

Fairfax County Restoration Project-
Watershed Conference

Urban Watershed Forestry

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What is Ecological Restoration?

- Used to be structural. Pick a “pristine” point in time and restore the structure of the ecosystem – plants and animals – that existed at the time.
 - Popular date for Americas would be June 30, 1491 – pre-Columbus



Problems with Structural Restoration

- Things are different – climate change, extinctions (both local and global)
- Don't really know what things were like then
- Only constant in nature is change – no analog future
- What does 'pristine' mean – Indians burned 55 million acres/year and created *terra preta* soils



Restoration Ecology is now
focusing more on function

So what are the functions of a
watershed forest?

Ecosystem Functions

Storage

Carbon/Energy

Water

Nutrients

Flows

Carbon/Energy

Water

Nutrients

Wildlife Habitat

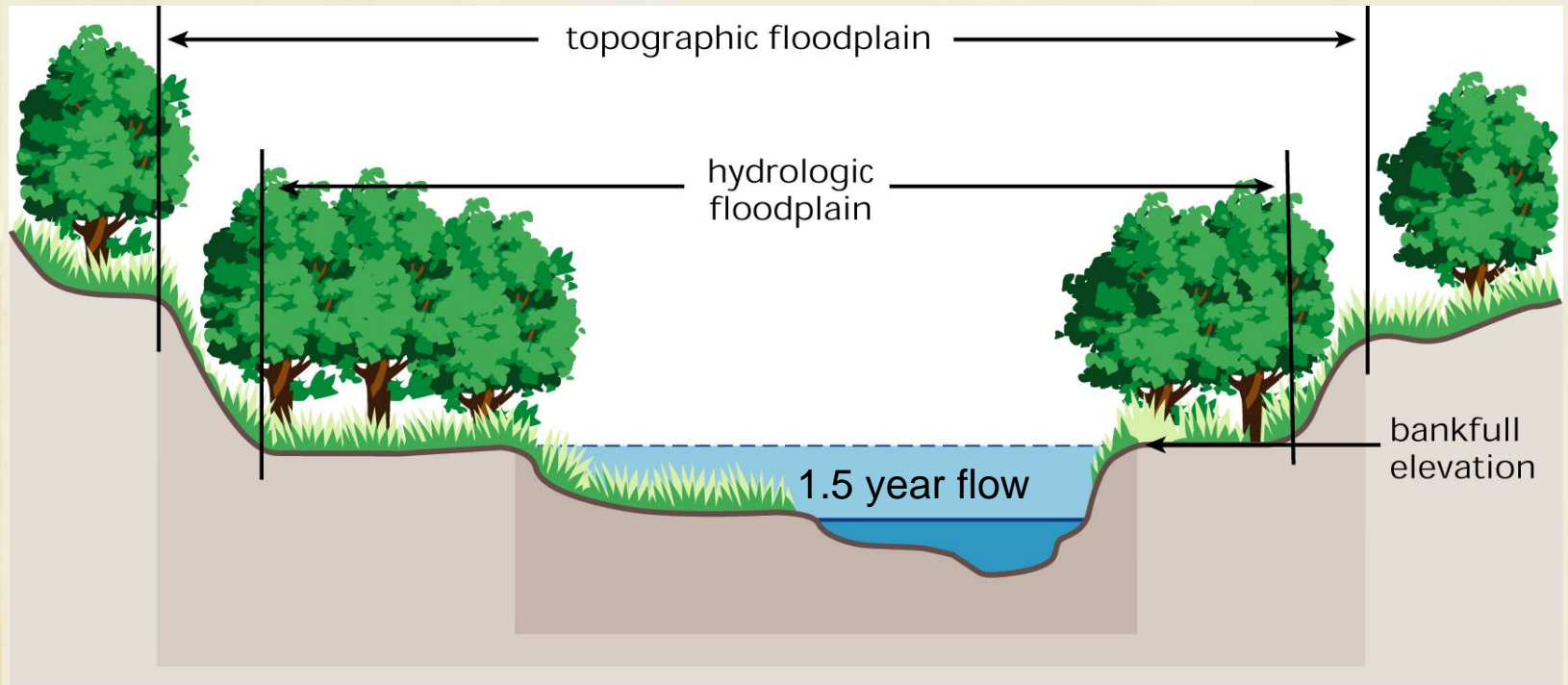
Soils



Forests and Water

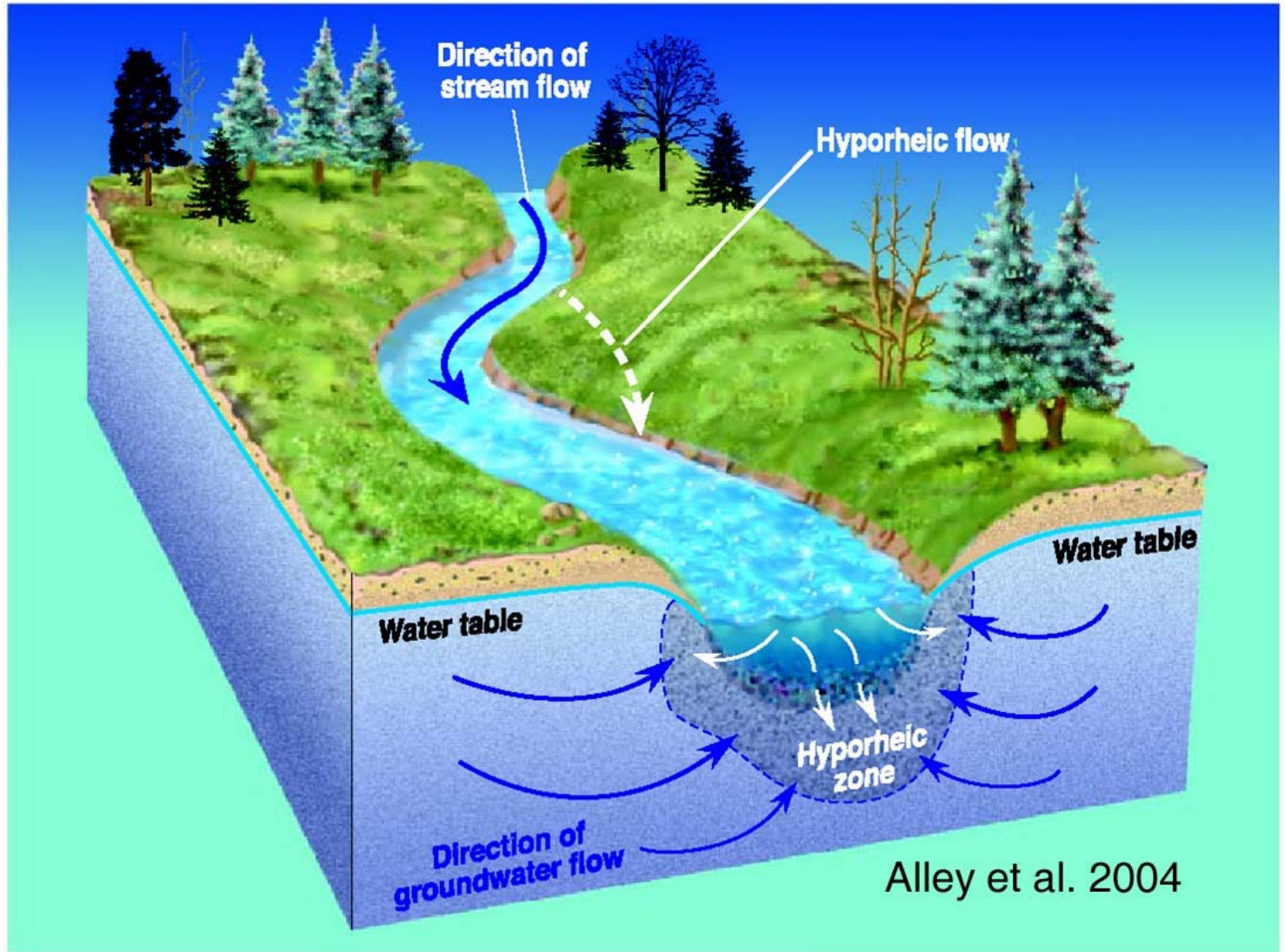
- Storage
 - Floodplain
 - Ground Water
 - Soil in stream banks
- Flow
 - Infiltration
 - Transpiration
 - Mechanical Energy in Streams

