



Trees and Structural Soils

A New Stormwater Management Practice for Sustainable Urban Sites



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Introduction

Stormwater management:

How can we harness the power of a forest in the city?



Challenges for Urban Settings



- Impermeable surfaces
 - Decreased infiltration
 - Increased runoff
- Compacted soils
- Lack of space



Stormwater Challenge- Paved Surfaces

- No ground water recharge
- Cannot store water
- Inhospitable to plant life



Photograph by: The Bureau of Land and Water Quality
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Infiltration BMPs

- Typical infiltration BMPs **concentrate** stormwater into a small area, increasing the risk of groundwater contamination in some cases



Common Stormwater Practices

Detention ponds

- Take up open space
- Lack distributed infiltration
- Issues with safety, pests and aesthetics



The Role of Trees

- We cannot mimic pre-development hydrologic cycles **without plants**



Evapotranspiration

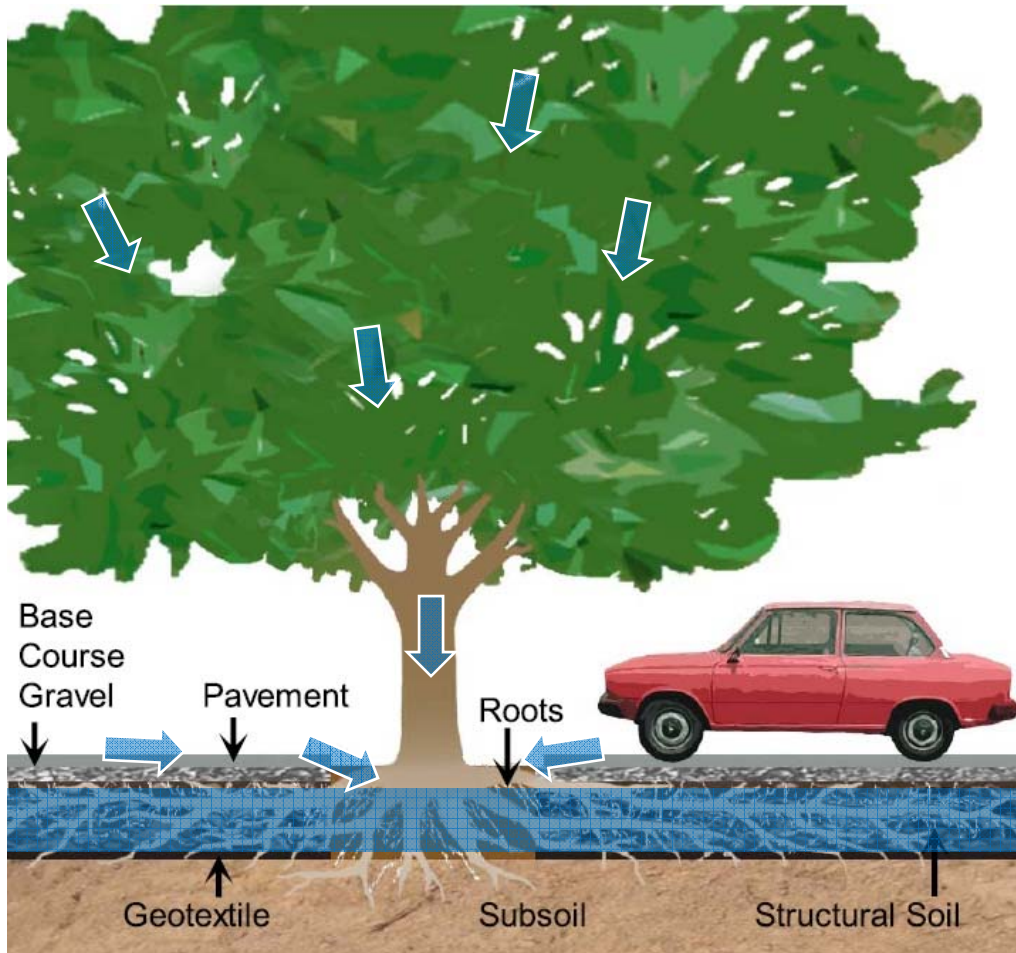
- Trees intercept and store water with their canopies, direct water to the soil with their trunks and roots and transpire water back to the atmosphere.



