

# Structural Soils and Low-impact Development

Stormwater Management that Combines Paved  
Surfaces and Urban Trees

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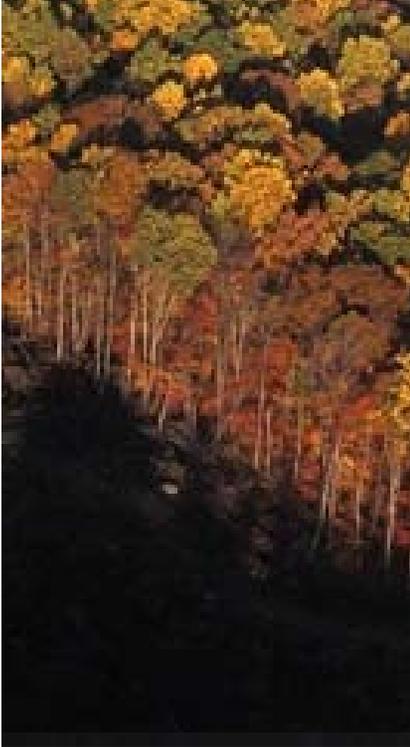
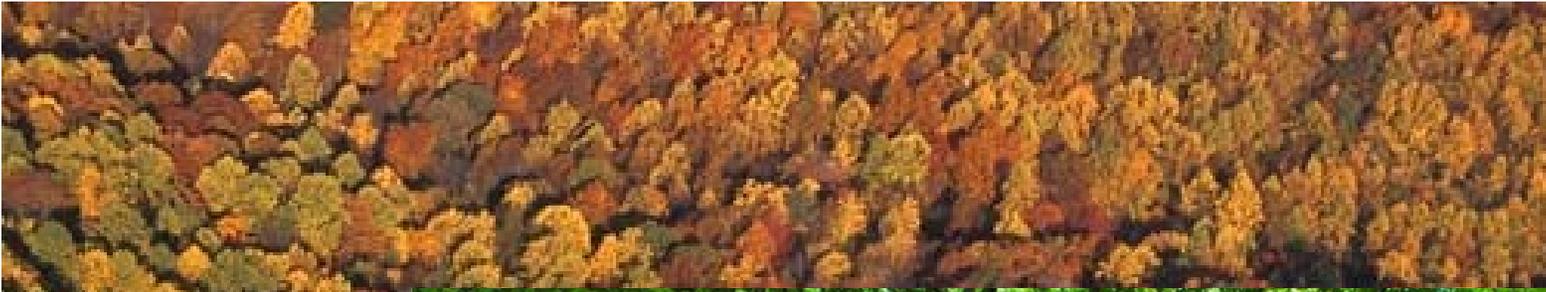
- ▶ Greater tree canopy
- ▶ Improve infiltration
- ▶ Distribute runoff quickly
- ▶ Allow roots to remove water
- ▶ Provide multiple uses (parking, green space, etc.)



