



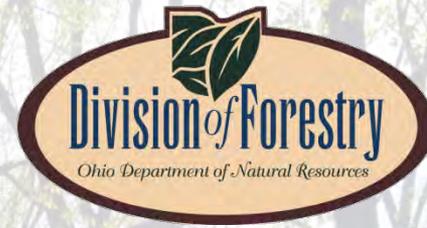
# Street Trees and Green Infrastructure

Wendi Van Buren

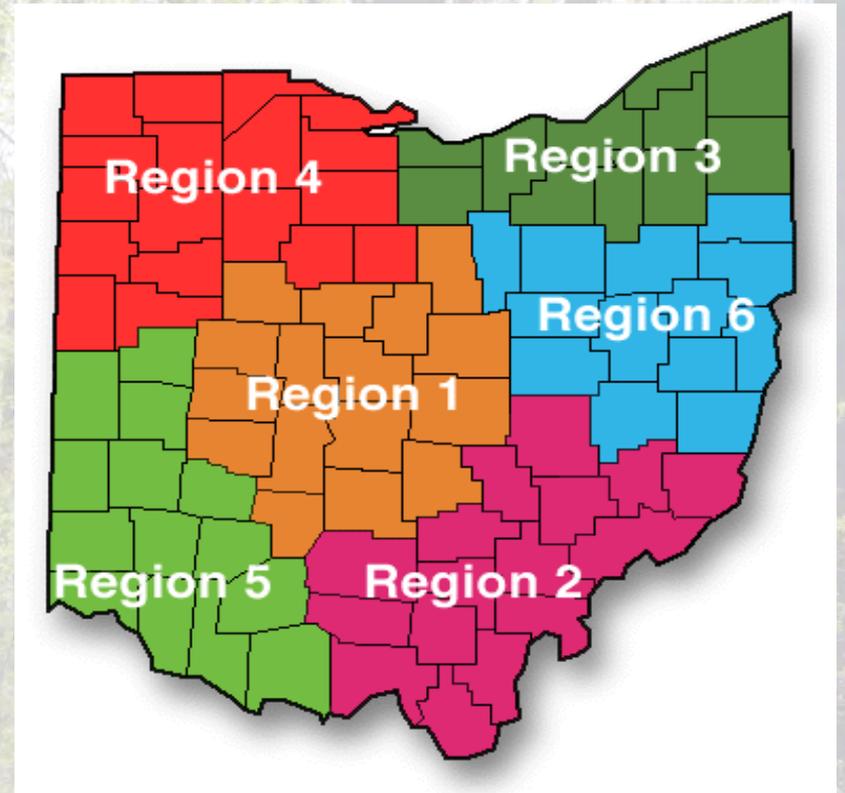
Regional Urban Forester

Ohio Dept. Of Natural Resources

# Ohio Division of Forestry



Wendi Van Buren  
Urban Forester  
Caesar Creek State Park  
8570 East SR 73  
Waynesville, OH 45068



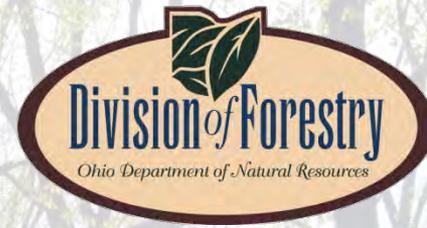
# Green Infrastructure



*Kent State  
University  
Parking Lot  
Rain Garden*

The green space in a city benefits people by *cleansing urban runoff, absorbing floodwaters, scrubbing airborne pollutants, sheltering wildlife*, and also supports *economic productivity, recreation, public health, cultural identity, and community cohesion*.