Forested Floodplains and Soil



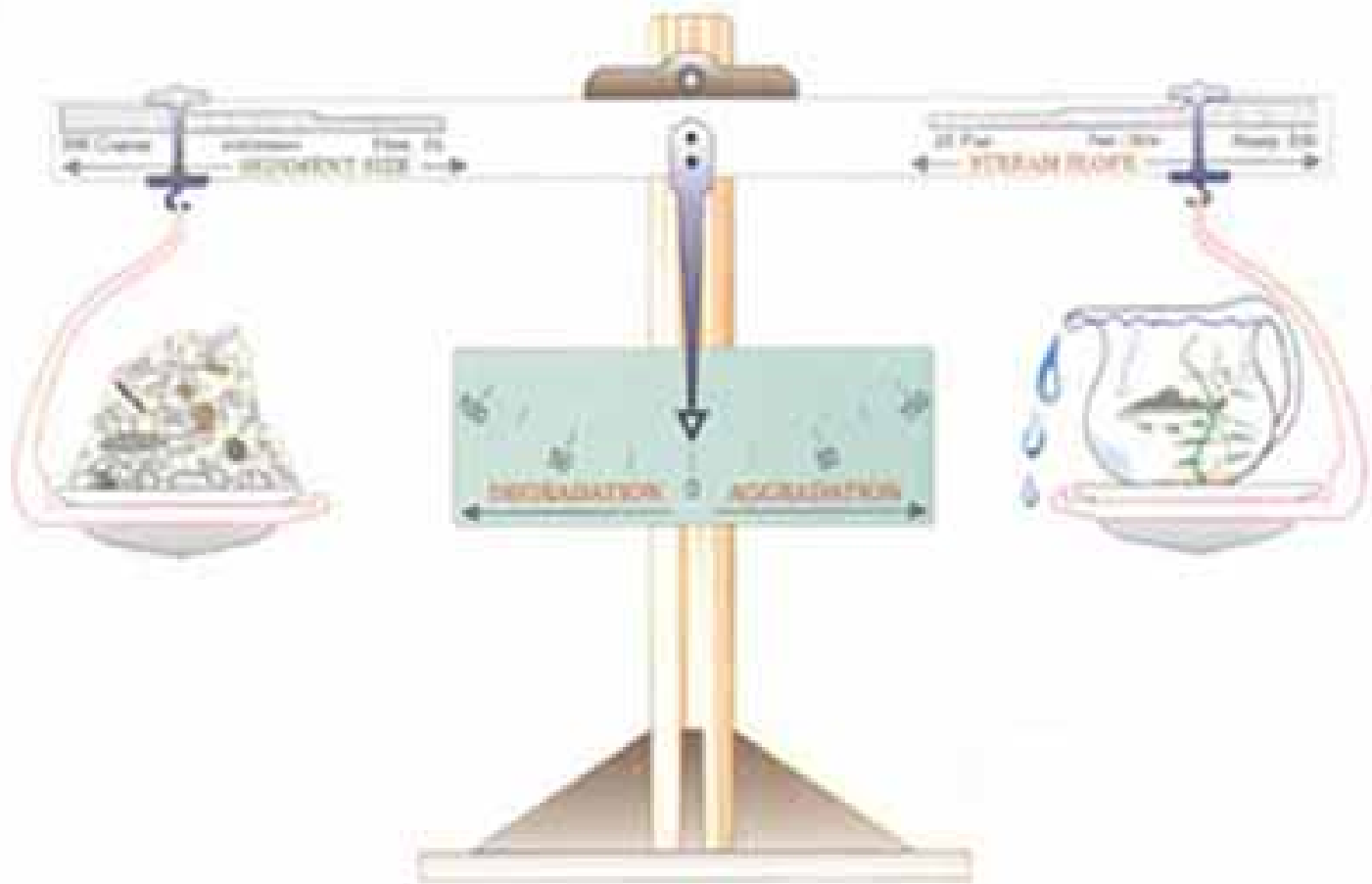
Floodplain provides temporary water storage and energy dissipation.
Roots prevent erosion and protect banks.

Hyporheic Zone



Alley et al. 2004

Sediment Transport



$$(\text{Sediment LOAD}) \times (\text{Sediment SIZE}) \propto (\text{Stream SLOPE}) \times (\text{Stream DISCHARGE})$$

