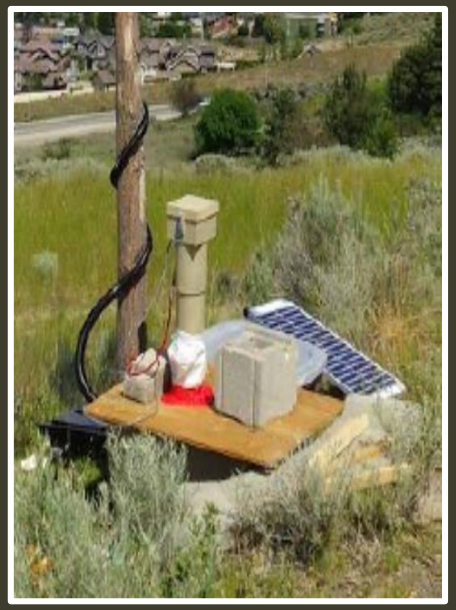
TREES AS GREEN INFRASTRUCTURE IN OUR CITIES



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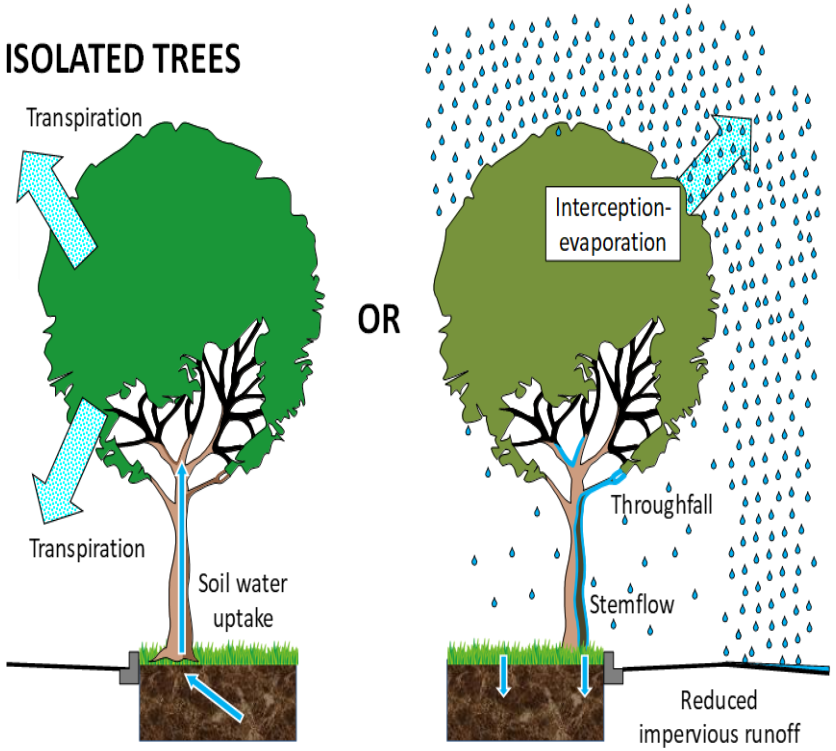
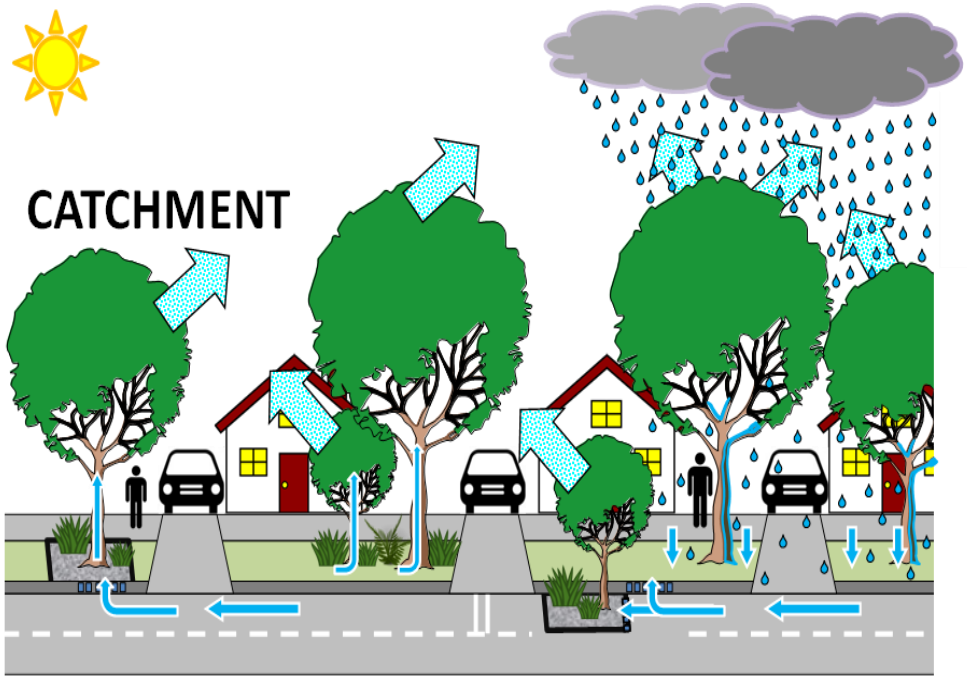
Introduction
Benefits of Trees for Urban Stormwater Management

