**Urban Site Index Site Analyses**

**Introduction**

The Urban Site Index (USI) is a tool for conducting a community soil inventory. The resulting soil inventory will provide urban forest managers and community tree commissions with valuable information for making local species selection decisions and anticipating existing tree growth and performance. A USI inventory is among the most stable and long-lived inventories conducted by urban foresters. The information remains valid for many years or decades barring soil disturbance. New USI data will need to be collected following street reconstruction, sewer, water, or gas reconstruction or other major soil disturbance.

**Methodology**

How to Conduct an USI Inventory

**Timing**

USI data should be collected when the soil is moist but not saturated. In Ohio this is usually in the spring and early summer (April, May, and June) then in late fall (October/November.) However, timing may vary significantly depending on the weather.

**Tools**

* Soil probe or shovel
  + 36-inch tube type soil sampler with step and 12”x 3/4 inch diameter sample tube is recommended
* Clip board and pencil or pen
* USI Data Sheets
  + PDF available on Division of Forestry web site
* Small street map of city
* Highlighter
* Vehicle (optional)

**Procedure**

It is advised to proceed with a crew of two people. One person will drive and record scores (Recorder) and the second person will take samples (Sampler.) The team will travel around the community or survey area stopping on each public block.

**Sampling**

At the beginning of each block or sample area, the Sampler will take 2-4 soil samples and walk the first property or two reporting the 4 soil scores to the Recorder. Soil samples may vary and the Sampler will attempt to average what they see to give a representative score for the entire block or sample area. After the initial scoring the Sampler should walk both side of the street taking samples and readings to confirm the initial scores or revise them.

Sample should be taken from the center of the tree lawn. Samples should not be taken near gas or water shutoffs, fire hydrants, or other pieces of infrastructure because these areas have been excavated and will not represent the condition in the rest of the tree lawn. The score for both sides of the street may not be the same. Unless each side of the street is to be managed separately the lower of the two scores should be recorded.

While the Sampler is collecting soil data, the Recorder should be recording the 4 street scores.

If the scores remain constant for the first distance the Sampler can ride to the midpoint of the sample area to do a quick sample to confirm or revise the score then ride to the end of the sample area and repeat. The frequency of stops and the distance sampled will be dictated by the variability of the soil.

Sample areas should be at least one block long dividing at good stopping points such as street intersections. (Let’s talk about this) The sample area can be longer than one block if the USI does not change. If the block is longer than ¼ mile and the USI changes the block should be divided into two sample areas.

**Data Collection**

**Soil Scores**

The quality of the soil is perhaps the greatest indicator the tree success.

**Vegetation:** Vegetation is a visual examination of the grass and turf weeds growing on the tree lawn. This vegetation is a good indicator of the quality of the growing space. If grass and weeds cannot grow on the site, trees will not have much of a chance to grow either.

**3** points are given for good (un-watered) lush grass, some weeds are ok

**2** for patchy grass and weeds

**1** for sparse weeds with dirt showing through

**0** for just bare dirt, gravel, or some sort of pavement

**Surface:** Surfaceis a measure of soil compaction. It is measured by walking on the tree lawn and feeling the soil beneath the feet and how much it crushes. Care must be taken not to confuse lush, watered turf with the feeling of the soil giving underfoot. By slowly walking on the turf the Sampler should be able to feel the irregularities of the soil beneath the turf and sense how it gives beneath the weight of the foot. Soil that gives underfoot is minimally compacted and will allow water and oxygen to seep into the soil providing water and nutrients to growing roots.

**3** points are given for soft sites, like walking on well-padded shag carpeting

**2** for moderate, like walking on living room carpeting

**1** for hard, like walking on office carpeting

**0** for no soil, pavement

**Probe:** The probe score is a measure of soil penetration. The Sampler pushes the probe or shovel into the ground and feels the resistance of the soil. Moisture content or the soil texture will impact the probe penetration. See the “Soil Moisture Effects on USI Scores” in related studies. Penetration is another measure of compaction. The easier the probe goes into the soil, the easier it will be for roots to grow through the soil.

