

Clean Water – One of Many Forest Products

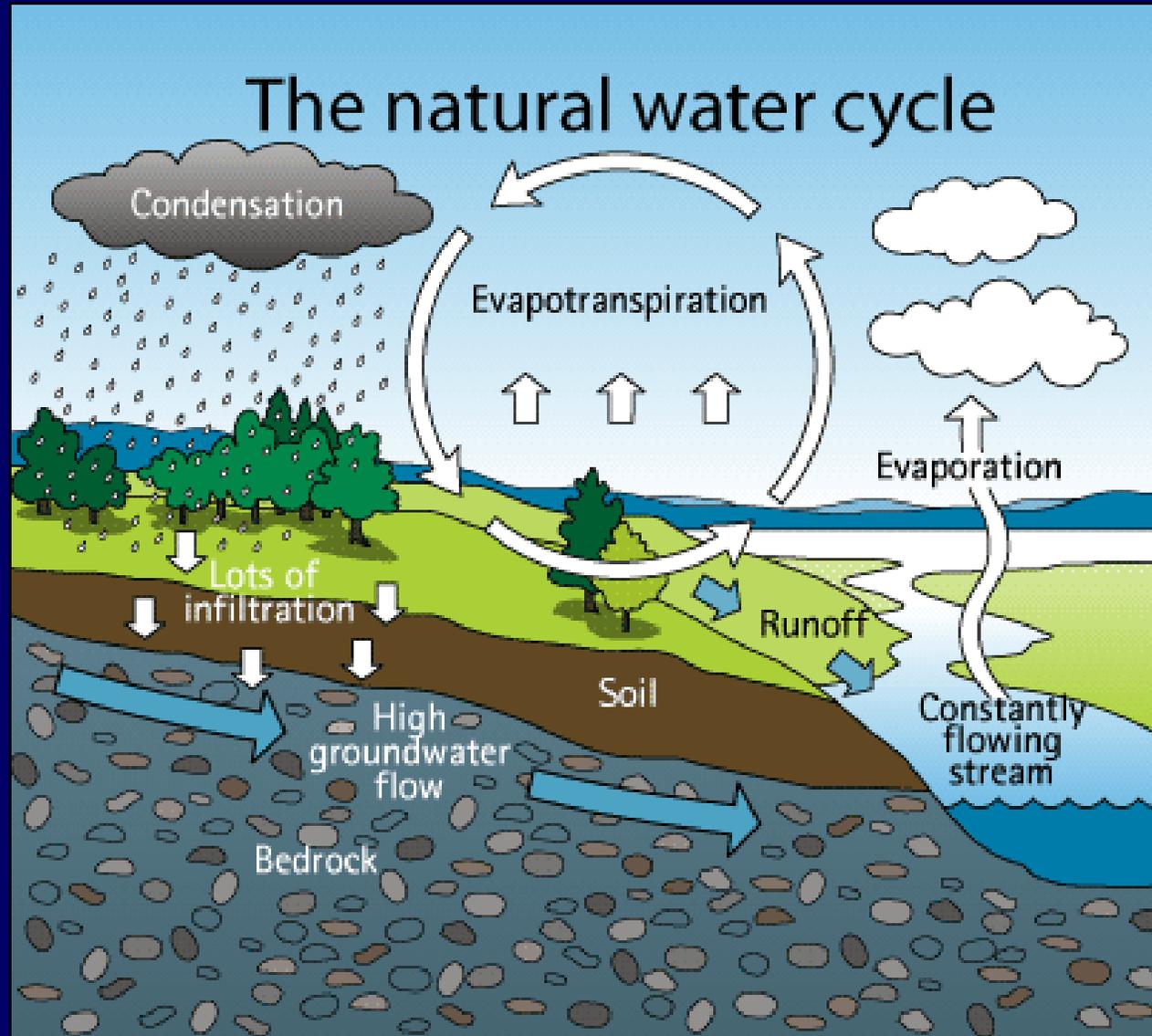


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These Maine Forests

- Cover about 89% of Maine
 - About 80% of the Sebago lake watershed
 - About 25% of the City of Portland
- Have about 6.5 million cords of wood harvested from them annually
- Are 94% privately owned