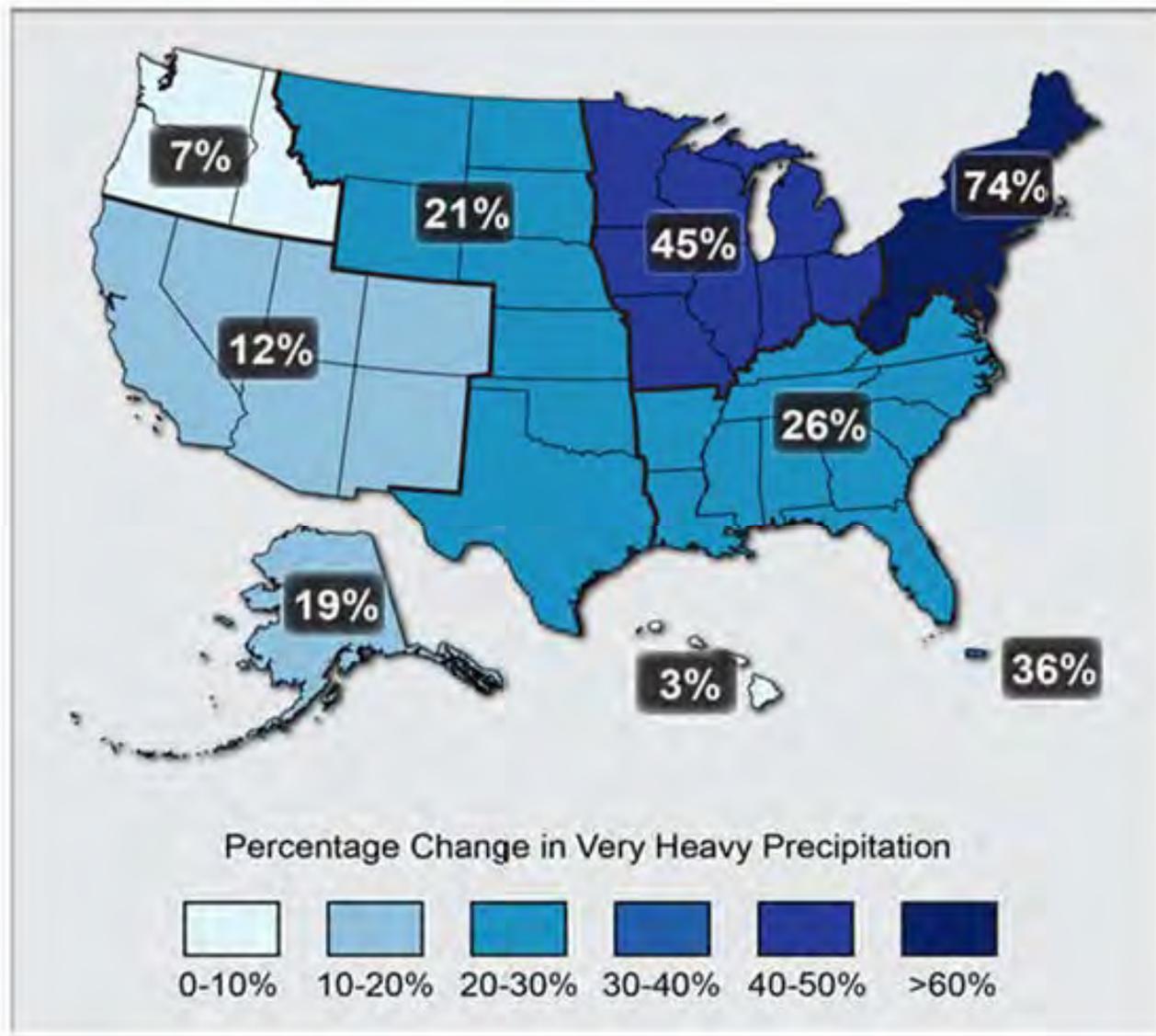
# Stormwater is a Problem



- Existing grey and green stormwater management systems are not enough to accommodate runoff.
- Adding trees is a cost-effective way to improve current stormwater system's function and reduce runoff.



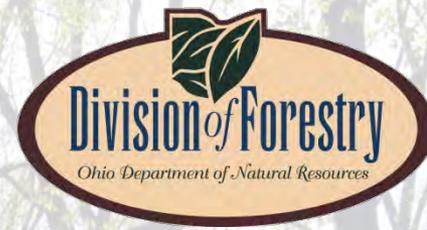
*Ohio has a greater amount of precipitation being concentrated in very heavy events*



