

Measurement and Prediction of Tree Growth Reduction in Parking Lots Based on Apparent Available Soil

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Urban conditions have been thought to affect tree growth, but little conclusive evidence as to the severity of those influences or whether different species respond differentially to urban stress exists. Understanding of reduced growth expectations affects design choices for the urban tree canopy, particularly as required by legislative mandate. Environmentally sustainable development and legislation continues to increase with the further urbanization in the United States.

A large part of “green friendly” development has been targeted towards parking lot design; for instance, formulae exist for the minimum number of trees to plant, required for ordinances or credits for design goals. Such formulae tend to use percent canopy cover, trees per number of parking spaces, or numbers of trees per paved area and there is typically a time frame associated with these requirements. When predicting the canopy area coverage in a design plan, it is uncommon to take into account the diminishing returns on tree growth due to smaller biotic capacity of the planting site. The goal of this study was to determine the relationship between canopy area to diameter at breast height (DBH) and attempt to determine the reduction of growth expectations based on site restrictions as represented by apparent available soil in the planting zone of the parking lot.

Five tree species (*Acer rubrum*, *Prunus serrulata*, *Pyrus calleryana*, *Quercus palustris*, and *Zelkova serrata*) growing in parking lots ranging 18 to 23 years old in central and northern New Jersey were measured for tree height, DBH, canopy radius, and apparent available soil (nonpaved planting zone area). Data was normalized within site, to facilitate a multi-site comparison.

Tree DBH, commonly recorded for many municipal inventories, was found to be a useful predictor of canopy area. Reductions in tree size were consistently associated with reduced apparent soil access, across different parking lots. The data exhibited that the current legislative and design growth canopy expectations are not being met if the published mature size is expected in 20 years. A previous study from Florida was used for comparison of regional data, permitting conclusions on canopy reductions, relative to specification of design space for tree establishment, in an attempt to extract general patterns across different regions in the United States.