protecting the remaining stem. Compartmentalization also depends on species, the activity of the parenchyma cells, and the availability of stored material. Late summer crown reduction may elicit both a favorable wound response and more manageable regrowth.

Retrenchment first referred to soldiers who retreated back to a line they could defend, where landforms and supplies allowed them to dig in and fight anew. This concept relates very well to declining trees, so before cutting any branches to reduce the size of the canopy, visualize the new canopy outline. The objective is to make reduction cuts so that branch tips are left intact on the new, smaller canopy. For trees with strength loss at the base, as little as a 10 percent reduction

Same tree in 2008. The 15 cm cut on the central leader totally closed in <6 years.

With restoration we choose ~1/3 of these sprouts to dominate, reduce 1/3, remove 1/3.

A 5-10 year pruning cycle works for regular maintenance on these mature willow oaks.

What is retrenching, what's it got to do with tree care, and why should I care?

I'm glad you asked! Dictionary definitions of 'retrench' include: To live at less expenses; To confine, limit or restrict; To cut off, pare away; To reinforce. The term has been used in literature and in relation to trees and their care in Great Britain since at least 1734.

What do European standards say? .

England, BS 3998 "Retrenchment pruning is a phased form of crown reduction, which is intended to emulate the natural process whereby the crown of a declining tree retains its overall biomechanical integrity by becoming smaller through the progressive shedding of small branches and the development of the lower crown (retrenchment).

This natural loss of branches of poor vitality improves the ratio between dynamic (biologically active) and static (inactive) mass, thus helping the tree as a whole to retain **good physiological function...**

The pruning should be implemented by shortening heavy, long or weakened branches throughout the crown, while retaining as much leaf area as possible and encouraging the development of new secondary branches from epicormic shoots or from **dormant** or adventitious **buds**."

Germany ZTV Baumpflege, 3.1.9: Focus on {growth} habit and physiological requirements.

3.1.9.1, Regenerative Pruning: Trees showing significant signs of aging in the outer parts of the crown and the development of a secondary crown are to be cut back as far as necessary (crown reduction).

3.1.9.2: Crown part reduction: Individual branches are to be reduced in accordance with safety requirements and/or the surrounding tree environment.

If necessary, areas (above) surrounding the sections that have been reduced may require thinning (removing downright laterals) to establish symmetry {via light penetration to interior buds}."



Germany ZTV Baumpflege (20 euros; in English!)

3.1.9.3: Crown reduction: The entire crown is to be reduced in height and/or spread, for safety or site needs.

The extent of crown reduction is specifically dependent on the species and growth habit, and shall be <20%....

Vigorous sprouts *must* be thinned and/or reduced. Cuts *must* be made above the old pruning wounds, avoiding damage to woundwood. As a rule, repeat every 3-5 years.

Form a secondary (reiterative) crown over time.”
Regenerating the crown by regenerative pruning: a more positive and accurate term than 'retrenchment pruning.'



What does the ISA BMP on Tree Risk Assessment say about retrenchment?

“Tree risk assessors should resist the ultimate security of risk elimination based on tree removal and consider possibilities for retaining trees when practicable...

Over-mature trees in natural settings may reconfigure as they age and deteriorate, a process sometimes called '**natural retrenchment**'.

They may continue to grow trunk diameter while branches die and fail—reducing overall height of the tree and **increasing stability**. Where tree risk is a concern, tree risk assessors can imitate this process by **recommending crown reduction.**”(page 43)



INTERNATIONAL PRUNING STANDARDS

BSI Standards Publication

Tree work – Recommendations

BS 3998:2010

15/12/2010 18:20, Uncontrolled Copy, (c) BSI

STANDARDS AUSTRALIA

Australian Standard Pruning of amenity trees

1 SCOPE

This Standard specifies methods for pruning of trees and gives guidance on correct and uniform practices. It is intended for use on amenity trees, including palms, and includes removal of deadwood, crown lifting, formative pruning, reduction pruning (including line clearance), selective pruning, crown thinning and remedial or restorative pruning. It does not include practices related to timber, foliage, fruit and flower production, chemical pruning nor to sculptural forms of pruning such as topiary, espalier, hedging and pleaching. The Standard does not include specific information on wildlife habitat or safety of the tree worker.

2 APPLICATION

This Standard is intended for use by arborists, tree workers, government departments, building contractors and others involved with contractual arrangements for tree pruning. The Standard will also serve as a guide for property owners and others who specify pruning procedures.

3 DEFINITIONS

ZTV Baumpflege

- Additional Technical Contractual Terms and Guidelines for Tree Care -

Prepared by the editorial board of ZTV Baumpflege

In close cooperation with the working group ZTV Baumpflege

User Instructions

The application of technical rules established by the FLL is generally voluntary. Mandatory application may result from legal or administrative regulations, contracts, or other legal grounds. FLL guidelines are the result of a voluntary effort based on a technical-scientific teamwork. Penetration of the implementation of these principles and rules the guidelines are to be regarded as a professional standard. FLL guidelines represent an important source of information for professional standards in normal situations. These guidelines cannot include all measures, whether broad or limited in scope, to address every unique situation. However, this establishes a benchmark for clear technical conduct and is relevant within the legal framework. FLL guidelines are to be established as "generally accepted technical rules". Using FLL guidelines does not eliminate responsibility for individual action and are to be used at one's own risk. Anybody discovering errors or misinterpretations which could lead to improper implementation is asked to inform the FLL so that corrections can be made. Modal auxiliary verbs (e.g. shall, should, must) are of particular significance and require special attention to gain a clear understanding of the regulations. For more information see DIN 820 "Standardization".

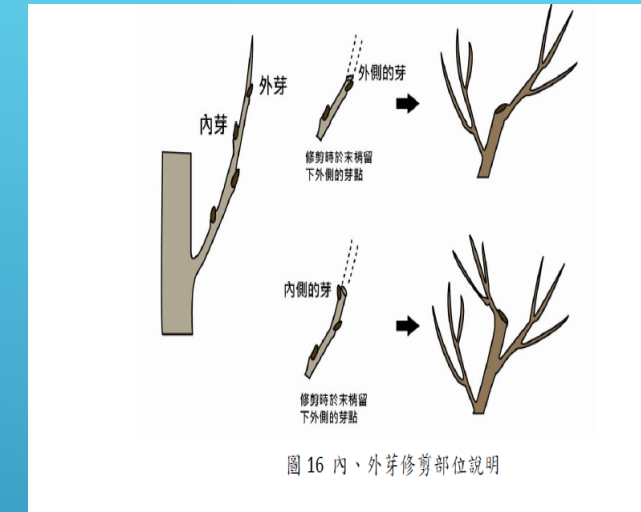
VETree

Welcome to the VETree project website.

VETree is an acronym for 'Vocational Education and Training on Veteran Trees', a European project set up by 5 partner organisations that started in november 2012 and will end in october 2014.

The aim of the project is to set up a European wide quality training programme in veteran tree management. The training programme will include both basic and advanced training material, online training tools and mentoring, video, ...

If you would like more information, please contact the project coordinator Inverde or one of the partner organisations.

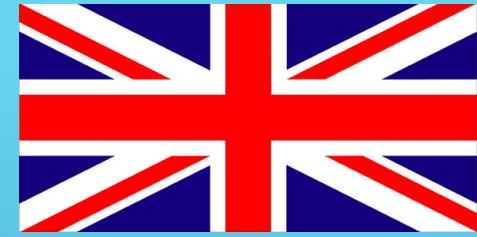




- ▶ Contracts, Supplemental Support Systems, Root and Soil Work, Pruning , Construction, 2007 *Informational wording embedded and italicized*
- ▶ Appendices for related material. Allied standards for landscaping and construction Cost: \$22 US, downloadable .pdf 66 pages
- ▶ Wording, in order of emphasis: must, shall, should. Primary audience is the contractor.
- ▶ Guidance on Regenerative Pruning. Contractor must inspect. “spurs are not permitted...**Limbs >10 cm (4”) should not be removed...**” Applies to horticulture and forestry.

GERMANY, ZTV-BAUMPFLEGE

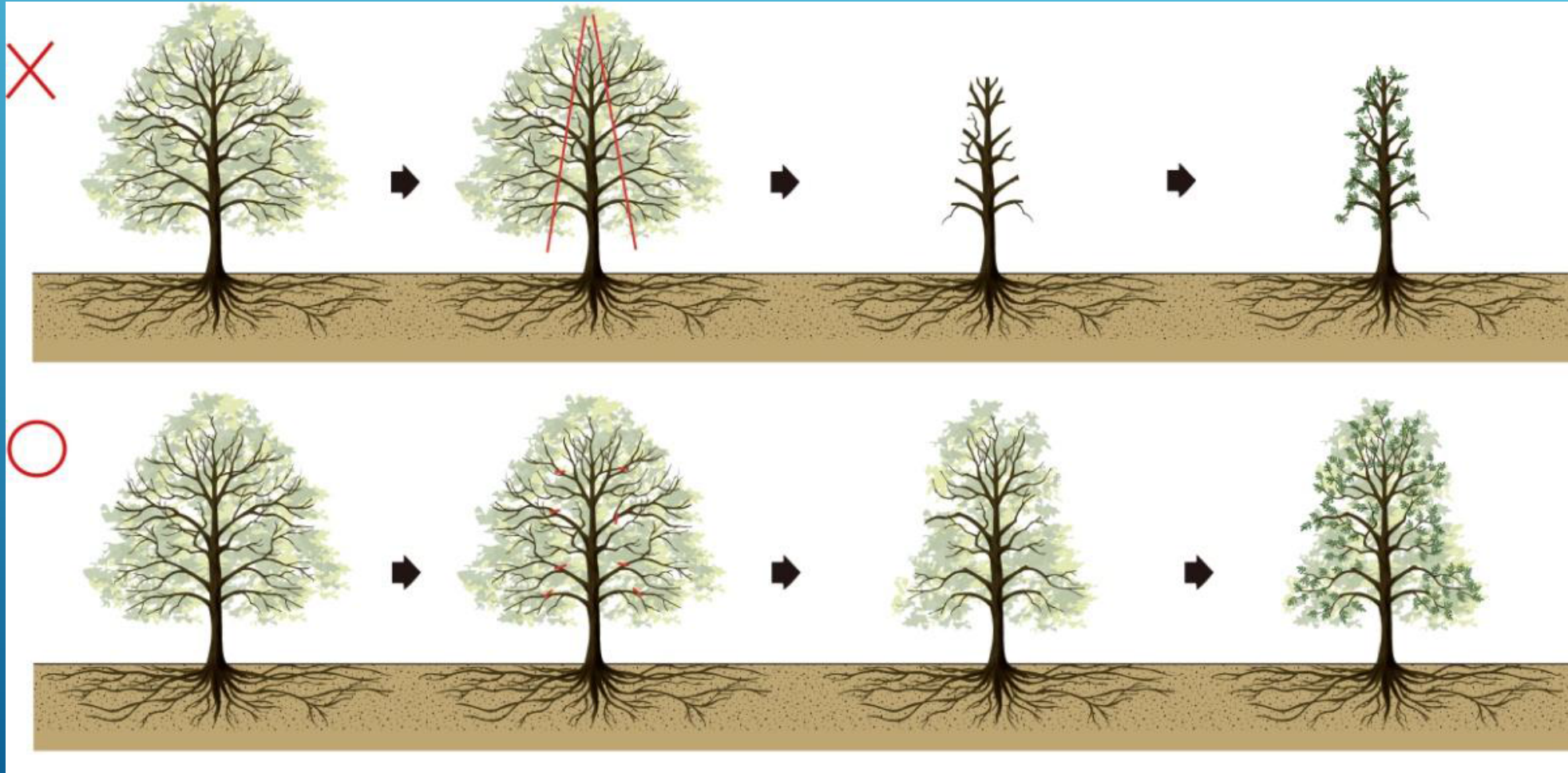
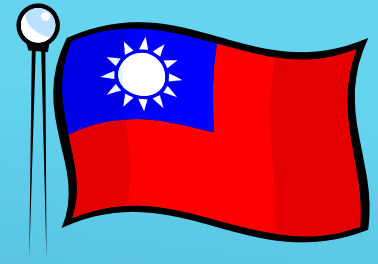
UNITED KINGDOM BS 3998: 2010 TREE WORK— RECOMMENDATIONS

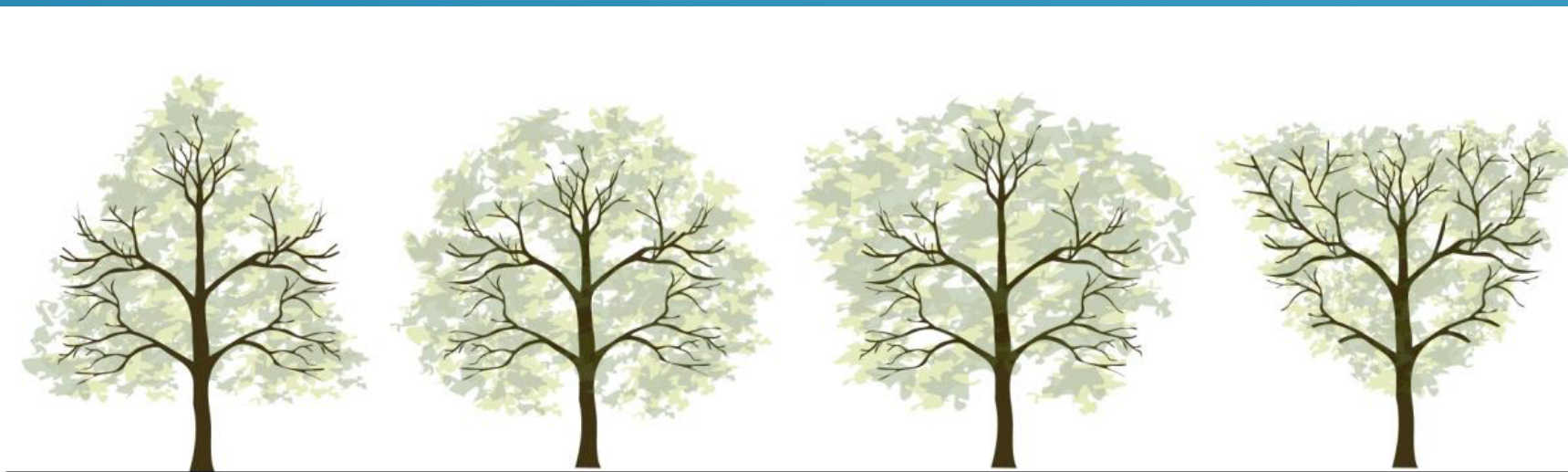
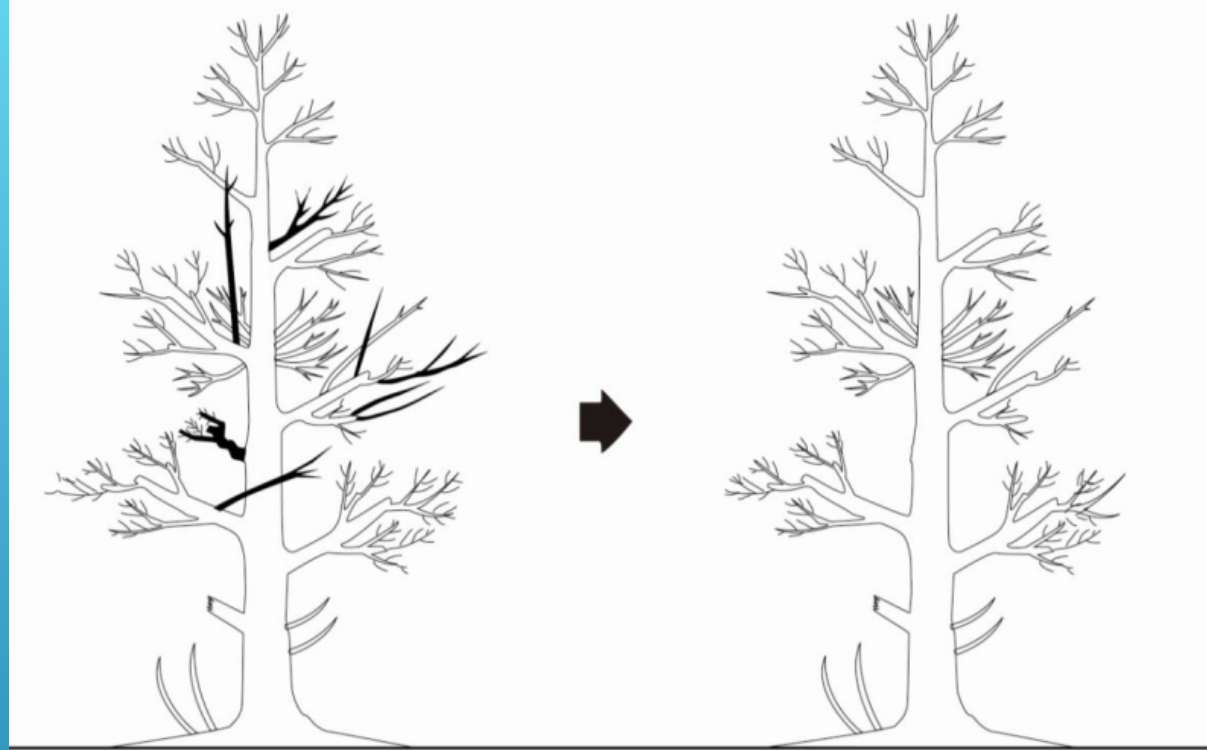
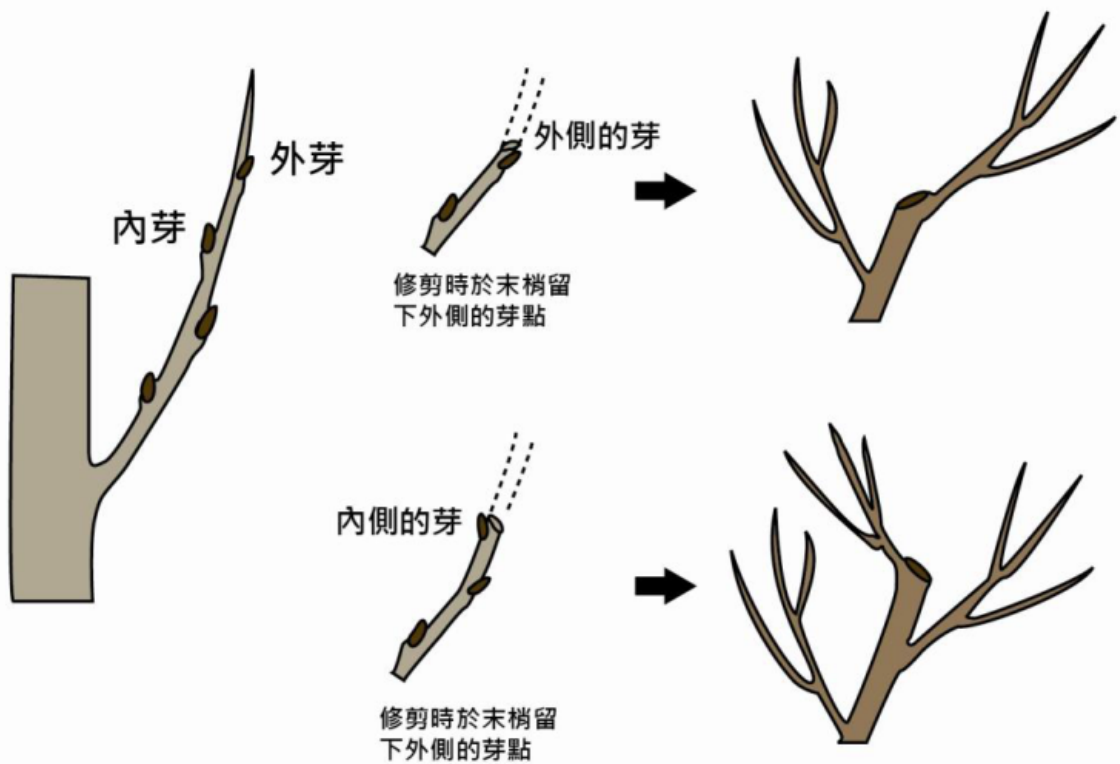


