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Aboveground Growth Response of *Platanus orientalis* to Porous Pavements 1

Abstract. Integrating healthy, mature trees into paved urban environments is a challenging task for urban foresters, as impervious pavements are associated with reduced tree growth and survival. It is thought that porous pavements may alleviate this problem due to their permeability to air and water. The authors of the following study tested whether porous pavements affect tree growth relative to impervious pavements by measuring aboveground growth in trees treated with an augmented factorial arrangement of pavement profile designs and pavement types. Fifty oriental plane (*Platanus orientalis*) seedlings were evenly distributed to control plots or one of four treatments. Treated plots were characterized either by porous or impervious pavement pads measuring 2.3 m × 2.3 m, that were underlain either by fine sandy loam or a gravel base and compacted subgrade, reflecting two pavement profile designs. Results show stem height, diameter, and biomass increased as a result of porous pavements. Greater growth proffered by porous pavements was negated by profile designs including a compacted subgrade and gravel base. Finally, impervious pavements did not negatively influence tree growth, relative to control trees.
Key Words. Biomass; Oriental Plane; Permeable; Pervious; Road; Sidewalk; Soil Compaction; Street Tree.

Joseph J. Doccola, David R. Smitley, Terrance W. Davis, John J. Aiken, and Peter M. Wild
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Abstract. Trunk injection of systemic insecticides or fungicides is an effective way to manage destructive insects or diseases of trees, but many arborists are still reluctant to inject trees because of the potential for infection by pathogens, structural damage, or adverse effects on tree health. The authors of the following study examined wound responses of green ash (*Fraxinus pennsylvanica* Marsh.) for two years following trunk injection, by sectioning tree trunks to look for evidence of infection associated with injection sites, and by collecting data on annual radial growth and rate of closure around injection sites. All healthy trees successfully compartmentalized injection wounds without any signs of infection, decay, or structural damage. Wound closure was positively correlated with the tree health as measured by annual radial growth.
Key Words. Canopy Dieback; Decline; Emerald Ash Borer; Stem Injection; Systemic Insecticide; Tree Health; Wound Closure; Woundwood.

Pascal Nzokou, Jessica Simons, and Anthony Weatherspoon
Wood Residue Processing and Utilization in Southeastern Michigan, U.S. 13

Abstract. This paper is an analysis of southeastern Michigan, U.S.'s wood residue processing and disposal facilities. The analysis was conducted in order to characterize wood supply patterns, evaluate recovery efficiency, and identify potential alternatives for wood residues. Wood collection and processing facilities were identified and surveyed throughout a 14-county area. This study documented at least 180 wood residue yards operating in the region, which employed an average of six employees per yard (for a total of 1,082 employees in the industry). The total volume of wood entering the yards was quantified at 6,659.6 thousand cubic meters (5.3 million metric tons), mainly from land-clearing and tree removal. The wood residue supply was used to produce a total of 2,035.8 thousand cubic meter (1.6 million tons) tons of new products (e.g., wood chips, mulches, firewood), which were mainly sold locally. The overall conversion rate was estimated at 30% for the entire industry, clearly indicating room for improvement. The industry is estimated to contribute approximately USD $40 million to Michigan's economy. Improvement of conversion rates and value-added product development would require fundamental changes in equipment, training, and processes used by tree service and land clearing companies.
Keywords. Disposal Yards; Urban Tree; Wood Residue; Wood Residue Recovery.

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Bixia Chen and Yuei Nakama
On the Establishment of Feng Shui Villages from the Perspective of Old Fukugi Trees in Okinawa, Japan 19

Abstract. A Feng Shui village landscape features Fukugi (*Garcinia subelliptica*) tree lines surrounding every house and orderly laid out roads. Such a green landscape, which is assumed to be planned or reformed during the modern Ryukyuan period around 300 years ago, is well preserved in Okinawa Island, Japan, and its nearby isolated islands. But it is still a mystery to the historians when and how these Fukugi trees were planted. In order to clarify the development process of the house-embracing Fukugi trees, all Fukugi trees that were assumed to be older than 100 years in Bise, Tonaki, Imadomari, and Aguni Island were measured. It was found that huge Fukugi trees older than 200 years, cluster around the core area *kami-asagi* or *haisyo* inside the village. Both the *kami-asagi* and *haisyo* are sacred places where guardian gods were summoned in order to hold ceremonies and rituals. The oldest trees were approximately 300, 268, 294, 296, and 281 years in Bise, Tonaki, Imadomari, Yae (East & West), and Hama in Aguni Island, respectively. These old trees might have been planted prior to the period from 1737 to 1750, when Sai On was a member of the Sanshikan, during which Fukugi trees were planned and recommended. While Fukugi trees might have been planted as windbreaks around the houses prior to the Sai On period, however, the current house-embracing Fukugi tree landscape came into being during the Sai On period based on Feng Shui concepts.
Key Words: Feng Shui Village; Fukugi; *Garcinia subelliptica*; Isolated Islands; Old Trees; Sacred Sites.

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Abstract. In order to model the impacts of tree root growth under pavement as a layered design, the behavior of the components need to be defined or assumed. Since the behavior of materials and the design of pavement sections work on the presumption of loading from the pavement surface downward, it is reasonable to check engineering behavior assumptions with a testing method for controlled loading upward from a growing perennial root. A root simulation was developed to inflate with water to known input pressure. Sand displacement in response to increasing input pressure was tracked over several sand density-moisture level pairings. Load cells tracked the translation of sand displacement to load at a simulated pavement surface to develop data plots of a line-load spreading wider with increasing distance between root and pavement. The results from the laboratory experiments were compared to the results from numerical simulations using finite elements to develop better understanding of the mechanisms of load generation due to the root growth. Sand was modeled as a Mohr-Coulomb type material for that purpose. The numerical results are qualitatively in agreement with the experimental results.
Key Words. Compaction; Pavement; Root.

Jason C. Grabosky, E. Thomas Smiley, and Gregory A. Dahle
Research Note: Observed Symmetry and Force of *Plantanus* × *acerifolia* (Ait.) Willd. Roots Occurring Between Foam Layers Under Pavement 35

Abstract. Root damage to infrastructure is common in the urban environment. Many problems could be avoided if more were known about tree root growth patterns and the forces involved. This study looks at the growth symmetry and forces from four roots to aid in the development of a computer model. Two primary roots, each from two trees, that were growing between two foam layers under pavement for 10 years were harvested and sectioned to measure radial growth symmetry to assist in the development of a computer simulation of root growth under pavement. The indentations in the foam created by the root growth were replicated using a universal loading press to estimate the radial growth pressure. Root growth was offset upward when close to the tree trunk, but shifted to a downward offset within 1 m from the trunk. Load penetration testing of the foam suggested a minimal load of 0.35–0.40 MPa to replicate the foam deformation.
Key Words. Infrastructure Damage; Root Diameter Growth; Root Pressure; Sidewalk Lifting.

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