## Structural Soils + Trees + Underpavement Detention

# Runoff Sink









# What is “Canopy”



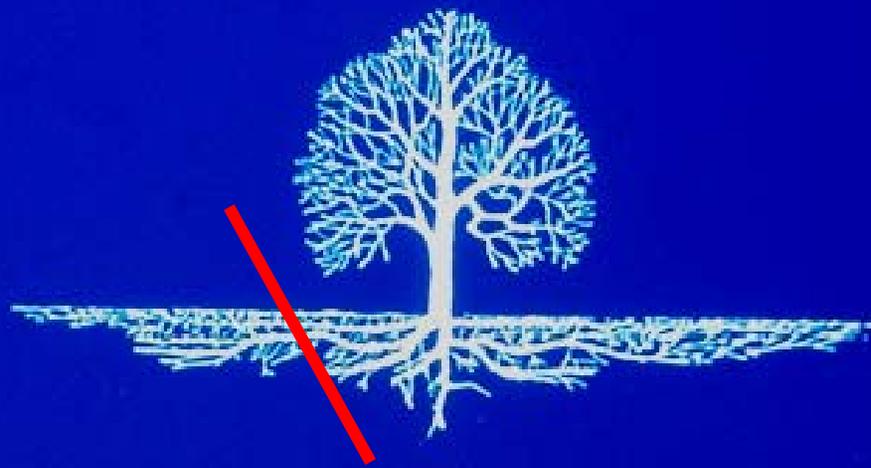
London plane in NYC

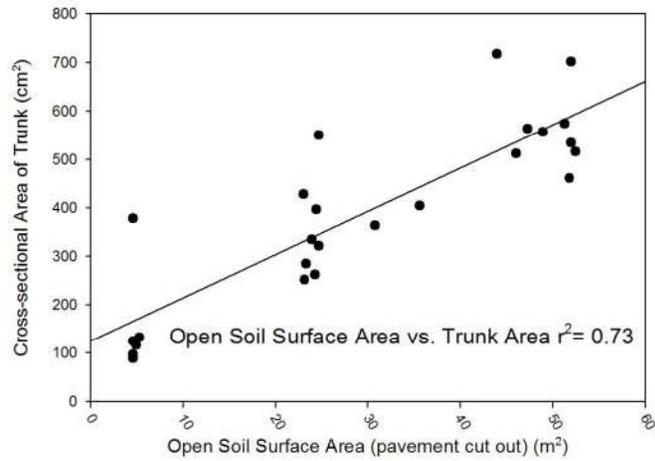