- ▶ Supplemental Support Systems, Pruning, Soil, Safety, Wildlife
- ▶ *Informational wording embedded and italicized*
- ▶ Annex on retrenchment is normative (standard). Annexes on laws, decision-making is informative. Downloadable.
- ▶ Cost: \$305USD, \$152 BSI member, \$59 'short version'.
- ▶ Wording: Mostly 'should's, recommendations, some 'may's, alternatives, 'can's, possible consequences 68 pg.
- ▶ **“Cuts should not be greater than 10cm (4”).**
- ▶ **“Illustrations should be used to communicate...”**

TAICHUNG , TAIWAN PRUNING STANDARD

Pruning only. Free download (Mandarin) Many illustrations, including regeneration







Going down south, this tree on the left is standing up on a latticework. How are we to measure the shell wall on that? It's like a bunch of ropes. On the Hill above Singapore; it's about 50 meters tall; they are some of the emergents, standing on dead tissue.

And how are we going to assess that rascal on the right?

OVER-RAISING = GIRAFFE PRUNING



Keep temporary branches as long as they are needed!

Autumn—September, October pruning -> less sprouting



LIONTAILED TREES FAILED



Give Trees Mitigation, or Give Trees Death

(with apologies to Patrick Henry)

By Guy Mettleur

Risk is the potential for injury. All trees and their parts carry risk. From the acorn on the sidewalk that can make us slip and fall, to that heavy branch that can break off and dent our car, to the old oak tree that can fall apart and crush us. Risk management involves "mitigating" — alleviating, moderating, reducing — that risk.

A "hazard tree" has a defect that creates an unreasonable level of risk to a target and requires action. Only after carefully evaluating the severity of the defect and measuring the size of the part and rating the value of the target can we identify a "hazard." Then the question becomes, how do we mitigate that risk?

Risk posed by acorns is removed by sweeping them off the sidewalk. Risk posed by that heavy branch can be mitigated by light thinning and reduction cuts near the end, or that risk can be removed by removing the branch. But removing that branch increases the risk posed by the rest of the tree. That big wound on the trunk is open to decay. The bark on the inner tree is now vulnerable to sunscald. Nearby

branches are newly exposed to strain from the wind, so they need to add tissue to reinforce themselves or they may break. The roots, too, are more stressed, because they have lost some shelter from sun and wind. The whole tree's balance is changed. It makes less food for itself than it did before. So, did removing that branch mitigate risk, or increase it?

Arborists cannot remove all tree risk, unless we clear-cut the entire planet. Our job is to mitigate risk, by providing clearance for wires or roadways or cars, and maintaining health and stability. At times we must remove branches, or entire trees, but sometimes removing trees increases risk. When a client wants that big tree near the house cut down because they fear it, a few reminders are in order:

The worst-case scenario: Let's assume that the tree uproots in a major storm and falls toward the house. First of all, setting wind exposure and other factors aside, the tree is more likely to fall away from the house, because construction damage, restricted root area and soil compaction tend to limit anchorage toward the house. If we still assume that the tree may fall toward the house, the closer to the house it is, the less velocity it will have, and the less damage it will cause. That 70-foot tall tree that's 50 feet away will do more damage, so where does risk end? In the past, the Federal Emergency Management Agency recommended removing every tree that was tall enough to hit the house, but few homeowners — or arborists — will go along with that program.

What about the "edge effect"? Just as removing a branch exposes other branches to increased stresses, the nearby trees will no longer have that big one near the house sharing the wind with them, and so they will be more vulnerable. They have developed enough girth to stand, but they



Heading these storm-damaged oak branches to nodes instead of reducing them to laterals lessens decay, sunscald, debilitation, frost loss — and risk. Decay recorded one year after heading.

are not used to standing on their own. It will take years for them to add enough trunk tissue to make them stable, and the perfect storm may arrive in the interim. So in some cases, mitigating the risk from that big tree by pruning and root invigoration may make the house safer than removing it entirely.

Bad stubs

Even in 2005, many trees are topped to reduce the perception of risk. Topping cuts are made at locations predetermined by humans. They often leave stubs between branch nodes, which decay rapidly and do not close. They force the tree to respond with weakly attached sprouts, so many topping jobs increase the risk that they were intended to reduce. On normal pruning for branch removal, leaving a stub outside the branch collar creates a barrier to wound closure and a food source for decay organisms. If a tree hangs over the road enough to concern motorists, first look for a lateral with a natural target such as a branch collar. Poor regrowth from decaying wood at topping cuts and large internodal stubs will create a greater risk.



Extensive tear-out wound on ash — past closure, decay wounds downward, cracking around rim.

Good stubs

When trees lose major portions of their canopies to storms, following the standard rule by cutting broken branches back to their origin or a major lateral can increase risk. Larger wounds are more likely to decay than smaller ones. Bark that is suddenly exposed to the sun can be "scalded," by making the tree more lipoidic, we make it less stable. Removing entire limbs because their ends are broken results in less photosynthetic area, thus less food for the tree. Leaving good stubs at nodes can lessen decay, sunscald, imbalance, food loss — and risk. Storm-damaged branches often can be cleaned back to stubs at the first good node, where there is a branch protection zone and dormant buds to carry on good growth.



Co-dominant tear-out wound on sugar maple — woundwood added may be 40 percent stronger than normal wood. Risk very low, little action needed.

Bad rips

When co-dominant stems and branches fail, the injury can extend far beyond the original defect, often catastrophically. This is why it's so important to identify and mitigate those defects ahead of time — by cabling, bracing, subordinating or thinning. One co-dominant can be removed safely if it is small enough for the wound to close. If not, reducing it until it is no more than a side branch — "subordinating" it — can be a permanent mitigation of the risk of failure. Co-dominant tear-outs in older trees are, of course, slower to seal over when the wounds are exposed to the sun and rain, callus tissue is slower to form, since more of its waxy suberin (which provides a waterproof coating) can be dissolved. Straight-grained species such as pine and ash are more likely to have bigger wounds from co-dominant failure, and these wounds are more likely to crack and fail than cross-grained species such as maple and sweetgum.

Repaired rips

If a tree responds to a co-dominant tear-out with good woundwood formation, this must be factored into the strength-loss assessment. Woundwood has been measured to be 40 percent stronger than normal wood. Necessary mitigation steps are often limited to clearing out debris that has been caught in the bottom of the wound, trimming the jagged wood and "bracing" the loose or jagged bark. The goal is to minimize the "pocket" that catches water and infectious material, speeding closure. Depending on weight and wind exposure, light thinning or reduction cuts at the branch ends to lessen strain on the defect may be advisable, to further mitigate the risk.

The first thing property owners are concerned about is safety, and understandably so. Each person has their own definitions of how much tree risk is acceptable, depending on how much they value the tree, what condition the tree is in, and how much they value the nearby target. Risk management is a straightforward way to advertise, prioritize, and sell tree care services. It all starts with inspection and assessment of trees, best done on a regular

basis. Basic references, such as the book (Evaluating Tree Defects: A Field Guide WE SELL IT) and TCI's VIDEO on "Hazard Tree Risk Assessment & Mitigation for Tree Workers," outline ways to systematically inspect trees. The US Forest Service also has a manual on "Urban Tree Risk Management," free for the downloading at [www.na.fs.fed.us/spfo/pubs/utrm/](http://www.na.fs.fed.us/spfo/pubs/utrm/utrm/)

Armed with basic knowledge and their own experience and common sense, inspectors can adopt the owner's mindset on acceptable levels of risk and deliver a tree care program that mitigates risk while increasing the tree resource. In essence, tree risk management and plant health care are really the same thing. Inspection and monitoring take vigilance. Responding to tree health and safety issues requires action. For the arborist and the owner to both accept that risk is a fact of life, that you cannot mitigate that risk by tree removal alone, requires bravery. The words of Patrick Henry again apply to tree care: "We are not weak if we make a proper use of those means which the God of Nature has placed in our power ... the battle, sir, is not to the strong alone. It is to the vigilant, the active, the brave."

Guy Mettleur is with Better Tree Care in New Hill, N.C. He will be presenting a discussion on this same subject, *Tree Risk Assessment & Mitigation*, at TCI EXPO in Columbus, Ohio, on Nov. 10.



This fast-growing cherry tree hanging over the road, obscuring motorists. Regrowth from decaying wound at topping cuts will create a greater risk.

2005

Looking
at risk,
and

Basic Tree Risk Assessment

By Guy McPherson

LEARNING OBJECTIVES

The arborist will be able to:

- review and apply the basic concepts of liability and tree risk.
- understand the process of basic tree risk assessment and some of the business management factors to be considered.
- explain a system for thoroughly and consistently assessing tree and site conditions.
- know the difference between some lower risk conditions and some higher risk conditions.

"Can you tell me if this tree is safe?"

We've all heard variations of this question, and it's a tough one to answer. Hurricane season is almost over in many areas of the United States, and tree owners have seen enough storm devastation, live and on television, to have some real concerns about their trees. The winter storm season lies ahead in other areas. Trees everywhere are exposed to gravity 24/7/365, and Nature's more explosive forces can strike at any time. Tree owners decide how much tree risk they will accept, depending on how much they value the tree, what condition the tree is in, and how much they value the nearby people and property—the "targets."

Tree assignment, should you choose to accept it, is to calculate and clearly communicate to the owners the risk associated with their tree, and what they can do about it.

"Risk" means danger, the possibility of suffering loss. The reality is, everything carries risk. A "defect" has been defined as a visible sign that a tree has the potential to fail. However, because every tree has the potential to fail, the questions of how visible, and how much potential, remain. Any harmless feature of a tree that looks unfamiliar to the inexperienced observer can be called a defect that creates a "hazard tree," defined as a tree with an unacceptable level

of risk to a target. The question is, what can be done about it? All risks can be lowered (abated, mitigated, lessened), but when afterthoughtful options are not carefully considered and clearly communicated, the owners cannot make an informed decision. Quickly labeling "defects" and "hazards" can lead to the needless removal of valuable trees, when more conservative actions may have been more reasonable.

Basic tree risk assessment involves an objective, systematic review of the tree's condition (good and bad), the site, and the exposure of targets. By listening to the owners' history of the tree and the site, you can gain vital information on the tree's condition, the use of the site, and associated risk. Both parties benefit from the insights and intelligence working in the other. As a professional arborist, you demonstrate competence and trustworthiness by looking at the tree's strengths as well as their weaknesses. It is important to learn all you can about past maintenance practices, previous symptoms noted, and changes in nearby plants. Recent disturbance, such as construction, grade changes, and trenching, can impact the stability of trees on the site and increase their risk of failure.

Risk is a fact of life—it's only a matter of degree. One attempt to numerically measure the degree of risk is the Quantified Tree Risk Assessment system (QTRA), which was devised in the context of law in the United Kingdom. Using this system, the risk of harm presented by a tree with dead branches over a road is 1 in 8,200. Removing the dead branches reduces that risk to 1 in 41,000. For safer than the 1 in 10,000 that is considered by medical groups to be an acceptable level of risk to the public.

You may or may not want to put a hard number on risk, using the QTRA or another system. It all depends on the job and the owners' needs and style of communication, but it is important to remember that there is no zero-risk scenario. An experienced arborist can inspect a tree, assess its relative terms the risk of failure and the risk of harm, and describe reasonable actions that can lower those risks.

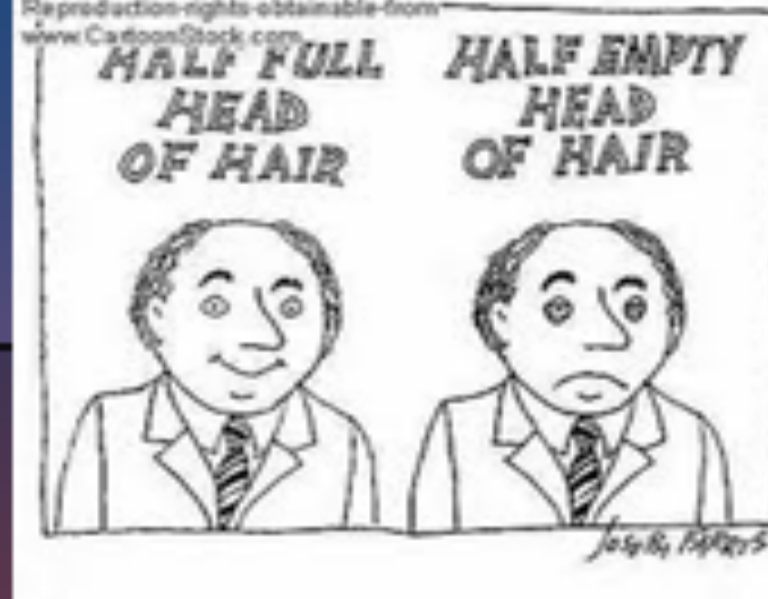
LIABILITY

Some arborists choose not to accept the assignment of assessing risk, out of a generalized concern about getting sued. Liability is assumed according to four specific factors:

- duty, the responsibility for the tree's care
- breach, the failure to act reasonably
- harm, damage or injury
- cause, proof that the breach resulted in the injury

A certain level of liability is unavoidable no matter what we do or not do, but there are steps that can limit our own personal and professional liability when assessing tree risk. First, define your assignment so that you and the owner understand the level of detail that you will be going to, and what items the written report will take. Second, unless you have a tag "S" on your chest, you cannot see inside the tree or under the tree. You cannot foresee what storms will be seeing the tree's strength, so you cannot guarantee its safety for a week or even for a day. You must state the job's limitations in a written "disclaimer." Finally, make it clear that

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com



This 2007 article proposed a balanced view toward assessing tree **strengths** as well as weaknesses, assets as well as liabilities, contributions along with targets. The tree is the owner's property, and it has value. **The tree is the first target to consider!** Ignoring tangible positives while focusing on perceived defects is not tree structure evaluation. It is tree structure **devaluation**. Look first at how tree stand up, and second how trees fall down.



