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E. Gregory McPherson

Benefit-Based Tree Valuation 1

Abstract. Benefit-based tree valuation provides alternative estimates of the fair and reasonable value of trees while illustrating the relative contribution of different benefit types. This study compared estimates of tree value obtained using cost- and benefit-based approaches. The cost-based approach used the Council of Landscape and Tree Appraisers trunk formula method, and the benefit-based approach calculated the net present value (NPV, total future benefits minus costs discounted to the present) of future benefits and costs using tree growth data and numerical models. In a hypothetical example, the value of a 40 year old green ash (*Fraxinus pennsylvanica*) was \$5,807 using the cost-based approach and either \$3,102 (for a tree growing in Fort Collins, CO, U.S.) or \$5,022 (for a tree growing in Boulder, CO) using the benefit-based approach. This example, however, did not consider planting and management costs. In a multitree example, 15 years after planting five pistache (*Pistacia chinensis*) street trees in Davis, California, the trunk formula (cost-based) value was \$8,756, whereas the benefit-based value NPV of benefits was negative at discount rates ranging from 0% to 10%. Negative NPVs occurred because future sidewalk repair costs were projected to be in excess of benefits, a relationship not fully captured in the cost-based approach to valuation. Removing and replacing the five pistache street trees was not cost-effective at 7% and 10% discount rates, primarily because high future sidewalk repair costs associated with retaining the trees were heavily discounted. Planting the five pistache trees in their current location was not an economically sound decision, but planting the same trees in a nearby shrub bed would have saved an estimated \$1,102 (10%) to \$12,460 (0%) over 40 years. These examples illustrate the use of the benefit based approach as a decision support tool for design and management.

Key Words. Tree Appraisal; Tree Benefits; Tree Value; Trunk Formula Method.

Joseph J. Docola, Eric J. Bristol, Samantha D. Sifleet, Joseph Lojko, and Peter M. Wild

Efficacy and Duration of Trunk-Injected Imidacloprid in the Management of Hemlock Woolly Adelgid (*Adelges tsugae*)..... 12

Abstract. Hemlock woolly adelgid (*Adelges tsugae*) (HWA) is an introduced piercing, sucking insect that affects hemlocks (*Tsuga* spp.) by extracting carbohydrates from the xylem ray parenchyma cells. Left untreated, HWA will result in reduced shoot growth, branch dieback, and ultimately tree death. In this study, the insecticide IMA-jet (5% imidacloprid w/w) was applied by trunk microinjection with the Arborjet Tree I.V. using the VIPER method. Sixteen randomly selected HWA-infested hemlocks were treated in 2002 and 2003 and eight trees were selected as untreated controls. Eight infested branch samples per tree were cut each year (2003, 2004, and 2005) and assessed. Four parameters were used to assess the efficacy and duration of treatments. These were percent HWA mortality, total and live HWA per linear centimeter shoot growth, and current-year shoot growth. The eastern hemlock (*T. canadensis*) in this study had high initial HWA pressure. In the 3 years of the study, winter low temperatures were insufficient to cause an appreciable or sustainable reduction in infestation levels. In the controls, HWA increased and hemlock growth decreased. Treatment with stem-injected imidacloprid did not provide a quick knockdown of the HWA; rather, it required time (i.e., at least 1 year). In the year after a second treatment, we observed sufficiently high HWA mortality for hemlock to resume growth. We have a high degree of confidence that a repeat treatment increased the levels of imidacloprid for the duration of efficacy observed. We recommend a 2x dosage (e.g., for trees in the 30 to 59 cm [12 to 23.6 in] size class, increase from 0.08 g A.I. to 0.16 gm A.I./cm trunk diameter at breast height [dbh]) for an increased level of efficacy to extend the injection interval (to once every 2 years) and to limit the number of wounds a tree receives to centimeters dbh/5 (dbh in/2). The new rate recommendations are reflected on the IMA-jet label amended in 2006. These results demonstrate that hemlock with high HWA pressure can be successfully treated using IMA-jet and the Arborjet Tree I.V. system.