Urban Settings Transformed

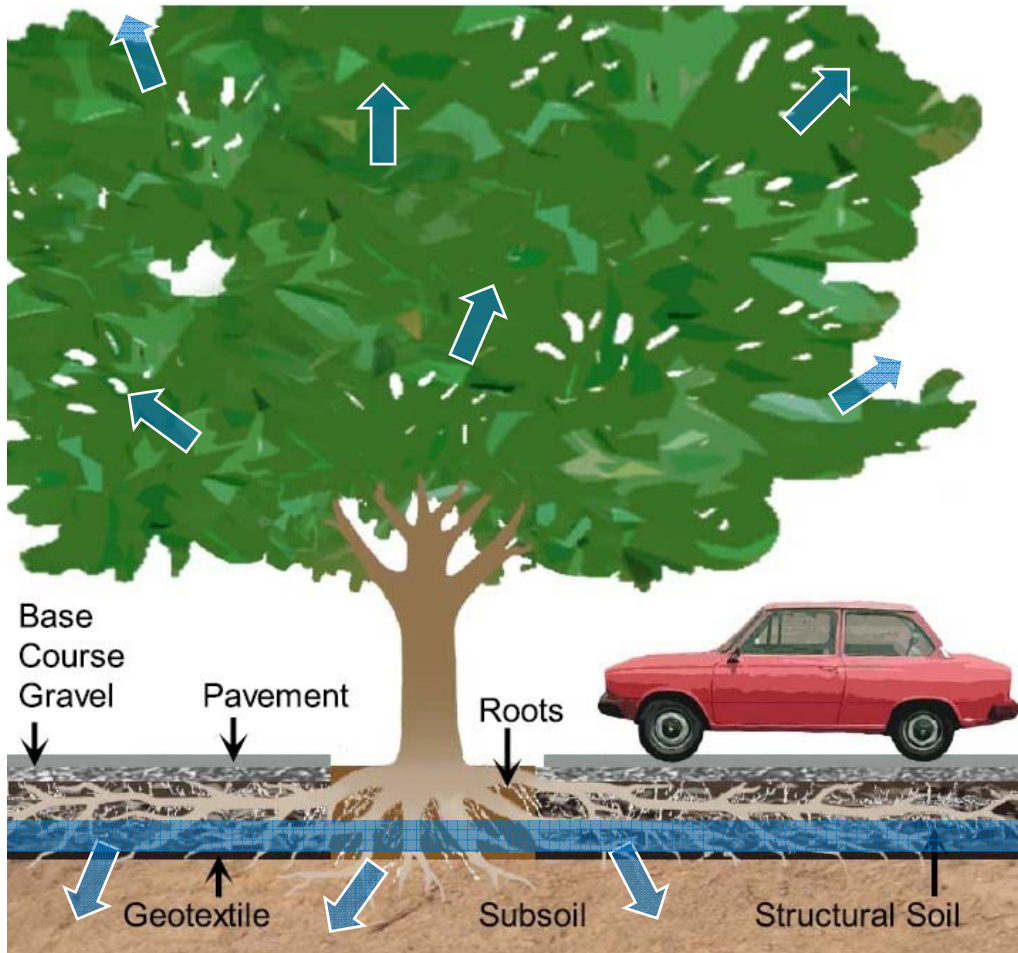


The Role of Trees in this Stormwater Management Technique



- Interception
- Guidance

The Role of Trees in this Stormwater Management Technique



- Infiltration
- Transpiration

Additional Tree Benefits

- Reduce particulate pollution
- Moderate temperatures
- Save energy
- Contribute to the surrounding aesthetics