Basic Tree Risk Assessment Form

Client _____ Date _____ Time _____
Address/Tree location _____ Tree no. _____ Sheet _____ of _____
Tree species _____ dbh _____ Height _____ Crown spread dia. _____
Assessor(s) _____ Time frame _____ Tools used _____

Target Assessment

Target number	Target description	Target zone			Occupancy rate 1 – rare 2 – occasional 3 – frequent 4 – constant	Practical to move target?	Restriction practical?
		Target within drip line	Target within 1x Ht.	Target within 1.5x Ht.			
1							
2							
3							
4							

Site Factors

History of failures _____ Topography Flat ☐ Slope ☐ _____ % Aspect _____

Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe _____

Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ _____ % Describe _____

Prevailing wind direction _____ Common weather Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe _____

Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ Foliage None (seasonal) ☐ None (dead) ☐ Normal _____ % Chlorotic _____ % Necrotic _____ %

Pests _____ Abiotic _____

Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe _____

Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ Relative crown size Small ☐ Medium ☐ Large ☐

Crown density Sparse ☐ Normal ☐ Dense ☐ Interior branches Few ☐ Normal ☐ Dense ☐ Vines/Mistletoe/Moss ☐

Recent or planned change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☐ LCR _____ %
Dead twigs/branches ☐ _____ % overall Max. dia. _____
Broken/Hangers Number _____ Max. dia. _____
Over-extended branches ☐
Cracks ☐ Lightning damage ☐
Codominant ☐ Included bark ☐
Weak attachments ☐ Cavity/Nest hole _____ % circ.
Previous branch failures ☐ Similar branches present ☐
Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐
Conks ☐ Heartwood decay ☐
Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐
Codominant stems ☐ Included bark ☐ Cracks ☐
Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐
Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐
Cavity/Nest hole _____ % circ. Depth _____ Poor taper ☐
Lean _____ ° Corrected? ☐

Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Roots and Root Collar —

Collar buried/Not visible ☐ Depth _____ Stem girdling ☐
Dead ☐ Decay ☐ Conks/Mushrooms ☐
Ooze ☐ Cavity ☐ _____ % circ.
Cracks ☐ Cut/damaged roots ☐ Distance from trunk _____
Root plate lifting ☐ Soil weakness ☐

Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Time Frame: 1 year? 100 years?

The TRAQ form is also called “Basic Tree Risk Assessment.” It’s somewhat similar to the old form that was in print 1994 but there are some good additions.

In only three places the user is oriented to look at the trees response growth, something that's holding the tree up, in response to loading.

Staying within this timeframe throughout the assessment process avoids ‘erring on the side of safety’. Those intentional mistakes can get compounded, and lead conclusions astray.

‘Improbable’ is very often true, but seldom chosen. After all, ‘Anything is ‘Possible’. Users who are wary of semantics will NOT skew opinions to the negative.

Risk Categorization																							
Condition number	Tree part	Conditions of concern	Part size	Fall distance	Target number	Target protection	Likelihood												Consequences				Risk rating of part (from Matrix 2)
							Failure				Impact				Failure & Impact (from Matrix 1)								
							Improbable	Possible	Probable	Imminent	Very low	Low	Medium	High	Unlikely	Somewhat	Likely	Very likely	Negligible	Minor	Significant	Severe	
1																							
2																							
3																							
4																							

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Notes, explanations, descriptions

Mitigation options

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐

Overall residual risk Low ☐ Moderate ☐ High ☐ Extreme ☐

Data ☐ Final ☐ Preliminary **Advanced assessment needed** ☐ No ☐ Yes-Type/Reason _____

Inspection limitations ☐ None ☐ Visibility ☐ Access ☐ Vines ☐ Root collar buried Describe _____

Investigative research, practice, and experience reduce the inflated perception of tree risk

- 4 Mitigation Options: Actions to lessen risk:
- Pruning: 1-3 meter crown retrenching
- Support: Add 2 cables to lessen pruning
- Soil Modification: Aerate and Amend
- Pest Management: Treat infections

Residual risk

Residual risk

Residual risk

Residual risk

Residual risk

Residual risk

Residual risk

Residual risk

Tree Risk Assessment



Companion publication to the ANSI A300 Part 9: Tree, Shrub, and Other Woody Plant Management—Standard Practices (Tree Risk Assessment a. Tree Structure Assessment)

“Defect: an imperfection, weakness, or lack of something necessary. In trees, defects are injuries, growth patterns, decay, or other conditions that (“may” added in 2015) reduce the tree’s structural strength.”

We guess much more than we know about what *decreases* tree strength. How good is our guessing????

We know what *increases* tree strength. This matters most.

Give trees a chance, to express their ability to respond, adapt, and grow.

JUNE 2014 EPISODE ON PRUNING A HOLLOW TREE

DETECTIVE DENDRO THE DIAGNOSTIC SLEUTH

By Guy Meilleur

The Case of the Lonely, Lashing Leader

After a week of witnessing pull tests and dissecting brush, Codit and I were aching to study the biomechanics of a standing, living tree. We got permission to visit the state champion red oak (*Quercus rubra*), which was cared for by our buddy, Jan Honeyman. The owner wanted it remeasured and nominated for the U.S. National Register of Big Trees. Jan also invited our old friends from Hong Kong, soil expert Ru Trundiepe, and his aerial assistant, Clai Minghai, along with two European colleagues. We all loaded our everyday gear, so we were ready for soil assessment, root measurement, climbing, tomography, resistance drilling, and sounding. The drive out to the tree was charged with anticipation. We parked along the street and started unloading the gear while Jan met with the owner. Just then, a man approached us from the property next door.

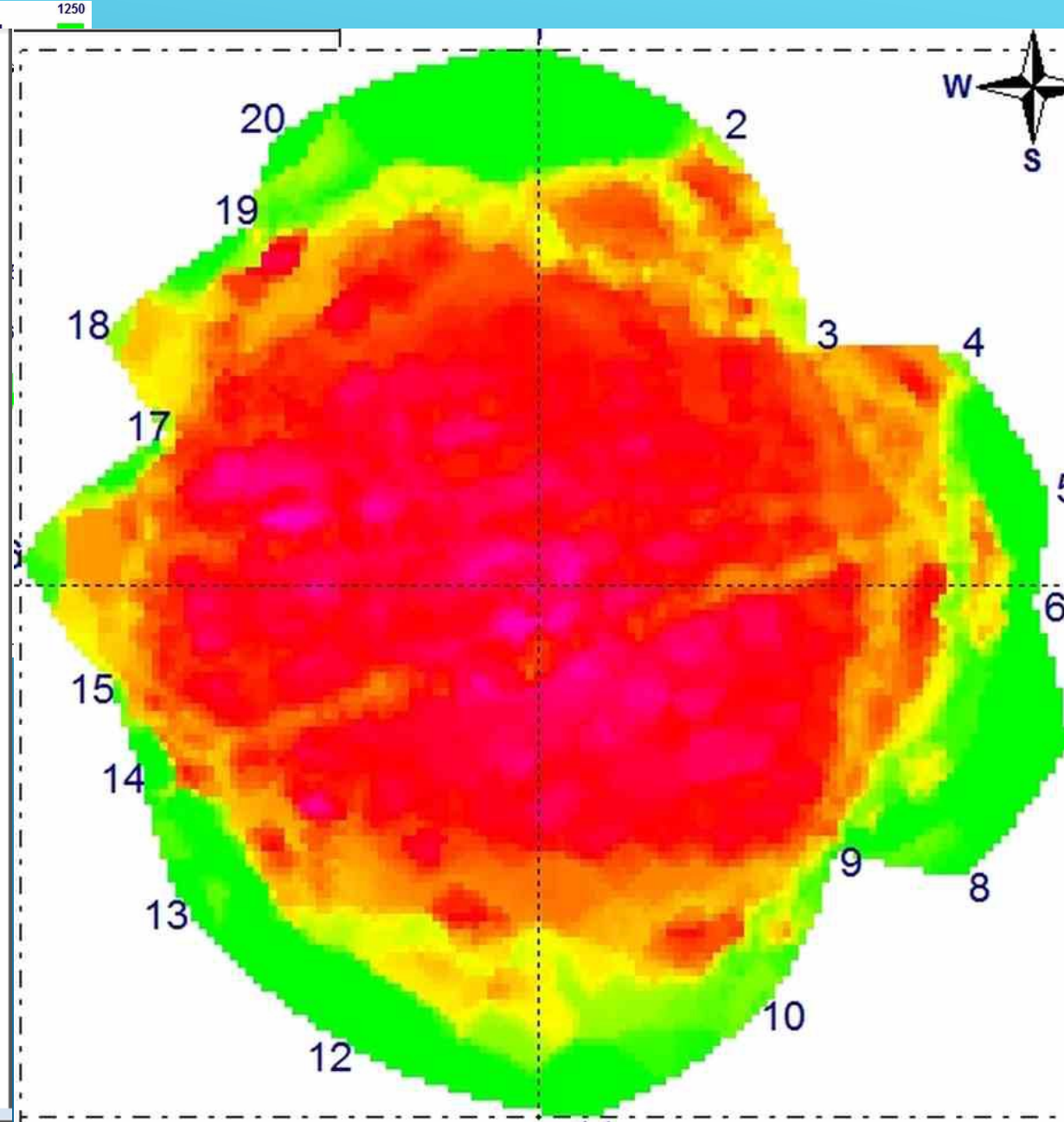
"So you're the tree crew, huh?" He hooked his thumbs under his belt and spat to the side. "It's about time that monster got removed. It's a ticking time bomb."

Codit cupped his hands behind his oversized ears and leaned toward the backyard, where the huge tree stood. His face squinted in silent concentration, but he shook his head. "I can't hear the ticking from here, sir. I'll listen again when I get closer."

The rest of us tried to keep from laughing as we promptly proceeded to the tree. The neighbor struggled to reply, but walked away after he saw the tree's owner approaching from the back garden.

"Good morning," she greeted us. "I'm Edith Robala-

went back to her gardening. Clai helped Codit with the pre-climb assessment, and ascended to check the eleven heavy cables that held the crown together. Ru and I used the long measuring tape to confirm the average crown spread, then sent it up to Codit, to drop from the summit. The rest of the team fastened twenty-four sensors to the gigantic



Case Study 5, OH state
champ *Quercus rubra*
Northern red oak

1 Assignment

Previous inspections showed that the oak has internal decay. The extent had to be assessed to evaluate both current safety and the future of this exceptional tree, using stress-wave ('sonic') tomography (ARBOTOM®), root diagnostics (ARBORADIX™) and resistance drilling.



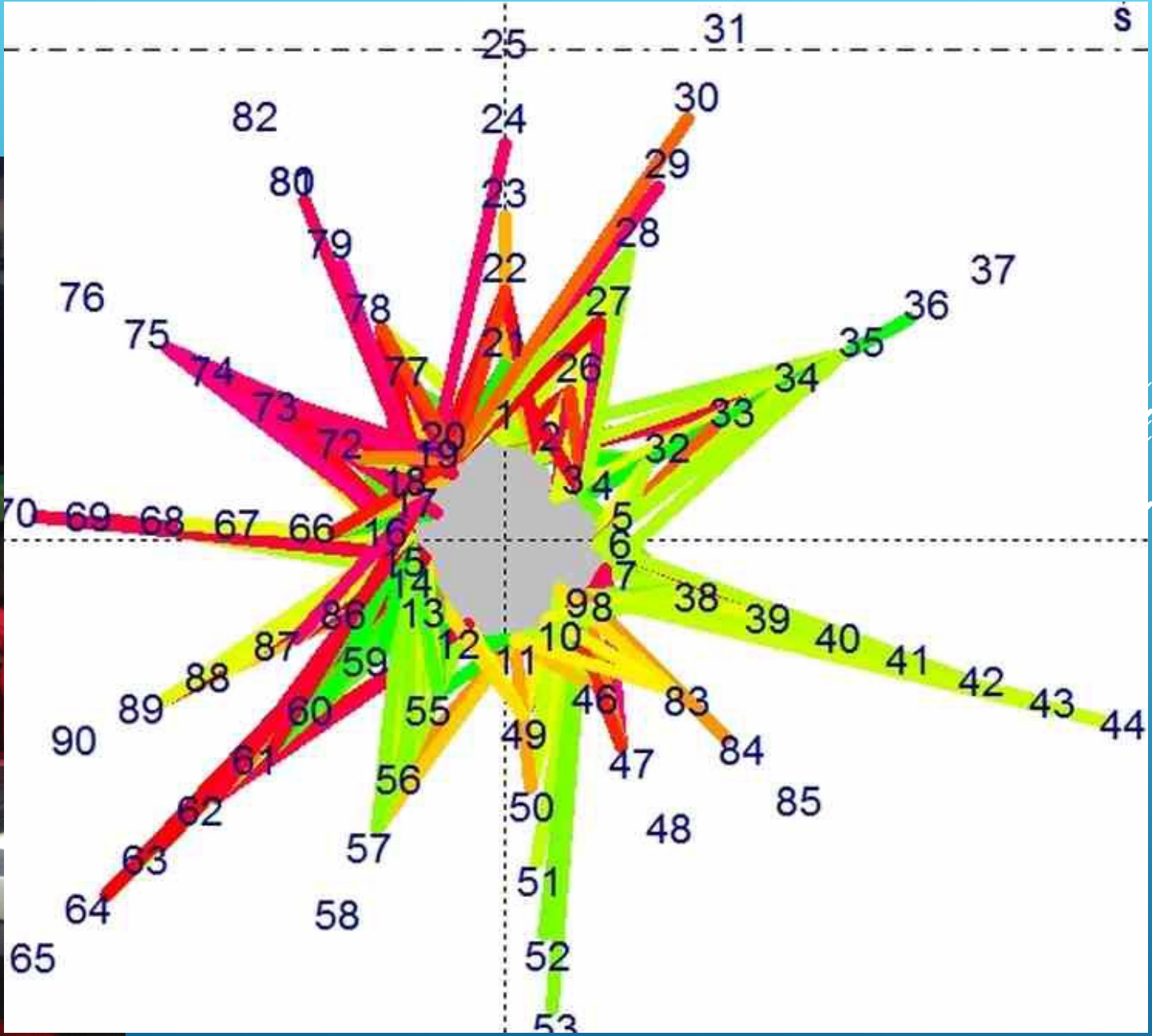
**TREE
RESPONSE.**



Phellinus

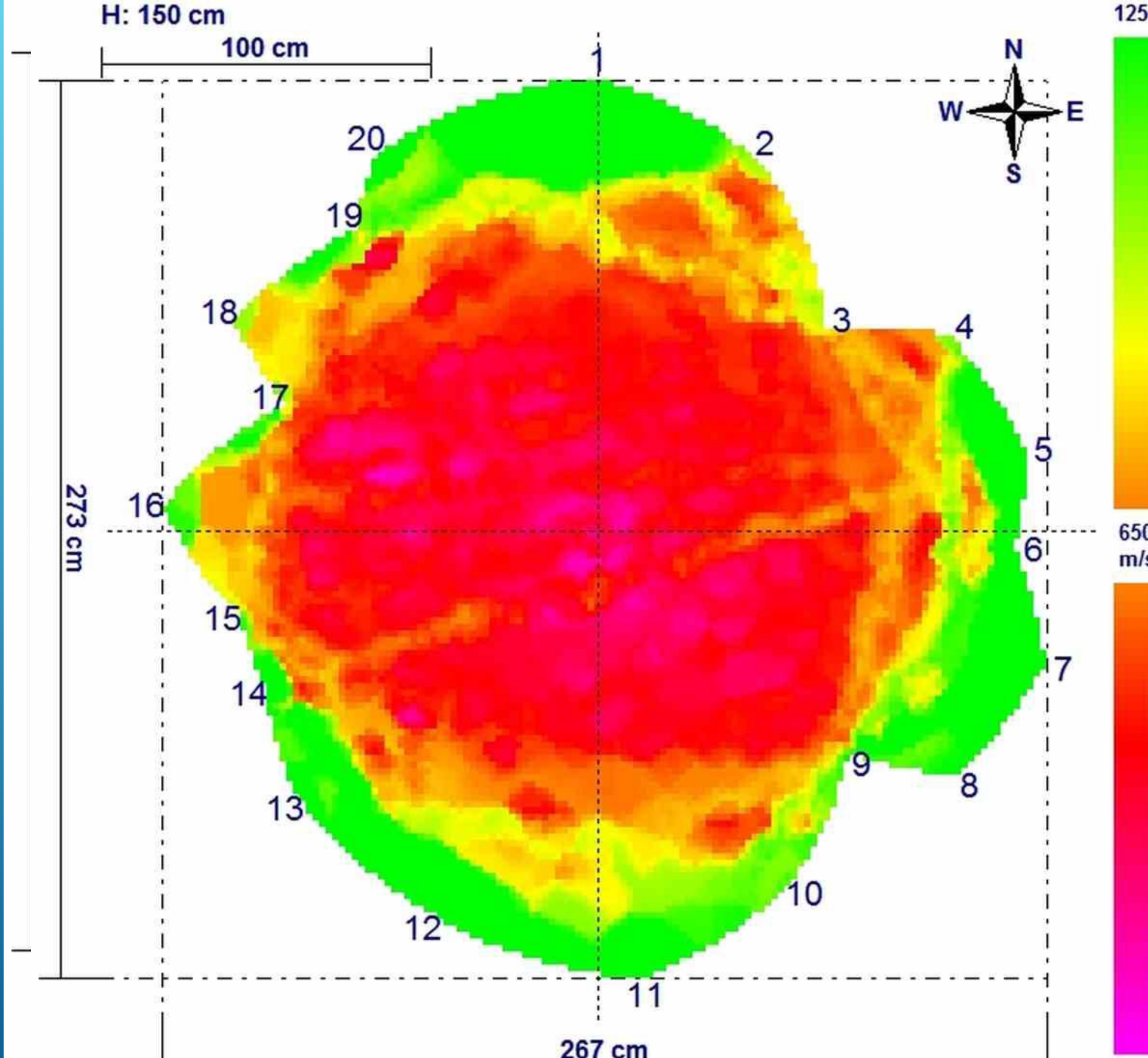


Root assessment gear and readings: More solid on eastern side, where invigoration work had been done.