Key Words. Arborplug; Hemlock; Hemlock Woolly Adelgid; IMA-Jet; Imidacloprid; Micro-Infusion; Plant Health; Systemic Injection; Tree I.V.; Trunk Injection; VIPER; Wound Response.

H.A. Catton, S. St. George, and W.R. Remphrey

An Evaluation of Bur Oak (*Quercus macrocarpa*)

Decline in the Urban Forest of Winnipeg, Manitoba, Canada 22

Abstract. Winnipeg, Manitoba, Canada, has a large, indigenous population of bur oak (*Quercus macrocarpa* Michx.). In the 1980s, many of these trees were showing signs of decline, a disease caused by a complex of abiotic and secondary biotic stressing agents. Potential causal factors were investigated by comparing various aspects of 120 bur oaks visually rated as healthy or declined based on crown dieback levels. The results indicated that many selected bur oak trees predated surrounding urban development and that declined trees were significantly older with more severe stem wounds and competition from surrounding trees than healthy specimens. Average annual growth ring widths of healthy and declined trees were similar in the early part of the 20th century. However, decline actually began decades before symptoms were noticed, coinciding with a period of intense city-wide urban development, as growth of declined trees was slower than that of healthy trees beginning sporadically in the 1940s and consistently from 1974 to 2001. During the early years of decline, the year-by-year separation in ring width between the two categories was significantly positively related to precipitation levels. This suggested that in wet years, declined trees may have been surrounded by unfavorable water-logged soils, possibly as a result of natural drainage patterns being impeded by urban development.

Key Words. Dendrochronology; Tree Decline; Urban Development.

Brian C. Kane

Friction Coefficients for Arborist Ropes Passing Through Cambium Saver Rings 31

Abstract. Friction is important in tree care operations; climbers encounter friction when ascending into, working in, and descending out of a tree. Twelve commonly used climbing ropes were tested on cambium saver rings made of three different materials to determine rope on ring static and kinetic friction coefficients. All ropes were tested before any field use. In addition, two ropes were tested after they had been used in the field for 2 years and were evaluated to determine the effect of rope wear on friction. Friction coefficients varied among ropes and ring materials, and surface roughness of ring material was the best predictor of friction coefficient. Used ropes exhibited higher friction coefficients than new ropes and, in most cases, superseded the influence of surface roughness of cambium saver rings. Simple physical models were developed to illustrate how friction coefficients can affect different aspects of tree climbing. There are important implications of these results for further studies on rope friction as it relates to reducing climber fatigue.

Key Words. Climbing; Friction Coefficient; Rope Friction.

Patrick J. Weicherding, Chad P. Giblin, Jeffrey H. Gillman, David L. Hanson, and Gary R. Johnson

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Circling Roots of Pot-Bound *Tilia Cordata* Mill. and *Salix Alba* L. 'Niobe' 43

Abstract. Pot-bound *Tilia cordata* Mill. and *Salix alba* L. 'Niobe' were planted in a Waukegan silt loam soil in June 2003 at the University of Minnesota TREE nursery in St. Paul, Minnesota. Before planting, the root balls of the container-grown plants were mechanically disrupted using one of three standard root pruning practices recommended to correct circling roots: scoring (slicing), butterfly pruning, or teasing. Root balls on the controls were left undisturbed. The trees were harvested in October 2004. Roots growing beyond the original root ball were counted and measured for diameter growth to assess the effectiveness of the root pruning techniques in encouraging root growth outside of the original root ball. All root disruption treatments resulted in increased fibrous root growth, but no mechanical root disruption method was significantly better than root balls left undisturbed.

Key Words. Butterfly Pruning; Circling Roots; Girdling Roots; Mechanical Root Disruption; Pot-Bound; Root Pruning; Scoring; Slicing; Teasing.

