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Gregory Dahle, Jason Grabosky, Brian Kane, Jason Miesbauer, Ward Peterson, Frank W. Telewski, Andrew Koeser, and Gary W. Watson

**Tree Biomechanics: A White Paper from the 2010 International Meeting and Research Summit at The Morton Arboretum (Lisle, Illinois, U.S.)..... 309**

**Abstract.** The International Society of Arboriculture, in conjunction with The Morton Arboretum (Lisle, Illinois, U.S.), convened Tree Biomechanics Summit in September 2010 – bringing together a panel of internationally-recognized experts in the fields of tree biology, tree structure, structural engineering, computer modeling, and arboriculture. Following two days of public research talks on the state of tree biomechanics research, presenters were invited to attend a researcher summit to discuss persisting research gaps and prioritize research needs. Over the course of the event, summit attendees identified five priority research areas: 1) improving efforts to assess mechanical failure potential in trees; 2) modeling the impact of mechanical loading on trees; 3) understanding the mechanisms and modes of tree failure; 4) understanding tree growth response to mechanical loads; and 5) increasing the effectiveness of tree risk mitigation practices. Beyond research priorities, summit participants discussed opportunities for advancing future tree biomechanics research efforts, including the creation of a formal working group dedicated to the subject.

**Key Words.** Biomechanics; Failure; Mitigation; Research; Structural Behavior; Summit; Tree Failure.

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Bryant C. Scharenbroch and Gary W. Watson

**Wood Chips and Compost Improve Soil Quality and Increase Growth of *Acer rubrum* and *Betula nigra* in Compacted Urban Soil ..... 319**

**Abstract.** Tree growth is negatively impacted by the removal of topsoil and compaction of subsoil associated with site development in urban landscapes. A research plot with 60 *Acer rubrum* and 60 *Betula nigra* was created, mimicking the typical urban landscape disturbance. Wood-chip mulch (WC), compost (COMP), inorganic fertilizer (FERT), aerated compost tea (ACT), a commercial biological product (CBP), and a water control (NULL) were assessed for their impacts on soil quality and tree growth after five years. The WC treatment significantly decreased bulk density and increased soil moisture, organic matter, and microbial respiration. The COMP treatment increased soil moisture, organic matter, microbial respiration, pH, N, P, and K. Soil P increased with the FERT treatment. Tree growth was significantly increased with WC, COMP, and FERT treatments. No significant changes in soil properties or tree growth were observed with ACT or CBP compared to NULL; and, compared to background soil levels or other treatments (e.g., COMP and WC) ACT and CBP supply relatively minimal amounts of microbes and nutrients. This research shows strong evidence that COMP topdressings and WC mulches are effective and also cost-efficient methods for improving soil quality and stimulating tree growth in compacted urban landscape soils.

**Key Words.** *Acer rubrum*; Aerated Compost Tea; *Betula nigra*; Compost; Inorganic Fertilizer; Organic Materials; Organic Matter; Soil; Wood-Chip Mulch.

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Holly M. Martinson, Chris Sargent, and Michael J. Raupp

**Tree Water Stress and Insect Geographic Origin Influence Patterns of Herbivory by Borers in Green (*Fraxinus pennsylvanica*) and Manchurian (*F. mandshurica*) Ash ..... 332**

**Abstract.** Emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae), is a devastating buprestid beetle introduced to North America from Asia. Asian ash trees exhibit resistance to EAB, likely due to a shared co-evolutionary history. Resistance to one pest, however, does not necessarily confer resistance to others. Should Asian ash be highly susceptible to North American herbivores, the utility of such species for hybridization, breeding programs, and establishment in managed landscapes could be compromised. Common urban problems, such as drought stress, can increase borer attack and survival and may further complicate the search for resistant plant material. The objectives of this study were to examine the relative susceptibility of green (*Fraxinus pennsylvanica*) and Manchurian (*F. mandshurica*) ash to EAB and indigenous borers and whether that susceptibility changed with drought stress. In a common garden experiment, EAB occurred more frequently and reached higher abundances in green than Manchurian ash. The frequency and abundance of bark beetles (Curculionidae), North American native clearwing borers (Sesiidae), and longhorn beetles (Cerambycidae) were similar in the two ash species. Generation time of EAB was uniformly one year and did not depend on ash species or water stress. Although borers increased as expected in stressed trees, the relative susceptibility of green and Manchurian ash to borers did not change. The findings suggest Manchurian ash may be resistant to several classes of borers, regardless of insect geographic origin, although these conclusions should be viewed with some caution until the results can be verified in larger trees.

**Key Words.** *Agrilus planipennis*; Ash Trees; Defense Free Space; Emerald Ash Borer; *Fraxinus*; Green Ash; Invasive Species; Manchurian Ash; Voltinism; Water Stress.

Matthew D. Taylor

**Preventing Death and *Taxus*: Review and Recommendations for Managing *Taxus* in the Landscape with Overview on *Phytophthora cinnamomi*, Soil, and Nutrition Status ..... 345**

**Abstract.** At least three major gardens or arboreta in the USA have experienced periods of significant decline and death of mature *Taxus* (yews) in the landscape. The symptoms displayed on declining plants are described as chlorosis of the needles, partial defoliation, and death of some of the branches. Eventually, the entire plant may die, but they are typically removed before reaching this stage. Information on managing mature *Taxus* in the landscape is limited. The objective of this article is to review the literature on *Taxus* cultural practices and use the information to develop best management practices for *Taxus* in the landscape. Soil moisture is the most critical factor for health of plants in the landscape. Saturated soils create anaerobic conditions for roots and create an environment ideal for root infection by *Phytophthora cinnamomi*, the major root pathogen affecting *Taxus*. During planting, proper site selection and well-drained soil are crucial for the long-term survival of plants. After planting, irrigation should be managed to avoid saturated soil. Management from a nutritional standpoint is poorly understood. Maintaining an appropriate pH of 6.0 to 7.0 and fertilizing plants based on soil and tissue testing is recommended. More research needs to be done to determine optimal fertilization rates and appropriate nutrient concentration in tissue and in soil. When plants become symptomatic, soil should be tested for *P. cinnamomi*. If the fungus is present, appropriate chemical controls should be used.

**Key Words.** Manganese; *Phytophthora cinnamomi*; Plant Nutrition; Root Rot; *Taxus*; Water Management; Yew; Zinc.

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