- **Interception loss**
- **Canopy drainage characteristics**
- Transpiration



Benefits of Trees for Urban Stormwater Management Continued

- Improve efficiency of other stormwater control measures (SMC's)



Canopy Water Balance

- **Interception loss (Ic):** evaporation of rainfall (Pg) stored on the canopy

$$I_c = P_g - (TF + SF)$$

- **Throughfall (TF):** passes directly through canopy gaps or drips from that canopy

- **Stemflow (SF):** flows along branches and down the boles of trees to the ground.

Typical Values for Mature Forests

Percentage of Growing-Season Rainfall

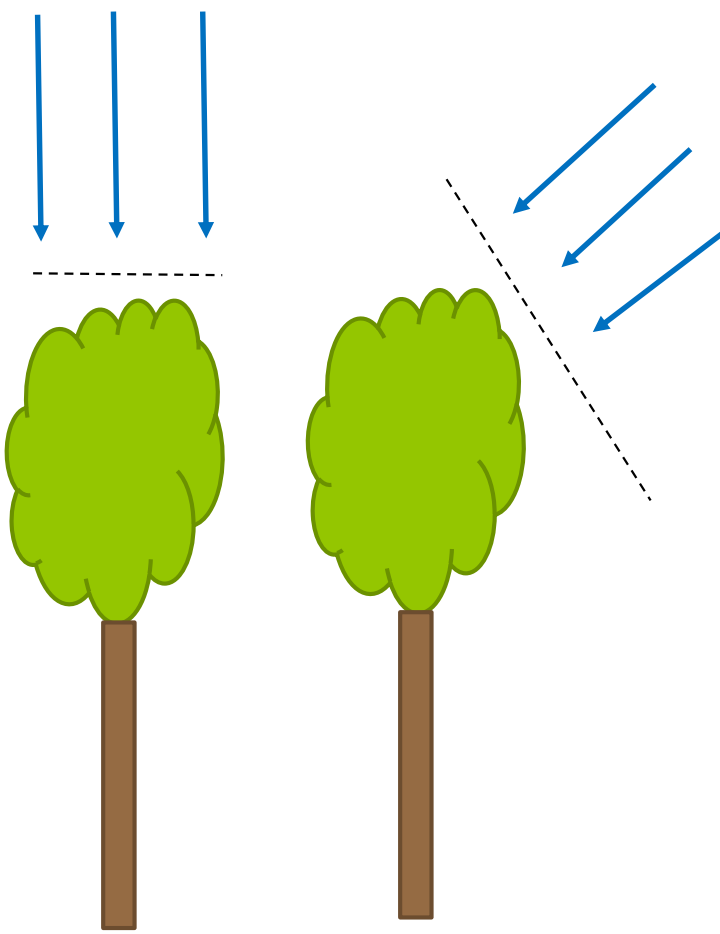
	Deciduous	Coniferous
Interception Loss	**13** (10 – 20)	**26** (15 – 30)
Throughfall	82 (78 – 85)	73 (70 – 85)
Stemflow	5 (3 – 9)	1 (0 – 2)

Urban Canopy Interception Loss Percentage of Season-Long Rainfall

- Isolated Street & Park Trees 36
  - Broadleaf 33
  - Coniferous 55
- Residential Lawns 15
- City-Wide
  - Tree-Scale 17
  - City-Scale 1-2
- Urban Remnant Forests 10

Urban Tree Interception Loss Efficiency

- On a per canopy area basis urban tree interception loss greater than natural forest counterparts. Why?
  - Urban tree architecture differs – **more voluminous** canopies, greater LAI
  - Isolated canopies have a **greater effective area** to capture wind-driven rainfall
  - **Increased energy** available for evaporation



Components of Interception Loss

- Canopy **Storage**
  - Evaporated after event
- **Evaporation** During Rain Event
- $I_c = S + E$

Example:

