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Xiping Wang and R. Bruce Allison

Decay Detection in Red Oak Trees Using a Combination of Visual Inspection, Acoustic Testing, and Resistance Microdrilling 1

Abstract. Arborists are often challenged to identify internal structural defects hidden from view within tree trunks. This article reports the results of a study using a trunk inspection protocol combining visual observation, single-path stress wave testing, acoustic tomography, and resistance microdrilling to detect internal defects. Two century-old red oak (*Quercus rubra*) trees located in Capitol Park, Madison, Wisconsin, U.S., were visually inspected and then evaluated using a single-path stress wave timer, an acoustic tomography, and a resistance measuring drill. The trees were subsequently felled, and a disk at each test location was obtained and examined. It was found that the visual inspection and single-path stress wave tests correctly identified a general problem but without specificity; the tomograph accurately revealed the general location and magnitude of the defect within the cross-sections tested but required resistance microdrilling to precisely locate defects and differentiate between decay and crack-induced acoustic shadows.

Key Words. Acoustic Tomography; Crack; Decay; Hazard Tree; Resistance Microdrilling; Resistograph; Risk Assessment; Stress Wave.

Richard J. Hauer, Cynthia J. Casey, and Robert W. Miller

Advancement in State Government Involvement in Urban and Community Forestry in the 50 United States: Changes in Program Status From 1986 to 2002 5

Abstract. This study investigated changes in state urban and community forestry (U&CF) programs since expansion of the federal U&CF program in 1990. Baseline data from 1986 compared with state U&CF program data in 2002 demonstrated significant expansion in state U&CF program capacity and assistance to local urban forestry efforts within the 50 United States. Use of Federal Cooperative Forestry Assistance Grants more than doubled, two additional state U&CF staff were employed within the program, time allocated to statewide coordination and regional implementation of the U&CF program approximately doubled, and a 111% national increase in the amount of state money used to finance the program occurred. In contrast, a similar minority of state coordinators in 1986 (40%) and 2002 (42%) believed adequate attention was given by the state agency housing the U&CF program. State coordinators in 2002 also had a similar outlook on the long-term future through expansion, reduction, or elimination of the state U&CF program reported in 1986 with slightly over 60% in both years believing expansion will occur. A significantly similar percentage of state U&CF program coordinators in 2002 (68%) compared with 1986 (77%) thought the state U&CF program would continue if federal funding was eliminated, however with a reduction in local assistance. Study findings suggest many positive changes in state U&CF program capacity occurred between 1986 and 2002 with various indicators suggesting dependence within some states on federal funding to maintain their current capacity.

Key Words. Financial and Technical Assistance; Program Capacity; State and Federal Urban and Community Forestry; Urban Forestry.

Edward F. Gilman, Jason C. Grabosky, Scott Jones, and Chris Harchick

Effects of Pruning Dose and Type on Trunk Movement in Tropical Storm Winds 13

Abstract. We built a machine with a propeller capable of generating 33.5 m/s (75 mph) winds to determine the influence of pruning dose and American National Standards Institute A300 pruning type on trunk movement of *Quercus virginiana* 'QVTIA' PP #11219, High-rise® at various wind speeds. Trunk movement was regressed against wind speeds and pruning doses for each tree tested. Increasing wind speed increased trunk movement, and the magnitude of the increase depended on pruning dose and pruning type. Increasing pruning dose reduced trunk movement and the magnitude of the reduction was greater at higher wind speeds. The predicted trunk movement of thinned trees was statistically greater than movement of structurally pruned, raised, and lion's tailed trees at wind speeds of 20.1 m/s (45 mph) and was greater than all pruning types at 26.8 m/s (60 mph). There was no difference in movement among reduced, raised, structurally pruned, and lion's tailed trees; and there were no statistical differences in trunk movement among pruning types at the lower wind speeds. We found that thinning the outer edge of the crown was one of the least effective pruning types for reducing trunk movement in wind.

Key Words. Crown Raising; Crown Reduction; Crown Thinning; Lion's Tailing; Pruning Dose; Pruning Type; Structural Pruning; Wind.

Edward F. Gilman, Forrest Masters, and Jason C. Grabosky
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Abstract. The goal of this study was to determine how different pruning techniques affect trunk movement on live oak subjected to hurricane force winds. Tree movement in wind on nonpruned trees was compared with movement on trees with crowns thinned, reduced, or raised. Twenty trees were blown using a wind generator up to 45 m/s (110 mph) maintained for 3 min. Each tree was instrumented with three orientation sensors at set heights along the trunk to measure its deflection. Thinning or reducing crowns significantly reduced upper trunk movement at all wind speeds, whereas raising did not. Lower trunk movement was not affected by pruning type. These data indicated that foliage and branches toward the top of tree crowns were 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 windstorms.

Key Words. Crown Raising; Crown Reduction; Crown Thinning; Hurricanes; Tree Damage.