T. Davis Sydnor, Matthew Bumgardner, and Andrew Todd

The Potential Economic Impacts of

Emerald Ash Borer (*Agilus planipennis*) on Ohio, U.S., Communities 48

Abstract. A survey of 200 communities with individuals such as urban foresters who have assigned responsibilities for their urban tree resource was conducted to provide baseline data on ash density within Ohio communities. Sixty-seven communities responded, including the five largest cities in Ohio. Data represent 25% of the population of Ohio and 33% of communities surveyed. Losses in landscape value for ash trees within community boundaries were estimated to be between \$0.8 (median-based) and \$3.4 billion (mean-based) assuming the complete loss of ash resulting from the emerald ash borer (EAB), a recently introduced exotic pest of native ash species in the United States. Tree removal costs would be somewhat smaller and range between \$0.7 and \$2.9 billion based on reported medians and means, respectively. Tree replacement costs in Ohio communities, including streets, parks, and private properties, would range between \$0.3 and \$1.3 billion. In aggregate, the total losses for Ohio communities, including ash landscape losses, tree removal and replacements, are estimated to range between \$1.8 and \$7.6 billion for a single insect pest in a single state. The potential total costs in Ohio are estimated to be between \$157,000 and \$665,000 per 1000 residents. Communities can use these figures to begin developing contingency plans.

Key Words. *Agilus planipennis*; Economic Impact; Emerald Ash Borer; *Fraxinus*; Green Ash; White Ash.

Joseph M. DiTomaso and Guy B. Kyser

Control of *Ailanthus altissima* Using Stem Herbicide Application Techniques..... 55

Abstract. Three herbicides were tested using four stem application techniques for control of both single trunks and clumps of tree-of-heaven [*Ailanthus altissima* (Miller) Swingle]. Imazapyr, triclopyr, and glyphosate were applied using cut stump, stump injection, and stem injection techniques. Imazapyr and triclopyr were also applied as a basal bark treatment. Treatments were compared against manual cutting and untreated controls. Untreated cut stems did not provide control of tree-of-heaven. Cut stump treatment with imazapyr and triclopyr (20% v/v in oil) resulted in more than 90% reduction in both vigor ratings and resprouting of single stems and clumps. In contrast, stump injection applications were ineffective with all herbicides. For stem injection treatments, undiluted imazapyr gave the best results (>95% canopy reduction), but glyphosate also provided excellent control (92% canopy reduction). Removing stems 4, 8, or 12 months after treatment did not impact the level of control with imazapyr. Imazapyr at half the standard rate also gave good control of multistemmed clumps. Basal bark treatments with imazapyr or triclopyr (20% v/v in oil) gave equally good results, providing nearly complete control. Triclopyr is less selective than imazapyr and thus offers a better option when desirable vegetation surrounds the stems. These results provide several effective options for the control of tree-of-heaven in both urban and riparian sites.

Key Words. *Ailanthus*; Basal Bark; Cut Stump; Glyphosate; Herbicide Control; Imazapyr; Invasive tree; Manual Cutting; Riparian; Stem Injection; Stump Injection; Tree-of-Heaven; Triclopyr.

Michael A. Arnold, Garry V. McDonald, Donita L. Bryan,
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Abstract. Adverse impacts of planting the root collar or main structural roots below grade on survival and growth were demonstrated for five species of container-grown trees from genetically diverse families. Adverse effects were demonstrated when root collars were located as little as 7.6 cm (3 in) below grade on all taxa tested, but severity of the responses varied among taxa. These responses were confirmed for both seed-propagated species, *Fraxinus pennsylvanica* Marsh. (green ash, family Oleaceae Hoffmansegg & Link) and *Platanus occidentalis* L. (sycamore, family Platanaceae Dumort.) as well as cutting-propagated taxa, *Lagerstroemia indica* L. × *Lagerstroemia fauriei* Koehne. 'Basham's Party Pink' (crap myrtle, family Lythraceae St.-Hilaire), *Nerium oleander* L. 'Cranberry Cooler' (oleander, family Apocynaceae Juss.), and *Vitex agnus-castus* L. 'LeCompte' (vitex, family Verbenaceae St.-Hilaire). In some cases, planting above grade by 7.6 cm (3 in) improved growth of plants over that of those planted either at or below grade. This effect was pronounced with sycamore and oleander.

Key Words. Apocynaceae; Landscape Installation; Lythraceae; Oleaceae; Pine Bark Mulch; Planting Depth; Platanaceae; Transplant Establishment; Tree Planting; Verbenaceae.
