Quantifying Stormwater Runoff and Pollution Removal by Houston's Urban Forest

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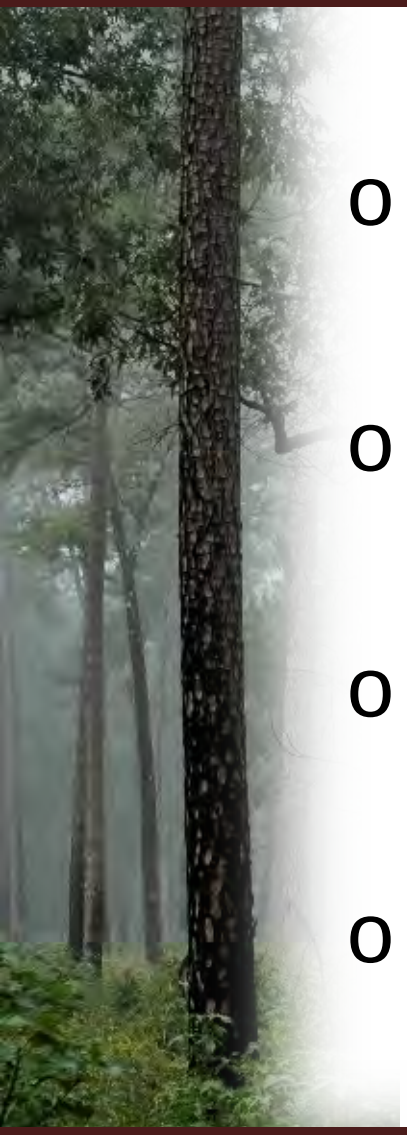
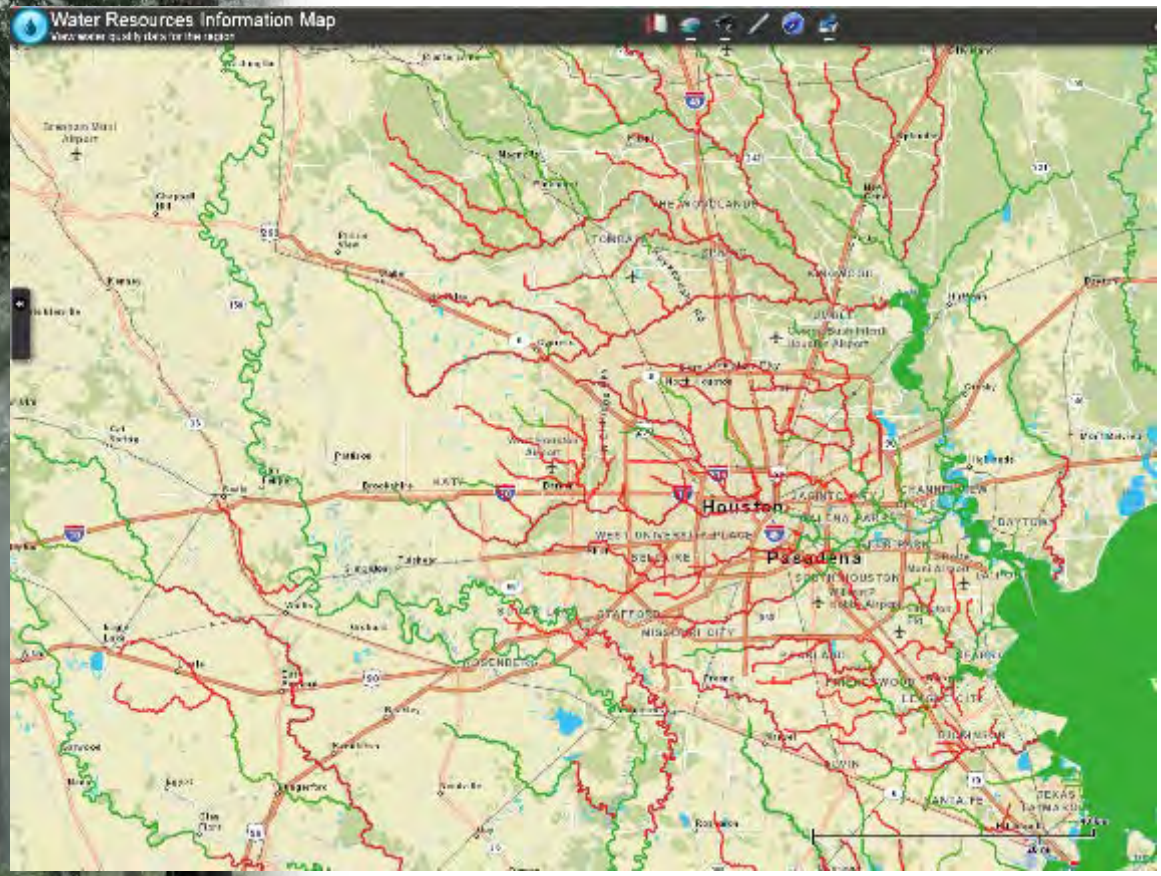
TEXAS A&M FOREST SERVICE

