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Bimal Aryal, MES, James W.N. Steenberg, PhD, and Peter N. Duinker, PhD
The Effects of Residential Street Tree Spacing and Crown Interactions on Crown Dimensions and Canopy Cover 183

Abstract. Urban trees provide people with a range of ecosystem services. Trees planted along streets have been a large focus of urban forest research and practice, and municipalities invest significant resources in their survival. However, the optimal spacing of street trees is not addressed in the scientific literature, and existing municipal street tree spacing standards are highly variable and poorly enforced. In this study, we examine variability in crown shape and size for street trees to test for possible interaction effects at closer spacings. We measured variability in crown diameters both parallel and perpendicular to street tree rows to test whether changes in crown dimensions can be explained by interaction effects with neighbouring trees, and whether crown interactions lead to a reduction in total crown projection area (i.e., canopy cover). We measured the crown dimensions and diameter at breast height of 1,338 street trees in Halifax, Canada. We used two-way analysis of variance to test whether crown shape and crown projection area were affected by crown interactions and spacing. We found that the effect of narrower spacing and interactions (i.e., crowns touching/overlapping) among trees translated to crowns extending away from the direction of interaction. We also found that these changing crown dimensions were associated with increases in canopy cover. Urban forest ecosystems are a vital resource for the increasingly urban population. There is a need for empirical research on spacing standards and practices that investigate their influence on the supply of ecosystem services, such as stormwater retention, air pollution removal, and cooling.

Keywords. Canopy Cover; Competition; Ecosystem Services; Spacing; Street Trees; Tree Planting.

F.D. Cowett and N.L. Bassuk
Is Street Tree Diversity Increasing in New York State, USA? 196

Abstract. Diversity in tree populations is viewed as essential for protecting the public investment in urban trees and for preserving the environmental, social, and economic benefits that these trees provide. It is therefore crucial for officials responsible for the management of municipal trees to know the diversity of their municipal tree populations and whether their efforts to increase diversity have been effective or should be modified. We assessed street tree diversity in New York State, USA by analyzing municipal street tree inventory data from two data sets, the first comprised of 75 inventories collated from municipalities, and the second comprised of 32 sets of inventories conducted at multiple points in time. This analysis builds on two previous papers containing similar assessments by analyzing more current data and by calculating diversity index statistics and relative abundance percentages for prevalent street tree species and genera. Findings indicate that there has been substantial progress to increase street tree diversity in New York State. This progress is correlated with reductions in the dominance of Norway maple (*Acer platanoides*), the state's most prevalent street tree species (17% of street trees statewide), and in the dominance of maple (*Acer*), the state's most prevalent street tree genus (35% of street trees statewide). Work remains to be done to further increase species and genus diversity so as to meet the challenges posed to municipal street tree populations by invasive pests and climate change. Strategies are proposed for accomplishing this.

Keywords. Climate Change; Diversity Index; Invasive Pests; Municipal Trees; Norway Maple.

Kevin L. Griffin, PhD, Thomas G. Harris, Sarah Bruner, MA, Patrick McKenzie, MA, and Jeremy Hise, BA
Is the Radial Growth of Irrigated Urban Trees More Strongly Correlated to Light and Temperature than Water? 214



Abstract. Background: Real-time monitoring of tree growth can provide novel information about trees in urban/suburban areas and the myriad ecosystem services they provide. By monitoring irrigated specimen trees, we tested the hypothesis that in trees with sufficient water, growth is governed by environmental factors regulating energy gain rather than by factors related to water use. Methods: Internet-enabled, high-resolution dendrometers were installed on 3 trees in Southampton, NY, USA. The instruments, along with a weather station, streamed data to a project

web page that was updated once an hour. Growing periods were determined using a Hidden Markov Model based on a zero-growth model. Linear models and conditional inference trees correlated environmental variables to growth magnitude and rate of growth. Results: Growth was governed by the interacting environmental variables of air temperature, soil moisture, and vapor pressure deficit (VPD), and took place primarily at night. Radial growth of spruce began April 14 after the accumulation of 69.7 °C growing degree days and ended September 7. Cedar growth began later (April 26) after the accumulation of 160.6 °C and ended later (November 3). During the observation period, these 3 modest suburban trees sequestered 115.1 kg of CO₂. Conclusions: Though irrigated, residential tree growth in our experiment was affected by environmental factors relating to both water use and energy gain through photosynthesis. Linking tree growth to fluctuations in environmental conditions facilitates the development of a predictive understanding useful for ecosystem management and growth forecasting across future altering climates.

Keywords. Carbon Sequestration; Climate; *Cryptomeria japonica*; *Picea glauca*; Tree Growth.