Trees and Stormwater

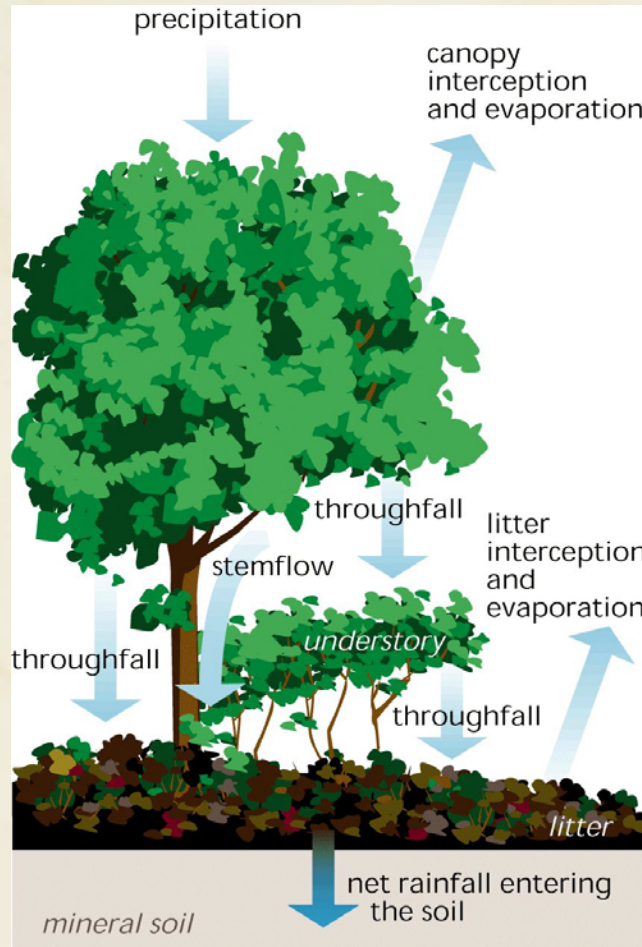
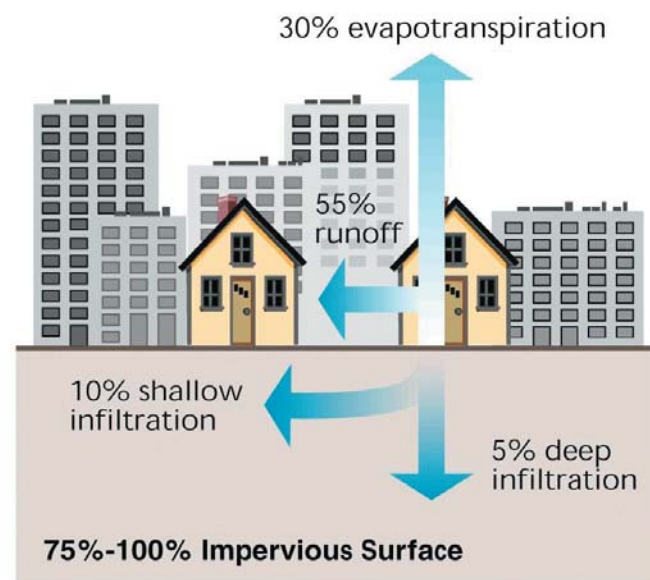
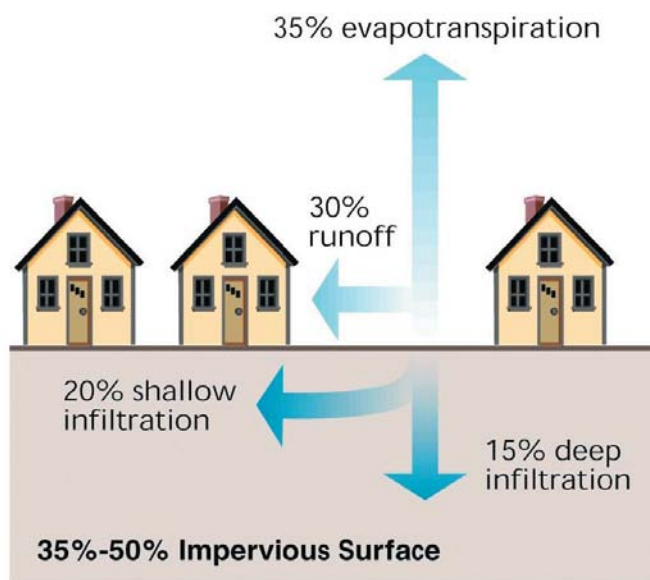
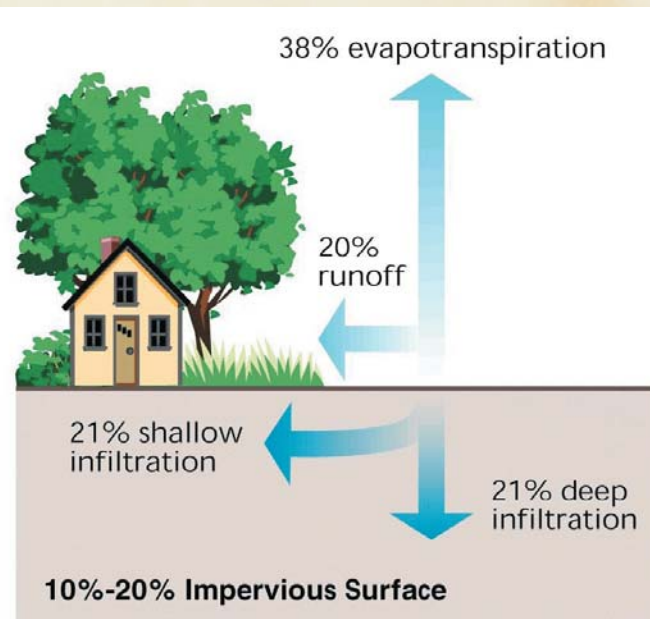
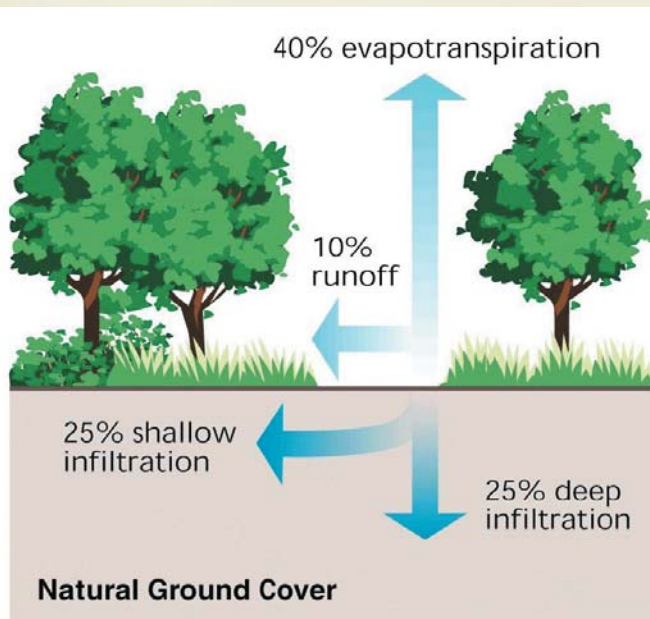


Fig. 2.3 – Typical pathways for forest rainfall. A portion of precipitation never reaches the ground because it is intercepted by vegetation and other surfaces.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
Interagency Stream Restoration Working Group (15 federal agencies)(FISRWG).