Overview



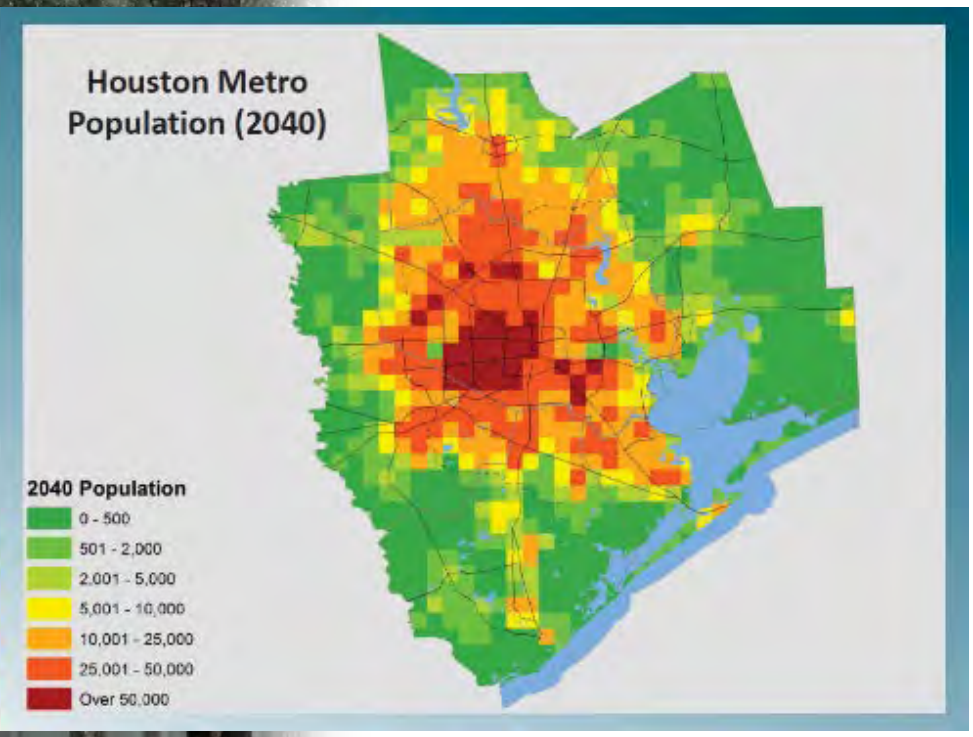
- Water Issues in the Greater Houston area
- Urban Forest and Water Relationship
- Houston Urban Forest Stormwater Study
- Future Opportunities

Water Quality



- 80% of waterways don’t meet WQS
- 63% impaired for bacteria
- 52% impaired for DO
- 52% exceed nutrient screening criteria

