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Daniel W. McKenney, John H. Pedlar, Denys Yemshanov, D. Barry Lyons, Kathy L. Campbell, and Kevin Lawrence

Estimates of the Potential Cost of Emerald Ash Borer (*Agrilus planipennis* Fairmaire) in Canadian Municipalities 81

Abstract. Emerald ash borer (EAB) is an invasive phloem-feeding insect causing extensive mortality to ash (*Fraxinus* sp.) in North America. Economic costs associated with EAB-related mortality of street and backyard trees in Canadian urban areas were estimated over a 30-year time horizon. The approach employed a simple spread model to approximate EAB arrival times at each community based on three maximum spread rates: slow (~10 km/year), medium (~30 km/year), and fast (~50 km/year). Costs are estimated for four discount rates (0%, 2%, 4%, and 10%) and three treatment rates (0%, 10%, and 50% of trees treated with an insecticide). Ash density along urban roads was estimated from a variety of sources, including a recently developed survey that allows for rapid assessment of street tree compositions. Based on the 30 km/year spread rate, a 4% discount rate, and a 10% treatment rate, the present value of the costs is estimated to be approximately CAD \$524 million (2010 currency rate); this value increases to roughly \$890 million when costs associated with backyard trees are included. These estimates are conservative because they focus only on damage to street (and backyard) trees; nonetheless, their magnitude suggests considerable justification for investments to slow the spread of EAB in Canada.

Key Words. *Agrilus planipennis*; Canada; Cost-benefit Analysis; EAB Spread Model; *Fraxinus*; Urban Forest Management.

Yolanda F. Wiersma, Troy L. Davis, Elizabeth C. Eberendu, Ian Gidge, Maria Jewison, Hiliary C. Martin, Kaylah C. Parsons, Heidi Patterson, and Ashley Quirke

Hurricane Igor Impacts at Northern Latitudes: Factors Influencing Tree Fall in an Urban Setting 92

Abstract. Hurricane Igor was a Category 1 hurricane when it passed the island of Newfoundland, Canada, causing extensive damage. Hurricanes are uncommon at northern latitudes, and boreal species are not adapted to hurricane-force winds. Moreover, much of the storm damage was in the urban area of the City of St. John's, where there are also numerous non-native trees. This research tested whether there were attributes of trees (e.g., height, diameter at breast height, slenderness, species, age, or distance to nearest tree) that may have influenced whether a tree fell or was left standing. The study authors sampled 70 trees and found that DBH was a significant predictor of tree fall (snapping or uprooting). Conifers were no more or less likely to fall in the storm than deciduous trees, nor were native trees more or less susceptible to wind damage than non-natives. These results suggest that for a boreal, urban ecosystem, there are no target species available that could be planted strategically to minimize risk of tree fall in a major wind event. Thus, to minimize storm damage to human-built infrastructure in regions where hurricanes are rare, the best strategy would be to avoid having large trees located in close proximity to infrastructure.

Key Words. *Abies balsamea*; *Acer platanoides*; *Acer pseudoplatanus*; *Betula papyrifera*; Boreal Forest; Hurricane; *Picea mariana*; *Tilia americana*; Tree Damage; Urban Forest; Wind Damage.

J. Veilleux, J. Leferink, and N.J. Holliday

Rapid Removal of Symptomatic Trees Reduces Dutch Elm Disease Infection Rates 99

Abstract. In the province of Manitoba, Canada, 14 communities were paired on the basis of size and location. From 2004 to 2010 in one member of each pair, rapid removal of American elm (*Ulmus americana*) trees that displayed symptoms of Dutch elm disease was practiced: newly symptomatic trees were removed within six weeks of symptom detection. The remaining member of each pair continued with autumn or winter removal of symptomatic trees. Treed urban study areas were selected in each community, and in 2008 an inventory of *U. americana* was taken in these areas. From this inventory and from records of tree removals, estimates of the number of living *U. americana* and prevalence of Dutch elm disease were made for each year from 2004 to 2010. Following the switch to rapid removal, the annual prevalence of Dutch elm disease in rapid removal communities was $1.5 \pm 0.2\%$, significantly lower than in communities with autumn/winter removal ($3.1 \pm 0.4\%$). The study authors estimate that in similar areas the value of the elm resource after 10 years would be almost CAD \$600,000/km² greater if rapid removal rather than autumn/winter removal were practiced. Therefore, under conditions similar to those in these communities, rapid removal should be a component of management programs for Dutch elm disease.

Key Words. American elm; *Hylurgopinus rufipes*; *Ophiostoma novo-ulmi*; Sanitation; Tree Removal; *Ulmus americana*.

Mark Johnston and Andrew Hiron

Going Online with Arboricultural Education 105

Abstract. E-learning is the delivery of learning, training, or education programs by electronic means. Over the past two decades this has become an increasingly popular way of delivering higher education courses, as this form of delivery provides significant benefits to students and the academic institution. Myerscough College has been a pioneer in developing a fully online degree level course in arboriculture not only in Britain, where the college is based, but also internationally with students now studying online in many different countries. This paper describes how the e-learning degree programs were developed, including the various challenges the programs faced and the interventions that were made to overcome them. It also presents a model for the development of e-learning vocational programs for arboriculture and related industries that other institutions may wish to use or adapt. The paper concludes with an indication of likely future developments in e-learning in arboriculture.

Key Words. Career Development; Continuous Professional Development; E-learning; Higher Education; Vocational Courses.

Gary Watson and Karel Jacobs

Control of Apple Scab and Cytospora Canker with Paclobutrazol..... 112

Abstract. Forty *Malus* 'Radiant' crabapples, a variety known to be highly susceptible to apple scab disease, were field-planted then treated three months later with paclobutrazol (PBZ) as a basal drench, at rates of 0, 0.8, 1.6, and 2.4 g a.i./cm caliper. Apple scab was significantly reduced for two years post treatment by all rates of PBZ applied. However, significant growth regulation occurred through the third and final year of the study. Thirty *Picea pungens* (Colorado spruce) trees in containers were treated with PBZ, applied as a basal drench, at rates of 0, 1.6, and 3.2 g a.i./cm caliper. Cytospora canker development from subsequent branch inoculations was significantly reduced by both PBZ treatment rates and persisted through the end of the two year monitoring period. Cytospora canker disease control with only moderate growth regulation indicates that a PBZ basal drench could be developed into a viable landscape treatment.

Key Words. Colorado Spruce; Crabapple; Disease Control; Growth Regulation; Paclobutrazol; *Picea pungens*.