Tomogram shows large hollow, with 3 areas of the shell quite thin. Speculation arises whether this tree is actually 3?+? Trunks that 'fused' together long ago...and now may be coming apart.

But the assessment was more about facts derived from inspection rather than speculation based on assumptions and generalisations that are based on generalisations and assumptions and speculation.



Vista shot to NW.
Owners Love Vistas!

Acorn crop heavy;
how will
retrenchment
redistribute fruit
loading?

Vigor at interior
nodes = locations
for pruning cuts.



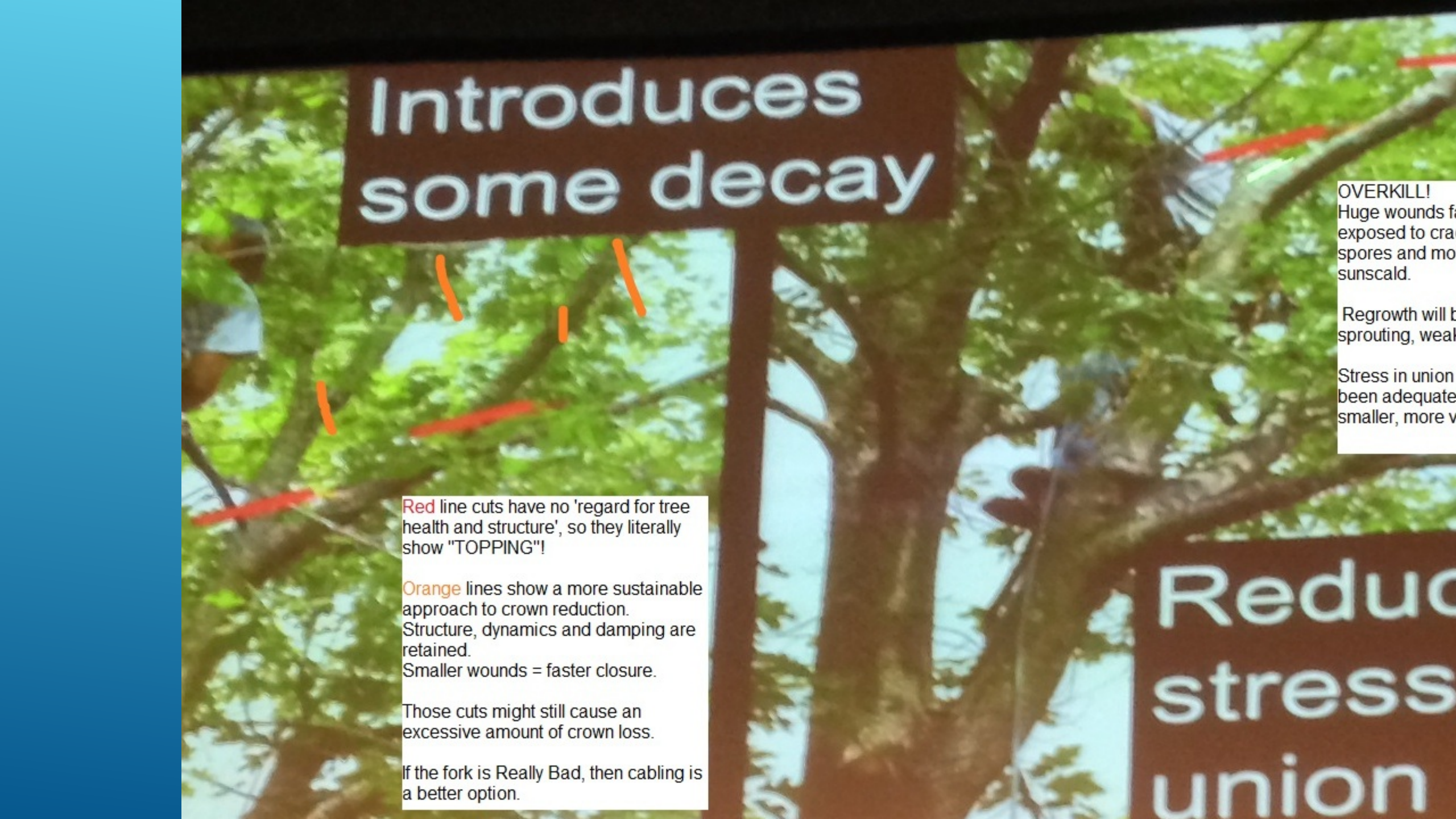




The dark area suggests what the ultimate crown size might be, in what I considered to be a worst-case sort of scenario.



Spec: Cuts 1"-2", reduce tips 3'-9', back to active growth points. Remove <9% total # buds. Retain apex and crown spread points.



Introduces some decay

Red line cuts have no 'regard for tree health and structure', so they literally show "TOPPING"!

Orange lines show a more sustainable approach to crown reduction. Structure, dynamics and damping are retained. Smaller wounds = faster closure.

Those cuts might still cause an excessive amount of crown loss.

If the fork is Really Bad, then cabling is a better option.

OVERKILL!
Huge wounds far
exposed to cracks,
spores and moisture
sunscald.

Regrowth will be
sprouting, weak

Stress in union
hasn't been adequate
smaller, more v

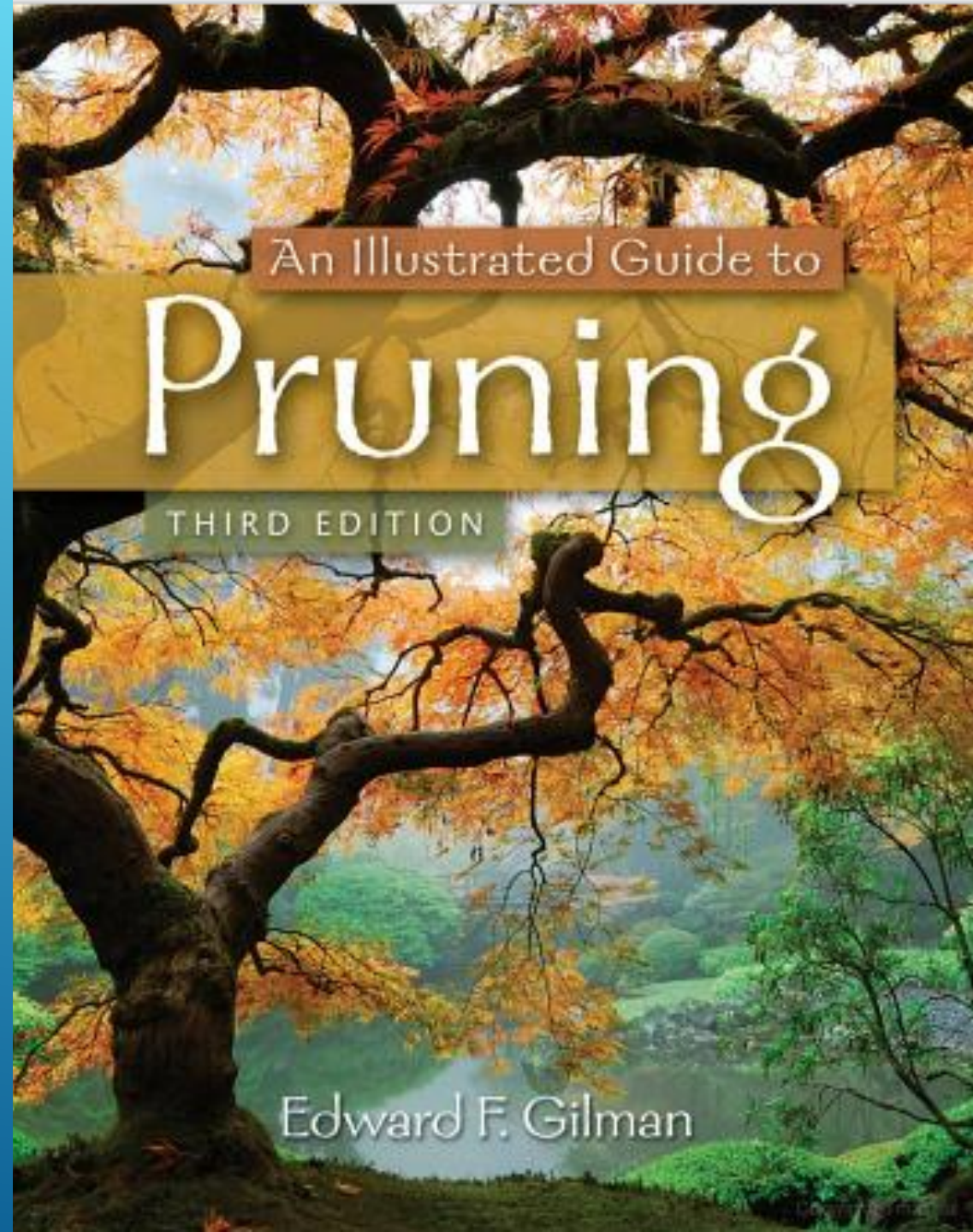
Reduc stress union

Dr. Ed Gilman, University of Florida:

“In Sweden, 600 to 800 year old trees have been reduced for hundreds of years.

4 or 5 foot trunks-some even larger - with 4 inches shell wall.

We remove too many trees and prune too few!”





















MD DNR: ~2-3 miles of cable attached. No reduction pruning.

1989: Drilled ~2' above grade, 4.5" sapwood measured

1997: Drilled ~2' above grade, 4.5" sapwood measured.

2006: Wye Oak fails ~2' above grade...

Reports disclaimed: "Even if these rings were counted, to prorate this very small sample across the diameter of the tree (112" @ dbh) would provide very unreliable results- a 'guesstimate' at best."

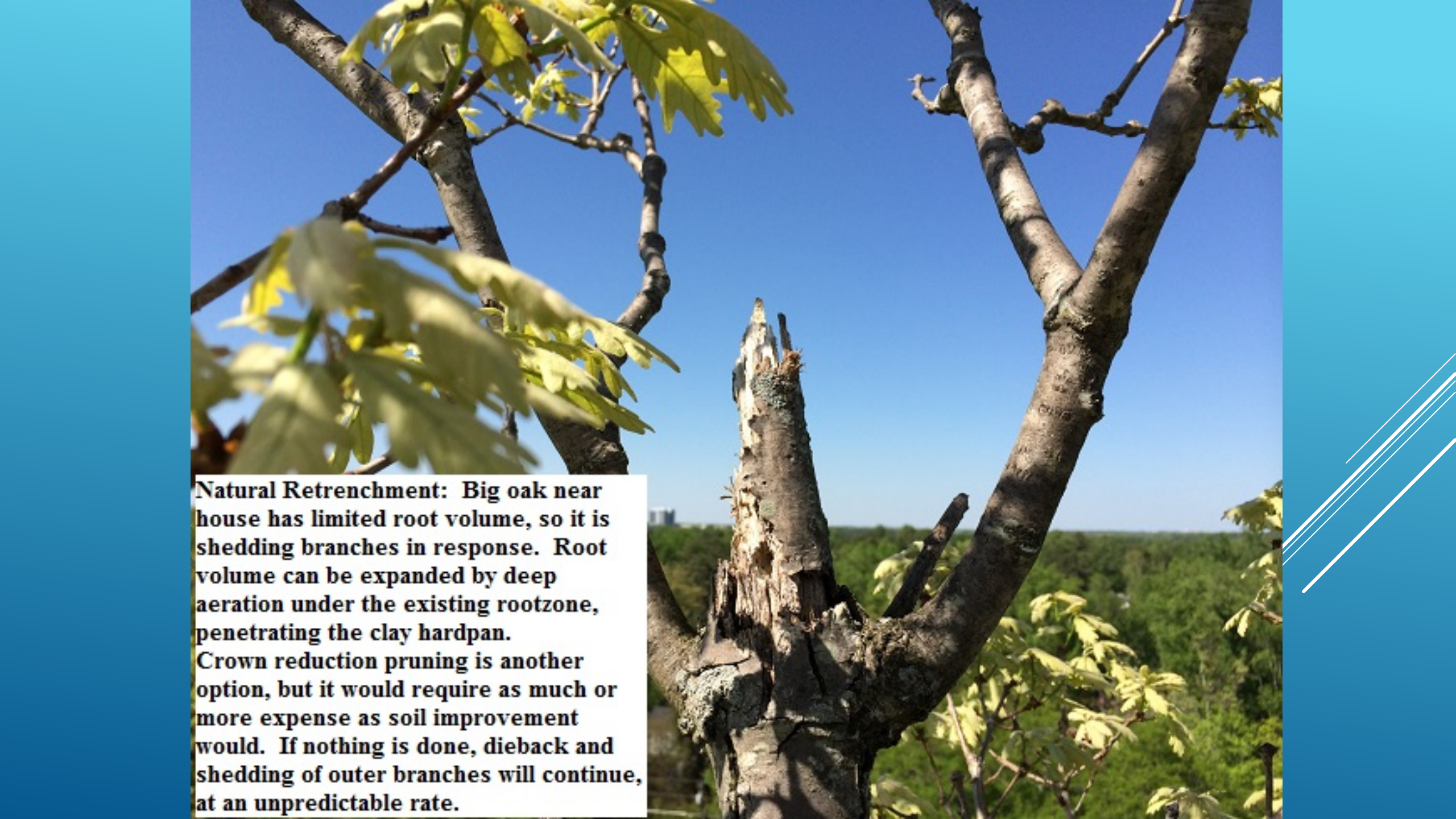
Was more drilling needed? No amount of this data can be used without overextrapolating. Is such guessing better, or worse, than no invasive assessment at all?



This is our former national champion white Oak the Wye Oak.. How did the cabling affect biodynamics? Support systems are good strategies, but reduction pruning should come first.



Wildlife need the trees. We need to maintain habitat in the trees for spiders and all these other beneficials in this ecosystem



Natural Retrenchment: Big oak near house has limited root volume, so it is shedding branches in response. Root volume can be expanded by deep aeration under the existing rootzone, penetrating the clay hardpan. Crown reduction pruning is another option, but it would require as much or more expense as soil improvement would. If nothing is done, dieback and shedding of outer branches will continue, at an unpredictable rate.