Factors Contributing to Water Issues



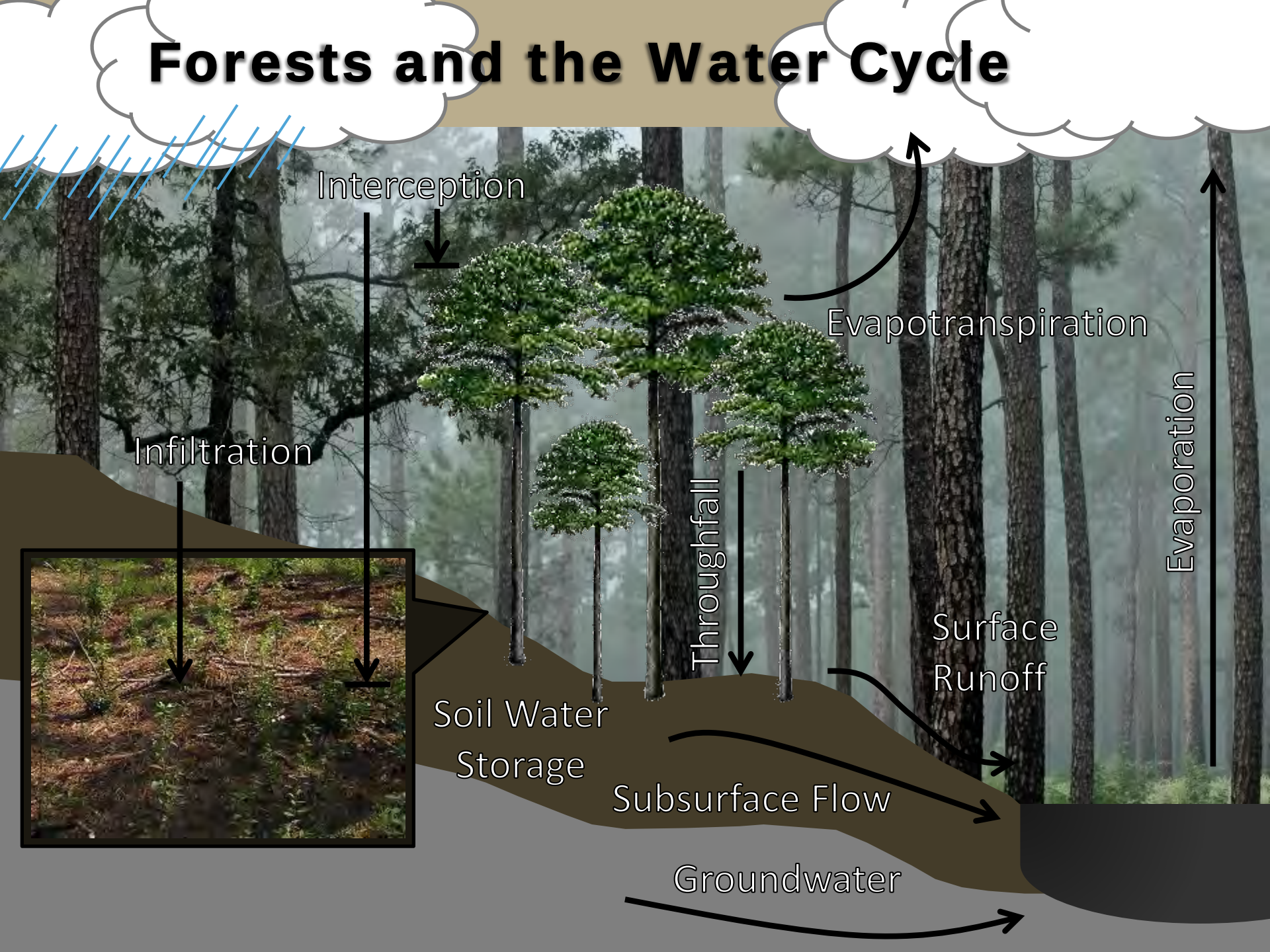
- Population Growth / Increased Demand
  - 6 million people
  - 3.7 million more by 2040
- Urbanization
  - Impervious Cover
- Weather
  - Stormwater Runoff
  - Drought

