

# **ROLE OF TREE CANOPY COVER AND STORMWATER RUNOFF**

**Taken from:**

***Urban Forests in Florida: Trees Control Stormwater  
Runoff and Improve Water Quality***

**and**

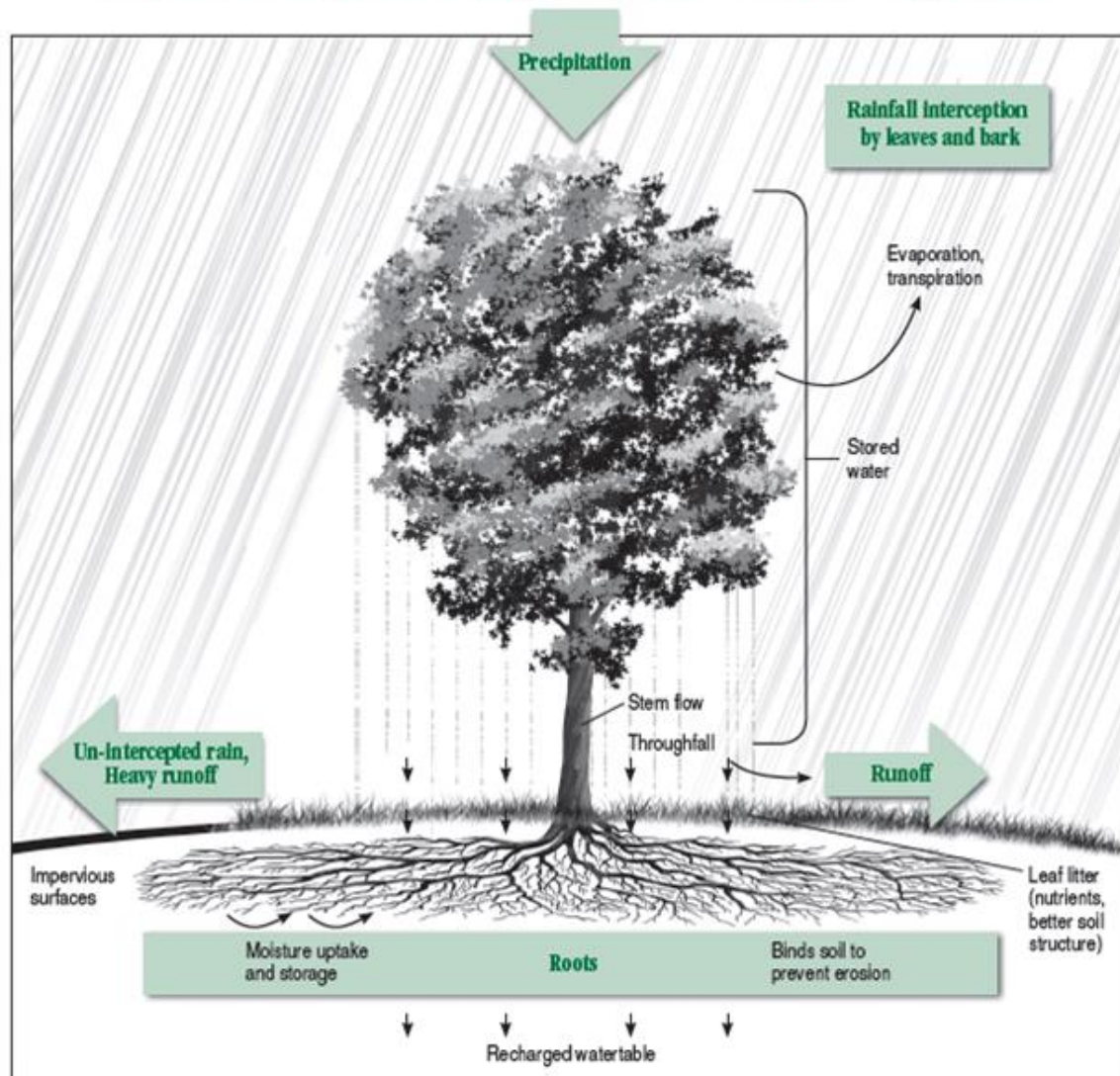
***Fact Sheet #4: Control Stormwater Runoff With Trees***

# HOW DO TREES AFFECT THE WATER CYCLE

- Trees are part of the water cycle due to transpiration
- Tree canopy provides “temporary storage” for precipitation
- Rainfall interception is the brief retention of rainfall by the tree canopy

