Space and Soil
What Trees Need!

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With information from
Deeproot Green Infrastructure, LLC
Trees and Soils

- Trees and soils are completely ecologically interdependent.
- Urban development processes disrupt the ecological balance between trees and soils.
- Most tree decline can be attributed to soil stress.
- Health of soil and soil/tree relationship has a major influence on tree health and performance.
We have all seen your typical street tree well with not nearly enough soil space or drainage for the trees. This results in the species *Quercus Horizontal-lie*.
Root Growth

- Roots grow where soil conditions are favorable
- Roots require space, organic materials, essential mineral elements, adequate oxygen, and water
- Fine, absorbing roots are found in the upper 6 to 10 inches of soil
- Few roots grow deeper than 3-4 feet
- Trees can develop much deeper root systems depending on species and environmental conditions
Soil Structure

- 50% of the soil is **space**, or pores, between soil particles
- **Macropores** are relatively large spaces, between aggregates; they cannot hold water against gravity and once drained they hold air
- **Micropores** retain water and are the source of available water to plants between rainfalls
To **conserve** a **Tree** you must conserve the **soils** the tree’s roots are in.
Naturally existing soils vs urban soils
Urban Soils

- No organic layer
- Compaction
- Disrupted profile
- Elevated pH
- Altered drainage
- Subsurface barriers
- No biological activity
- May need de-compaction and soil amendments
- Have a soils test done before amending
So, how do we give trees the space they need?

- Educate home owners, builders and developers
- Bring trees needs to the beginning of a project, pre-application meetings before plans are designed with homeowners and designers
- Make sure Tree Ordinances have the soil space requirements clearly stated
- Allow modifications to home footprints on the lot, administrative variances to setbacks to allow high value trees and their soils to be conserved.
b. **Soil Volume**

- Trees planted for tree canopy cover credit shall have a minimum amount of soil volume present at the time of planting to promote health, growth, and the ability to achieve the size potential for the species.

- The minimum depth of soil shall be 36 inches and the minimum open soil surface area, soil volume and planting area dimension for trees by mature canopy size are shown in Table 2.
Table 2. Required Minimum Open Soil Areas and Soil Volumes by Mature Canopy Size

<table>
<thead>
<tr>
<th>Mature Canopy Size</th>
<th>Minimum Open Soil Area</th>
<th>Minimum Soil Volume</th>
<th>Minimum Planting Area Width for Landscape Strips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>400 square feet</td>
<td>1,200 cubic feet</td>
<td>5 feet</td>
</tr>
<tr>
<td>Medium</td>
<td>225 square feet</td>
<td>675 cubic feet</td>
<td>4 feet</td>
</tr>
<tr>
<td>Small</td>
<td>100 square feet</td>
<td>300 cubic feet</td>
<td>3 feet</td>
</tr>
<tr>
<td>Very Small</td>
<td>36 square feet</td>
<td>108 cubic feet</td>
<td>3 feet</td>
</tr>
</tbody>
</table>
Add Soil requirements!

a. **Soil Quality**

- The rooting zone of all trees planted for tree canopy cover credit shall contain quality soil to enhance, and not limit, tree growth. The minimum standards for soil quality include:
  - Loamy, well-aerated soil that includes topsoil
  - Approximately 5 percent organic matter, 45 percent mineral matter and 50 percent pore space for holding water and oxygen
  - A pH (soil acidity) between 5.5 and 7.0

Without this type of requirement in your tree code you are unable to specify soils types
Add Suspended Pavement systems and root barriers in code

- The city arborist may approve the use of suspended pavement systems, such as structural cells, to meet soil depth and volume requirements in areas where the soil surface must be covered by pavement for parking lots, driveways and sidewalks.

- The planting site shall have good drainage from the bottom of the planting hole to ensure root health and tree survival. Soil compaction shall be avoided within the critical root zone of protected trees.

- Root barriers should be used to redirect root growth away from sidewalks, curbs, driveways and buildings.

Without this type of requirement in your tree code you are unable to require Structural soil systems or root barriers
Drainage is the key in compacted soils

Remember:

- No amount of gravel will change the soils ability to drain, you must de-compact the soil

- Potholes are not good planting locations
Things to consider

Watering, think ahead, make sure watering is scheduled with landscapers. Structural soil cells can be used for some stormwater storage. You can divert storm water into system but must have a drainage outflow pipe so trees don’t sit in water (must be designed by professionals)
The Street Scape Project
Hampton Inn Downtown Decatur Georgia
4- 2.5” caliper Willow Oaks
So, What’s Below The Concrete that makes this project different? **Soil Space!**

- Soil Volume per tree: 450 cf
- Silva Cell 1X system
- Showing the Strongbacks before adding soil
Silva Cells structural cells filled with soil

- Strongbacks on and filled with soil then removed and Decks installed
Once the cells are filled, they are covered in geotextile fabric and the sidewalks are poured

- Fabric cut out at tree openings
- Ready for base coarse layer and paving
Then the trees are planted
Hampton Inn
Downtown Decatur

- Trees Planted in
  Spring 2019
Hampton Inn Downtown Decatur

- Trees looking good
  Spring 2021
- 2nd growing season
Trees in July 2022
Soil Cells in Three Sizes

Design Flexibility is key when working on urban sites.

**1x system**
- System Height: 16.7”
- Width: 24”
- Length: 48”
- Soil volume capacity: approximately 10 cubic ft of soil

**2x system**
- System Height: 31”
- Width: 24”
- Length: 48”
- Soil volume capacity: approximately 20 cubic ft. of soil

**3x system**
- System Height: 43”
- Width: 24”
- Length: 48”
- Soil volume capacity: approximately 30 cubic ft. of soil
Soil Cells below Pavement

- Vehicular Rating means you can have trees and cars plus shade in your parking lots. Permeable pavement makes this into a bio-retention facility providing storage and filtration.
Getting Water Into the System

- Channel Drain
- Trench Drain
Getting Water Into the System

Permeable Pavers

SILVA CELL SYSTEM + PERMEABLE PAVEMENT
KEY PLAN
A. SILVA CELL SYSTEM (DECK, BASE, AND POSTS)
B. PERMEABLE PAVEMENT
C. AGGREGATE STORAGE LAYER
D. OPTIONAL PONDING SPACE
E. COLLECTION PIPE
F. CONNECTION TO MUNICIPAL STORM SYSTEM
DIRECTION OF WATER FLOW
Getting Water Into the System

- Catch Basin
- Distribution Pipe
Before and After Results

Adequate Soil Builds Resilient Trees that can Withstand Drought and Disease
100 Peachtree Plaza

- 800 CF of Soil per Tree in this urban plaza
- Open system for filling soil
- Amended Site Soil
100 Peachtree Plaza

Trees planted in Fall 2015
100 Peachtree Plaza

• 3rd Growing Season
• 2018
North Avenue Park
Historic 4th Ward

Trees planted in 2014
North Avenue Park
Historic 4th Ward

2019-plaza in full shade after just four years
North Avenue Park
Historic 4th Ward

2020
Historic 4th Ward Park

Trees Planted in 2011
Bridging with Silva Cells
Historic 4th Ward Park

2018

These trees look like they are 15 years old.
Decatur's Tree Information Page
Tree Protection Ordinance and Administrative Standards
Building Checklists etc...
Silva Cell Information

www.deeproot.com
Questions?

Thanks!!!!

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