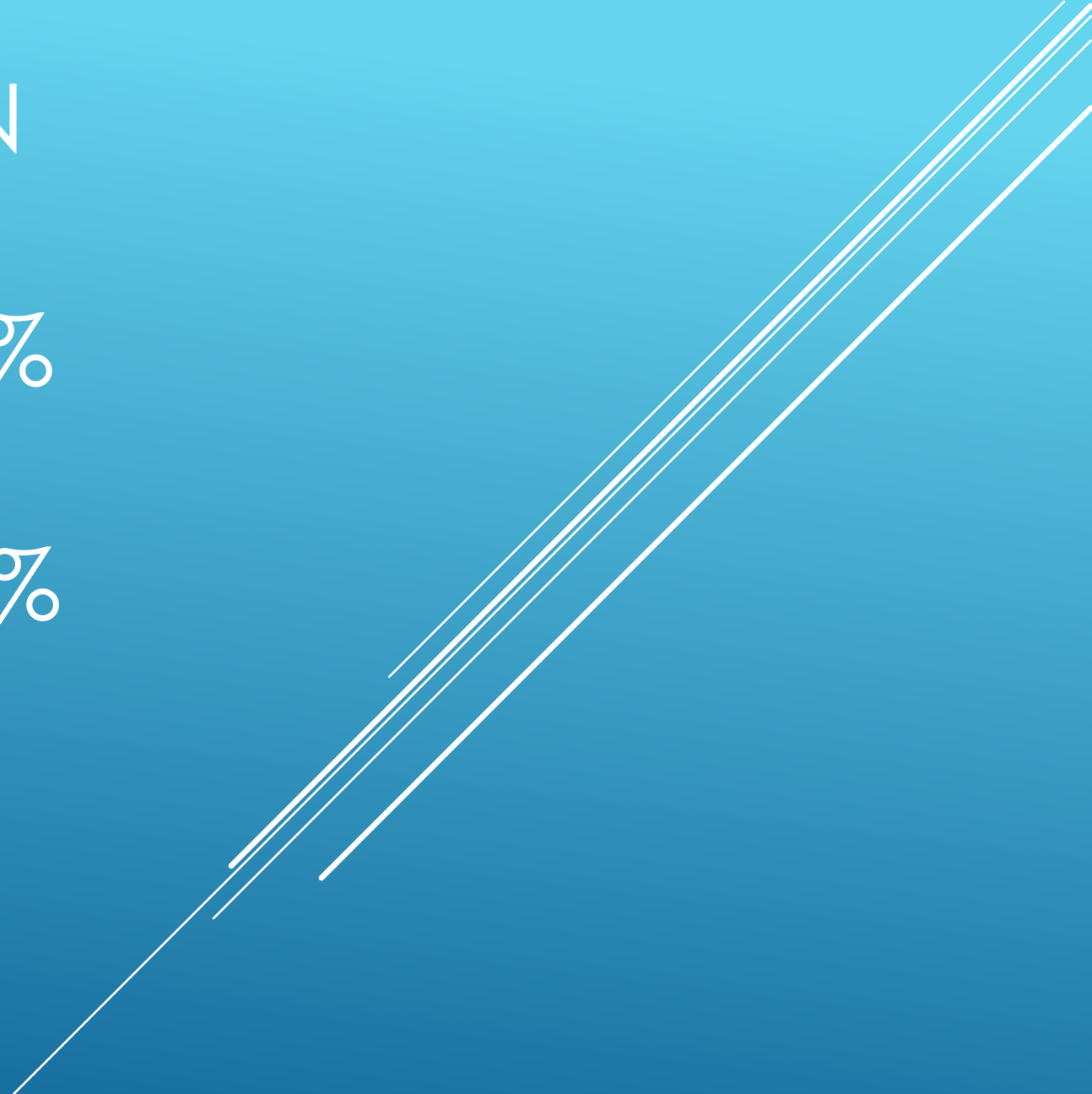
CROWN REDUCTION

CROWN HEIGHT -14%

CROWN AREA -24%

SAFETY FACTOR +50%

Paul Muir - Arboricultural Consultant



CONIFER CARE GUIDELINES

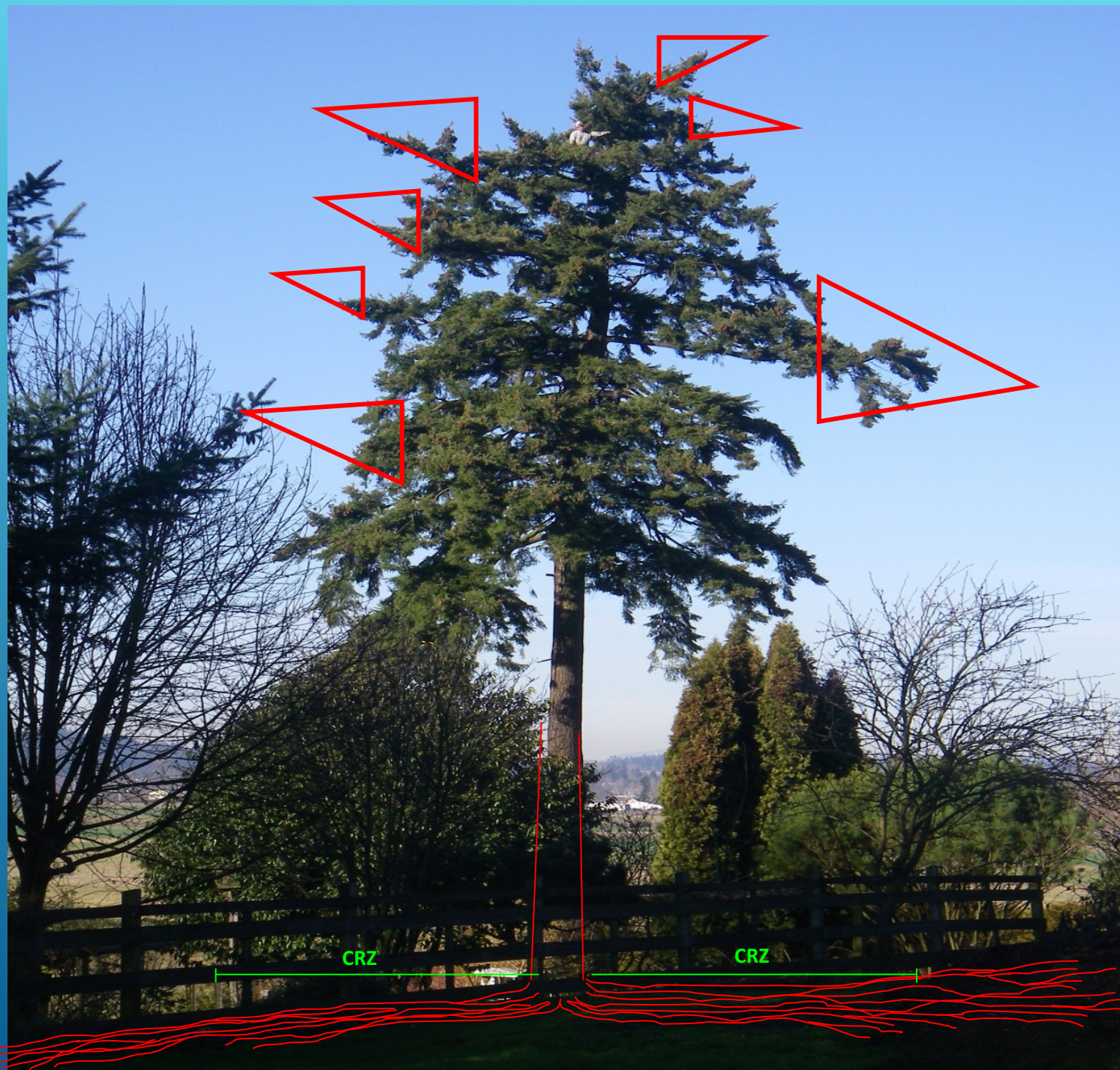
LESSONS LEARNED IN THE PACIFIC NORTHWEST

PRESENTED BY NICHOWHITTAKER DANKERS
SEATTLE, WA

In a Climbers' Corner presentation on the tradeshow floor, Nicho Dankers gave the best talk on pruning I have ever heard. He applies the principles of retrenchment pruning to conifers.

Targeted reduction of overextended branches in the upper crown can significantly extend a tree's useful life.

Nicho is pursuing a Master's at the University of Washington, working with Douglas-fir trees.





Case Study 1: White Oak

OWNERS WANTED TO SEE IF THIS TREE WAS GOING TO DO THE SAME AND IF IT WAS INCLINED TO FAIL WHAT TO DO ABOUT IT. THAT MEANS SPECIFY MITIGATION OPTIONS.

ON LARGE TREES OF SIGNIFICANCE I TYPICALLY DO NOT MAKE RECOMMENDATIONS. I **RECOMMEND** THAT YOU DO NOT OFFER TO MAKE RECOMMENDATIONS AS A DEFAULT SERVICE.

WHO DO WE THINK WE ARE WE ARE? WE WERE HIRED TO PROVIDE INFORMATION, SO THE OWNER CAN MAKE THE DECISION ABOUT THE TREATMENT OPTIONS.

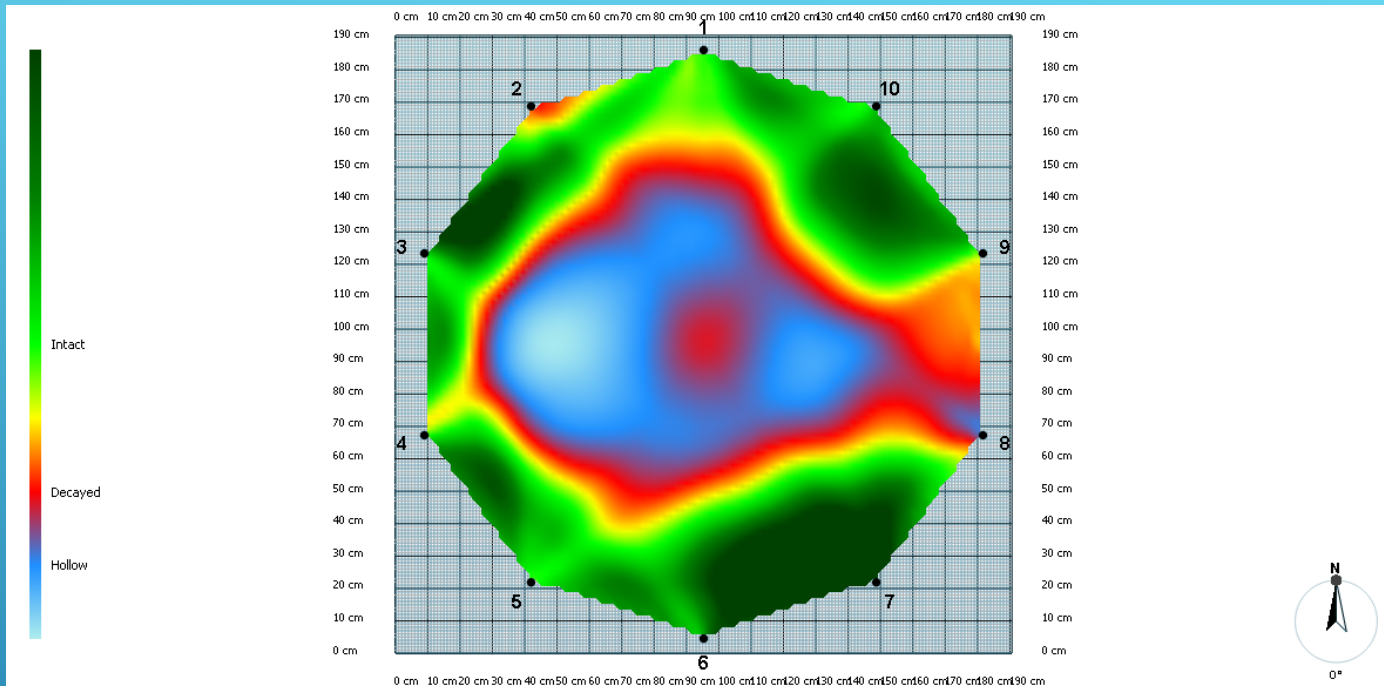
IN ORDER TO TELL SOMEBODY HOW TO MANAGE THEIR TREE WE HAVE TO UNDERSTAND THEIR BUDGET. WE HAVE TO UNDERSTAND WHAT THEY THINK OF THE TREE.

AVOID MAKING RECOMMENDATIONS UNLESS YOU ARE SPECIFICALLY ASSIGNED TO, AND GIVEN A BUDGET TO COMPETENTLY DO IT. CONSIDER KEN JAMES' APPROACH: "I JUST GIVE INFORMATION AND LET THE CUSTOMER DECIDE WHAT TO DO WITH IT."



Bodnarzewia berkleyii:
a rare fungus known to
cause white rot.

Weighing in at....
19 Pounds!



41.9% Decay

Spreading faster



to the back wall

READING 3 : 5 CM HIGH

for Tree Care Operations –
Tree, Shrub, and Other Woody Plant
Management – Standard Practices
(Root Management)



“83.3.4 INSPECTION SHOULD INCLUDE...:

CONDITIONS IN THE CROWN THAT MAY REFLECT ROOT CONDITIONS;

STEM TISSUE **CONNECTING** THE CROWN AND THE ROOTS;

GIRDLING OF BUTTRESS ROOTS OR STEMS BY ROOTS OR FOREIGN OBJECTS,
AND THE TREE’S **RESPONSE**;

TREE ASSOCIATION WITH **BENEFICIAL** AND HARMFUL INSECTS;

TREE ASSOCIATION WITH PATHOGENIC AND **BENEFICIAL MICROORGANISMS**
(E.G. MYCORRHIZAE);

WOUNDS, AND THE TREE’S **RESPONSE TO WOUNDS**;

MECHANICAL DAMAGE TO DETECTABLE ROOTS, AND **RESPONSE**;

INDICATIONS OF ROOT DISEASE AND, **RESPONSE** AND

GRAFT UNIONS IN GRAFTED TREES;”

MULCH, SOIL AND FOREIGN MATERIAL SHOULD BE REMOVED TO ALLOW
INSPECTION.

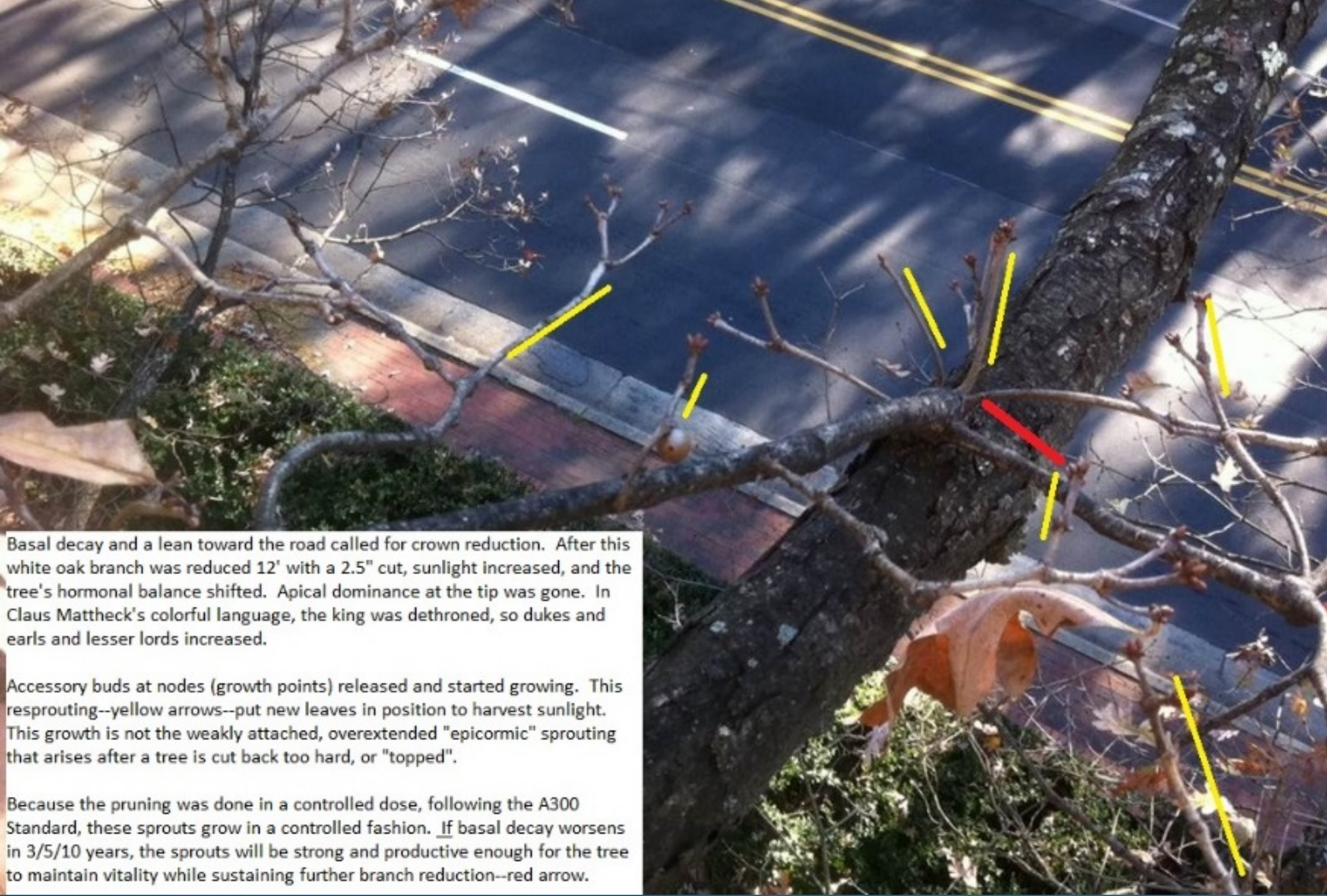
BARK TRACING OF WOUNDS SHALL REMOVE **ONLY** DEAD, LOOSE, FOREIGN
AND DAMAGED TISSUE.

EVALUATE DECAY, CALLUS AND **WOUNDWOOD GROWTH, AND RESPONSE
GROWTH** IN TRUNK AND CROWN.”

- ▶ Advancing basal decay called for further reduction of the crown by 9%.
- ▶ Response growth seen in scarring, buttressing.
- ▶ Response in sprouting highly significant.

