Street Tree Decline and Mortality in Commercial Urban Spaces

This document provides a synopsis of an investigation undertaken to better understand the decline and mortality of street trees planted in structural soil cells along Bloor Street, Toronto, Canada.

In 2016, the UFRED group of Ryerson University investigated reasons for tree decline and mortality along Bloor Street with the objective of advancing design, planting, and maintenance practices related to street trees growing in soil cells.

Site & Project Description **-** Bloor Street revitalization was finalized in 2011 and involved the planting of 133 London plane trees in structural soil cells (Silva Cells®). These trees performed poorly and were removed and replaced in 2015.

Data Collection & Analysis **-** Research quantified multiple variables potentially influencing tree vitality (Figure 1). The collected data focused on evaluating the growing conditions, temporal variation of tree health and growth of the trees removed in 2015, as well as the condition of replanted trees now present on Bloor Street. These data were investigated using analysis of variance, classification and regression tree, and correlation analysis, with the objective of identifying drivers of tree decline, and their associated contribution, to tree performance.

Figure 1: Types of data collected

Results **-** Trees that were alive at the time of removal (2015), displayed good canopy condition, and attained higher annual growth, had: (1) lower levels of soil salinity; (2) fewer signs of trunk/branch damage and canopy distress; and (3) higher daily exposure to direct sunlight; however, the positive effects of light availability were only evident for trees receiving less than 6 – 7 hours of direct sunlight at the peak of the growing season. Increased incidence of drought, and several extreme heat events between 2010 and 2014 likely contributed to overall restricted growth and high tree mortality. Characteristics of the built environment, including in ground pit style planters and close proximity to road intersections were negatively associated with tree performance, displaying increased soil salinity and diminished soil nutrient levels. De-icing salt application along Bloor Street, and heat stress caused by extreme sunlight exposure, were identified as primary factors influencing tree performance; the interactions between the environmental variables investigated and their cumulative effects were also of significant importance (Figure 2).

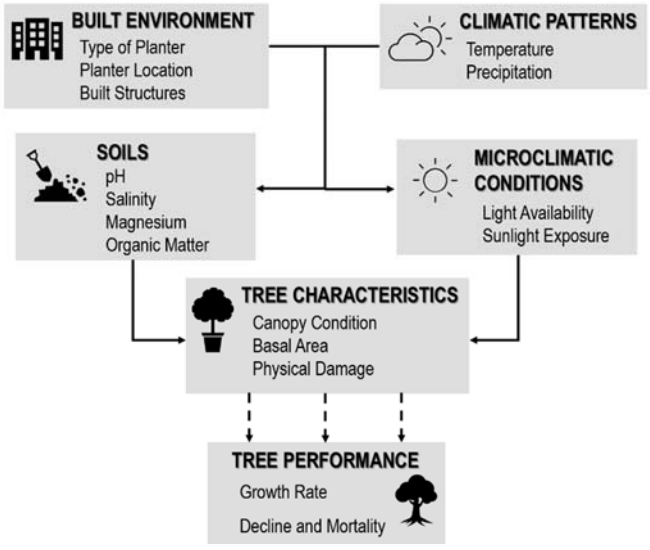

Figure 2: Synthesis of results, indicating influences and interactions

Recommendations - (1) Minimize planting of trees directly into streetscape where de-icing salt application is known to be high; (2) Watering of trees must be increased, especially in spring to flush salts and during summer in locations that receive prolonged direct sunlight; (3) Educate BIA / building managers / retailers about de-icing salt and appropriate application; (4) Select appropriate tree species for location (e.g., salt tolerance, drought and heat tolerance), considering micro-climate at the scale of a sidewalk block, or part thereof; and (5) Expand research efforts focused on the movement (and residence time) of de-icing salts in structural soil cells and the associated impacts on tree performance.