W.G. Jones State Forest, Conroe, Texas

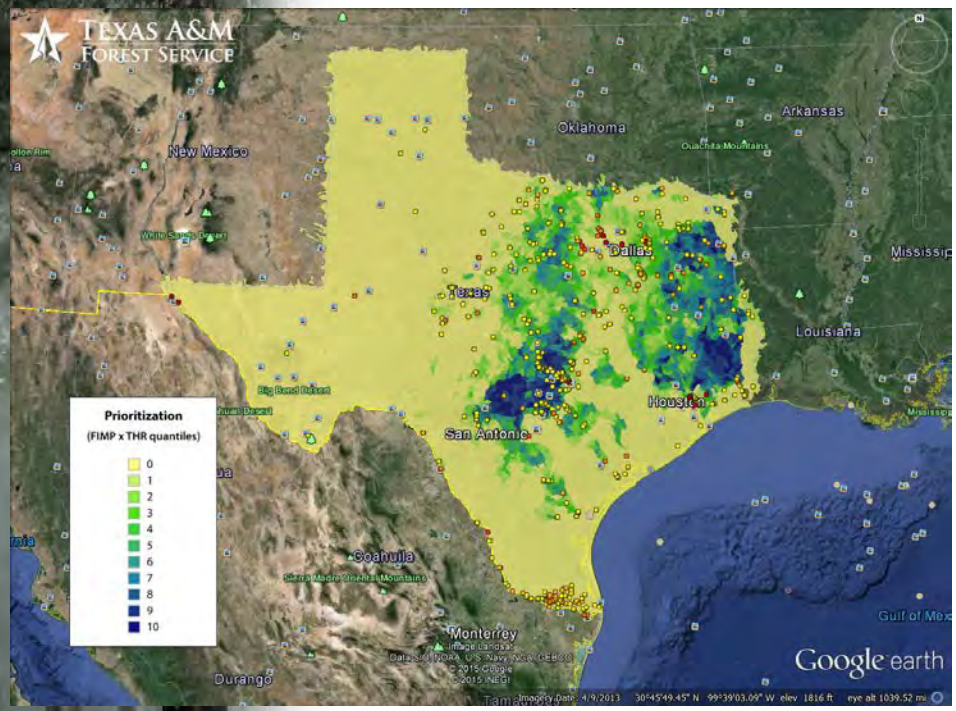
So What is the Urban Forest?

All the trees, public and private, within a community

Forests and the Water Cycle



What is TFS and USFS Doing?



Watershed Assessment

- Identifying priority areas to target education / technical assistance

Urban Forest Canopy

- Stormwater reduction
- Water Quality Improvement

Houston i-Tree Hydro Modeling Study

i-Tree™

Houston i-Tree Hydro Modeling Study

- From 2012 imagery
- 24.5% tree canopy
- 34% impervious
- 32.6% herbaceous
- 8.9% other