Purpose of Structural Soils

- Traditional tree pits limit canopy cover



Greater Soil Volume = Larger Tree Canopies



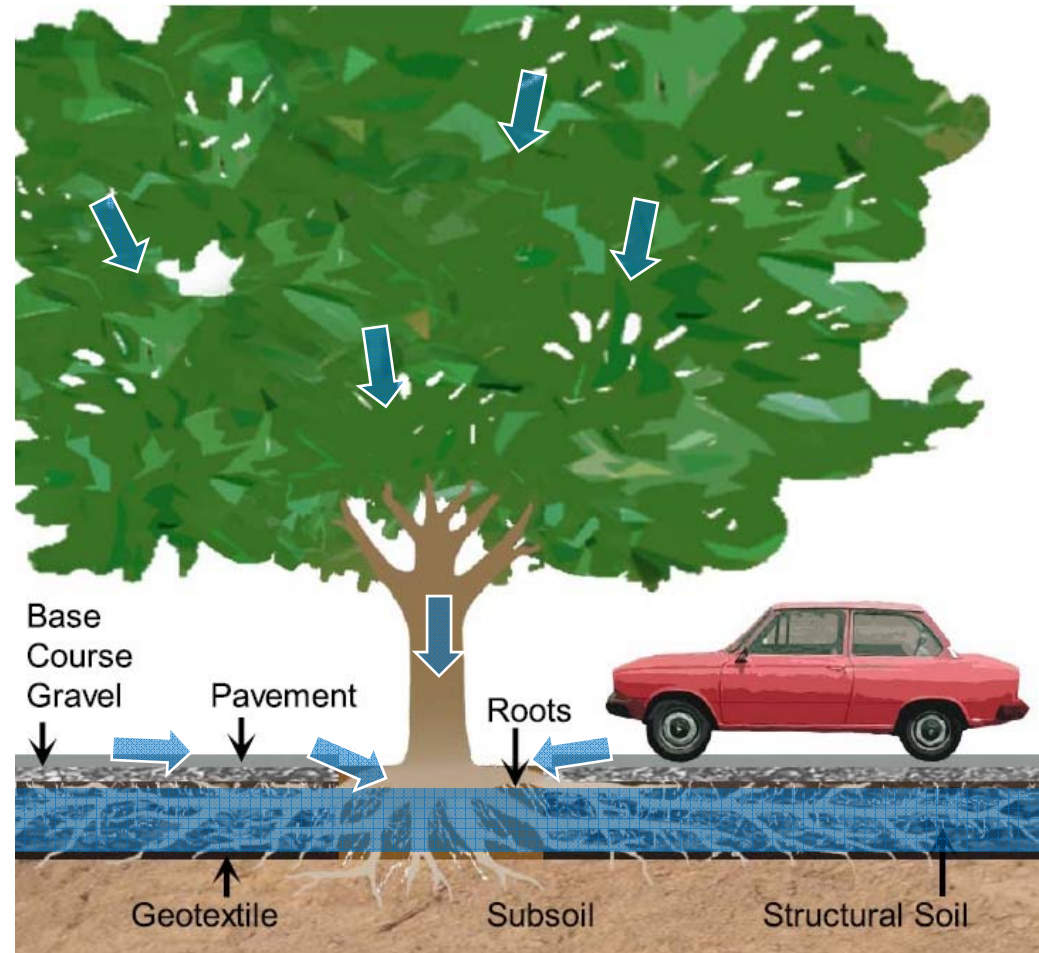
What are Structural Soils?

- Support the weight of pavement, cars and other structures
- Provide space for tree roots to flourish under paved sites
- Porosity of 30-35%, and infiltration rates (514 cm/hour!)