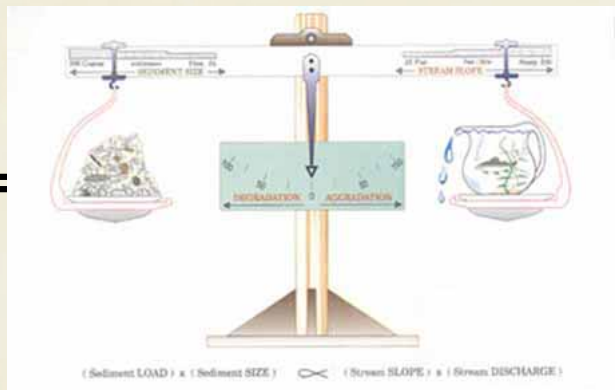
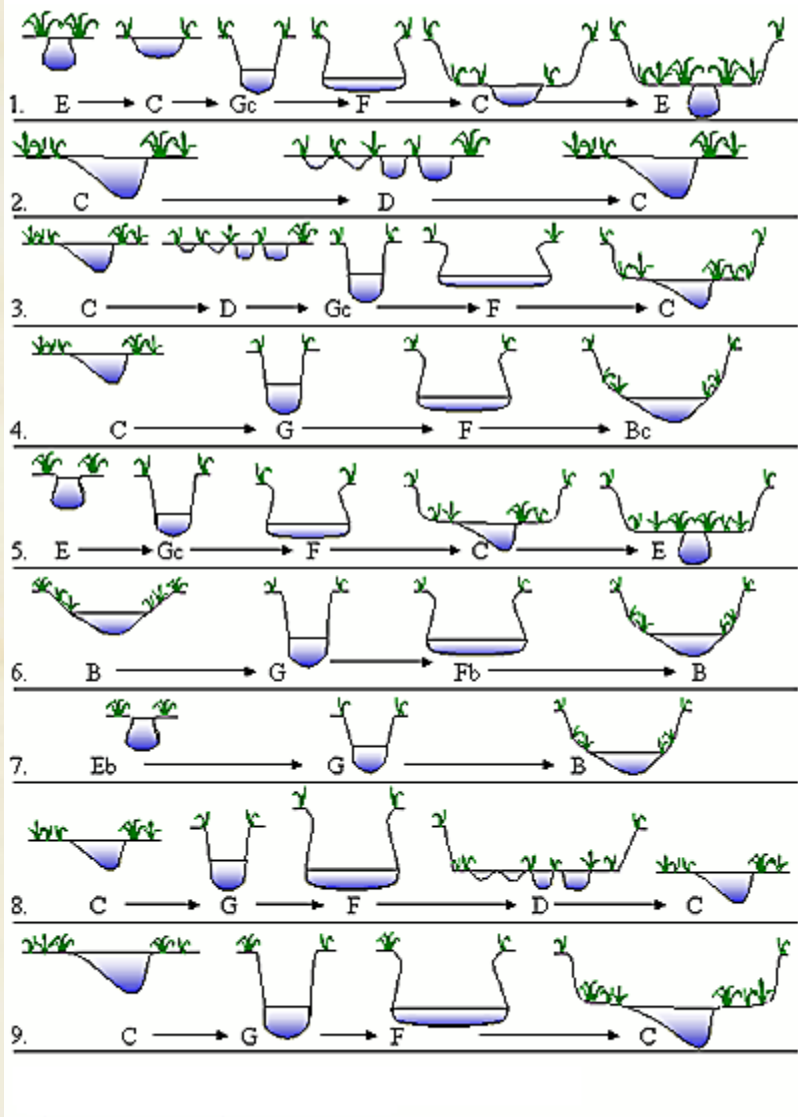
In an eastern deciduous forest 13% of all precipitation per year is intercepted and evaporated before reaching the ground.





Effect of Loss of Forest Cover

- Reduced Infiltration and Interception
- Increased Stream Flow During Storms
- Reduced Base Flow Between Storms
- Reduced Water Flow Management Function
- Reduced Ground Water Storage Function
- Reduced Floodplain Storage Function Through Channel Incision