London plane in Budapest

# Urban Trees are Grouchy





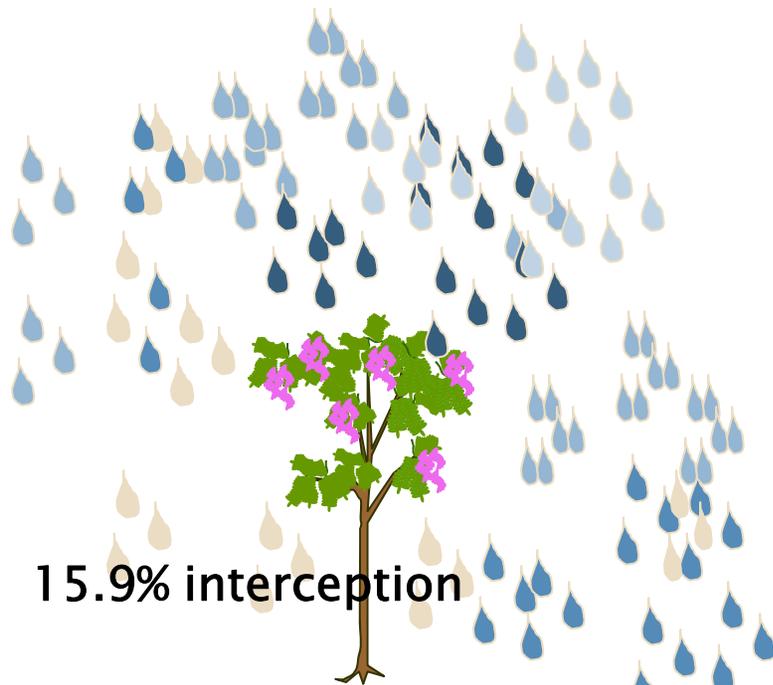


# Soil Resources Dictate Tree Size



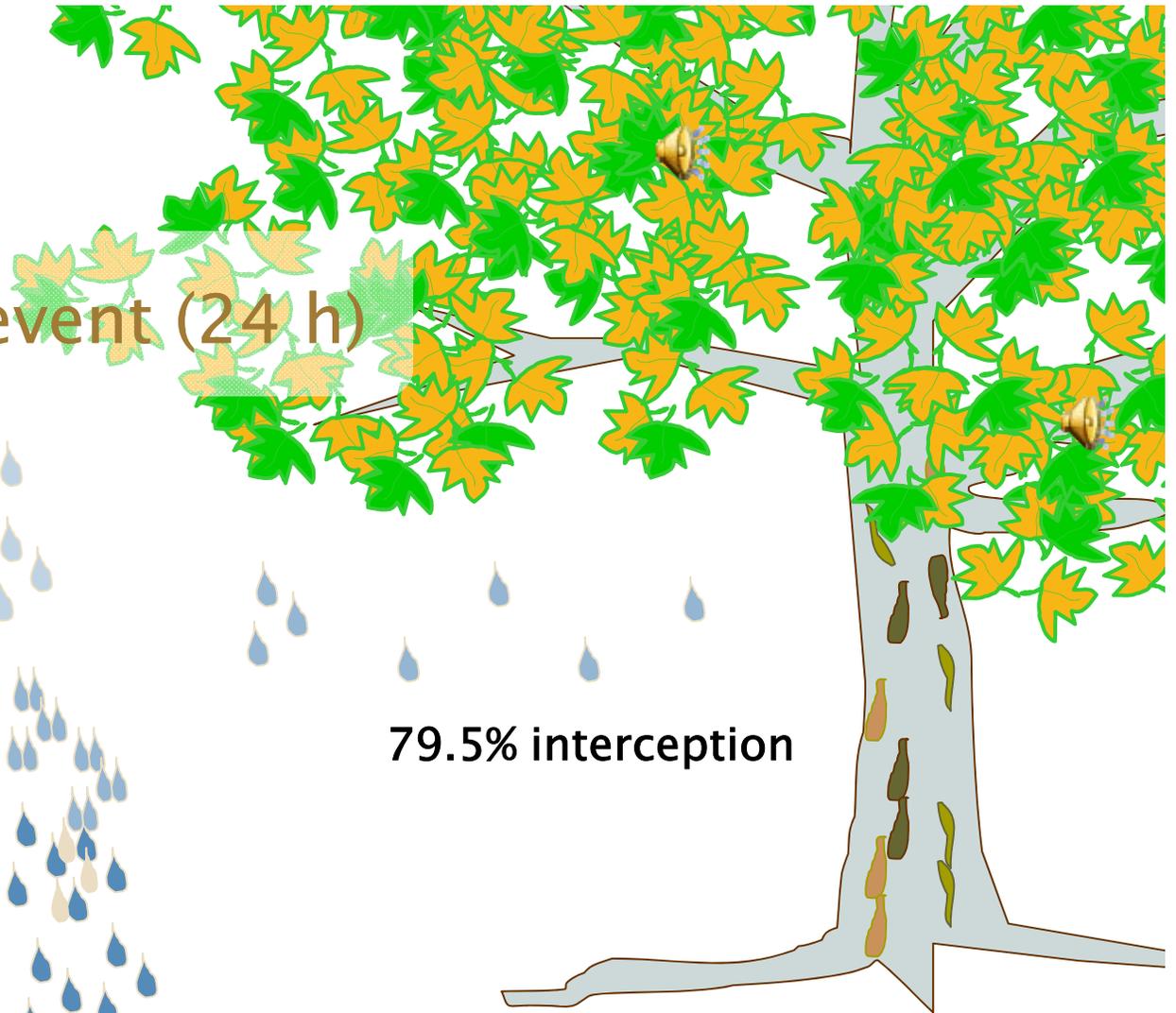


~1 inch rainfall event (24 h)