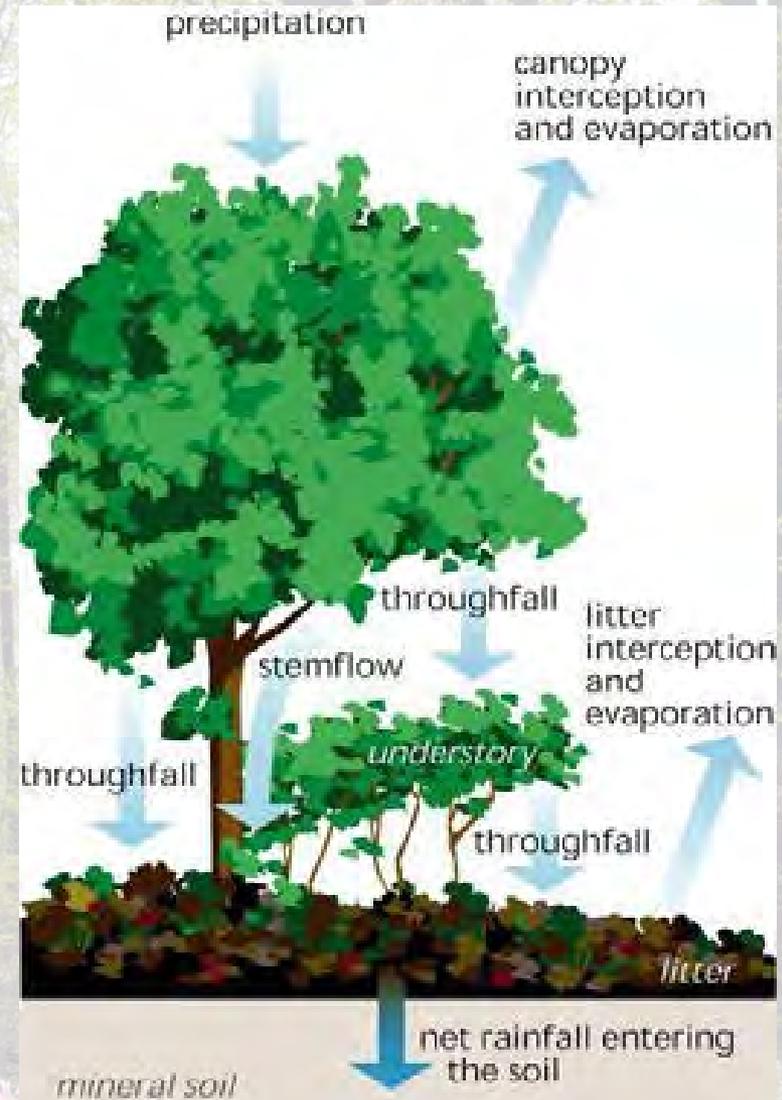
# What slows the flow when it rains?



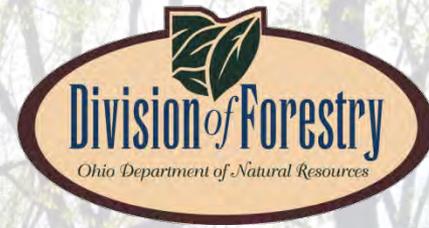
# Canopy Interception and Infiltration



- Forests filter water and regulate the flow of water,
- their leafy canopy intercepts rainfall, slowing its fall to the ground and the forest floor,
- Forest acts like an enormous sponge, typically absorbing up to 18” of precipitation before gradually recharging ground water.



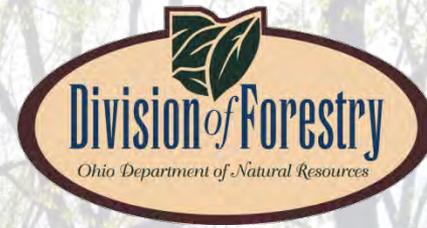
# Trees help slow stormwater loads



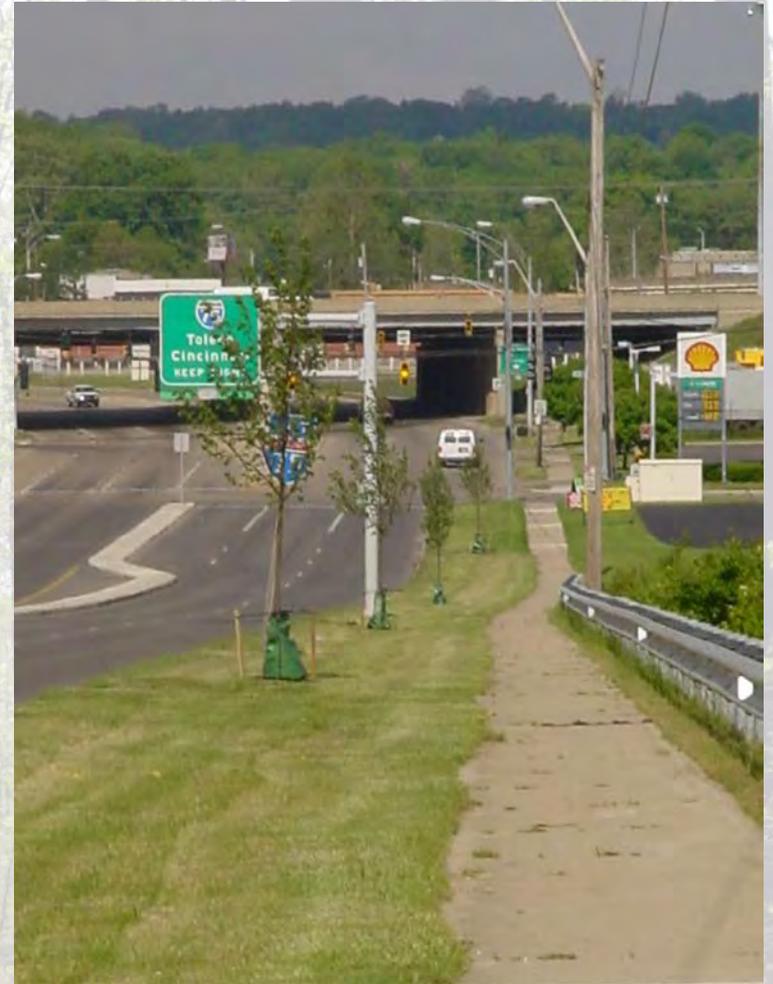
- Average interception of rainfall by a trees canopy ranges from 10-40% depending on species, time of year, and precipitation rates per storm event.
- A single deciduous tree can intercept from 500 to 760 gallons per year;
- and a mature evergreen can intercept more than 4,000 gallons per year.
- Even young, small trees help.