2013





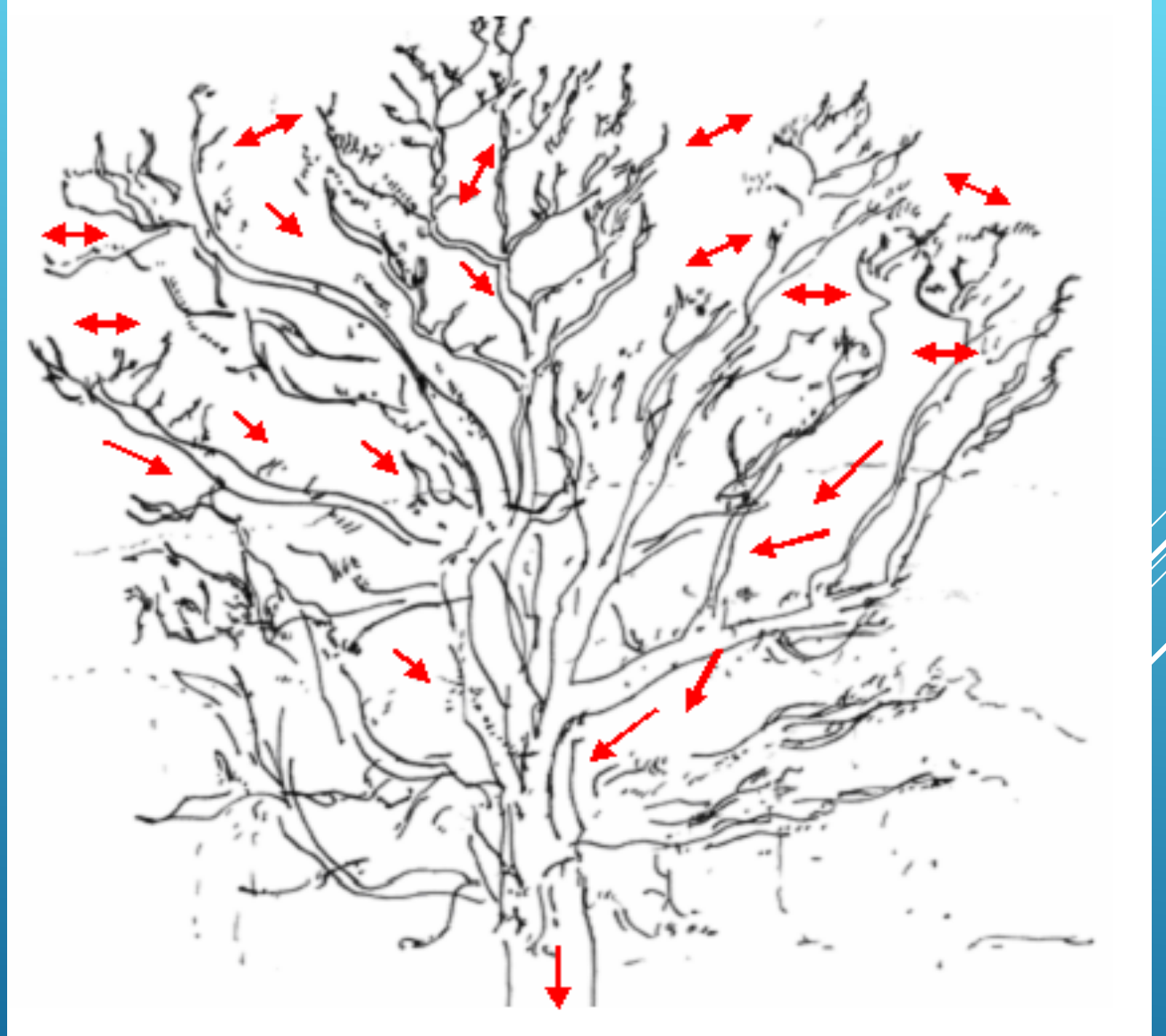
Basal decay and a lean toward the road called for crown reduction. After this white oak branch was reduced 12' with a 2.5" cut, sunlight increased, and the tree's hormonal balance shifted. Apical dominance at the tip was gone. In Claus Mattheck's colorful language, the king was dethroned, so dukes and earls and lesser lords increased.

Accessory buds at nodes (growth points) released and started growing. This resprouting--yellow arrows--put new leaves in position to harvest sunlight. This growth is not the weakly attached, overextended "epicormic" sprouting that arises after a tree is cut back too hard, or "topped".

Because the pruning was done in a controlled dose, following the A300 Standard, these sprouts grow in a controlled fashion. If basal decay worsens in 3/5/10 years, the sprouts will be strong and productive enough for the tree to maintain vitality while sustaining further branch reduction--red arrow.

“A tree’s crown acts as a dampener of force – via multi directional oscillation of twigs and branches – which dissipates force both via stepping it down and channelling it toward the ground”

Ken James, Engineer & tree mechanics specialist ISAAC Conference 2008



Objective: Reduce risk by reducing load from the crown, while retaining the dampening effect of interior foliage.

Spec: Reduce upper and southward branches 6-16'. Cuts <3". <9% off.

Here's a climber reaching above some healthy new growth to reduce a leader.



A 2" cut removes
10' of lever arm.



All the existing tips
had what looked
like damage by lack of
water + air pollution.

No blistering seen on
new growth since
pruning began in
2006.

Retrenchment =>
Rejuvenation.





Response of Two Oak Species to Reduction Pruning Cuts

Jason C. Grabosky and Edward F. Gilman

Abstract. Reduction pruning cuts were used to prune *Quercus virginiana* (live oak) and *Quercus Shumardii* (shumard oak). One-half of the pruning wounds were harvested and dissected 3 years later to observe extent of discoloration in response to the pruning cut. Shumard oak did not limit discoloration as effectively as live oak. Discolored area in the wood increased with size of the pruning cut surface in shumard oak and less so in live oak. Dissections showed that the shape of the discolored area attenuated with depth. The branch connection morphology and response (branch–trunk aspect ratio, branch angle, release growth after pruning) appeared to influence discoloration pattern in reduction pruning. The angle of the reduction cut relative to the American National Standards Institute-recommended angle bisect method was not found to influence discoloration. **Discoloration in the less efficient compartmentalizing species (Shumard oak) was related to cut surface area, but not to cut angle.** There was no relationship between aspect ratio and discoloration in the 3 years after

Smaller
laterals grow
more than
larger
laterals after
reduction
pruning

Sharon's wish came true! Many studies have affirmed the effectiveness of specified reduction pruning.

sistent. **Larger pruning cuts resulted in greater discoloration from the increased initial cross-section of exposed wood.** Although it is convenient to simply state larger cuts yielded larger discoloration zones, it was observed to be contradicted in some live oak replicates and a weak assertion with the live oak species data set in general. Given the small data set for each species, it is quite likely that subtle relationships were not developed in the analysis as a result of the natural variability within seed propagated species. With such consideration, several points are worth noting.

Reduction pruning released the smaller remaining lateral branches as the new primary growth axis on the shoot more than larger lateral branches. Novel explanations to explore in future data collection should be to consider the release of the

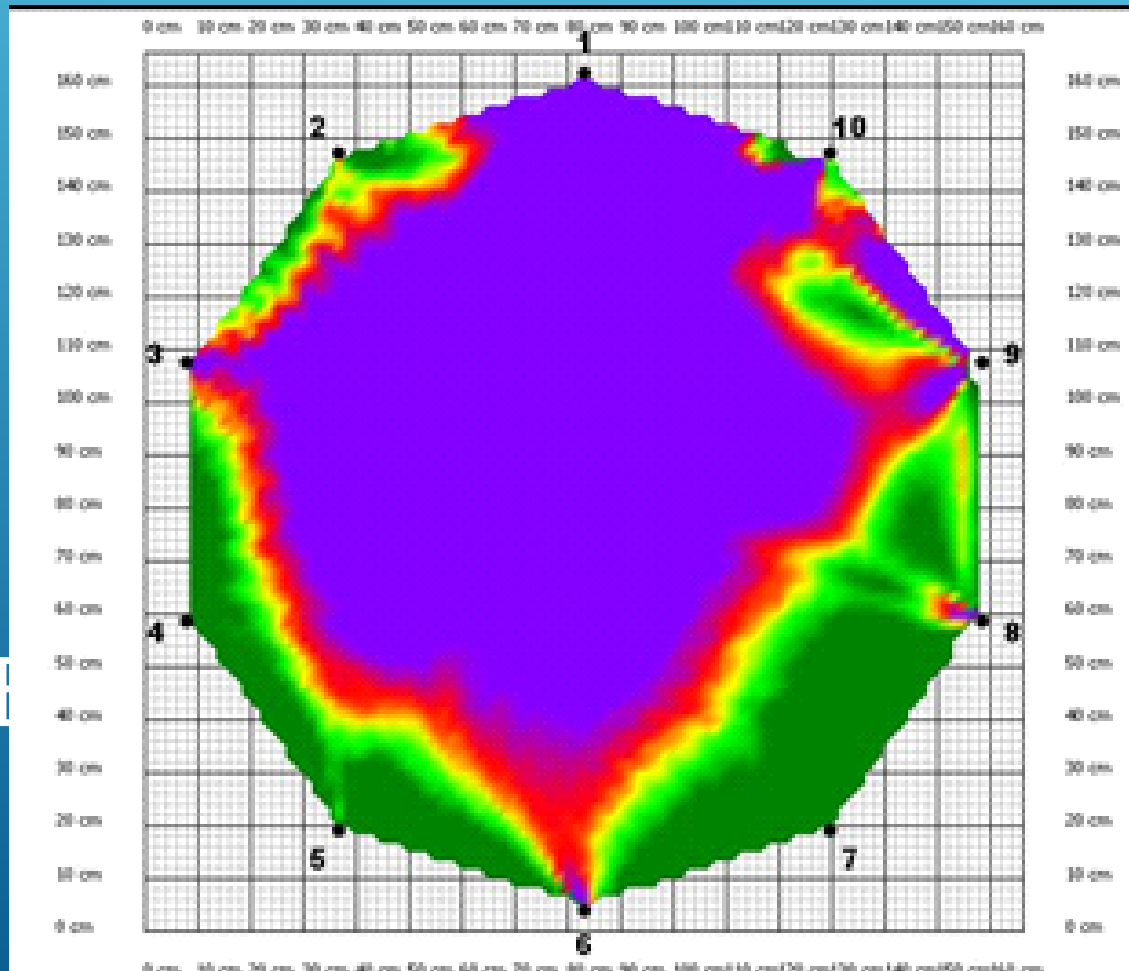
Case 2:

Southern Red Oak

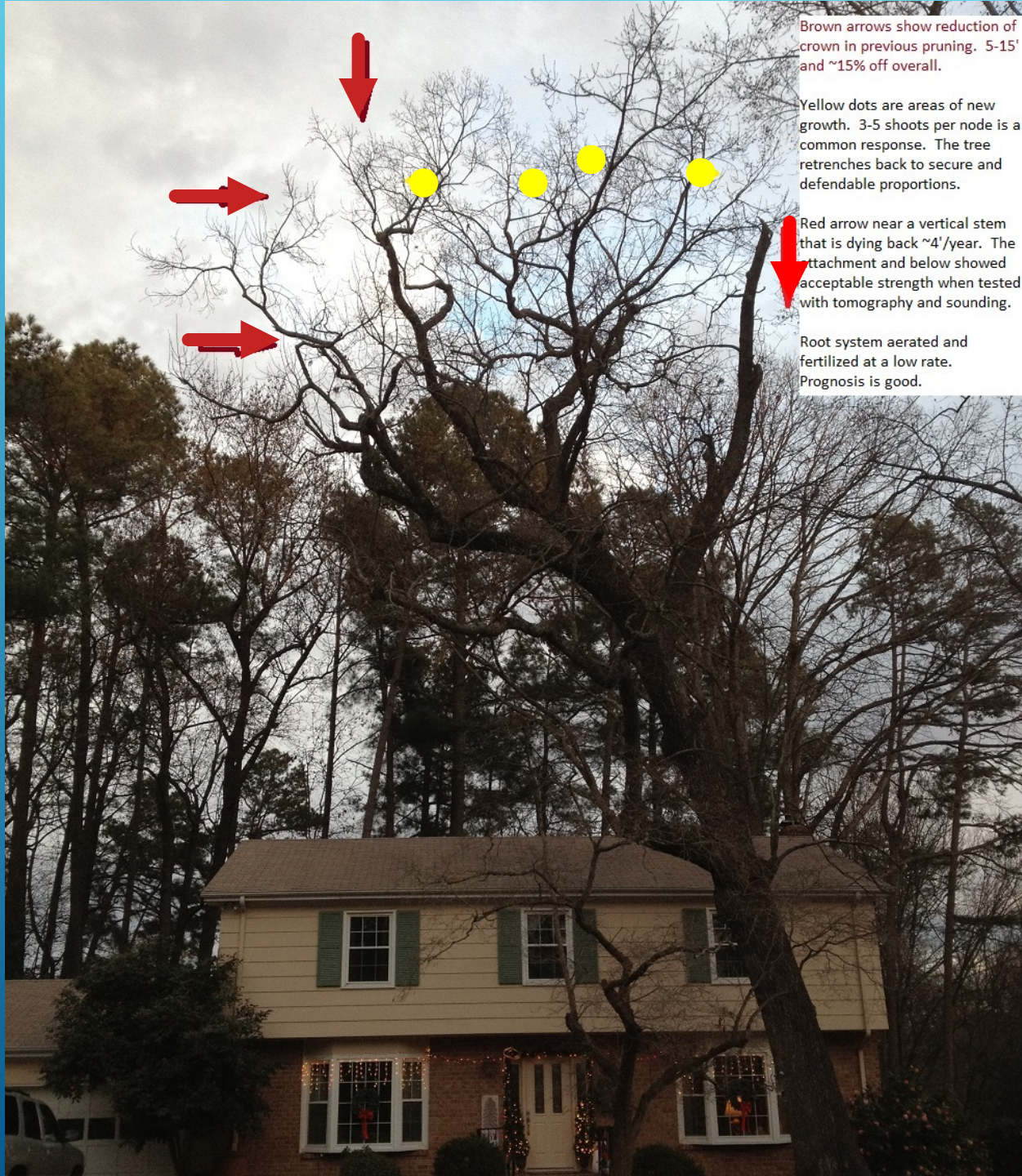




RF



71.6% decayed area



- Brown arrows show reduction of crown in previous pruning. 5-15' and ~15% off overall.
- Yellow dots are areas of new growth. 3-5 shoots per node is a common response. The tree retrenches back to secure and defensible proportions.
- Red arrow near vertical stem is dying back ~4'/year. The attachment and below acceptable when tested with tomography and sounding.

Root system aerated and fertilized at a low N rate. Prognosis is good.



After reduction: Reiteration! The sprouts form at nodes, growth points where terminal buds were set and axillary buds formed, and lay dormant. The distal 'stub' is left to avoid drying and dysfunction of the new terminal. With this new growth underway, removing the 2 downright laterals maintains health and further reduces load and risk.





May 12, 2014:

Interior growth
response abundant

More reduction to
mitigate lean

Covered the hollow
with window screen,
to lessen concern.