**3** points are given goes in fully with ease, at least 12 inches deep

**2** for goes in at least 12 inches deep, but requires lots of effort

**1** for goes, in but not completely

**0** for does not go into the ground

**Layers:** Layers is a visual examination of the soil development. Better sites will have original soil layers or horizons still intact. Original soils possess years of organic matter development that supports soil biology and fertilizes the tree. Organic matter turns the soil a deep, rich, black color. As the organic matter moves deeper into the soil, the subsoil begins to darken giving the soil a fading appearance, dark at the top and fading deeper in the sample, the A Layer. A quality soil with organic material will be friable, so the edges within the probe sample will look flakey. Samples of poorer soil with little to no organic material will be slick and smooth. Topsoil in post World War II development is typically removed. After construction a layer of foreign topsoil is laid on top of the crushed subsoil. These soil samples will have a very distinct color change line between subsoil and top soil. Some may even have a gravel layer in-between the top and subsoil. This artificial soil development does not support tree life and is scored low.

**3** points are given for a good A Layer throughout 12 inch soil sample

**2** for layering in the soil from the old native soil

**1** for no top soil un-layered subsoil only *or*

a clear separation between topsoil and un-layered subsoil

**0** for no soil

**Street Scores**

Environmental factors associated with growing trees in a developed environment influence tree survival and species selection.

**Speed:** Vehicle speed on streets is an indicator of the amount and distance chemicals, including deicing salt and debris, are thrown onto trees and the treelawn. The higher the speed the greater the chemical volume & distance throw.

**2** points are given for speeds less than 30 mph

**1** for 35 to 45 mph

**0** for 50 mph or more

**Lanes:** The number of street lanes is a good indicator of street use volume and maintenance frequency, including salt application.

**2** points are given for a street with 2 lanes of traffic

**1** for 3 or 4 lanes

**0** for 5 lanes or more

**Parking:** On-street parking provides a periodic buffer between traffic and trees. Parked cars can also act as a traffic calming device, slowing traffic speeds, thus reducing chemical and debris loads from being thrown up on the tree lawn.

**2** points are given for a street with on-street parking

**1** for streets without street parking

**Length:** The length between traffic control devices dictates the average speed that traffic is able to reach. Long distances between stop lights, stop signs, sharp curves, or dead ends allow drivers to reach higher cruising speeds, often above the posted speed limit. Short distances prevent drivers from reaching higher speeds. Frequent stops and starts slow traffic speed reducing chemical and debris loads from being thrown up on the tree lawn.

**2** points are given for traffic control devices less than ¼ mile apart

**1** for traffic control devices ½ to ¼ mile apart

**0** for traffic control devices more than ½ mile

**Special Note:** It has been Ohio Urban Foresters’ experience that visual estimates are unreliable. It is highly recommended that other methods such as the vehicle odometer or Google maps be utilized to better gauge distances.

**Data Mapping, Storage, and Use**

There is no set procedure for mapping or storing data collected in this inventory. A few commercial street tree inventory software programs include an USI Field for each tree that can be populated after this soil inventory. Other methods can be as simple as a city map with the streets highlighted with colors coded to the respective USI Score (see *Master Planting Design*.) GIS layers can be created showing USI scores. No matter which method is used to map the soils, the original field survey sheets should be archived for future use.

“Once you have a data set, you are only limited by our own curiosity.”

~ Paul Thiess, Tree Commissioner, Silver Lake Ohio, 2013

There are many uses for a soil survey using the USI method. The most common is as a tool for selecting tree species to plant. Trees with a known USI score should be planted on sites with the same score or higher than the tree score.

Communities may adjust their program depending on their confidence with their tree scores. If a community is relying on a general tree list (see *Division of Forestry Tree List*,) they may choose to plant trees only on sites with a site score one higher than the tree score to account for variability between what other communities have found and what is in their community. A community may also choose to plant species on sites that are 1-3 scores higher, but no higher so as to save higher scoring sites for more sensitive tree species.

The USI survey is the basis for a community Master Planting Design. Details can be found on this web site under *Master Planting Design*.

This soil survey may also be used to develop a list of trees for each community. A community can assign a number for each tree based on the performance of that species in their community based in the USI. For details see *Species Assessment Methodology* on this web site.

The USI survey may also be used to identify trees that need to be monitored. Tree species planted on sites that score less than what the trees should thrive in will be more susceptible to insects, diseases, stress, and decline.