# TREES AND STORMWATER RUNOFF

## Important Ways a Tree Helps with Stormwater Management



# HOW DO TREES AFFECT THE WATER CYCLE

- Rainfall interception is a function of:
  - Type and amount of leaves
  - Deciduous trees can intercept 500-700 gallons/year
  - Evergreen trees can intercept >4,000 gallons/year
- Tree density
- Understory (plants growing under the canopy)

# HOW DO TREES AFFECT THE WATER CYCLE

- Local climate
- Land use (i.e. urban, rural, suburban)
  - Suburban and rural areas intercept more than urban (central California study)
- Timing of precipitation

# COMPARISON OF ANNUAL RAINFALL INTERCEPTION BY TREE COVER

*(Sacramento County, California)*

Type of Land	Annual Rainfall (mm)	Rainfall Intercepted (%)
Urban Lands and City	393	6
County	414	11
Suburban	433	13
Rural	416	13
Pine Flatwoods (Forest)	1040-1238	18
<i>Xiao, Q.F. et al. 1998.</i>		

# HOW DO TREES AFFECT THE WATER CYCLE

- Individual trees intercept only a small percentage of total rain compared to urban forest cover
- Stormwater is the rainfall that accumulates on the ground during and immediately after a rain storm

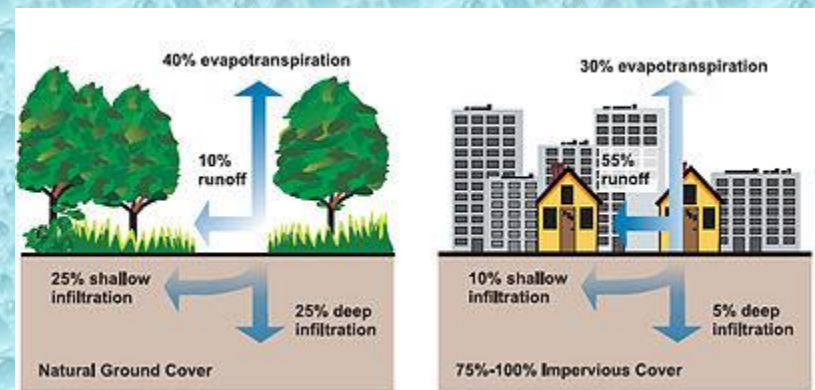
# HOW DO TREES AFFECT THE WATER CYCLE

- Rainfall interception helps reduce the impact on storm sewer systems and the cost of maintenance and new construction
- Trees intercepted 1.6% of total annual precipitation providing a benefit of \$111,000 or \$3.80 per tree (Santa Monica, CA)



# HOW DO TREES AFFECT THE WATER CYCLE

- Water stored in tree canopy may be:
  - Returned to the air by evaporation
  - Transmitted to the ground via leaves and bark for absorption
  - Returned to the atmosphere via transpiration
  - Rainfall interception helps reduce the impact on storm sewer systems and the cost of maintenance and new construction