15.9% interception

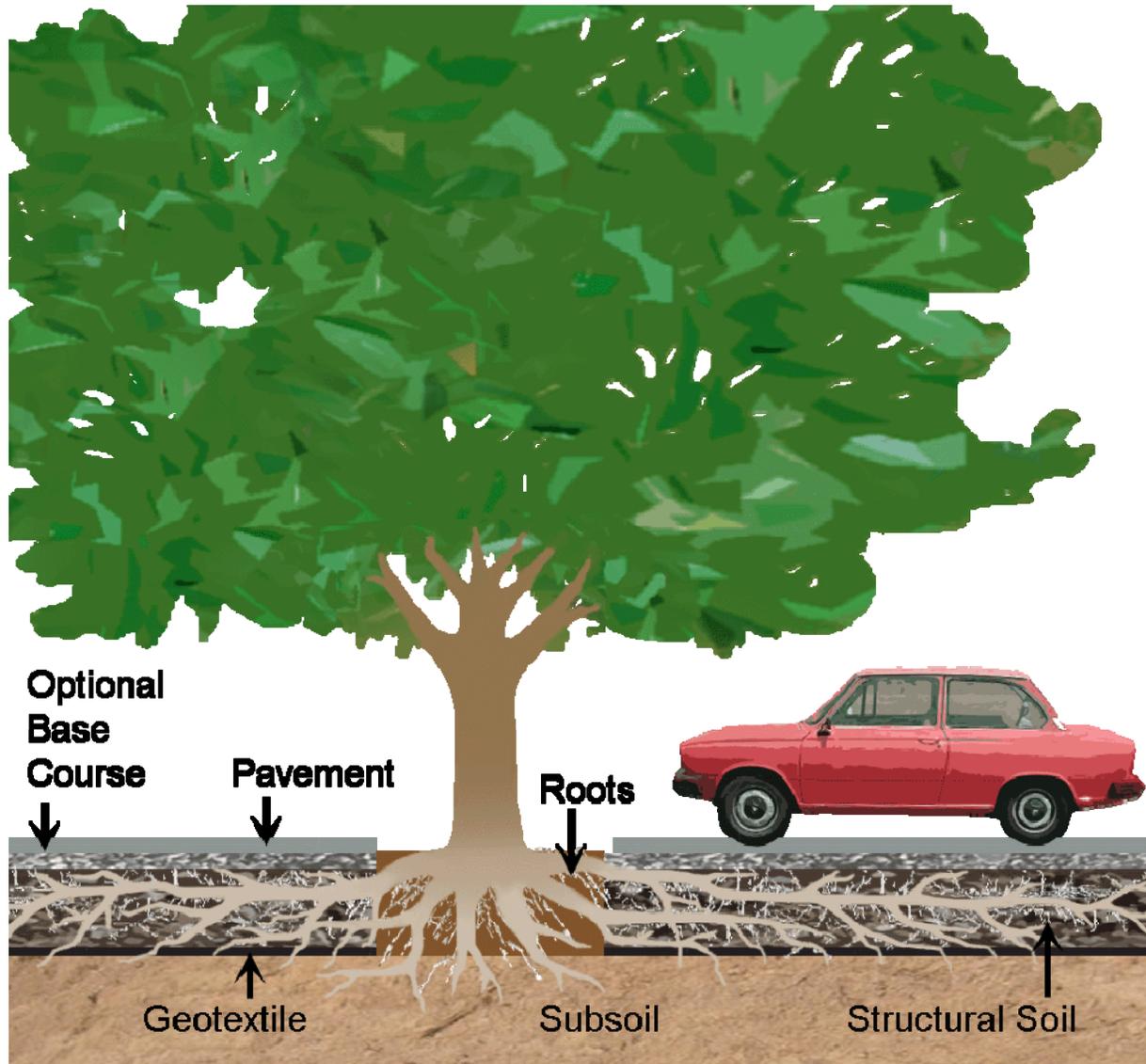
*Jacaranda mimosifolia* (~2" caliper)