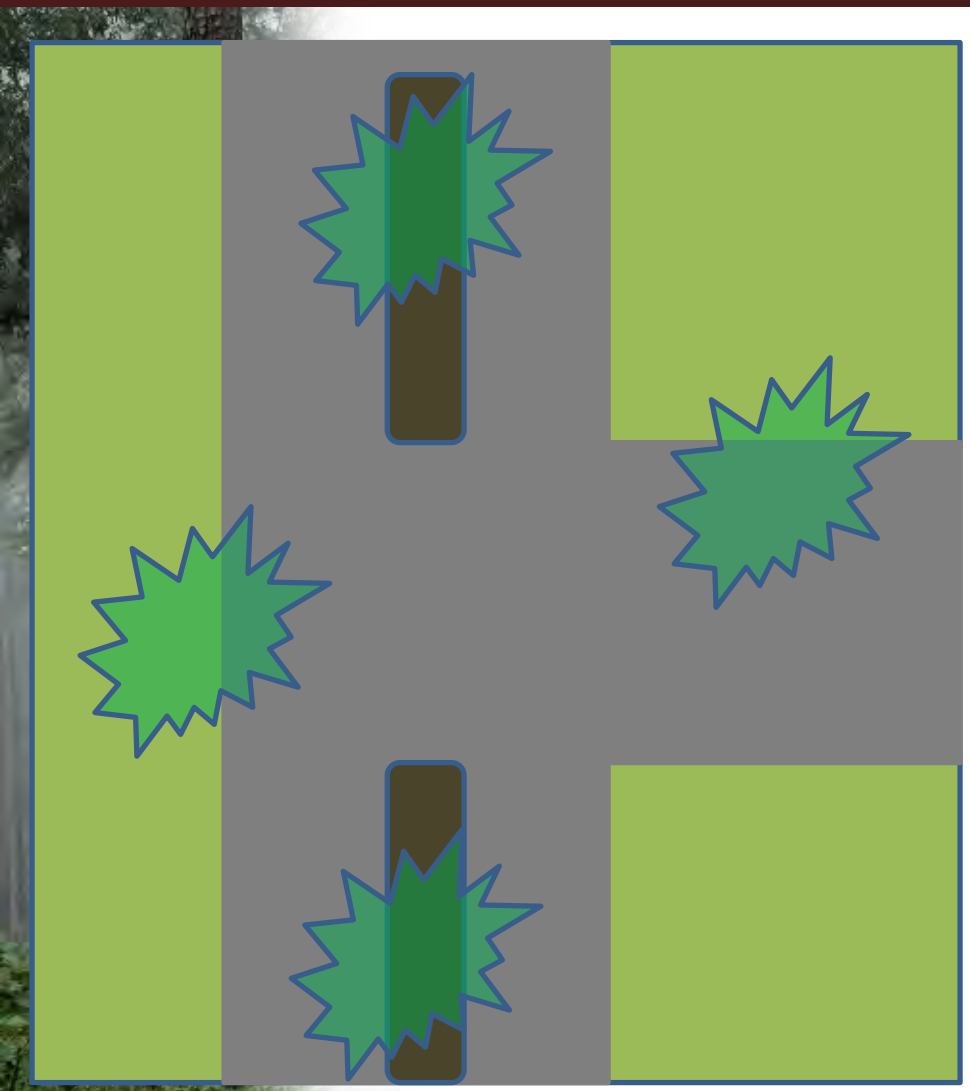
- 15.3% impervious under tree canopy

Houston i-Tree Hydro Modeling Study

i-Tree Hydro data needs

- Land cover attributes
- Digital Elevation Model
- 2012 Streamflow data
  - USGS gauges
- Local Meteorological data
  - 2012 Houston Hobby airport

Houston i-Tree Hydro Modeling Study



- Two future scenarios based on available tree planting space
- Increase tree canopy cover
  - Scenario 1: Increase canopy by 25%
  - Scenario 2: Increase canopy by 50%
- Plant trees so that canopy covers impervious surface
  - Next to roads
  - In parking lots
  - In median strips

Stormwater Volume Results

% Tree Canopy	% Impervious	% Impervious Under TC	Gallons Reduced (Million)	% Change
24.5	34	15.3	-	-
30.5	30.4	22.1	225.6	-1.9
35.1	18.6	30.6	389.7	-3.2

Pollution Reduction Results

% Tree Canopy	TSS (kg)	% Change
24.5	1,585,011.1	-
30.5	1,514,185.3	-5.21
35.1	1,468,143.3	-10.01

The Bottom Line – Tree canopy reduces stormwater velocity so that BMPs can work more efficiently.