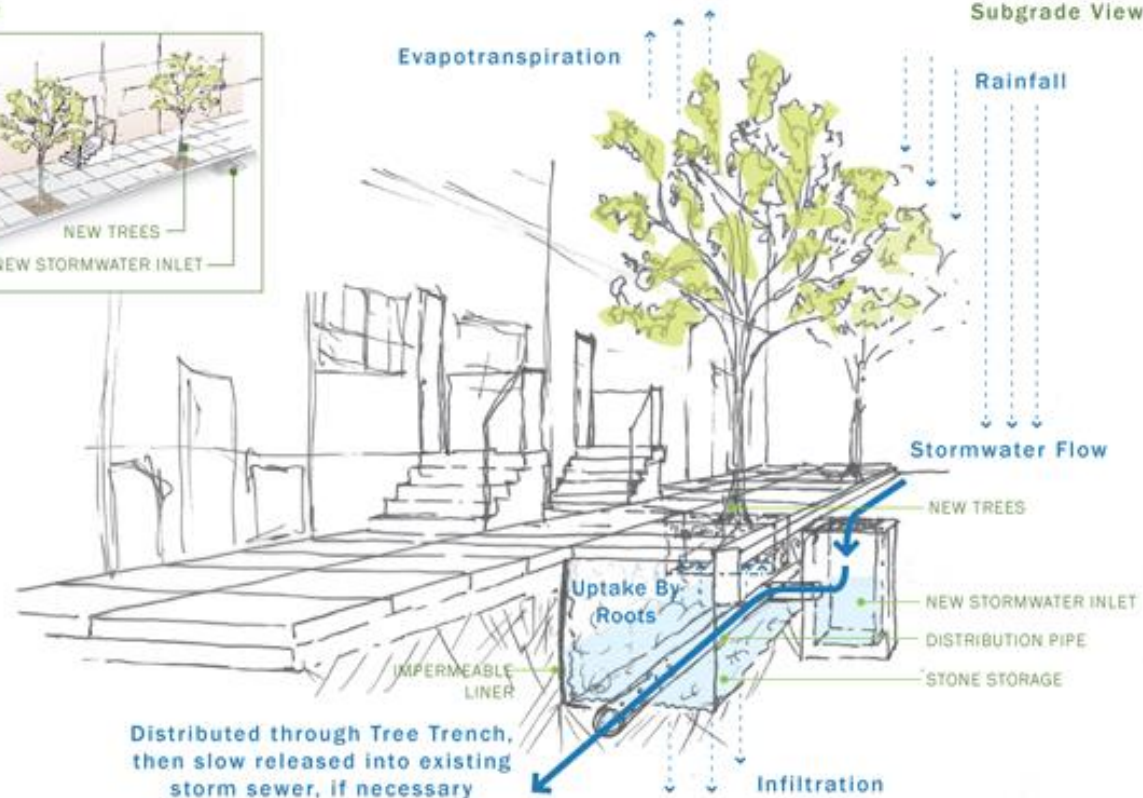


## GREEN STREETS: STORMWATER TREE TRENCH

Street View



Subgrade View



# HOW DO TREES AFFECT THE WATER CYCLE

- Canopy water that is left behind will:
  - Drip to the ground for absorption
  - Flow down the trunk as stemflow reducing raindrop impact
  - Leaf litter acts as a sponge and soaks up water
- All of these benefits help prevent soil erosion and compaction

# HOW DO TREES AFFECT THE WATER CYCLE

- Soil compaction and reduced infiltration can result from:
  - Food and vehicular traffic
  - Road and footpath construction
  - Removal of tree cover



# HOW CAN URBAN FORESTS REDUCE STORMWATER?

- Increases the infiltration rate and reduces runoff
- Help clean water of pollutants
- Reduces the impact on stormwater systems
  - Stormwater runoff was reduced by 7% in Dayton, OH and 26% in Baltimore, MD





# HOW CAN URBAN FORESTS REDUCE POLLUTANTS?

- Water quality is strongly related to runoff
- Stormwater picks up and transports:
  - Heavy metals
  - Fertilizers
  - Bacteria
  - Pesticides



# HOW CAN URBAN FORESTS REDUCE POLLUTANTS?

- Urban forests act a sponge can remove pollutants, sediment, and nutrients from stormwater
- Most pollutants are transformed by plants into non-harmful forms
- Tree canopy can help reduce water temperatures, thereby increasing dissolved oxygen, and reducing algal blooms



# POINTS TO REMEMBER

- Rainfall interception is influenced by:
  - Intensity and duration
  - Tree species
  - Tree architecture
  - Weather
- Trees store more water during a 1 inch rainfall event that lasts two hours versus one that lasts only two hours

# POINTS TO REMEMBER

- A medium sized tree can intercept as much as 2,380 gallons of water per year
  - Broadleaf evergreens intercept more water than deciduous species
- Trees work in combination with other stormwater control measures
  - Backyard cisterns
  - Swales
  - Berms
  - Grates and drywells





# POINTS TO REMEMBER

- Strategies to enhance the urban forest and mitigate stormwater runoff include:
  - Planting more trees in appropriate places
  - Improve tree maintenance
  - Plant species with higher growth rates, if appropriate
  - Plant trees that have good architecture
  - Match trees to rainfall patterns
  - Plant trees in groves, if possible
  - Plant native, low-water use species

# SUMMARY

- Proper management practices can help preserve the urban forest and provide many benefits:
- Maximize growing space and understory vegetation
- Preserve established and healthy trees
- Minimize clearing of trees and vegetation
- Use pesticides and fertilizers properly and as needed

# SUMMARY

- Route excess stormwater to bio-retention areas
- Establish and maintain riparian areas along parking lots and other hard surfaces
- Maintain and increase the amount and width of urban forest buffers around water bodies