

Pruning Researcher Summit White Paper

Steve Bevil

Introduction

ISA's Science and Research Committee convened a one-day Pruning Summit for researchers on January 8, 2007 in Phoenix, Arizona. The summit was held in conjunction with a pruning workshop sponsored by ISA Western Chapter. At the workshop, Summit participants presented research papers, which followed a day of discussions focused on research in progress, gaps, and needs.

The following participated in the Summit:

Bob Tate, Larry Costello, Ted DeJong, Robert Farrell, Francesco Ferrini, Edward Gilman, Jason Grabosky, Richard Harris, Joe Kellerhals, Joseph Murray, Tom Smiley, Christopher Luley, Nelda Matheny, Sharon Lilly, Steve Bevil

Summit objectives included the following:

- Assess the current state of knowledge concerning pruning
- Identify gaps in our knowledge
- Identify promising new methodologies and opportunities for collaboration
- Prioritize research and education needs
- Identify funding sources and outline a course of action for future research on pruning

Abstracts of Research Presented

Effects of pruning on tree response to hurricane force winds and growth

Edward F. Gilman, University of Florida, Gainesville, FL and

Jason Grabosky, Rutgers University, New Brunswick, NJ

The goal was to determine how different pruning techniques affect trunk movement on live oak subjected to hurricane force winds. Tree movement in wind on non-pruned trees was compared to movement on trees with crowns thinned, reduced, or raised. The trees were blown using a wind generator up to 45 m/s (110 mph), maintained for three minutes. Each tree was instrumented with three Microstrain 3DM-GX1 orientation sensors at set heights along the trunk to measure its deflection in all three axes. Thinning or reducing crowns significantly reduced trunk movement at all wind

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speeds; whereas raising did not. This data indicates that the foliage and branches toward the top portion of the crowns are largely responsible for trunk movement in straight-line wind with those toward the bottom less important. Trees that are reduced or thinned in the manner described could receive less damage in wind storms.

Response of two oak species to reduction pruning cuts

Jason Grabosky, Rutgers University, New Brunswick, NJ and

Edward F. Gilman, University of Florida, Gainesville, FL

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 three 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, less so in live oak. Dissections showed that the shape of the discolored area attenuated with depth, and the shape of the attenuation is worth greater investigation. 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 ANSI 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, so a cross-cut perpendicular to the growth axis minimizing cut surface may be preferred over the angle bisect method for the that species in this study. There was no relationship between aspect ratio and discoloration in the three years following pruning. The data suggests that reduction cuts can be made back to lateral branches as small as 1/3 the diameter of the removed stem.

Evaluation of subordination pruning techniques in young trees

Joe Murray, Blue Ridge Community College, Weyers Cave, VA and

Rob Farrell, Department of Forestry, Yorktown, VA

This study was designed to compare the effectiveness of reduction pruning vs. thinning pruning to influence branch growth and attachment strength in landscape trees. Subordination pruning is commonly recommended to alter the growth of branches or codominant stem in order to improve the strength of the branch union. However, there is little research to support to this practice.

In this study, three methods of subordination pruning (50% length reduction, 25% length reduction, 50% thinning pruning, and control) were applied to young red oak and white oak trees. Three branches were selected in each tree and measured for diameter, total length, length of previous year's growth, and position in the crown. Height, diameter, and length of previous year's growth were also measured for each tree.

Preliminary results indicate that aspect ratio decreased for almost all pruned branches. This would indicate that each of the subordination pruning methods was effective in reducing the diameter of the branch relative to that of the trunk. However, the aspect

ratio also decreased in almost all of the control branches. Future study goals include more extensive data analysis, continued annual measurements, and additional study sites to test more species and ages of trees.

Modeling effects of pruning on tree architecture and carbon allocation

Ted DeJong, University of California, Davis, CA

Studying and understanding tree growth and development is a difficult endeavor. Plants are very complex organisms that are governed and influenced by a multitude of factors. In the past our ability to study and integrate plant function has been largely limited to only dealing with a couple factors at a time and communicating those interactions verbally or with two dimensional diagrams. The subject of studying and understanding dry carbon partitioning in plants is a good example of this limitation. Modeling carbon partitioning is a complex problem because of the dynamic nature and relationships between carbohydrate partitioning, growth and plant architecture. Until recently there have been few tree simulation models that have attempted to quantitatively model these three processes simultaneously. The L-PEACH model is an attempt to develop a detailed model of tree carbon economy in which growth and function of each organ is modeled individually within an architecturally explicit model of canopy growth. L-PEACH combines the supply/demand concepts of carbon allocation of the previous PEACH model with an L-systems model of tree architecture to create a distributed supply/demand system of carbon allocation in a three dimensional, growing tree. The model can be used to simulate how pruning can influence growth, architecture and carbohydrate partitioning within a tree. The modeling process stimulates re-examination of fundamental concepts about how trees grow in response.

Pollarding and its effects on tree physiology: A look to mature and senescent tree management in Italy

Francesco Ferrini, Università di Firenze, Sesto Fiorentino (Florence) – Italy

Many mature trees are radically pruned every few years just to keep them in control and out of the way. This practice of massive pruning at frequent intervals can quickly lead to tree structural and pest problems. In fact, a tree responds to pollarding by building a dense mass of woody fibers around the cutting points. This bulky mass resists decay and effectively divides the vigorous juvenile growth from the aging stem. Hence, the defensive and structural integrity of the tree is maximized using this pruning system, because pruning cuts are made when biological reactivity of the trees is quite high and living cells quickly react to wounds and environmental changes and can develop a strong defensive reaction. Also pollarded trees develop a constantly rejuvenated, energy-creating young canopy, on top of an increasingly ancient trunk. This slows the tree's normal aging processes. Pollarding was an ancient practice all over Europe and Italy. It was widely used not only for aesthetic purposes, but also to provide food for the animals that could eat the fresh shoot produce by some species.