Tree advertised to
buyers as an asset

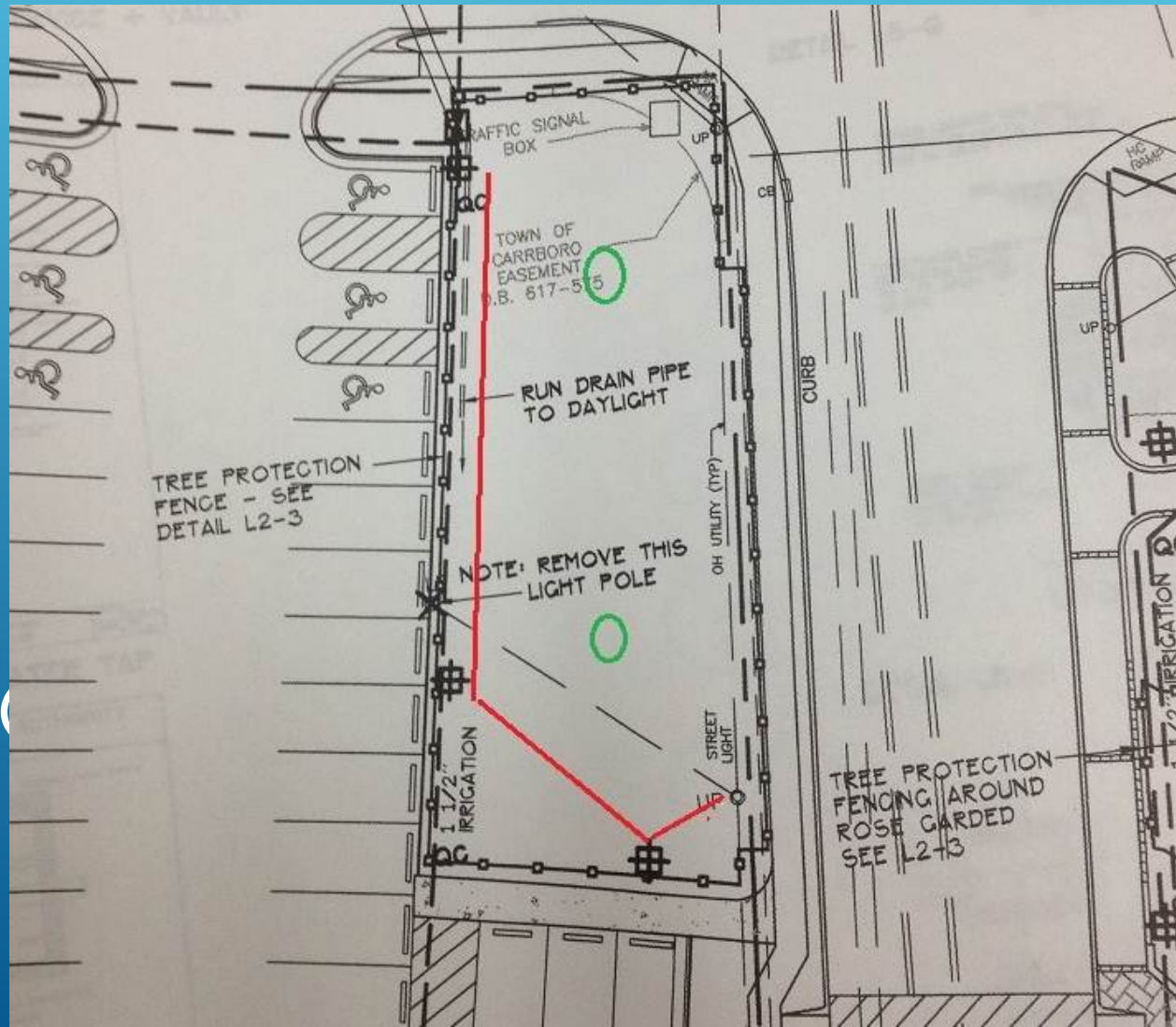




Case 3: Post Oak

As seen in Arborist News,
December 2013

ROO

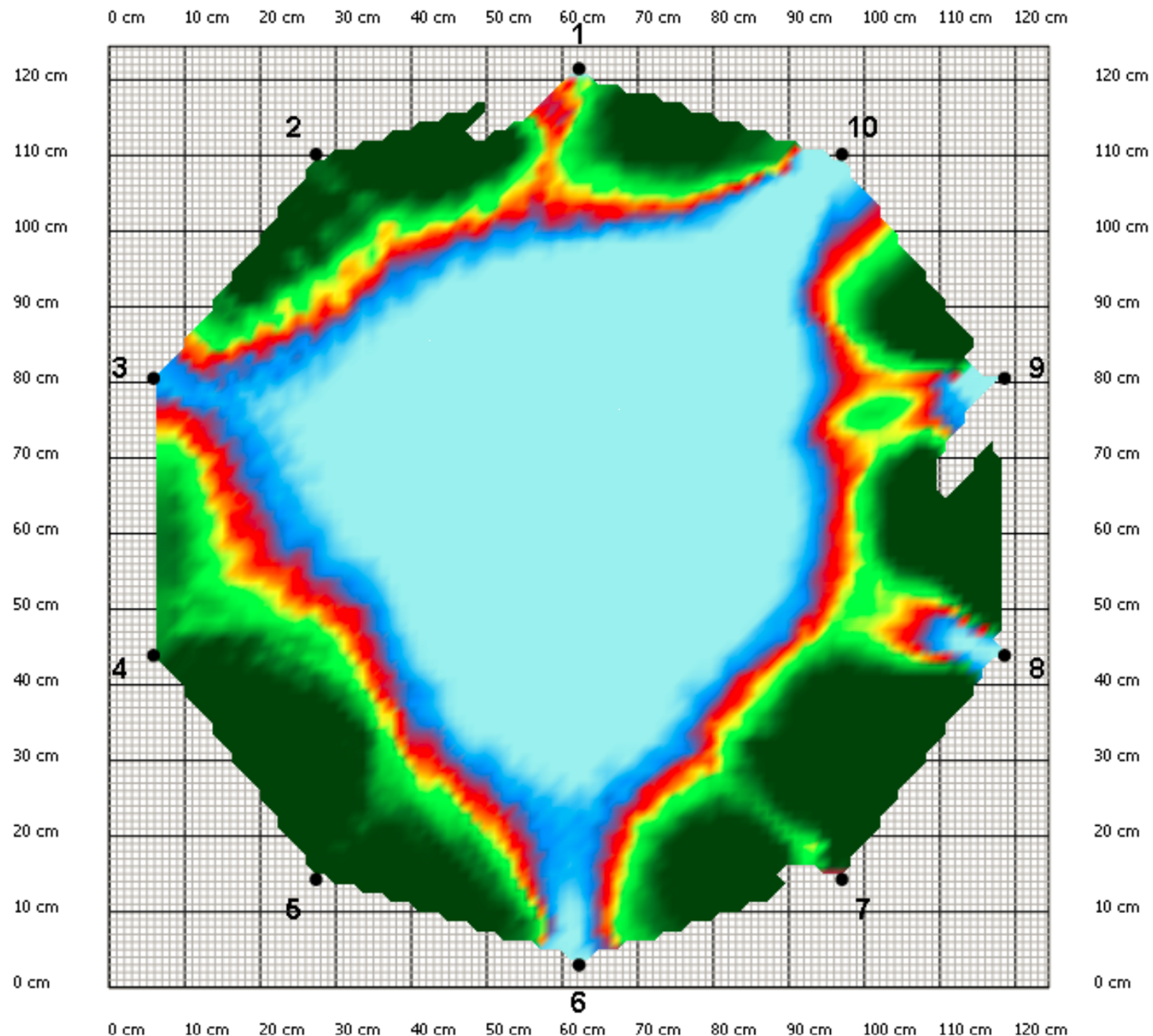


- Green circles – Post oak
- Dotted line protection fence
- Red lines - trench location
- Unnecessary 500 square feet rootzone damaged
- Did the fence prevent the trencher from going along the pavement?

OVERVERMULCHING = STERILITY GROWTH

RESPONSE





Specifications written as part of the assessment. There is no better time for this vital service. The owner cannot understand mitigation options unless they are spelled out.

Town arborist wanted more than 6' off. This was granted, on a few limbs. Town arborist also voiced concern that all cuts be made at optimal locations.

Explanation: cuts cannot all be optimally located due to difficult access, and inherent imprecision of tool (pole saw). However, cuts will expose minimal heartwood, so precise location is less crucial.



Reduce height and spread with cuts at red lines. Remove 5-10% living mass in the tree. Cuts to vigorous laterals. Specs were to reduce 3'-6', but changed to <9'. Portions that collide with adjacent oak retained for stability.

Total removed from tree. Approximately half living mass, half dead.

Red line: Largest cut on living wood, <4"



ANSI A300

U • P • D • A • T • E

By Guy Meilleur



The health, stability, and longevity of this veteran oak tree are greatly improved, by using the A300 Tree Care Standard to develop simple specifications, following **83.1.3**, Soil volume, fill, air and water movement, drainage, and the distance between roots and infrastructure should be considered.

"All work shall be performed according to ANSI Standards" is common language in U.S. contracts these days. Unfortunately, those words alone mean very little, in the landscape or in courts of law.

The American National Standards Institute (ANSI) A300 Tree Care Standard, Parts 1 through 9, covers Pruning, Soil Modification, Support Systems, Lightning Protection, Construction, Planting, Vegetation Management, Root Management, and Risk Assessment. In other countries,

the A300 is used as a reference, just as other countries' standards are referenced when the U.S. standard is revised. The first step in applying this standard is to establish the *objective*. The client's goals are not automatically adopted. They are adapted, in the light of the A300, best practices, and observations, arborists establish the objectives, defining their own assignments.

The A300's mission: *To develop consensus performance standards based on current research and sound practice for*

writing specifications to manage trees, shrubs, and other woody plants. With the client agreeing, the second step is to describe specific tasks, or *specifications*. These "specs" keep everyone literally on the same page. Simple jobs can be spelled out in 20 words or less, as a proposal to a client, or the brief work order on this post oak: 1. *Clear flare 6"*. 2. *Expose root collar*. 3. *Measure adventitious roots*. 4. *Reduce branches south and west 1-9' using 1-3" cuts, <10% overall*.

The A300 Standard helps determine and communicate these details. Brief or long, written specifications connect performance and management with a common objective. Without this connection, chaos is more likely. To avoid chaos in this article, we'll update the current state of all 11 Parts in order, showing the (date) of the current publication. The images are from a hollow post oak (*Quercus stellata*). The captions contain excerpts from the new Part 8, Root Management. From the beginning:

Part 1 (2008) **Pruning** is currently in revision, most recently at the semiannual A300 meeting of October 2013. The committee heard from arborists who find A300's stripped-down style needs interpretation, and are requesting a more user-friendly format. One change underway is to describe potential Objectives in more detail and toward the front of the document, because the pruning objective has to be established by the arborist and the owner before Specifications can be written. Another fundamental change is to incorporate utility pruning, instead of confining it in its own section.

Part 2 (2012) **Soil Management: Modification, Fertilization, and Drainage** now has a broader range of potential practices, like soil aeration, replacement, injection, and amendment. Increasing the amount and activity of beneficial microorganisms is a vital objective, but more guidance is needed. By referencing the section on soil drainage, the movement of air, and water, arborists can enable healthy growth in tree roots and their associates.

Part 3 (2013) **Supplemental Support Systems** has also evolved to embrace new procedures. Installing through-cabling systems "into decayed areas where sound wood is less than 30% of the trunk or branch diameter" complies with **33.4.3**, because only the cable itself passes through the tree. Washers are no longer required with through-hardware, unless the manufacturer recommends them. The use of offset washers to align systems was not included in this revision, and lag hooks are still not acceptable in wood over 10" diameter.

Part 4 (2013) **Lightning Protection Systems** now incorporates more terminology and parameters from the National Fire Protection Association (NFPA), to be consistent with the broader national standard. These systems can protect adjacent property by preventing sideflash to buildings, and damage to utilities through contact with roots. Those benefits are not mentioned, because that would conflict with the NFPA standard.

Part 5 (2010) **Management of Trees and Shrubs during Site Planning, Site Development, and**



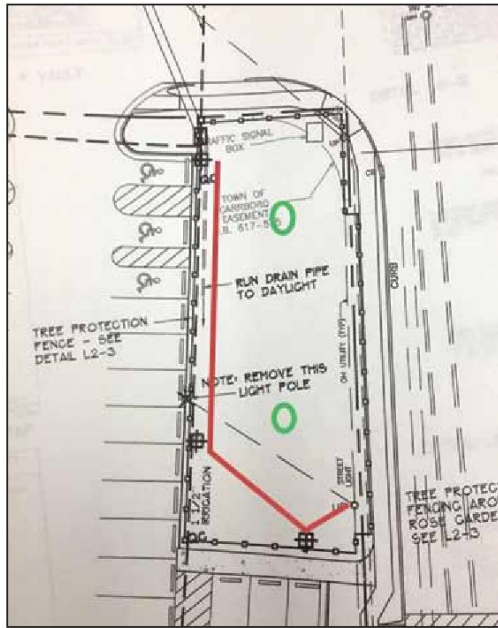
Section **83.3.4** states, "Inspection should include... Conditions in the crown that reflect root conditions..." Branches that had historically been reduced were removed, aggravating health and stability concerns. Wound closure was poor.



Section **83.3.5** states, "Mulch, soil, and other materials should be removed as needed to allow for inspection." After fresh mulch was removed, a 2" layer of compacted mulch remained above the soil. No root growth was found in this shredded hardwood, which looked and smelled as sterile as peat.

Construction has grown substantially. Many contracts call for a certified arborist to be involved in development, but this involvement is too often too little, too late. Per **53.3.9.2**, "The arborist **shall** note the trees' function in the ecosystem, the incentives for conservation, and mitigation potential for the site." ("Shall" indicates a requirement, "should" indicates a recommendation.) This echoes our roles and responsibilities in risk assessment, and IPM as well. Part 5 empowers arborists to persuade towns and developers to proactively manage trees before, during, and after construction.

Part 6 (2012) **Planting and Transplanting** can also improve the odds for success when a knowledgeable



Town planners specified the power line just inside the pavement, following **84.5.1**, "When non-selective root cutting is necessary, roots shall be cut as far from the trunk as practical." Unsupervised, contractors trenched the shortest path possible (red line), cutting off over 500 square feet of rootzone. This damage was discovered via **80.4.5**, "The location of utilities and other obstructions both below and above ground shall be considered prior to root management operations."

arborist is involved. Most arborists know **64.5.4**, "The bottom of the trunk flare shall be at or above finished grade." Now, **64.4.3** clarifies that "The soil **directly** beneath the rootball should be undisturbed or prepared to prevent settling." Soil deeper than, but outside of the rootball can be aerated and amended to promote healthy roots.

Part 7 (2011) **Integrated Vegetation Management (IVM)** is intended to "promote sustainable plant communities that are compatible with intended uses of the site, and discourage incompatible plants. . ." Part 7 calls for proactive communication with stakeholders, cultural and biological control, and a quality assurance program. Dave Nowak provided technical advice based on a mutual understanding that "IVM is used to understand, justify, choose among, selectively apply, and monitor different types of treatments, with an overall goal of eliciting site-specific, ecosystem-sensitive, economically sensible, and socially responsible treatment effects that lead to refined achievement of management objectives."

Part 8 (2013) **Root Management** is the newest Part of the A300 Standard. First conceived as Root and Root-zone Management, Part 8 was revived when Part 2 Fertilization became Soil Management. Part 8 focuses on inspection, establishment, pruning and cutting roots, blocking roots with barriers, and guiding roots with channels. Defining selective root pruning as distinct from non-selective cutting was a turning point in Part 8's development. The same distinction applies to cutting or pruning branches, in Part 1. The root subgroup included talented and tenacious technical advisors, and public commenters also played a key role. After several years of discussion, Part 8 passed a final public review and was approved by ANSI.



Section **83.2.8** states, "Evaluation of decay, callus and woundwood growth, and response growth in the trunk and crown shall be considered." Adventitious support roots were found on both sides of the cavity and in the other sinuses. These were measured up to 2 3/4". Measuring response growth over time documents a gain in strength with numerical data.

Part 9 (2011) **Tree Risk Assessment**, in its first edition, has been the basis for the ISA BMP, assessments done by the U.S. Forest Service's Urban Forest Strike Team, and the Tree Risk Assessor Qualification (TRAQ). Section **93.6.2.1.2**, "All recommendations should include a statement addressing residual risk following mitigation," is echoed four times at the end of the TRAQ form, emphasizing the need to consider the positive effects of a range of mitigation options.

Part 10, **Integrated Pest Management**, was reviewed as a working document by the A300 committee at its October 2013 meeting. The committee is advised by Mike Raupp, whose textbook teaches interdisciplinary ecosystem management and "A third basic premise of IPM is that the use of natural control agents is maximized. A great diversity and number of beneficial organisms inhabit the landscape." IPM guidance involves details on working with "Mother Nature's Hit Squad," along with synthetic alternatives.

Part 11, **Urban Forest Products**, is also moving forward, with a defined scope, purpose, and application. The current draft states, "Objectives for urban wood resource recovery shall be established to address management of the urban forest, planning for tree removals and recovering the maximum value in available wood resources." A draft Part 11 will be circulated among experts in the next few months, and reviewed at the spring 2014 meeting.

The ANSI A300 Committee is charged with writing and updating a meaningful performance standard for the tree care industry. The challenge has always been to write a standard based on proven science and practice, not just introduce ideas that seem good at the moment. It is critical for users of the standard to review them, to assure they are credible and usable. Comments are accepted from around the globe during preannounced 30- or 45-day public review periods, and at any time by your representative(s) or other committee members. ISA's rep is Richard Hauer (Richard.Hauer@uwsp.edu).

"All work shall be performed according to ANSI Standards," when arborists establish clear objectives and write better:

- Proposals, to communicate and compete effectively,
- Objectives and Assignments, so everyone expects the same results, and
- Specifications, so everyone stays on the same page.

Please visit the website for the ANSI Standard (www.tcia.org/business/ansi-a300-standards) for public review opportunities and more information.



Guy Meilleur is a practicing ISA Board Certified Master Arborist and aerial consultant with HistoricTreeCare.com. The author thanks Gordon Mann and Neville Fay for substantial contributions.

Images from previous tree chosen to illustrate this article, because root management was the most important aspect of the job.

A300 Part 8 subclauses relied upon by the practitioners

"**83.2.8** Evaluation of decay, callus and woundwood growth, and response growth in the trunk and crown shall be considered.

■ "Inspection should include conditions in the crown that reflect root conditions.

■ **83.3.5** Mulch, soil, and other materials should be removed as needed to allow for inspection."



Open cavities between buttress roots are not uncommon in old oaks, and interior decay is typical. Healthy trees are supported by their buttress roots, and wall off the spread of decay. Concrete is visible deep inside the trunk, placed

On the north side of the trunk, toward the house, trunk tissues have cracked apart under the strain.

The crack ends at a growth point, where tissues are strengthened. Even after the branches are cut off, the protection zone remains. The crack ends near ground level. There is no sign of the crack spreading in either direction.

The woundwood on either side of the crack matches like a jigsaw puzzle, indicating that this crack was closing or closed. Then in 2012 the





The Crying Tree's limbs to the north were removed. The limbs to the south sprawl toward the sun. This imbalance strains the tissues under tension on the north side







CASE STUDY 5: OSAGE ORANGE TREE

THE LAST REMAINING *MACLURA POMIFERA*
IN A 'HEDGE' PLANTED IN THE 1840'S BY
DR. POTTER, A FOREFATHER OF EXTENSION
EDUCATION.

MACLURA WERE PLANTED EXTENSIVELY
TO CONSERVE SOIL DURING THE 'DUST
BOWL' LOSSES OF THE 1930'S.







Cuts made at red lines would mitigate the risk associated with the size and the lean of this tree. Cuts made at the orange line might be sufficient, depending on conditions. This species is very tough, so stem failure is very unlikely. Pruning would save money, and the tree.



An excellent job was done correcting the lean by pruning. If the base and roots have lost a lot of strength, and a support system is deemed impractical, further pruning at the red lines would increase stability even more. If loss of support is not extreme, smaller cuts in the upper crown would increase stability with much less shock to the tree.

Stem-girdling root formed in response to sidewalk damage--should be pruned. (straight orange line). Area bounded by orange appears to be dead tissue due to root damage from sidewalk construction. Probing into lower left corner with a long rod will reveal extent of hollow inside--no need to drill through living tissue! Hollow may be extensive even in stable trees. Tissue to right of this area appears to be formed afterward, a sign the tree is adding tissue in the right place to hold itself up.



Damage from the careless installation of sidewalk can kill trees and people. The driver of this truck was very fortunate to make a full recovery. Inspections on a regular cycle, even 5 years, can prevent the loss of trees and people.