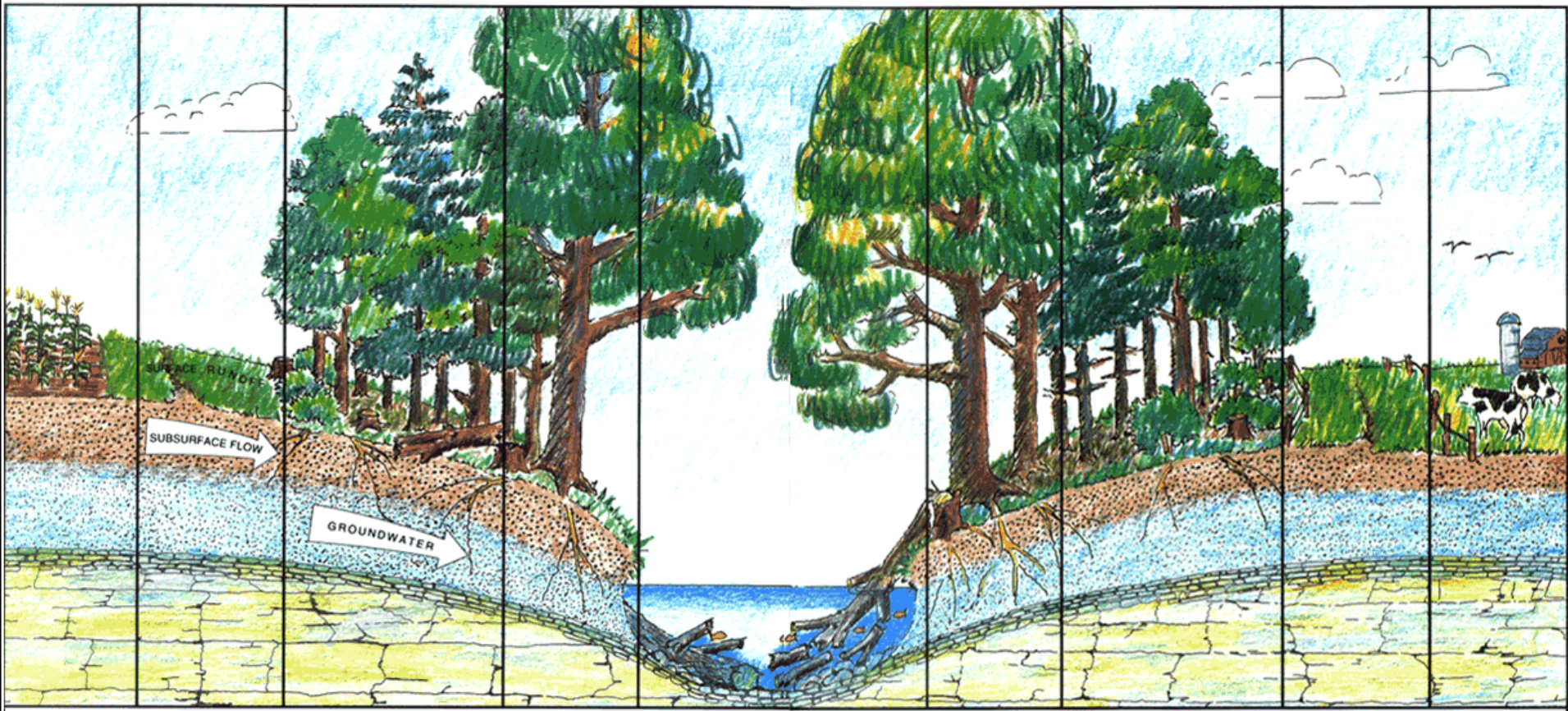




Functions to Restore

- Storm Water Management Through Infiltration/Interception
 - Water Quantity/Quality
 - Mechanical Stream Energy

THE STREAMSIDE FOREST BUFFER



	20'	60'	15'		15'	60'	20'	
CROPLAND	ZONE 3 RUNOFF CONTROL	ZONE 2 MANAGED FOREST	ZONE 1 UNDISTURBED FOREST	STREAM BOTTOM	ZONE 1 UNDISTURBED FOREST	ZONE 2 MANAGED FOREST	ZONE 3 RUNOFF CONTROL	PASTURE
Sediment, fertilizer and pesticides are carefully managed.	Concentrated flows are converted to dispersed flows by water bars or spreaders, facilitating ground contact and infiltration.	Filtration, deposition, plant uptake, anaerobic denitrification and other natural processes remove sediment and nutrients from runoff and subsurface flows.	Maturing trees provide detritus to the stream and help maintain lower water temperature vital to fish habitat.	Debris dams hold detritus for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	Tree removal is generally not permitted in this zone.	Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through vigorous tree growth.	Controlled grazing or haying can be permitted in Zone 3 under certain conditions.	Watering facilities and livestock are kept out of the Riparian Zone insofar as practicable.



Functions to Restore

- Storm Water Management Through Infiltration/Interception
 - Water Quantity/Quality
 - Mechanical Stream Energy
- Stream Energy – Heat and Biochemical
 - Powers In- Stream Functions