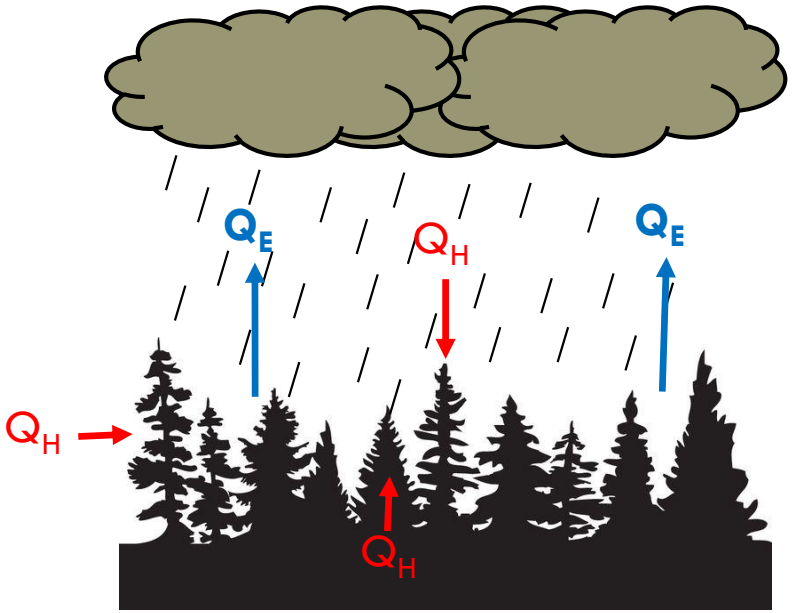
Rainfall depth = 8 mm, duration = 3 hours:

I_c from tree with S =1.0 mm and E = 0.25 mm / h

I_c = 1.0 + (0.25 mm / h x 3 h)

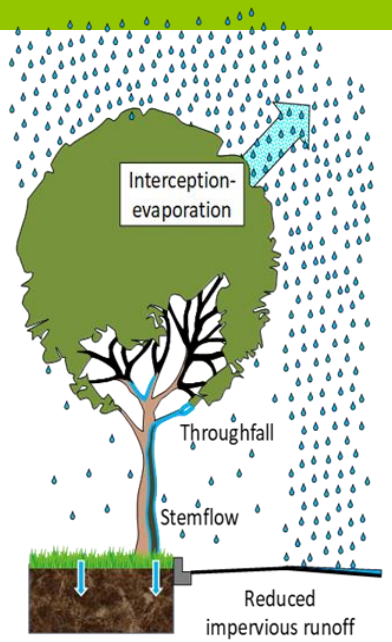
I_c = 1.0 + (0.75 mm)

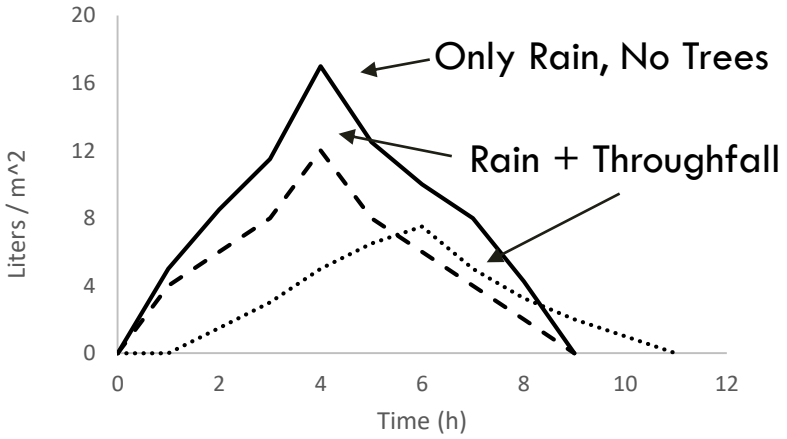
I_c = 1.75 mm or **22 %**



Canopy Drainage

- How a tree canopy partitions drainage through a canopy can be important in cities.
- Throughfall is diffuse, stemflow is concentrated
- Peak throughfall may be temporally delayed compared to peak rainfall





Stemflow in Urban Environments

- Stemflow greater for isolated trees

- Average season-long stemflow as high as 12%, event maximum = 23%

Funneling Ratios

- Funneling Ratios for rains > 10 mm averaged 26 (max average = 86)

- Event funneling ratios as high as197

Rain = 25.6 mm

SF = 5040.6 mm

- Importance:
  - Stormwater Management
    - SF = 10 – 40 % of Interception Loss
  - Self-Irrigation

Thank You

https://www.youtube.com/watch?v=DqXwgD8u8Pg

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