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A Site Index for Urban Trees

by Bryant Scharenbroch, Ph.D.

Site and soil assessment is a critical component of urban tree and forest management. Urban sites and soils are extremely variable. Current urban soil maps are often not available, and even if they are, they do not tell us about the suitability of the site for an urban tree or forest. Consequently, arborists and urban foresters must be able to assess sites and soils for the trees they manage. A practical and accurate approach for site assessment is needed for arboriculture and urban forestry.

An urban site index will help to increase urban forest diversity and urban tree health. Site quality identification will facilitate better matching of sites with species. Low quality sites should be planted with tough trees. High quality sites should be planted with new species introductions to the urban forest or trees with relatively weak resistance to urban site stress. An urban site index will also improve our management of individual urban trees. Site assessment will identify those poor quality soils in need of some management for urban trees. Additionally, site assessment will allow us to detect whether our management actions are effective at improving soil quality.

Michelle Catania and Marlene Hahn performing an urban site assessment, Baker Hill subdivision, Glen Ellyn, Illinois

For the past ten years, we have been working on developing a practical and accurate site assessment approach for arborists and urban foresters (Scharenbroch and Catania, 2012; Scharenbroch et al., 2017). We have two goals with the project: (1) develop an index that can be used for assessing sites for urban trees and (2) increase awareness and education on urban soils (i.e., teach arborists and urban foresters about soils and how to assess them).

Our first step in this process of developing the urban site index was to examine all possible soil and site properties that might be useful in predicting urban tree growth and health. We surveyed the literature, made a list of important properties, and then measured these ~50 properties in urban landscapes with trees. We developed some predictive models and found that the most important soil properties for urban tree growth and health were: soil texture, density, aggregate stability, pH, electrical conductivity, total organic matter, and labile organic matter. We concluded that these properties are important for urban tree health, and that we need to develop field assessment techniques for these properties to be included in our site assessment model.

Quercus rubra *in a low quality urban site in Chicago, Illinois (left).* Tilia cordata *in a high quality planting site in Cleveland, Ohio (right).*

The second step in this process was to develop a model and approach for assessing these properties (Scharenbroch et al., 2017). The model we developed and then tested included 15 site and soil properties. Each of these properties are measured in the field and then scored (0-3). The total score is summed up and divided by the total maximum possible points to return a site index score of 0-100. This model was tested in urban landscapes and the scores were correlated to urban tree health and growth. We concluded that this approach was somewhat accurate and practical for urban site assessment. The site assessment requires minimal equipment, time (~5 to 10 minutes), and expertise. Further evaluation of the model has led us to conclude that the accuracy of the model can be improved when the approach is modified to recognize variability within cities (manuscript in preparation).

A Site Index for Urban Trees *(continued from front)*

The third step, which we are currently working on, is to collaborate with individual arborists and urban foresters to tailor the model and approach to improve its accuracy for specific users. The process is summarized below:

1) Identify sites to assess
2) Determine the potential limitations that are present on these sites
3) Identify the site properties related to these limitations
4) Develop scoring functions for those site properties
5) Create a tailored site index model for these sites
6) Assess sites using the model
7) Utilize the site index scores

This research would not have been possible without the generous support of TREE Fund. The researchers would like to thank TREE Fund and all of its partners and donors.

If you are interested in learning more about the site index approach or would like to develop and test your own site index, please contact Bryant Scharenbroch at bryant.scharenbroch@uwsp.edu.

References

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Behind the Research: Meet Dr. Bryant Scharenbroch

Dr. Bryant Scharenbroch was born in Manitowoc, Wisconsin and spent his childhood living in and exploring the central Lake Michigan coastal region of the state. His childhood love of being outdoors propelled him to seek degrees in urban forestry, plant science, and soil science and a career in natural resources. Bryant is currently an Assistant Professor of Soil and Waste Resources at an alma mater of his, the University of Wisconsin - Stevens Point (UWSP), and a Research Fellow at The Morton Arboretum in Lisle, IL (both January 2015 to present).

Before joining the faculty at UWSP, Bryant worked as a soil scientist at The Morton Arboretum and he was engaged in many research projects there. Despite the wide reach of the arboretum, Bryant knew he could have more impact on the vital, neglected study of urban trees and soils by joining the faculty at UWSP. Soil is an underrated resource for our rapidly expanding urban ecosystems, and the world needs more people who care for the degraded soils sustaining urban trees. Teaching and research go hand in hand for Bryant, and he was able to continue his research projects at the arboretum by becoming a Research Fellow there.

Bryant is not immune to some soil problems of his own; he is currently working on improving the low fertility and low water weight capacity of the sandy soil on his own property by applying a heavy, two-foot thick layer of organic material and allowing it to sit on top of his soil for a year. A bonus? It also kills weeds! After this, he is planning to install raised beds and plant several fruit trees in his backyard. These trees will join a small woodland area he is developing on his property and the two oak trees he planted in front of his house courtesy of seedlings he received at an ISA conference.

When Bryant is not busy improving soils at home and abroad (the most interesting soil he ever studied was in Moscow, Russia), he can be found caring for his three children and sharing his passion for the great outdoors with them.

Read about more about his TREE Fund supported research and watch his webinar at www.treefund.org.