Water exits through
photosynthesis and transpiration



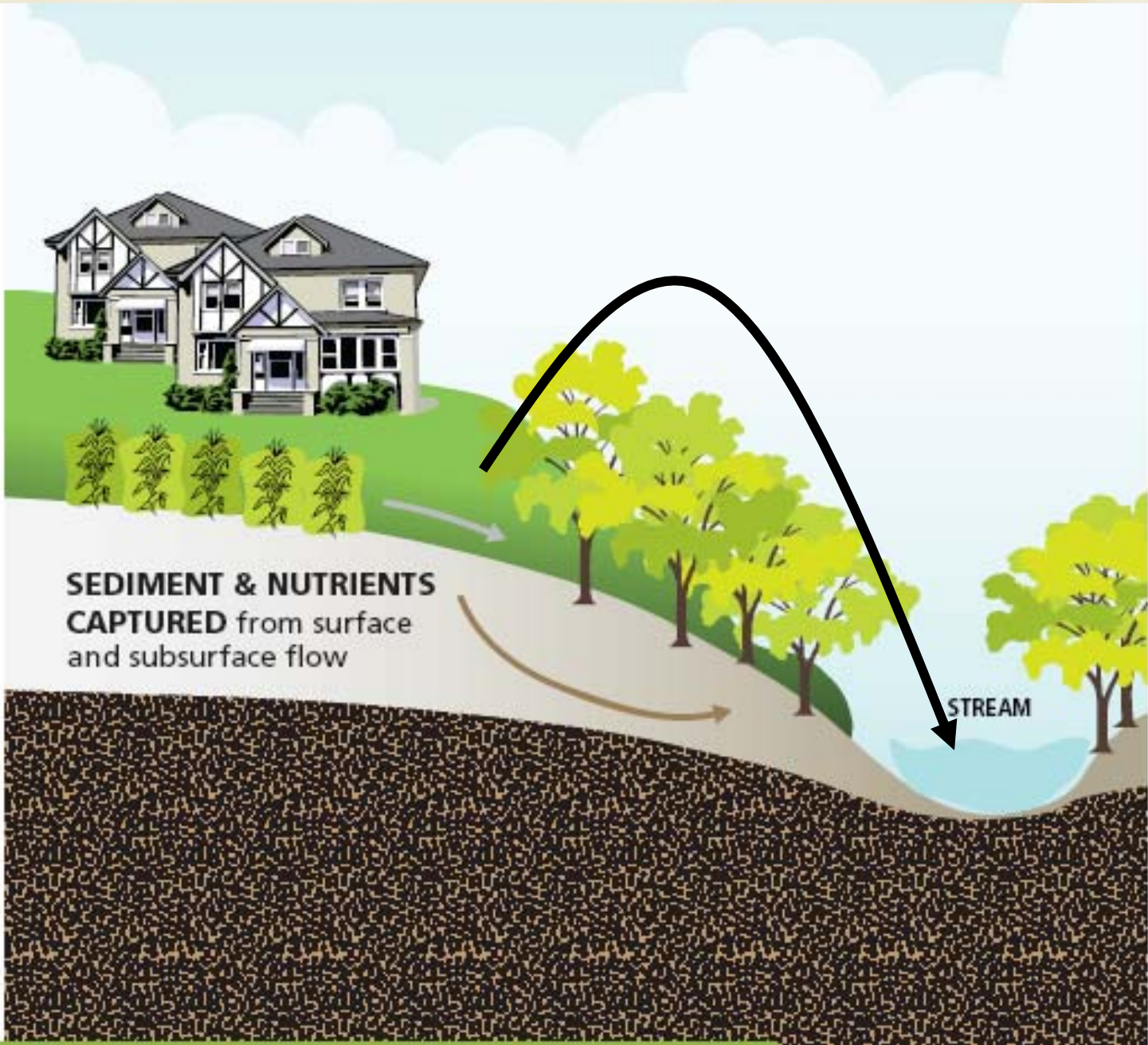
Water enters through roots.

About 98% of solar energy falling on forests is used for transpiration, which pumps heat into the atmosphere



Functions to Restore

- Storm Water Management Through Infiltration/Interception
 - Water Quantity/Quality
 - Mechanical Stream Energy
- Stream Energy – Heat and Biochemical
 - Powers In- Stream Functions
- Heat Pump





Watershed Forest Restoration

Surface Area is the Key

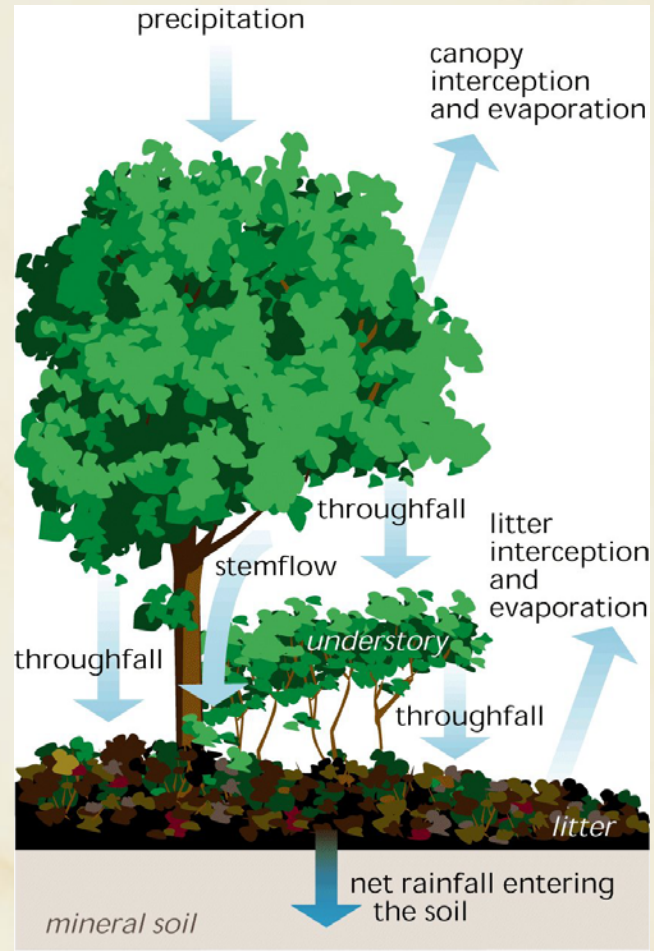


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Instructions

Species: If you're looking for a Willow Oak it's listed as "Oak, Willow". If your tree isn't listed, use the general "Other" listings.

