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Sten Gillner, Sandra Korn, and Andreas Roloff

Leaf-Gas Exchange of Five Tree Species at Urban Street Sites 113

Abstract. For street trees, site-specific soil and microclimate conditions can restrict growth, health, and longevity for many species. Many urban sites are characterized by a high amount of impervious surface and paved areas resulting in a high rate of surface runoff, low infiltration into soil, and strong reradiation effects. In maintaining the ecologic and economic benefits of street trees through future decades, it is essential to establish species with a high tolerance to stressful urban environments.

Researchers measured leaf-gas exchange of *Acer platanoides*, *Acer pseudoplatanus*, *Platanus × hispanica*, *Quercus rubra*, and *Tilia platyphyllos* to assess stomatal conductance, transpiration, and net photosynthesis at impervious urban sites in the city of Dresden, Germany.

The results show significantly higher leaf-gas exchange rates for the species *Platanus × hispanica* and *Quercus rubra*, compared to the species *Acer platanoides* and *Acer pseudoplatanus*. The significantly higher mean values of water-use efficiency of *Platanus × hispanica* and *Quercus rubra*, and in particular the values during the selected periods with a high vapor pressure deficit, indicate more economical water consumption.

Key Words. *Acer platanoides*; *Acer pseudoplatanus*; Climate Change; Dresden; Germany; Leaf-Gas Exchange; *Platanus × hispanica*; *Quercus rubra*; Street Trees; *Tilia platyphyllos*; Urban Trees; Water-Use Efficiency.

Gabriel P. Hughes, Clifford S. Sadof, and Matthew D. Ginzel

A Borer-Specific Assessment Scheme for Identifying Sentinel Trees to Delimit Invasive Borers in Urban Forests 125

Abstract. Aggressive insects like the emerald ash borer [*Agrilus planipennis* (Fairmaire)] (EAB) increasingly threaten the health of the urban forest. Early detection of exotic wood-boring pests is critical for rapid response efforts, and allows for effective management while populations are relatively low. During street tree inventories, arborists record subjective rankings of tree condition and pest incidence; however, the extent of insect attack is rarely quantified. Moreover, it is unknown how the assessment of tree vigor provided by city foresters during these inventories relates to the likelihood of wood-borer infestation. In this study, researchers developed a borer-specific tree vigor assessment scheme to rapidly evaluate street trees, and to identify when EAB populations begin to grow exponentially based on the health of the forest. This scheme incorporates common indicators of EAB attack, including canopy thinning and epicormic sprouts, as well as attack by common native wood-boring insects. This scheme was used to track the health of ash trees from 2010 to 2013 in one urban forest with advanced symptoms of EAB decline and one without (Indianapolis and Lafayette, Indiana, U.S., respectively). Trees declined more rapidly in Indianapolis where emergence holes from native borers were positively correlated with EAB in infested areas. Over the course of the study, first detections of EAB occurred on progressively weaker trees at both sites, suggesting that early detection of incipient EAB populations can be improved by surveying apparently healthy trees.

Key Words. *Agrilus planipennis*; Early Detection-Rapid Response; Emerald Ash Borer; Surveys; Tree Inventory; Tree Vigor; Wood Borers.

Rebecca W. Dolan

Two Hundred Years of Forest Change: Effects of Urbanization on Tree Species Composition and Structure 136

Abstract. Despite their importance, the dynamics of urban floras are not well understood, and quantitative historical data are rare. The current study used three data sets for trees in Indianapolis/Marion County, Indiana, U.S., to document change over 200 years to the original beech-maple forest and to examine future implications of contemporary tree planting efforts in light of these changes. Data on tree composition and size collected before significant settlement in the early 1800s are compared with recent surveys of trees in remnant natural areas and with trees found on city streets and rights-of-way. All the species recorded in historical surveys are still present in either remnant natural area forests or among city street trees, but frequencies and sizes have changed, and many additional species are now present. Comparison of the composition of the original forest with current remnants shows a 95% decline of American beech (*Fagus grandifolia*), the most common species in presettlement forests. Sugar maple (*Acer saccharum*) has more than doubled in number. Silver maple (*Acer saccharinum*) is the most important street tree, with eight species of non-native broadleaf trees among the most common on city streets, along with evergreen gymnosperms that are not documented in the presettlement flora. Data for contemporary tree planting efforts in the city show a focus on native species that targets replacement of species that have declined in frequency, especially oaks, in proportions that should be sustainable. Patterns reported here are likely representative of those in many forested areas undergoing land conversion and development, so the findings apply to many cities.