Glynn C. Percival and Ian P. Keary
**The Influence of Nitrogen Fertilization on Waterlogging Stresses in
Fagus sylvatica L. and *Quercus robur* L. 29**

Abstract. The aims of this study were to determine the influence of nitrogen (N) fertilizers on tree tolerance under prolonged waterlogging conditions and investigate the effect of N fertilization on aiding tree recovery from waterlogging damage using containerized English oak (waterlogging-intermediate) and European beech (waterlogging-sensitive) as test species. English oak proved to be more waterlogging-tolerant than European beech. Tree vitality as measured by chlorophyll fluorescence, photosynthetic rates, leaf chlorophyll content, stomatal conductance, leaf and root protein concentration, and foliar N content was consistently higher in trees in which N fertilizers were added to the waterlogged solutions compared with trees waterlogged with tapwater only for 18 days. Measurement of light absorbance, light trapping, electron transport, and dissipation fluxes per leaf cross-section of photosystem II after the 18-day waterlogging period indicated a beneficial influence of N fertilization on leaf photosynthetic processes at the cessation of the waterlogging period. Addition of N induced greater resource allocation in favor of roots over shoots in both tree species. At the cessation of the 18-day waterlogging period and after a 10-day regeneration period, growth (leaf area, shoot, root, total plant dry weight) was constantly higher in N waterlogged trees compared with non-N waterlogged ones. In a separate study, recovery rates of trees as measured by chlorophyll fluorescence, photosynthetic rates, leaf chlorophyll content, and stomatal conductance over a 6-week period after the cessation of 18 days waterlogging were 30% to 50% higher in N-fertilized trees compared with non-N-fertilized trees irrespective of species. In all cases, nonfertilized trees had the least capacity for recovery. In addition, leaf area, shoot, root, and total plant dry weight were higher in N-fertilized trees compared with nonfertilized ones. Results of this investigation indicate 1) applications of N fertilizers enhance the tolerance of trees under prolonged waterlogged conditions; and 2) applications of N fertilizers after waterlogging stress would be of benefit to improve tree recovery rates and growth. From a practical point of view, N fertilization 14.5 g (0.51 oz) or greater N per liter (0.26 gal) of water is tentatively suggested based on preliminary results of this study.

Key Words. Chlorophylls; Chlorophyll Fluorescence; English Oak; European Beech; Photosynthesis; Physiogenic Stress; Plant Health Care; Protein; Root Deoxygenation; Stress Enzymes, Stress Tolerance.

Bonnie L. Lewis and John G. Boulahanis
**Keeping Up the Urban Forest:
 Predictors of Tree Maintenance in Small Southern Towns in the United States 41**

Abstract. A mail survey of mayors of small towns in 13 southern states assessed the importance of urban forests and current urban forest practices. Topics covered were local tree management practices, resource allocation, and community influence. The findings, based on the responses of 504 mayors, indicate that small southern towns vary widely in their support of urban and community forests. Descriptive and multivariate analysis showing the relative effects of several predictors of basic tree maintenance indicate that basic solutions are near at hand. A clear linkage of state resources and organizational structure to local tree maintenance supports the important role played by the U.S. Department of Agriculture Forest Service and its support for state agencies. In addition, the particular challenges communities face are outweighed by other factors.

Key Words. Small Towns; Urban and Community Forestry; Urban Forest Management.

Joseph Heimlich, T. Davis Sydnor, Matthew Bumgardner, and Patrick O'Brien
**Attitudes of Residents Toward Street Trees on Four Streets in Toledo, Ohio, U.S.
 Before Removal of Ash Trees (*Fraxinus* spp.) from Emerald Ash Borer (*Agrilus planipennis*) 47**

Abstract. Toledo, Ohio, U.S. residents on four streets in an area with mature street trees, including ash, scheduled for removal as a result of attack by emerald ash borer were surveyed to determine their attitudes toward their street trees. Toledo is in the process of removing some 5,000 trees. Large trees with a variety of summer and fall foliar characteristics were highly valued suggesting that residents would be satisfied with a mix of species rather than planting each street to a single species. The fact that their trees canopied the street was also important to residents and is characteristic of larger urban trees. Residents would be pleased if replacements were planted before removing existing trees. Flowers were not a significant concern for residents. In Toledo, as it is in many communities, the primary maintenance concern regarding trees in this survey is the potential damage to sidewalks.

Key Words. *Agrilus*; Ash Replacements; Community Safety; Emerald Ash Borer; *Fraxinus* spp.; Green Ash; Resident Attitudes; Street Trees.

Abstract. Products and systems used to stabilize trees at transplant should be prescribed based on site conditions, tree characteristics, and planting and maintenance practices. Alternatives to traditional aboveground trunk staking and guying methods exist, generally consisting of products that anchor tree rootballs rather than supporting tree trunks. When assessing the need for tree stabilization at transplant, several factors should be considered, including material costs, time required for installation and maintenance, product persistence in the landscape, and aesthetics.

Key Words. Balled and Burlapped (B&B); Container-Grown; Guying; Rootball Anchoring; Staking; Transplanting; Trunk Support.