Diameter: How wide is your tree at about 4.5 feet from the ground?

Enter your tree info:

Enter your tree's species:

*

Enter your tree's diameter (between 0 and 45 inches):

*

What land-use type is this tree nearest?

*

Calculate

National Tree Benefit Calculator

Beta

Trees in urban areas provide a number of important benefits. They help to clean the air, curb stormwater runoff, raise property values, sequester carbon, and reduce energy costs.

You have chosen:

Zip Code: 22310

City: ALEXANDRIA, VA

Climate Zone: South

[change](#)

Enter information about a street-side tree and learn about the benefits it provides. Street-side trees are typically located in front yards, medians, parkways, planting strips or other common planting areas adjacent to streets.

National Tree Benefit Calculator

Beta

Overall Benefits

Stormwater

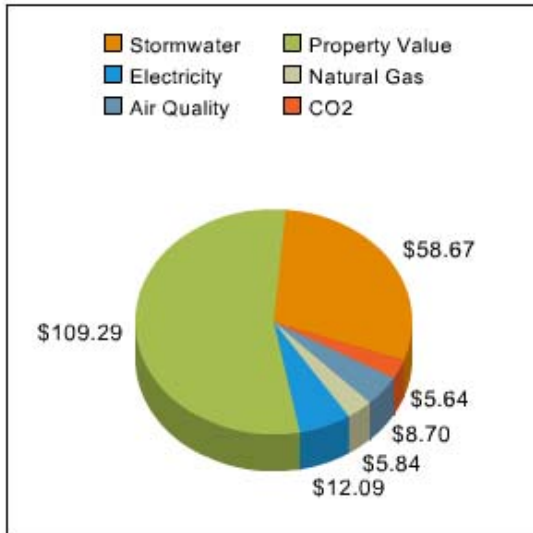
Property Value

Energy

Air Quality

CO2

About the model



Breakdown of your tree's benefits

Click on one of the tabs above for more detail

This 20 inch Red maple provides overall benefits of: **\$200** every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 25 inches, it will provide **\$254** in annual benefits.



Red maple
Acer rubrum

National Tree Benefit Calculator

Beta

Overall Benefits

Stormwater

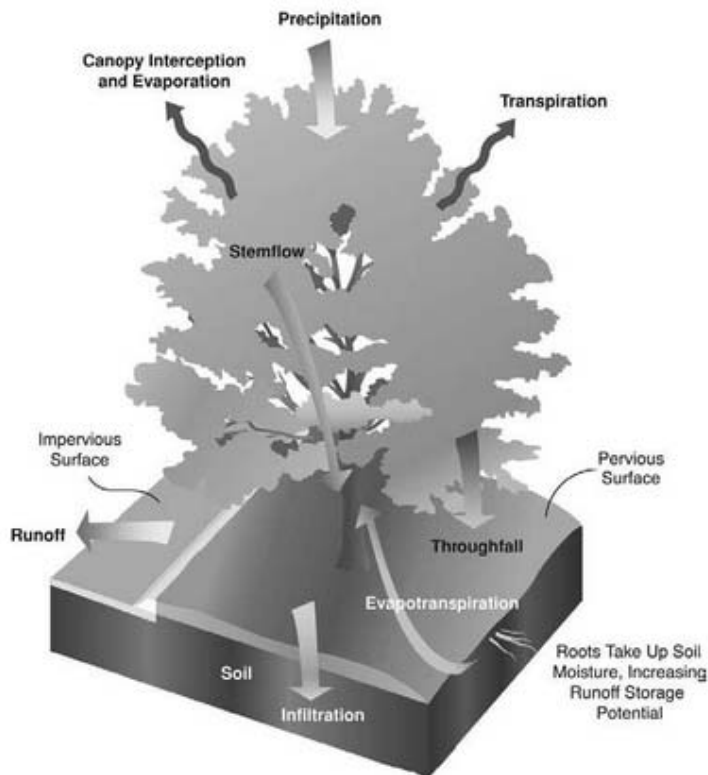
Property Value

Energy

Air Quality

CO₂

About the model



Your 20 inch Red maple will intercept **5,926 gallons** of stormwater runoff this year.

Urban stormwater runoff (or "non-point source pollution") washes chemicals (oil, gasoline, salts, etc.) and litter from surfaces such as roadways and parking lots into streams, wetlands, rivers and oceans. The more impervious the surface (e.g., concrete, asphalt, rooftops), the more quickly pollutants are washed into our community waterways. Drinking water, aquatic life and the health of our entire ecosystem can be adversely effected by this process.

Trees act as mini-reservoirs, controlling runoff at the source. Trees reduce runoff by:

- Intercepting and holding rain on leaves, branches and bark
- Increasing infiltration and storage of rainwater through the tree's root system
- Reducing soil erosion by slowing rainfall before it strikes the soil

For more information visit: [The Center for Urban Forest Research](#)



Watershed Forest Restoration

- Plant More Trees – Everywhere
- Emulate Natural Forest Vertical Structure – Forbs under Shrubs under Trees
- Reduce Impervious Surface and Turf
- Use Natural Mulch – Helps Build Soil
- Plant Natives for Wildlife Habitat
- Avoid Monocultures