# Dayton Study



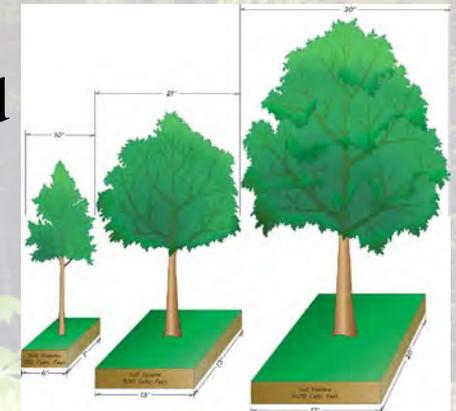
- A study in the 1980's of Dayton, Ohio's existing tree canopy found that stormwater runoff was reduced by 7% and could be increased to 12% through planting more trees.
- Planting large canopy trees over impervious surfaces has much greater impact on reducing storm water (8x greater) reduce peak flows



# Bigger Trees Reduce Runoff More

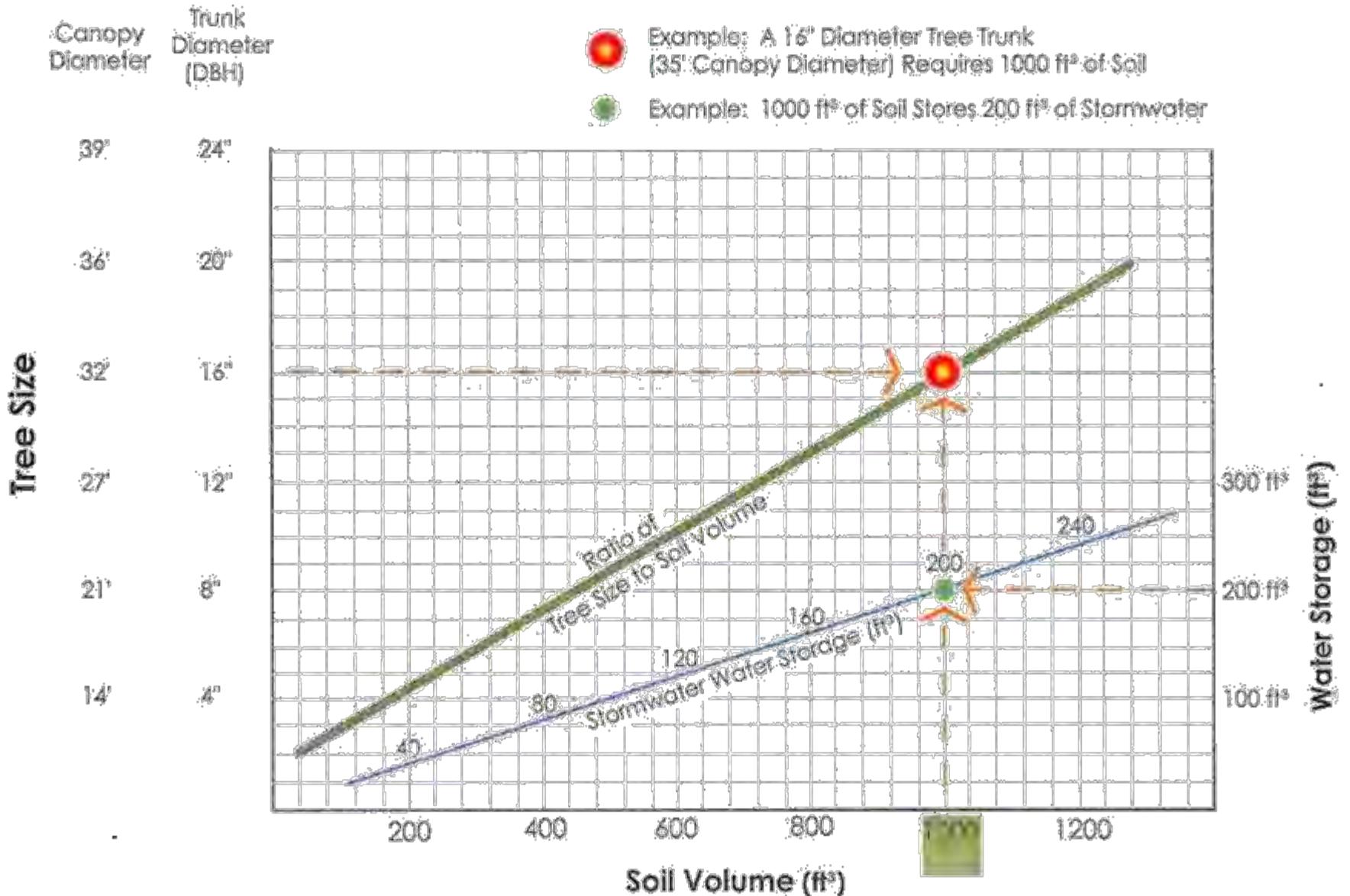


- Engineering a tree planting area which enables trees to grow to their full size, and where space allows to grow big trees, takes planning.