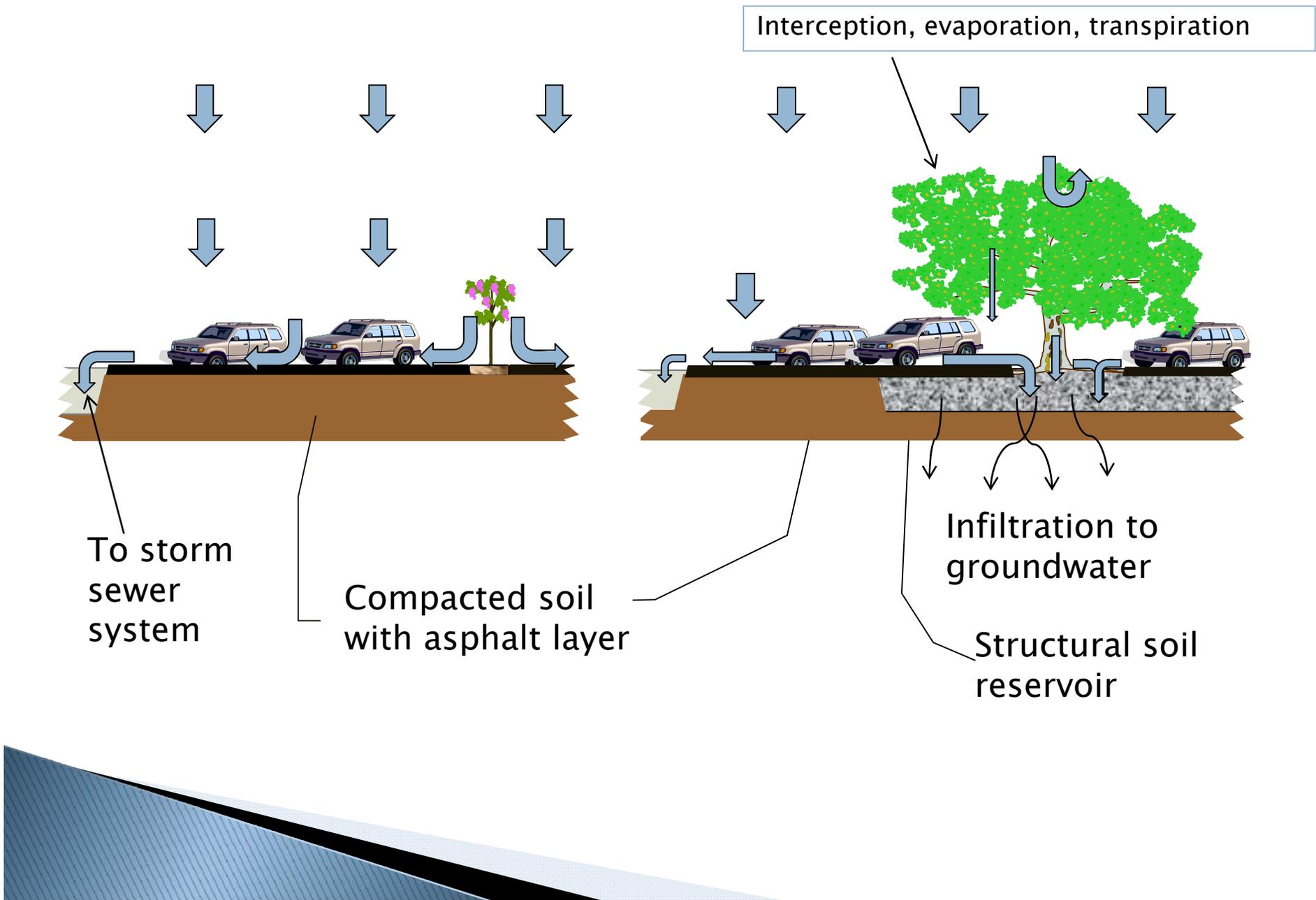


79.5% interception

*Platanus xacerifolia*

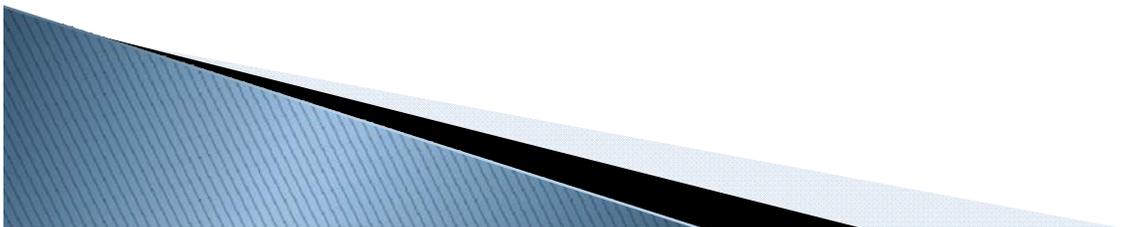
Xiao Q., and E.G. McPherson. 2003. Rainfall interception by Santa Monica's municipal urban forest. Urban Ecosystems





# Structural Soils Allow Root Growth Under Pavement

- ▶ Roots often cannot penetrate dense soils
- ▶ **Structural Soils** are designed to allow root growth under pavement AND support pavement
  - CU Soil ~ developed at Cornell University  
[www.hort.cornell.edu/UHI/](http://www.hort.cornell.edu/UHI/)
  - Carolina Stalite  
[www.stalite.com](http://www.stalite.com)
  - Multiple Others