Reducing Runoff

Increase canopy over impervious surfaces

Reducing Runoff

Manage for increased leaf area

- Provide increased soil/rooting volume

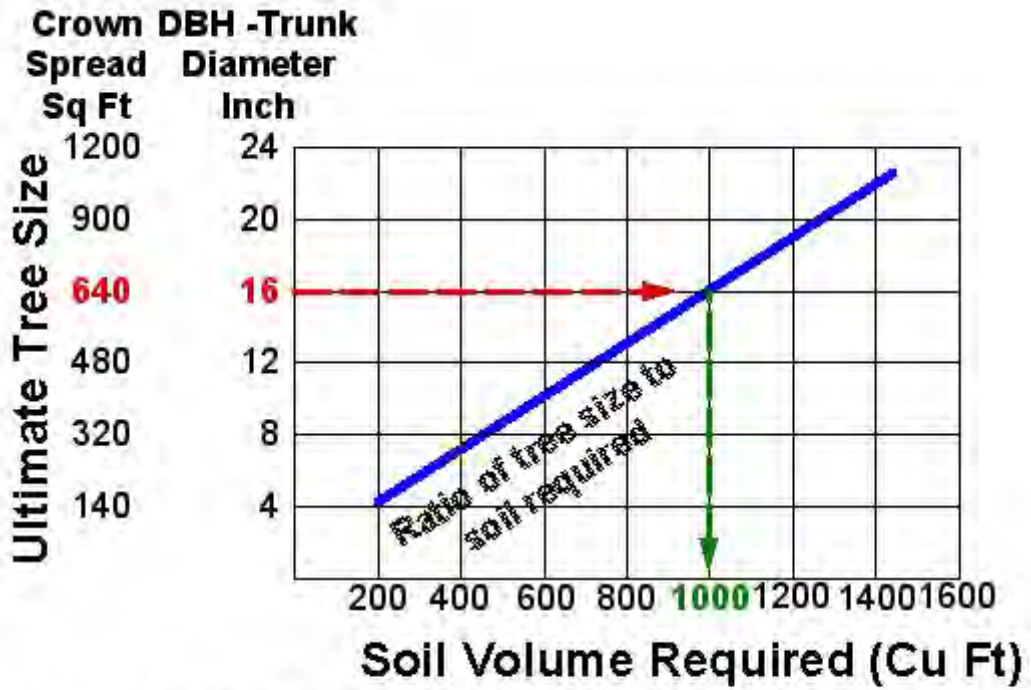
Reducing Runoff

Providing adequate area for increased root volume in urban environments

Reducing Runoff

Manage for increased leaf area

- Provide increased soil/rooting volume



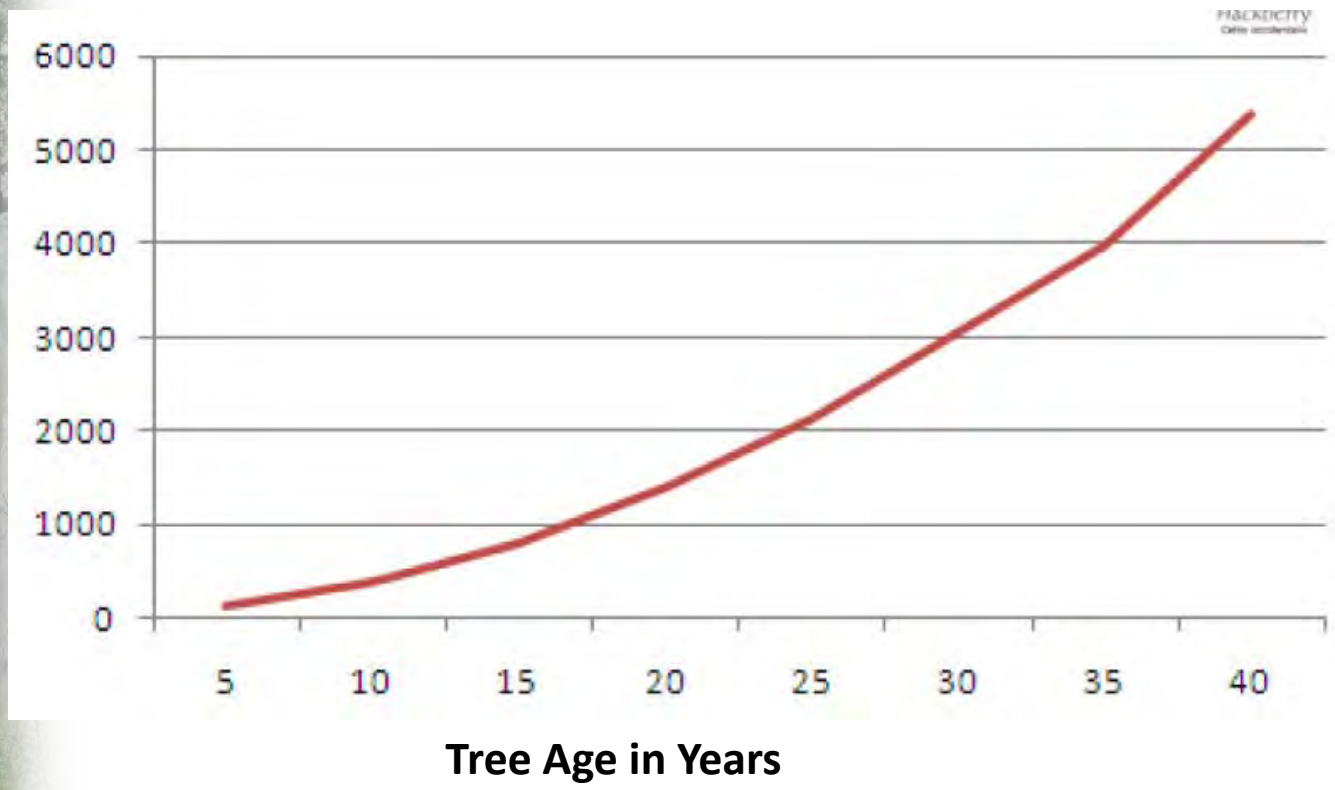
Example: A 16 inch diameter tree requires 1000 cu ft of soil

Tree/Soil Volume Requirements

Reducing Runoff

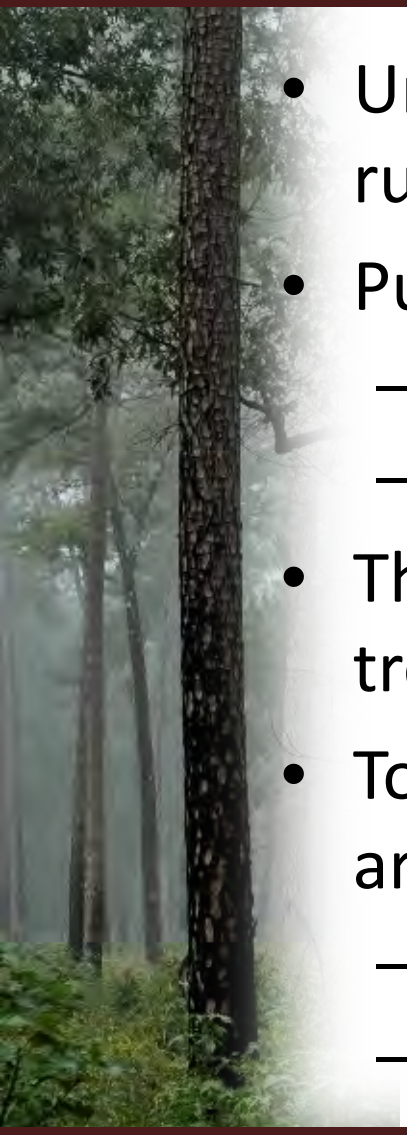
Encourage the planting of larger, longer-lived trees

- Stormwater interception by large trees



Source – McPherson et al 2006

Conclusions



- Urban tree canopy can help mitigate stormwater runoff /pollution loading
- Public domain tools (i-Tree) can help
  - Quantify stormwater benefits from the urban forest
  - Manage the UF for co-benefits
- The urban forest is the initial BMP of a GSI treatment train
- To maximize benefits, manage to increase leaf area
  - Larger trees have greater leaf area
  - Greater leaf area = greater benefits

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