- Big trees require large volumes of soil and aboveground and belowground space to grow. Much research has been done to determine the relationship between soil volume and mature tree size. It is generally accepted that a large-sized tree (16 inches diameter at breast height) needs at least 1,000 cubic feet of uncompacted soil.



# Soil Volume/Stormwater Storage and Big Urban Trees

english units

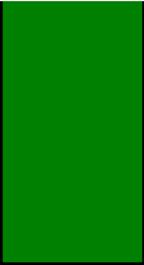
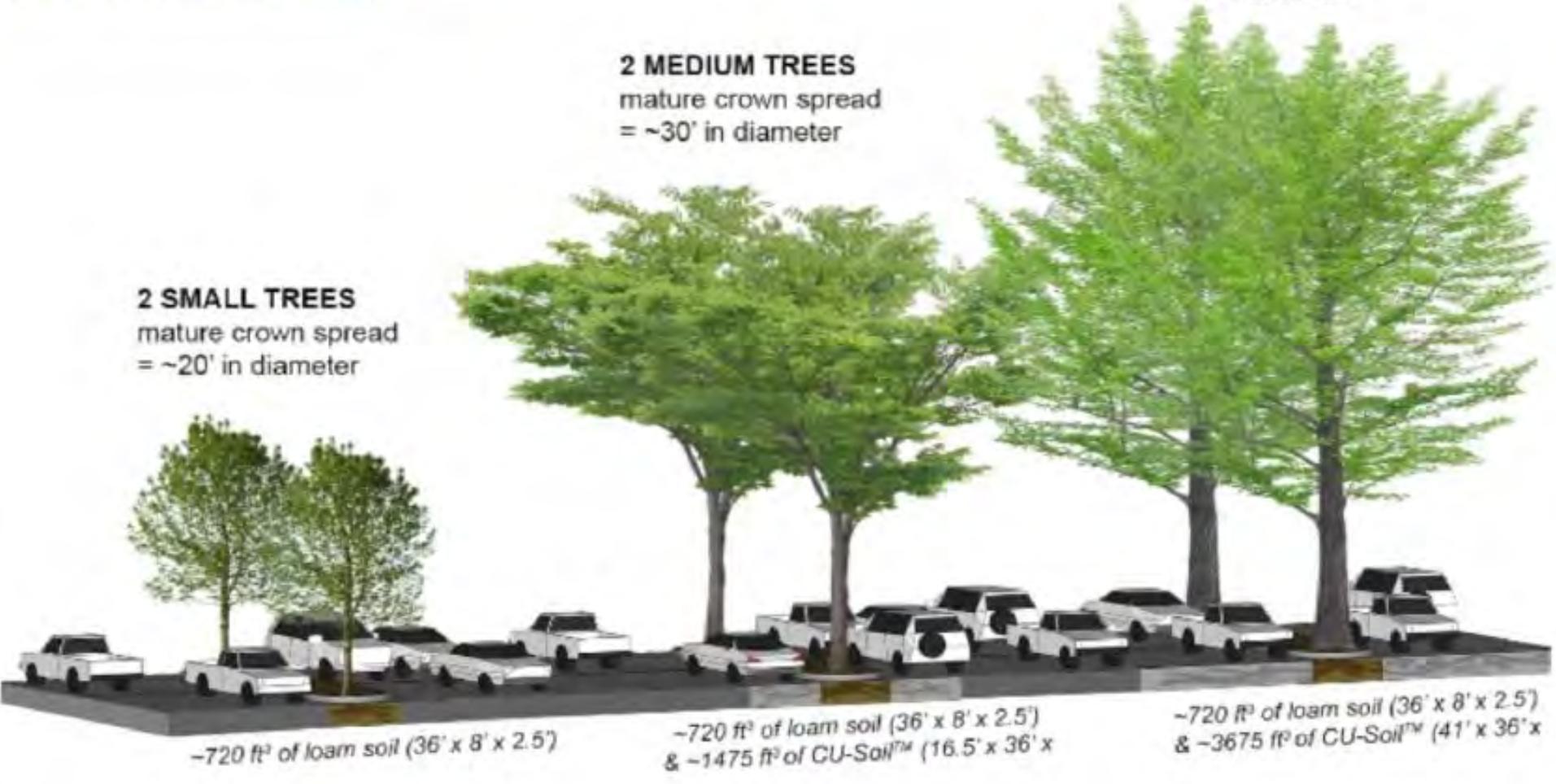