Pruning Standards for San Francisco

L.R. Costello, University of California Cooperative Extension, Half Moon Bay, CA

Pruning standards that are based on ANSI A300 Standards and ISA Best Management Practices for Pruning were developed for the City of San Francisco in 2006. These

standards were deemed necessary because of a lack of consistency and quality in tree pruning operations. The document begins with an introduction identifying the need, scope and application of the standards. Subsequent sections describe each of 13 standards that cover pruning objectives, basic practices, mature tree pruning, structural pruning of young trees, palms, and root pruning. Each standard describes required and recommended actions, and is preceded by a short statement of rationale. Lists of references and resources are included. These standards were approved by both the San Francisco Urban Forest Council and the Board of Supervisors, and are now City policy.

By taking general standards and tailoring them to address specific needs and conditions, a set of local standards has been developed. In the process, practices of local importance have been emphasized, while other less relevant practices have been minimized or eliminated. For instance, pruning requirements for palms are unlike those for conifers or hardwoods. Since palms are relatively common in San Francisco, a separate standard was developed for palm pruning. Likewise, in the San Francisco area, pruning Monterey pine (*Pinus radiata*) during the summer months increases the likelihood of bark beetle infestation. To address this issue, a statement was included that restricts pine pruning to the winter months. By including such tree and site specific information, pruning standards can be more carefully focused to address the needs of local areas. The San Francisco document may serve as a model for other municipalities considering the development of locally adapted standards.

Abstracts not submitted

Effects of tree pruning on trunk movement

Tom Smiley, Bartlett Tree Research Laboratory, Charlotte, NC

Effects of pruning cycle on storm damage and service requests

Chris Luley, Urban Forestry LLC, Naples, NY

Pruning Summit Recommendations: Education and Research

Pruning Summit Survey Results – The pruning summit survey was sent to the science and research committee and summit participants to develop thoughts and consensus on pruning research and education needs. The survey was also used as a guide to stimulate discussion among pruning summit attendees (see attachment).

**The list of education and research needs below are recommendations that arose out of the summit while discussing the pruning summit survey results. Pruning summit attendees brainstormed ideas and decided priorities based on consensus.

Top Education Needs – Recommendations to the Education Goods & Services Committee

- Pruning specification kit - A kit in the form of a CD to be used as a reference/template for writing pruning specifications. This CD would include recommendations and suggested language usage.
- Evaluating and pruning storm-damaged trees
- Species variables to be considered when applying pruning standards
- Stop tipping back, lacing, lions tailing, topping
- Right tree, right place reduces need to prune
- Growing well-structured trees in the nursery his

Public Education Needs:

Consumer Pruning Guide – This guide is a project under development by EGS. Sharon Lilly sought input from summit attendees about the appropriate breath and depth of content. Tentatively, the guide would be a consumer based booklet about tree pruning.

The following are topics suggested to include in the guide:

- Top 5 most commonly asked questions (utilize master gardener groups in different states as a resource to narrow down top 5 questions)
- Pruning after storm damage
- Shrub pruning

Develop Framework for Local City and County Pruning Ordinances

(see abstract on Pruning Standards for San Francisco by Larry Costello)

Top Research Areas – Recommendations to the Science and Research Committee

- What traiHow much and what type of pruning needed to reduce branch/stem/root failure (volume and/or length)
- What is optimum pruning dose (season, species, vigor, site, age, evergreen/broadleaf, decurrent/excurrent)
- Scaling tree pruning response from small trees to large trees
- How do we restore damaged trees?
- Effects of root pruning (dose, root diameter, distance from trunk) on tree stability and health

Recommendation of Potential Funding Sources – External and Internal

External	Internal
Insurance Companies -managing risk and reducing hazard	NUCFAC
National Association of Realtors - property value	Tree Fund
Home Land Security - Utility industry	National Arbor Day Foundation
American Public Works Assn. - root pruning, life of pavement	ISA
Dept. of Transportation - pavement life	Davey Tree Expert Company
Waste Management Authorities	Asplundh
Dept. of Criminal Justice - partner to address pruning for safety	F. A. Bartlett Tree Expert Company
Dept. of Interior, Parks Service - pruning parks trees	The Care of Trees
USFS - State and Private Forestry	American Forests
Europe - Ministry of the Environment, Public Dept. of Arts	Society of American Foresters
National Historic organization in UD	Husqvama
UKI National Trust	STIHL
US Bureau of Reclamation and Corps of Engineers?	ALTEC
Getty Foundation	Vermeer
Audobon Society	Casey Tree
Edison Electrical Institute	

Evaluation of Pruning Summit/Feedback

Overall, participants thought the summit was highly beneficial. Researchers enjoyed the opportunity to exchange information face-to-face about research results, methods, gaps, and opportunities for new research. Researchers expressed interest in hosting the next summit at a university to discuss techniques hands-on and to see how tools work. It was also suggested to have the summit during summer or winter break. It was recommended that the summit span over two days: Presentations of research would occur on the first day (as a workshop) and researcher discussions on the second day. The workshop would be open at a fee to tree care professionals. Some participants also thought it best to have the researcher summit after the completion of a literature review. Summit participants encouraged a greater level of involvement from members of the Science and Research Committee in the future, as well as members of other relevant ISA committees.