- ▶ Green ash (*Fraxinus pennsylvanica*)
- ▶ Red maple (*Acer rubrum*)
- ▶ Black oak (*Quercus velutina*)



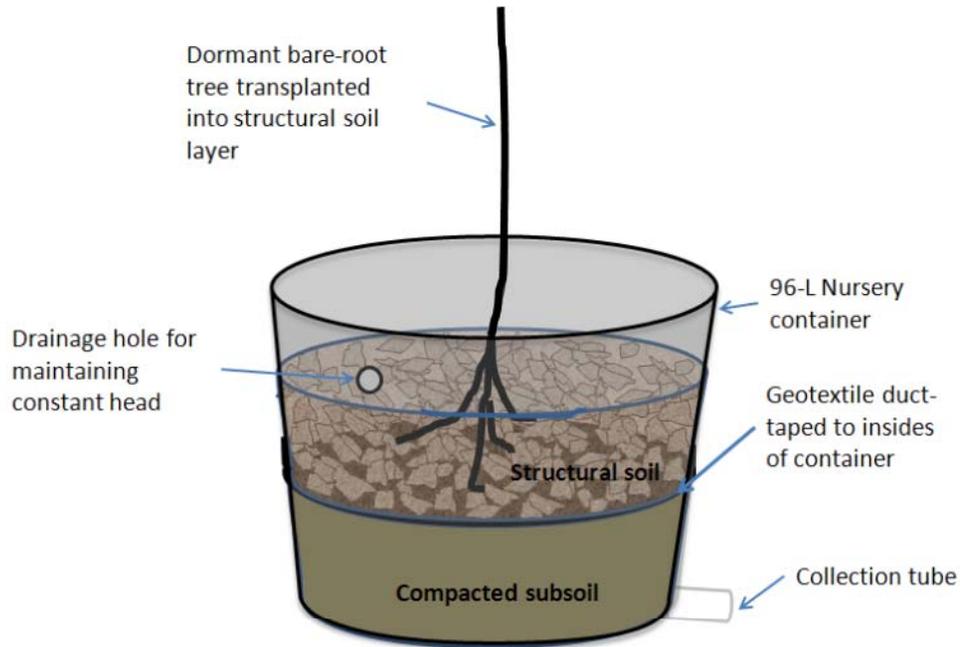
fibrous roots (ash, maple) ■ coarse roots (black oak)

- ▶ Both types of root systems increased infiltration.