Growing larger trees in parking lot islands with CU-Structural Soil®

**2 LARGE TREES**  
mature crown spread  
= ~40' in diameter

**2 MEDIUM TREES**  
mature crown spread  
= ~30' in diameter

**2 SMALL TREES**  
mature crown spread  
= ~20' in diameter



# Tree Pits



- Small cut out in sidewalk
  - Usually  $< 20 \text{ ft}^3$



# Soil Volume/Stormwater Storage and Big Urban Trees

english units

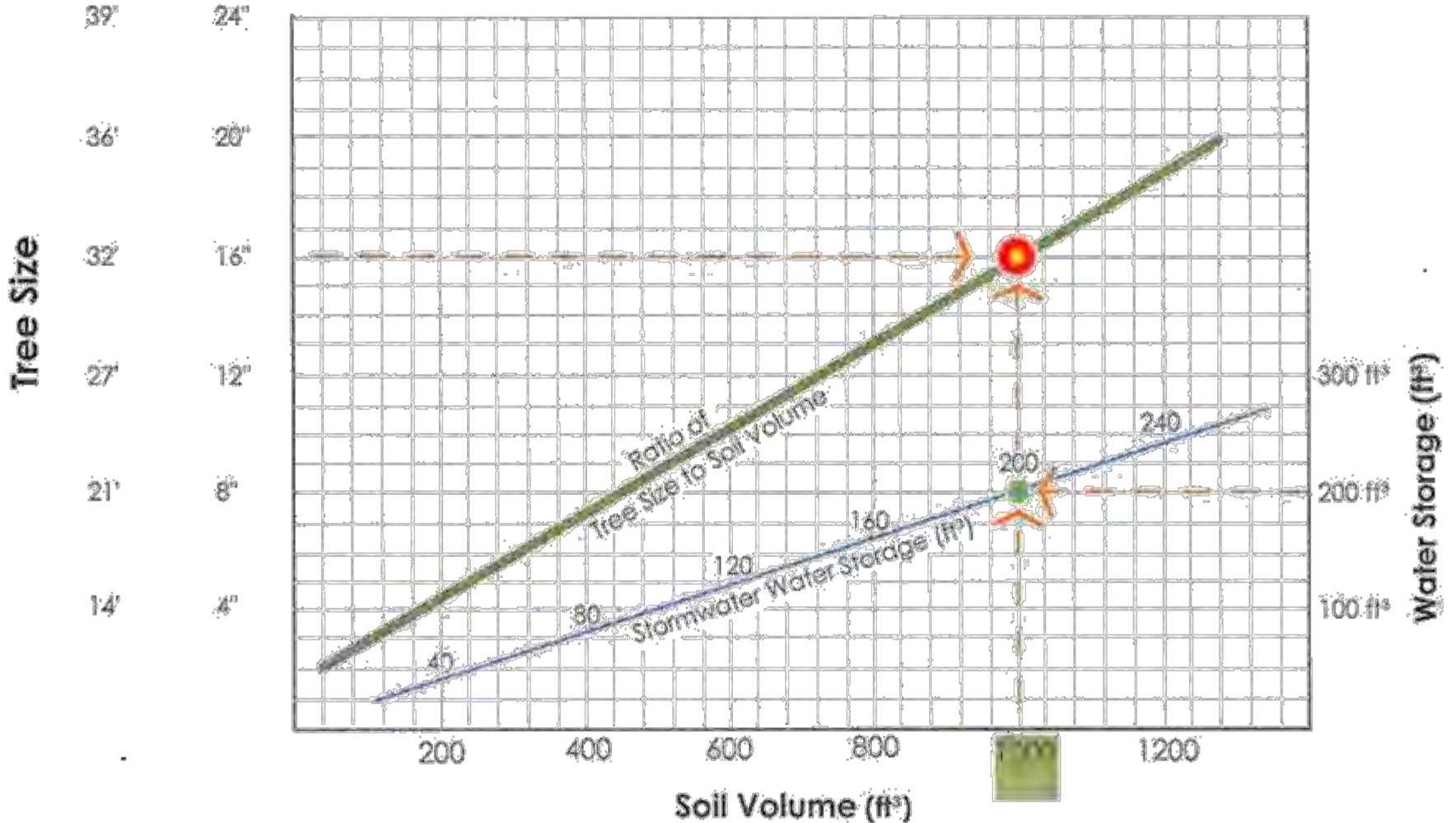
Canopy Diameter  
Trunk Diameter (DBH)