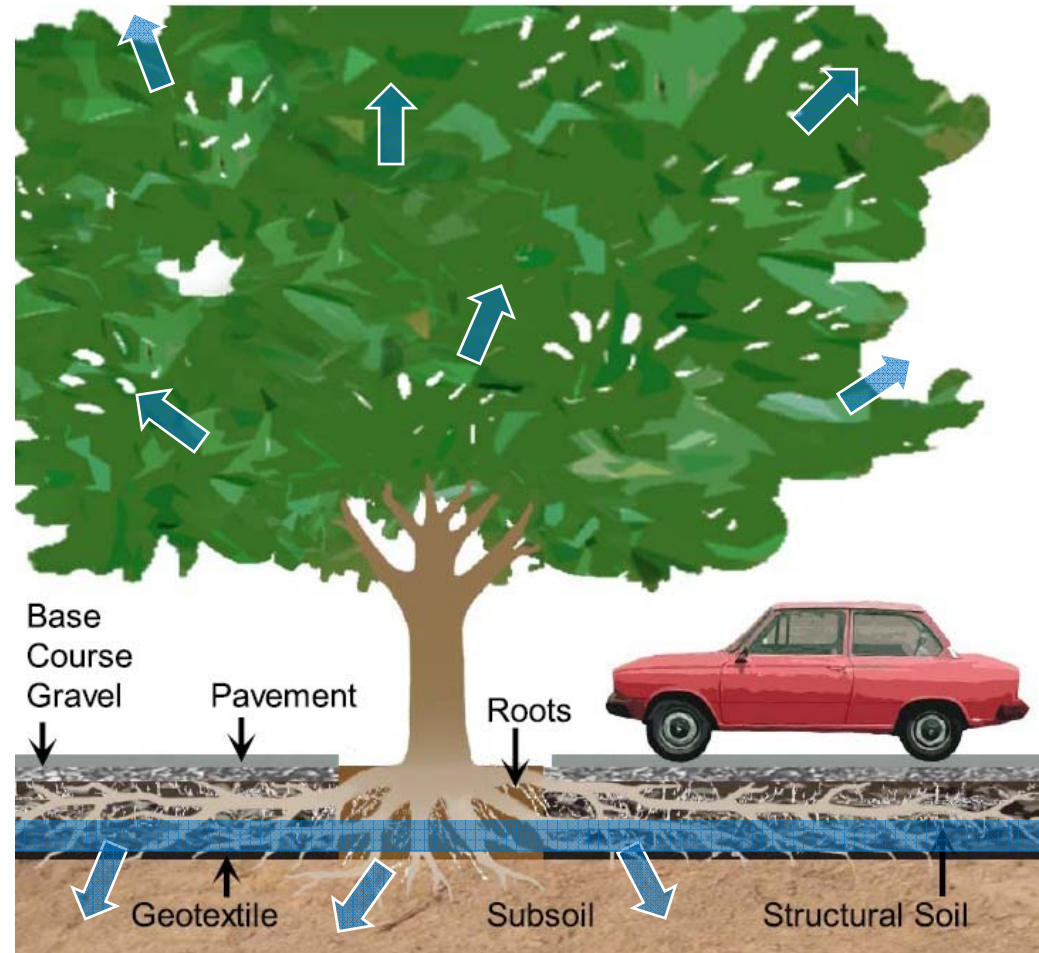
How does the System Work?

- Water enters the structural soil reservoir through pavement swales and tree pits (or through porous pavement)



How does the System Work?

- Water filters through the structural soil and recharges the groundwater below or is transpired by the tree



Benefits

- Tree canopy is increased—so runoff is of lower intensity over a longer period
- Water storage occurs under pavement and out of the way
- Infiltration is enhanced, improving watershed hydrology
- Water quality is improved compared to direct runoff



Resources

- This presentation is based on:
 - Day, S.D., and S.B. Dickinson (Eds.) 2008. Managing Stormwater for Urban Sustainability using Trees and Structural Soils. Virginia Polytechnic Institute and State University, Blacksburg, VA.
(<http://www.cnr.vt.edu/urbanforestry/stormwater/Resources/TreesAndStructuralSoilsManual.pdf>)
- Stormwater Management with Trees and Structural Soils
<http://www.cnr.vt.edu/urbanforestry/stormwater/>
- Virginia Tech Urban Forestry Gateway
<http://www.cnr.vt.edu/urbanforestry/>
- US Forest Service (Center for Urban Forest Research)
<http://www.fs.fed.us/psw/programs/cufr/>
- Urban Horticulture Institute
<http://www.hort.cornell.edu/UHI/>



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