Buried Root Systems:
Their association with stem encircling and girdling roots, and relationship with tree condition

by

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Abstract

This study examines buried root systems among street trees surveyed in three Minnesotan cities. Buried root systems can cause tree roots to encircle, girdle a tree stem, cutting off vital nutrients to the tree canopy and causing the tree to decline, die. Results of this study will help arborists and urban foresters better understand the association between the depth of soil over a tree's first lateral root and frequency of these encircling, girdling root systems.

Background Terms

Stem encircling roots (SERs) are roots that are encircling the stem but are not yet compressing or touching the stem.

Stem girdling roots (SGRs) are encircling roots that are compressing the stem of a tree.

Methods

Surveys of landscape trees were conducted in three Minnesotan cities: Minneapolis, Rochester, and St. Paul (see Table 1 for participating cities and cohorts). These cities gave permission for University Urban Forestry Outreach Research Lab (UFOR) staff to perform boulevard root collar examinations on their street tree inventories. Trees surveyed were selected based on their size, with Diameter at Breast Height (DBH) classes between 3-9-inches. Researchers measured the depth of soil over roots, frequency of SERs and SGRs, and canopy/stem condition ratings. Evaluations were performed by separate two teams. The first team "blind" rated toperform canopy and stem condition. The second team rated root collar conditions.

Table 1. Participating study cities and sample cohorts

City	Year	Species
Minneapolis	1997	*Acer saccharum*
	1999	*Fraxinus pennsylvanica*
	1999	*Tilia cordata*
Rochester	2001	*Celtis occidentalis*
St. Paul	2004	*Gleditsia triacanthos*

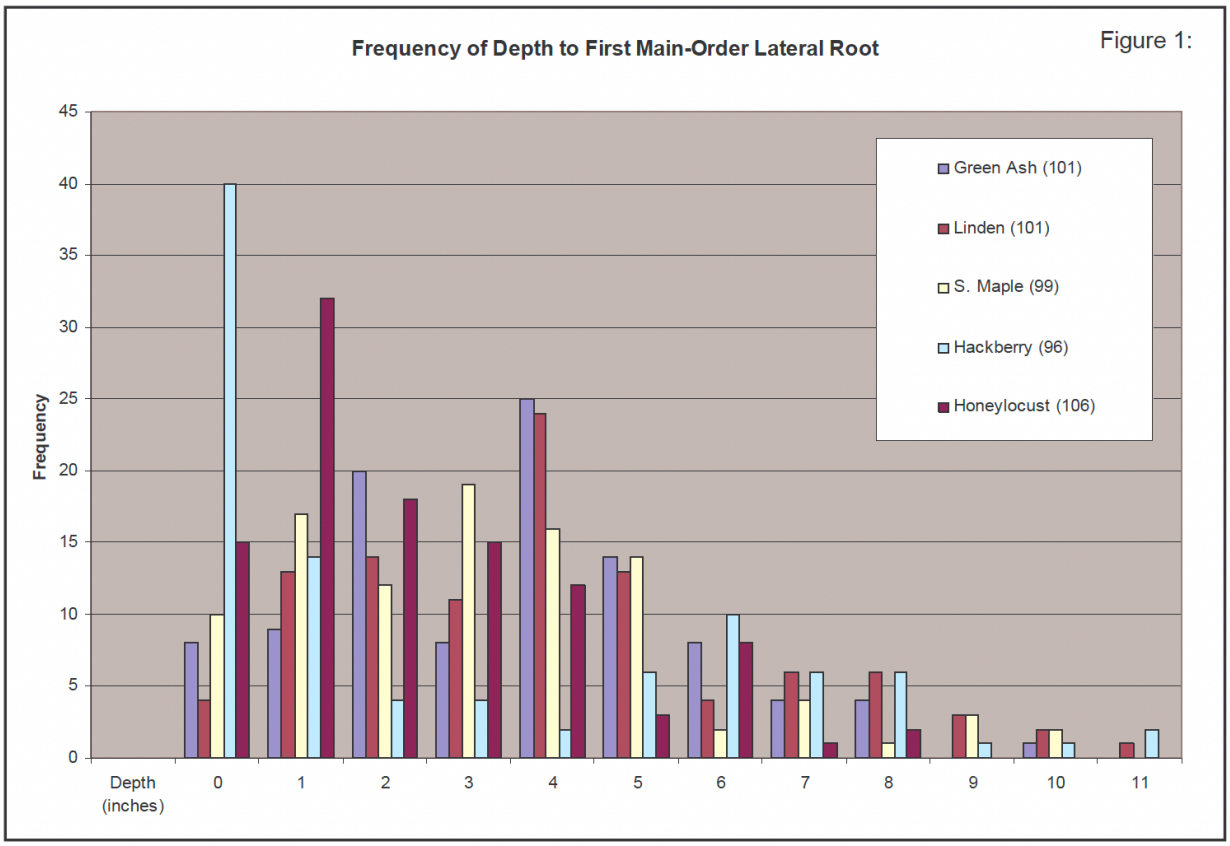
Tree Condition Ratings were given using a four-degree scale, where 0 represented "poor or dead" and 4 "good" condition. Canopy condition ratings were based on observations of Characteristic crown density for the species, live crown ratio, symmetry of the crown, dieback, and stag heading. Stem condition ratings based on observations of bark loss or separation, hollow sounds (decay), signs of decay, and stem openings (cracks, seams, or holes). Condition ratings are subjective, and interrater consensus was used to minimize bias perceptions of individual researchers.