Example: A 16" Diameter Tree Trunk (35' Canopy Diameter) Requires 1000 ft<sup>3</sup> of Soil



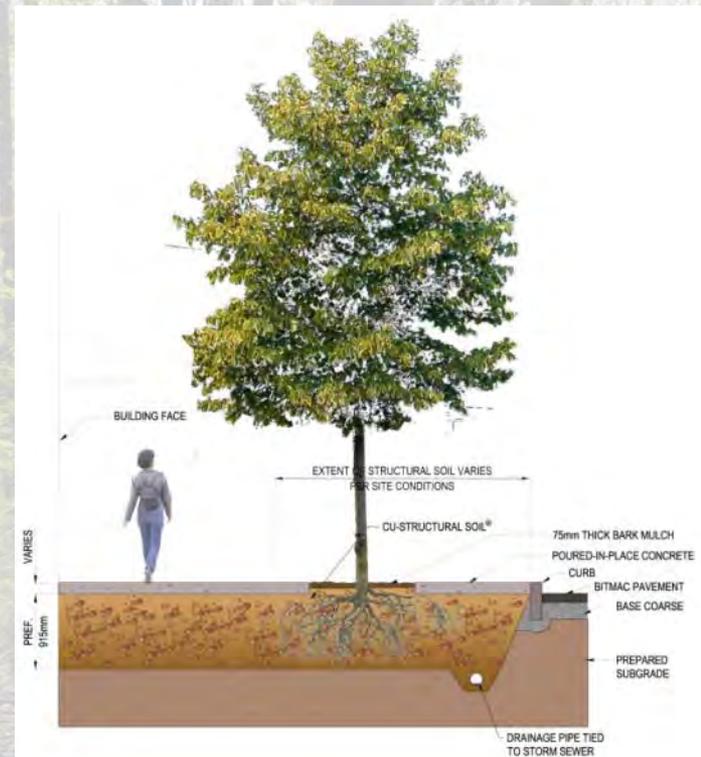
Example: 1000 ft<sup>3</sup> of Soil Stores 200 ft<sup>3</sup> of Stormwater





# Structural Soil

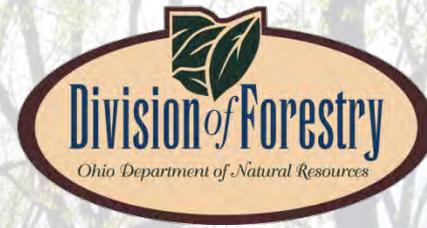
- Continuous base under pavement
- Provides material for tree root growth





*Compaction of CU-Structural Soil<sup>®</sup> during installation. For proper installation, CU-Structural Soil<sup>®</sup> must be compacted every 6 inches. Photo courtesy AZ Best, LLC*

