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Abstract. Fungicide injection is regularly performed to prevent and manage Dutch elm disease (DED) of American elm (*Ulmus americana*). In an effort to better understand the effects of long-term fungicide injection on tree health, sonic tomography (SoT) and electrical-resistance tomography (ERT) were used to nondestructively determine the incidence and severity of internal decay in the lower trunk of American elms in suburban and urban settings. Overall, 253 sonic and electrical-resistance tomograms were generated from 210 American elms. Sampled trees were partitioned into two fungicide injection groups: (1) regular injection; and (2) irregular injection or no known history of injection. Among all American elms, the incidence of internal decay in the lower trunk was 30% (63/210) with a mean percent decay, as determined by SoT, of 39%. Based on Chi-square analysis, there were no significant differences in the frequency of elms with decay by injection history ($P = 0.799$). Mean percent decay was significantly different by dbh class ($P = 0.005$) and while linear regression demonstrated a positive correlation between percent decay and dbh, most of the variability went unexplained ($R^2 = 0.182$). For elms with decay, there was a significantly higher frequency of trees in the lowest decay class (< 25% of the cross section) compared to the highest decay class (> 75% of the cross section). The results suggest that the wounding associated with regular fungicide injection does not increase the likelihood of internal decay and that American elms exhibit a low frequency and severity of internal decay.

Keywords. Butt Rot; Decay; Risk Assessment; Systemic Fungicides; Urban Forestry.

Abstract. Local governments have created regulations aimed to maintain and increase valuable urban tree cover. The City of Falls Church, Virginia, USA, requires each residential redevelopment to retain or plant enough trees for 20% canopy cover within ten years. To assess whether this goal is being met, we studied 21 Falls Church residential lots redeveloped between 1994 and 2011 where existing houses had been replaced with larger ones. Initial tree inventories and measurements prior to redevelopment were recorded in redevelopment plans. We remeasured preserved and planted trees in a ground survey and modeled tree canopy growth from a periodic tree diameter growth model linked to a model relating tree and crown diameters. Geospatial analysis was used to calculate nonoverlapping canopy cover within lots from crown diameter measurements and/or model predictions. We found that the City of Falls Church generally met its 20% canopy cover goal, but that the canopy cover metric alone is insufficient to fully describe urban forest recovery. Although canopy cover might recover rapidly from planting many small trees, recovery to the larger tree sizes that maximize ecosystem services can take much longer. Our modeling of lot-scale growth from field measurements showed the potential to manage forests using traditional diameter-based forest metrics that would relate results to canopy cover when needed. These forest stand metrics—based on basal area and trees per hectare—can account for tree size changes masked by the canopy cover metric.

Keywords. Basal Area; GIS Buffer; GIS Dissolve; Municipal Tree Ordinance; Municipal Tree Policy; Quadratic Mean Diameter; Urban Forestry.

Abstract. Pests, disease, and climate change pose major challenges to street tree survival, and diversity in tree species and genera is widely considered to promote the sustainability of municipal street tree populations. Conversely, the lack of sufficient diversity in street tree population was judged a contributing factor in the death and removal of thousands of street trees in Worcester, Massachusetts, that state's second most populous city, due to an infestation of the Asian longhorned beetle (ALB, *Anoplophora glabripennis*). Therefore, reducing the dominance of prevalent street tree species and genera and increasing tree species and genera diversity are considered vital to sustainable street tree management and to the preservation of the ecosystem services and social benefits that street trees provide. This paper assesses street tree diversity in Massachusetts by analyzing a nonrandom sample of collated municipal street tree inventory data stratified by plant hardiness zones. Consistent with results previously found for Connecticut, New Jersey, New York, and Pennsylvania, results in Massachusetts indicate that a relatively small number of species and genera dominate the composition of most

municipal street tree populations, including in particular *Acer* spp. (maple), one of the ALB's favorite host genera. There is accordingly a need for greater species and genus diversity in municipal street tree populations statewide. While there may be a trend towards increased street tree diversity and reduction in the dominance of *Acer* spp., considerable work remains to be done.

Keywords. *Acer* spp.; Asian Longhorned Beetle; Diversity Indices; Ecosystem Services; Worcester.

Abstract. Diplodia tip blight (*Diplodia pinea*) affects mature pines, including Austrian (*Pinus nigra*) and Ponderosa (*P. ponderosa*) pines. Infections spread from needle fascicles to branch and, if unchecked, to the entire tree. Efficacy studies of fungicide injections in conifers are limited. Minute vascular tissues and resin exudate, a response to drilling, present impediments to injection. The efficacy of Propizol (14.3% propiconazole) for control of Diplodia tip blight in Austrian pines was evaluated. We evaluated (1) time of year, (2) injection spacing, and (3) fungicide dilution with respect to injection efficiency. Late fall injections expedited uptake, which is consistent with the reduced monoterpene emission rates in autumn and winter reported by Kim et al. 2005 and Lim et al. 2008. The time required for the dose to be administered was recorded for close and wide spacing of injection sites. Close spacing had the greatest impact on reducing the application time, irrespective of time of year. Low volume injections required less time to apply compared to high volume. Regardless of the application method, we observed a significant decrease in disease incidence in Propizol-treated trees. Injections applied in late fall resulted in a mean reduction in infections of new candles in the next growing season. Injections in the following spring, however, did not result in improvement in candle condition until a year later. We believe that these differences are based on whether the fungicide was applied prior to or after infection. Based on these findings, we recommend Propizol prior to infection for optimal results.

Keywords. Austrian Pine; Diplodia Tip Blight; Propiconazole; Tree Injection.

Abstract. Urban tree canopy (UTC) assessment is essential for understanding the structure and function of urban forests and for devising management strategies. Geospatial techniques are routinely used for UTC assessment, yet their capabilities and limitations may not be apparent to urban forestry practitioners. This paper provides an overview of two primary methods of geospatial UTC assessment: photo interpretation (PI) and computerized image classification (IC). These methods were evaluated through a case study of an urbanized college campus in the eastern United States. The web-based application *i-Tree Canopy* is a PI method that uses statistical point sampling to estimate land cover. To examine the effect of point sample size on accuracy and certainty of the land cover estimates, we performed independently replicated assessments of our study area at various point sample sizes. We compared these findings with two IC methods: a proprietary analysis using high-spatial-resolution imagery and a low-spatial-resolution analysis using the web-based application *i-Tree Landscape*. With *i-Tree Canopy*, the estimate of UTC in our study area stabilized at a mean of 14.7% when point sample size reached 100 points, but it required more than 500 points to reach a tolerable standard error of less than 1.7%. By comparison, high-resolution imagery (considered the most robust form of assessment) estimated UTC in the study area at 16.1%, and *i-Tree Landscape* substantially underestimated UTC at 11.3%. Possible sources of variation in these estimates, along with practical considerations for choosing an appropriate UTC assessment method, are discussed.

Keywords. Geospatial Analysis; Image Classification; *i-Tree* Canopy; *i-Tree* Landscape; Photo Interpretation; Remote Sensing; Urban Forestry; Urban Trees.