# Whips planted into experimental setup



$K_{\text{sat}}$  ↑ by a factor of 1.5 on average

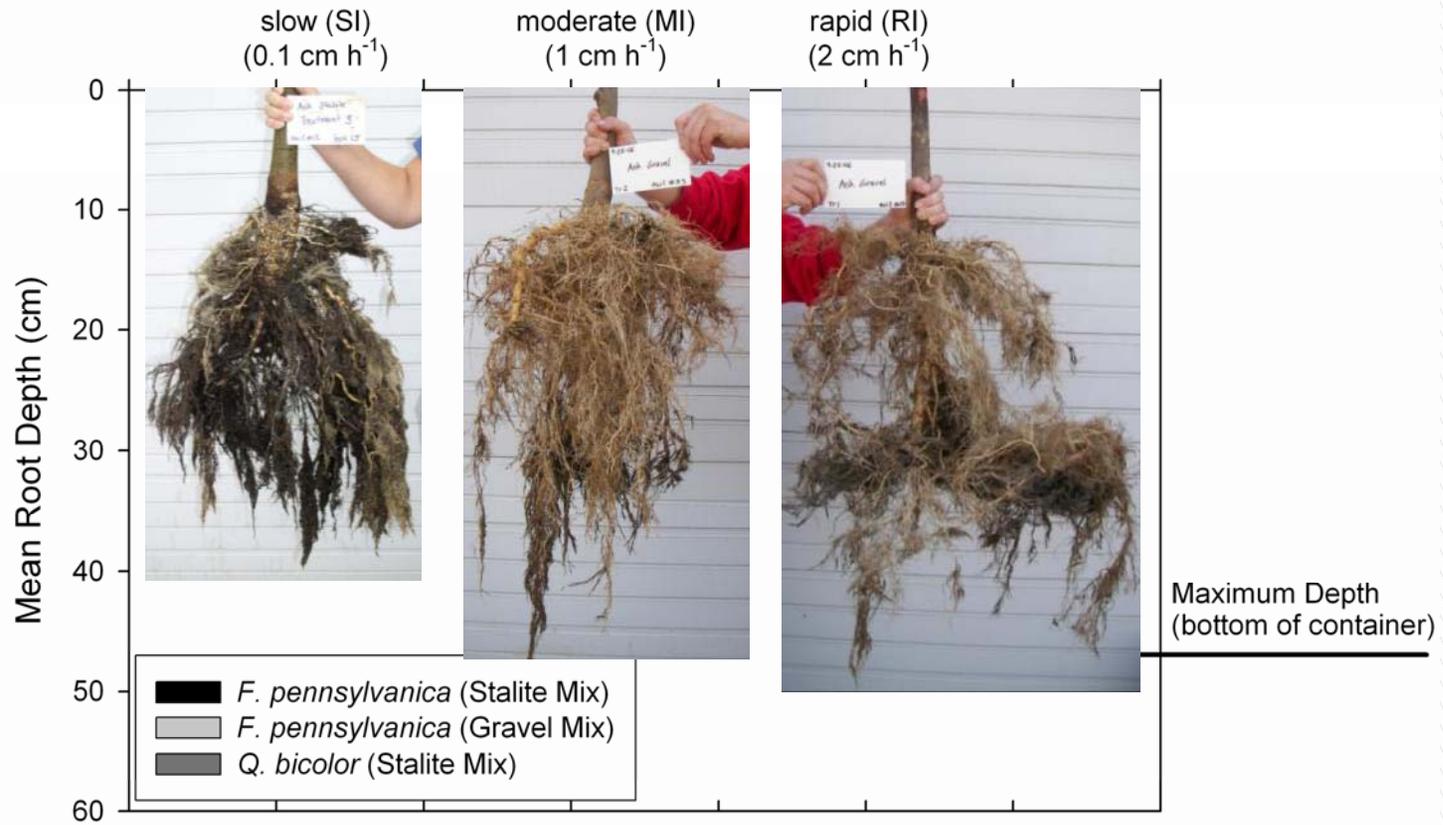


$K_{sat}$  ↑ by a factor of 27 on average

Transpiration rates are within the normal range



## Simulated Infiltration Rate



Reservoir should drain in 2 days





# Tree-based Stormwater Management is Feasible



# Thank You

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Visit us on the web for  
more information.

**Stormwater Management**  
*Using trees and structural soils to improve water quality*

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### About Us

Welcome to the Stormwater Management with trees and structural soils project site. This project began in 2004 as a collaborative effort between the Urban Forestry and Urban Horticulture programs at Virginia Tech, the Urban Horticulture Institute at Cornell University, and the Department of Land and Water Resources at the University of California at Davis. With funding from the USDA-Forest Service's Urban and Community Forestry Grants Program, we developed and evaluated a system for capturing and retaining stormwater under pavement in structural soil: a specialized soil mix that supports pavement and supports extensive tree root growth. **Our vision was a full-canopy parking lot that allowed trees to serve their natural role as mediators of the hydrologic cycle.** This new technology puts another tool in the kit of municipal public works—especially those dealing with increased infill development. It can be put to use in streetscapes and plazas, as well as parking lots.

This website provides many resources such as a BMP design manual based on our research, a presentation for explaining how this system works to your municipality or business, and many other resource links. Research continues to

**Download Stormwater Manual**  
**View Stormwater Presentation (.pps) (.pdf)**  
**Stormwater Presentation Notes**

**Partners**

Virginia Tech Urban Forestry Gateway  
Cornell Urban Horticulture Institute  
Center for Urban Forest Research

**Urban Forestry Links**

[www.cnr.vt.edu/urbanforestry/stormwater](http://www.cnr.vt.edu/urbanforestry/stormwater)