# Silva Cells



- Modular, pre-engineered cell system
- Creates large spaces under pavement
- Supports sidewalk
- Fits irregular urban conditions
- $\approx 95\%$  of space in cells for tree-rooting soil
  - High net soil volume

SINGLE CELL WITH DECK



THREE CELLS WITH DECK





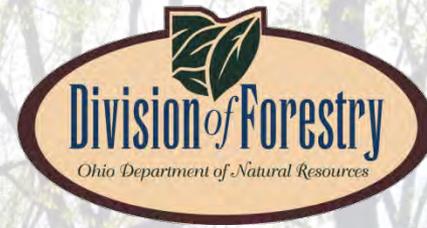
# Cincinnati Casino



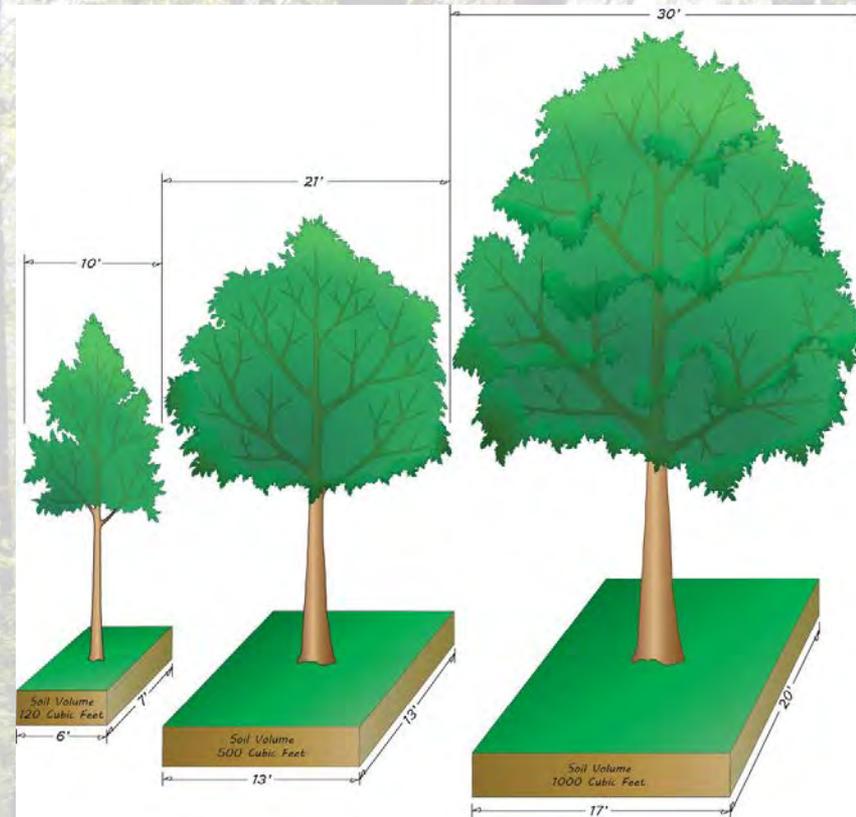
# Shade Trees have More Impact

- In older existing communities, increasing tree canopy cover along streets, in yards and in parking lots can have a positive impact on our watersheds.
- Planting large canopy trees provide the most benefit – 8 times that of small maturing trees, according to new USDA Forest Service research.

# BUT We must give them what they need to live



- A tree's ability to establish, grow to its full potential, and remain healthy is largely dependent upon soil volume.
- If too little soil is available, the tree will not reach full stature, regardless of what species of tree is planted.
- Trees without adequate soil volume tend to be short-lived and don't function as useful components of a city's infrastructure.



# Trees Consume Stormwater



- Trees absorb and use tremendous amounts of water for growth, thereby consuming storm water.
- A single mature oak tree can consume over 40,000 gallons of water in a year.
- Trees evapotranspiration also serves to cool and modify surrounding summer temperatures.



# Kent State University



*Raingardens and  
Prairies*



# Benefits of Trees for Stormwater Management

The presence of trees in a streetscape, neighborhood, and community can decrease the amount of stormwater runoff and pollutants that reach local waters.

- Trees reduce stormwater runoff by capturing and storing rainfall in their canopy and releasing water into the atmosphere.
- Tree roots and leaf litter create soil conditions that promote the infiltration of rainwater into the soil.
- Trees help slow down and temporarily store runoff and reduce pollutants by taking up nutrients and other pollutants from soils and water through their roots.
- Trees transform pollutants into less harmful substances.



Questions?

Thank you!

Wendi Van Buren  
SW Ohio Regional Urban Forester