Evaluation of the roots included observations of stem-encircling (SERs) and stem-girdling roots (SGRs). SER measurements included the stem circumference at the encircled point, as well as

the distance that the root encircled the stem. After data collection, researchers calculated the percentage stem affected. Similarly, SGR measurements of the circumference were taken at the point of compression, as well as the distance of the compressing root. Follow-up calculation of the percentage of stem affected was used to rate the root system.

Results

Figure 1. Frequency of different depths of soil over first-order lateral roots by tree species.



Figures 2, 3. Observations of root systems

Figure 2. Frequency of Stem Encircling Roots

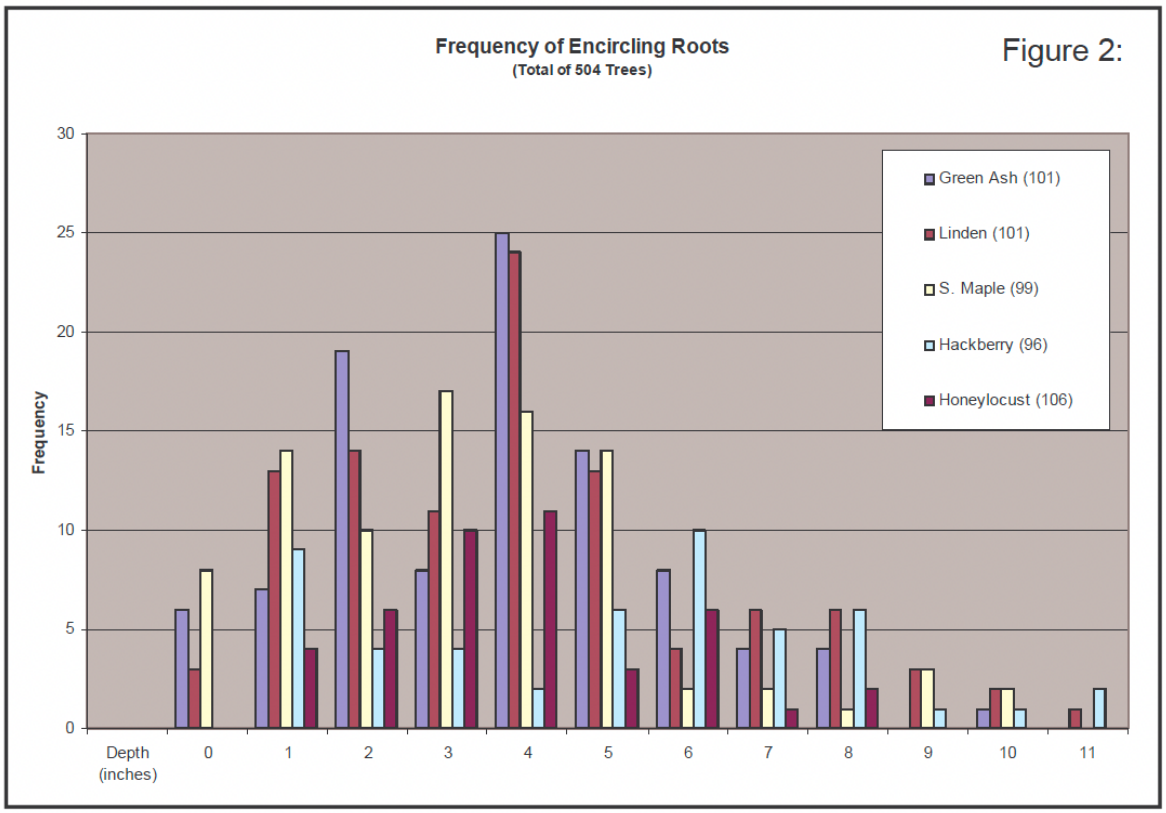


Figure 3. Frequency of Stem Girdling Roots