Aerial assessment confirms durability of Maclura wood. The 'stub' from the city's pruning job is left alone for now, to avoid drying and decay of the stem. The sprouting will be monitored during the next inspection. Tour des Trees riders give the tree encouragement. "Grow, Tree, Grow!"





This 'After' shot shows thinning done to tallest leader. Specifications for aggressive pruning mitigate an unknown amount of root damage under the sidewalk.

A summer storm packing 70 mph winds did not damage the tree.

City executives are comfortable with current condition and prognosis. (Arborists are not comfortable with root damage, but manage conditions in the best ways possible!)

Case Study 6:

Acer negundo in
Ontario, Canada

Pruning at the same
nodes, like pollarding.
Small cuts made
“after sprouting
slows”, when the
replacements are
established.

The crown is reduced
due to the loss of
strength at the base.



The stick goes through the base of this boxelder, and out the other side

The sinus to the south is also open.



Woundwood is developing at all of the margins of the cavity.

Maintaining screen and air quality and wildlife values are among the objectives.



Aussie Cassian Humphreys on the left,
Ryan Redvers, who drew a thesis on a T-shirt, in
the middle.

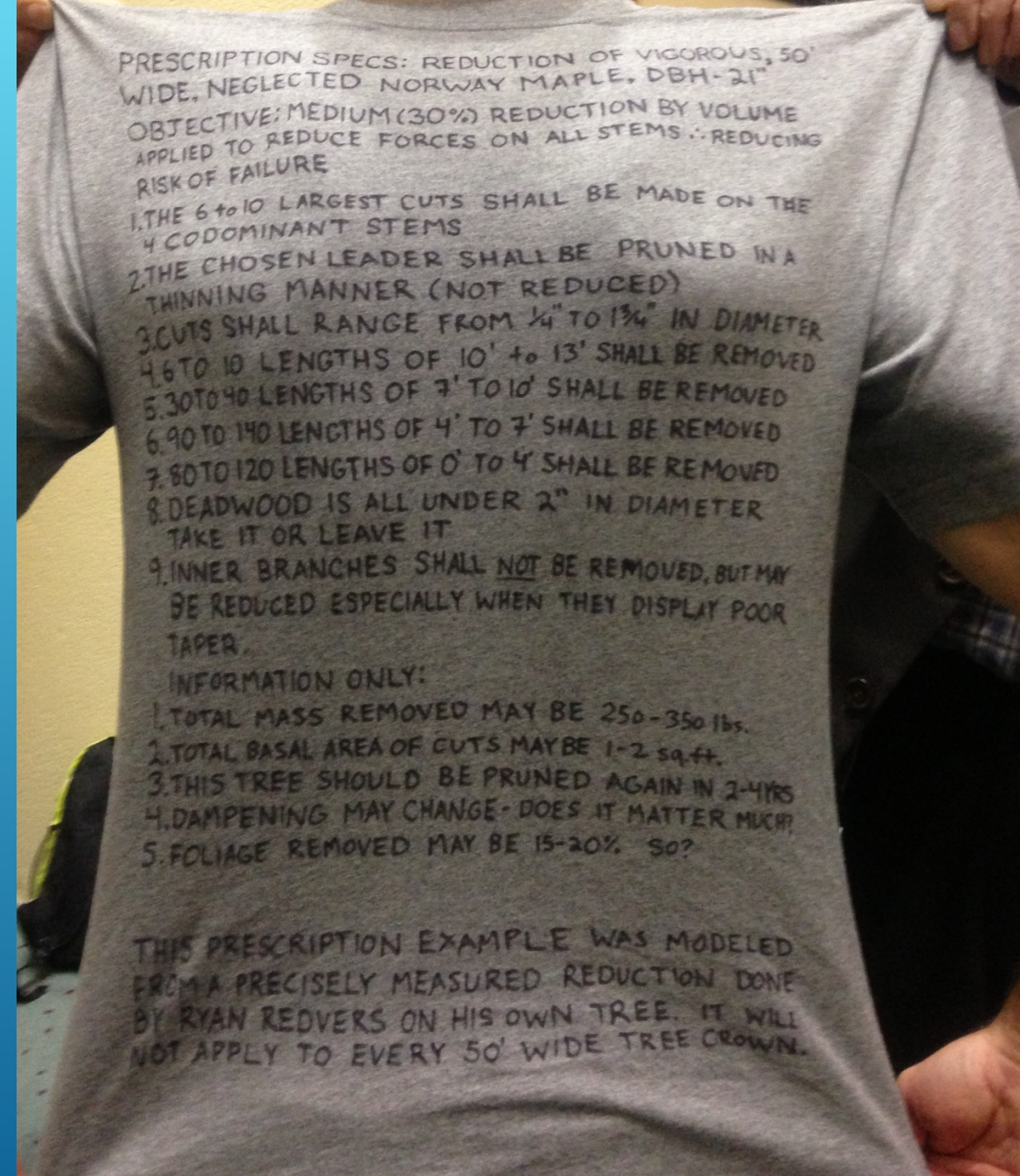
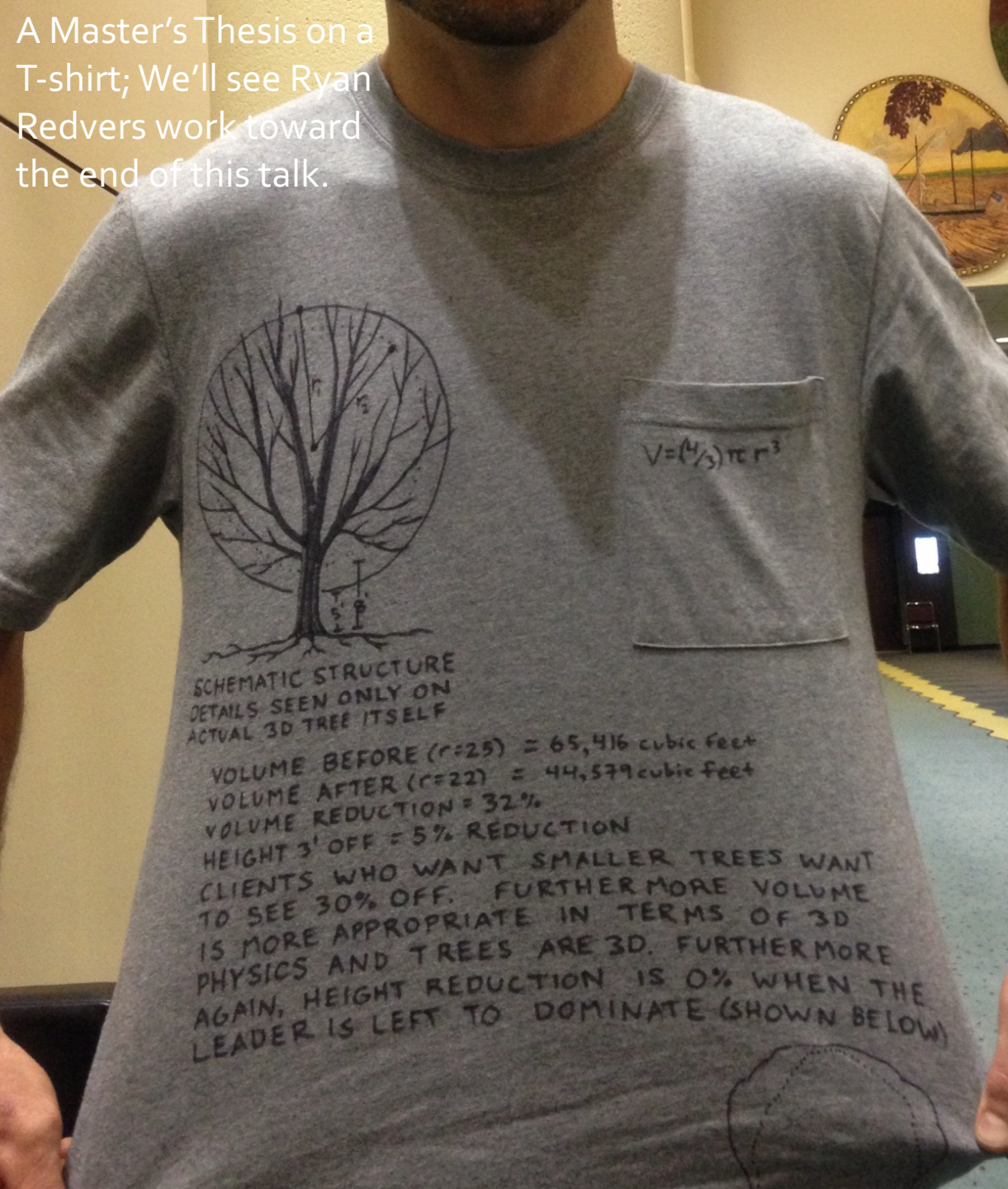
I was glad to work with someone who sweats
more than I do!

Ryan is presenting at ISA International August
8. Reduction and retrenchment pruning are also
in the main Program, but we will be in a
breakout session called
'Restoration and Heritage Tree Pruning'.

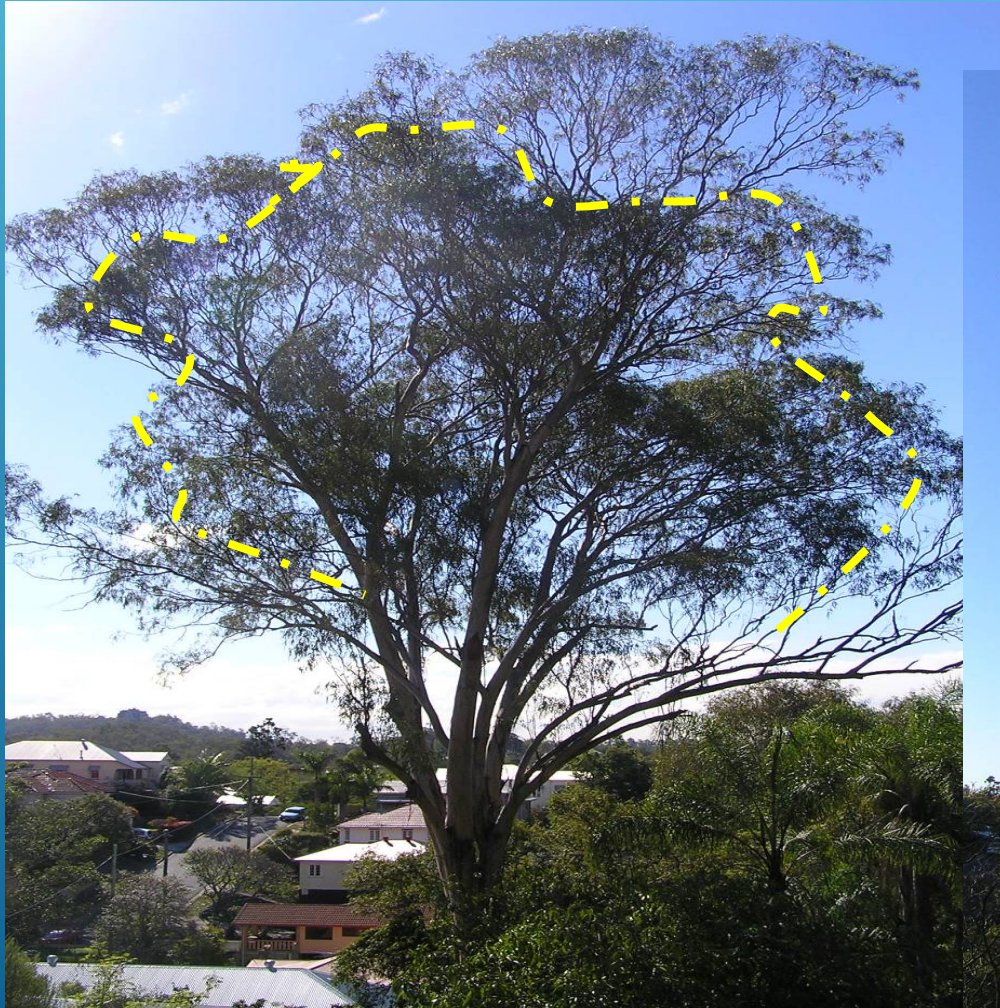
Most of the trees we are called to care for are
mature, so reduction pruning is common
practice.



A Master's Thesis on a T-shirt; We'll see Ryan Redvers work toward the end of this talk.



AUSTRALIAN UTILITIES REGENERATE HOLLOW TREES



Before



After

Here is a before-and-after of a eucalyptus tree that is very hollow at its base. Energex is a utility contractor that preserves hollow trees for their wildlife and other values. The 2011 presentation by Matt Palmer is viewable on the ISA website.



- Located between a school and electric transmission lines, this eucalyptus is getting carefully specified attention.





Epicormic – Latin for “upon the stem”



Endocormic – Latin for “in the stem”



This slide and the next were shared by Cassian Humphries from Australia. The sprout on the left clearly was adventitious, newly formed on the stem, and tore away easily from the inner bark. The branch at the right broke without damaging the attachment. The location of the break, ~2x of the branch's diameter, is often seen in research done by John Goodfellow,. Breaks in this Critical Fracture Zone, or CFZ, are avoided by reducing the ends 10-20%.



2016: Revision US standard

ESTABLISH THE OBJECTIVE!

- ▶ “Harmonization with related industry standards will be considered.”

Combine German ZTV and UK's BS3998?

NO! ☹

- ▶ Arborists must add their experience to the Standards process.
- ▶ “We are in the business of defining our own business.” (Neville Fay, UK)

American National Standard

ANSI A300 (Part 1)-2001 Pruning
Revision of ANSI A300-1995

*for Tree Care Operations —
Tree, Shrub, and Other Woody Plant
Maintenance —
Standard Practices (Pruning)*



RECENT AND
ONGOING
RESEARCH:
BIOMECHANICS
WEEK 2010—2013—
2016...

JOIN US IN 2019!

November 2016
issue of Tree Care
Industry magazine

www.tcia.org



The testing grounds was a Davey Tree Research Farm tucked away between corn and soybean fields in northeast Ohio. Photos courtesy of the author.

By Guy Meilleur, BCMA

Davey Tree Research Farm is tucked away between corn and soybean fields in northeast Ohio. Once every three years, researchers and technicians gather here for Biomechanics Research Week, a chance to cut, pull and learn from trees that Davey planted for research purposes more than 50 years ago. This past August, researchers from

Biomechanics, according to Wikipedia, is “The study of the structure and function of biological systems ... by means of the methods of mechanics (the details about how something works or is done).” Tree function can only be studied over time – one view does not tell us enough to understand a system as complex, dynamic and interrelated as a mature tree. Over time, this triennial event in Ohio makes understanding possible.

By directly measuring response growth, decay and compartmentalization over time, we can see the tree restore mechanical stability in spite of formulas.

In 2013, pull testing trees and branches in one direction, “pure static loading,” was the primary activity, culminating with “The Wager Tree.” This 10-inch DBH red maple (Images 2 & 3) had a gruesome-looking open cavity more than 6 feet long.

Biomechanics Week 2013 The Wager Tree

40 bets were made on where this hollow, rotten red maple would break.

Over half chose the hollowest, rottenest location.

Only after the tree fell over did woundwood fibers around the open cavity separate.



The first failure was a foot above the open cavity. The fibers separated longitudinally on the tension side.

The second failure was at mower damage on a tension root.

The trunk was bent over 60 degrees when the woundwood around the cavity started failing. But it sprung back into position, with just a little help.



After the brush was cut off, one person with a pole pushed the trunk back up to the angle shown here.

The first failure had been at the height indicated by the man's right hand.

The tree's response growth will be measured and tested at the next Biomechanics Week.



"Science is an attitude, of skeptically interrogating the universe, with a fine understanding of human fallibility."
Carl Sagan

TRACE INCLUDED BARK TO INOSCULATE

(FROM AN "INNIE" TO AN "OUTIE")

From Included Bark to Branch Bark Ridge: *A Tribute to Bob Wulkowicz*

Scope: *Q. alba* included bark 10"
codom stems

Objective: Turn included bark into a
branch bark ridge

Specifications:

1. Clean fork by scraping with trowel,
knives, chisels
2. Rinse with water while scraping.
Avoid breaking barriers and
exposing living tissue??
3. Cauterize with blowtorch,
evaporating water but not burning
tissue
4. Monitor 14 months later





14 MONTHS LATER: RE-CLEAN

1 YEAR LATER: FINI! FROM INCLUDED BARK TO A BARK RIDGE IN 2 SEASONS.





Image 4: By winching branches in two directions simultaneously, Adolfo Sanchez and Eduardo Medina were able to document the effects of combined static and torsional loading.

Cross-pollination of ideas was “the original intent of Biomechanics Week, even before the research”, recalled Ward Peterson.

“Getting researchers and practitioners working together helps them all get a broader view of their potential connections and contributions to the industry.

Culturing a climate of creativity and mutual understanding is breeding fresh approaches to the research and practice of tree care.”

JOIN US IN 2018 AND 2019!



Image 5: Ward Peterson of Davey holds up a 6-inch pin oak branch torn off in a pull test. The stub was left alone to respond on its own, so the results of this “natural fracturing” can be studied. The break stopped near a node, which had no laterals but a lot of strength.