Key Words. American Beech; *Acer saccharinum*; *Acer saccharum*; *Fagus grandifolia*; Indiana; Indianapolis; Presettlement Forest; Remnant Forests; Silver Maple; Sugar Maple; Urban Forest; Witness Trees.

Edward F. Gilman, Maria Paz, and Chris Harchick

Retention Time in Three Nursery Container Volumes Impacts Root Architecture 146

Abstract. Four general-use insecticides (Astro®, Onyx®, Dominion® Tree & Shrub, and Xytect 2F®) were evaluated for their effectiveness at preventing attacks by the southern pine beetle (SPB) (*Dendroctonus frontalis*) and the small southern pine engraver (*Ips avulsus*) using a previously developed small-bolt method. Evaluations were conducted between 58 and 126 days post treatment. Southern pine beetles from New Jersey and Mississippi, U.S., were evaluated using a mixture of field and laboratory small-bolt trials; beetle origin did not appear to affect results. Astro and Onyx bole sprays were effective at reducing or eliminating attack by SPB, while the imidacloprid soil drench products (Dominion and Xytect) were ineffective. With *I. avulsus* in Louisiana, U.S., Astro was effective at reducing bole utilization at 58 and 83 days posttreatment but failed at 126 days. Onyx, Dominion, and Xytect were ineffective against *I. avulsus* in these tests. Imidacloprid phloem residues averaged 0.74 (µg/g phloem dry weight) for Dominion and 1.31 for Xytect, values that are similar to other studies but low for purposes of control. These results support previous findings that systemic imidacloprid is ineffective for protecting pines against *Dendroctonus* bark beetles and that bole sprays with bifenthrin or permethrin can be effective. However, permethrin was the only active ingredient that was effective against *I. avulsus* in the current study.

Key Words. Bifenthrin; *Dendroctonus frontalis*; Imidacloprid; Insecticide; *Ips avulsus*; Mississippi; New Jersey; Permethrin; *Pinus*; Soil Drench; Southern Pine Beetle; Southern Pine Engraver; Systemic Insecticide.

Edward F. Gilman, Maria Paz, and Chris Harchick

Container Wall Porosity and Root Pruning Influence on *Swietenia mahogani* Root Ball Architecture and Anchorage After Planting..... 155

Abstract. The emerald ash borer (EAB), first discovered in North America in Michigan in 2002, continues to expand its distributional range. Early detection of EAB remains a major caveat in efforts to implement proactive management strategies. Past reports have shown that ash trees infested with EAB have an increased risk of branch failure and other symptoms associated with tree decline. Therefore, early detection efforts could be improved if a suite of tree symptoms—prior to visible signs of EAB infestation—can be identified. Researchers initiated a four-year study in Ohio, U.S. (2009–2012) to investigate and document symptoms associated with the EAB–ash tree complex in urban sites. The prior history of EAB at the study sites ranged from ash trees with no visible evidence of infestation to those that were infested for more than two years. In trees shown to be recently colonized by EAB, visible signs of infestation, such as adult emergence holes, presence of EAB galleries, bark loss, and canopy loss were not always apparent. However, in EAB-positive trees, there was a significant tendency for the presence of cracks in scaffold branches, branch fractures within the upper canopy, and branch fractures specifically located closer to the union with the stem as opposed to at the branch tip or at the branch’s center of gravity. This study highlights tree symptoms associated with the initial colonization of EAB when host trees are still apparently healthy, which could greatly facilitate future detection efforts for EAB.

Key Words. *Agrilus planipennis*; Arboriculture; Ash; Branch Fracture; Early Detection; Emerald Ash Borer; *Fraxinus*; Invasive Species; Scaffold Crack; Urban Forestry.