Forests and the Water Cycle



Forests and the Water Cycle

Interception

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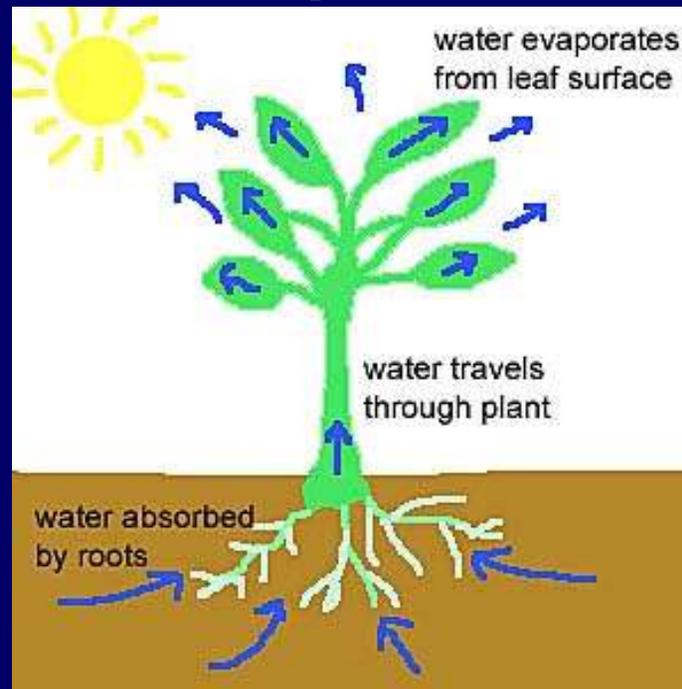
Evaporation



**Interception and evaporation from the leaves
can reduce the amount of water reaching the
ground by over 25%!**

Forests and the Water Cycle

Transpiration

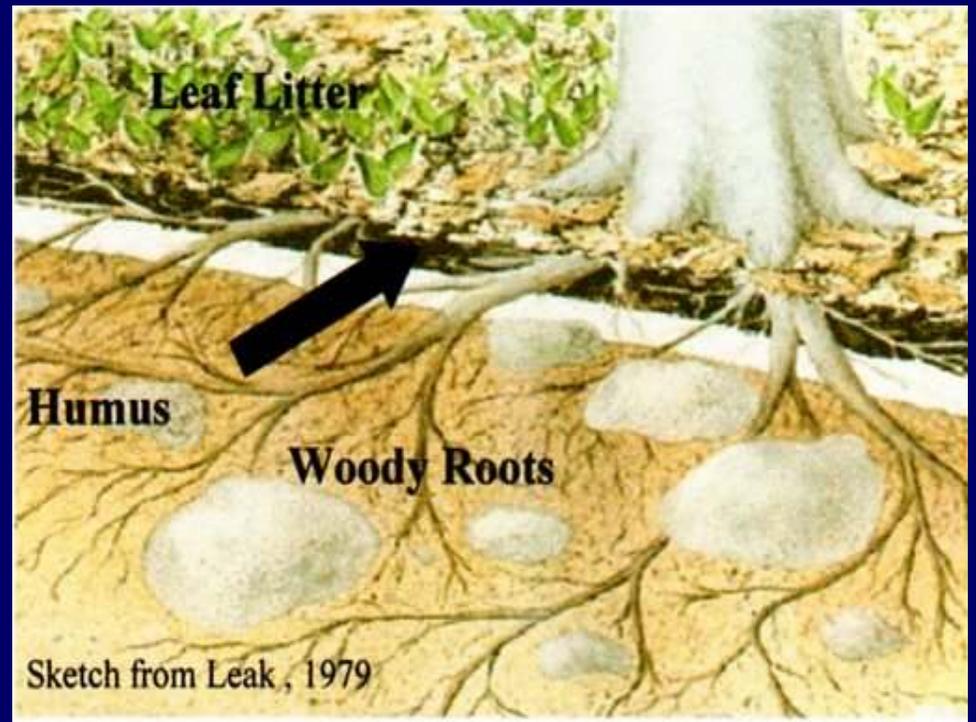


Trees move considerable amounts of water out of the soil and back into the atmosphere.

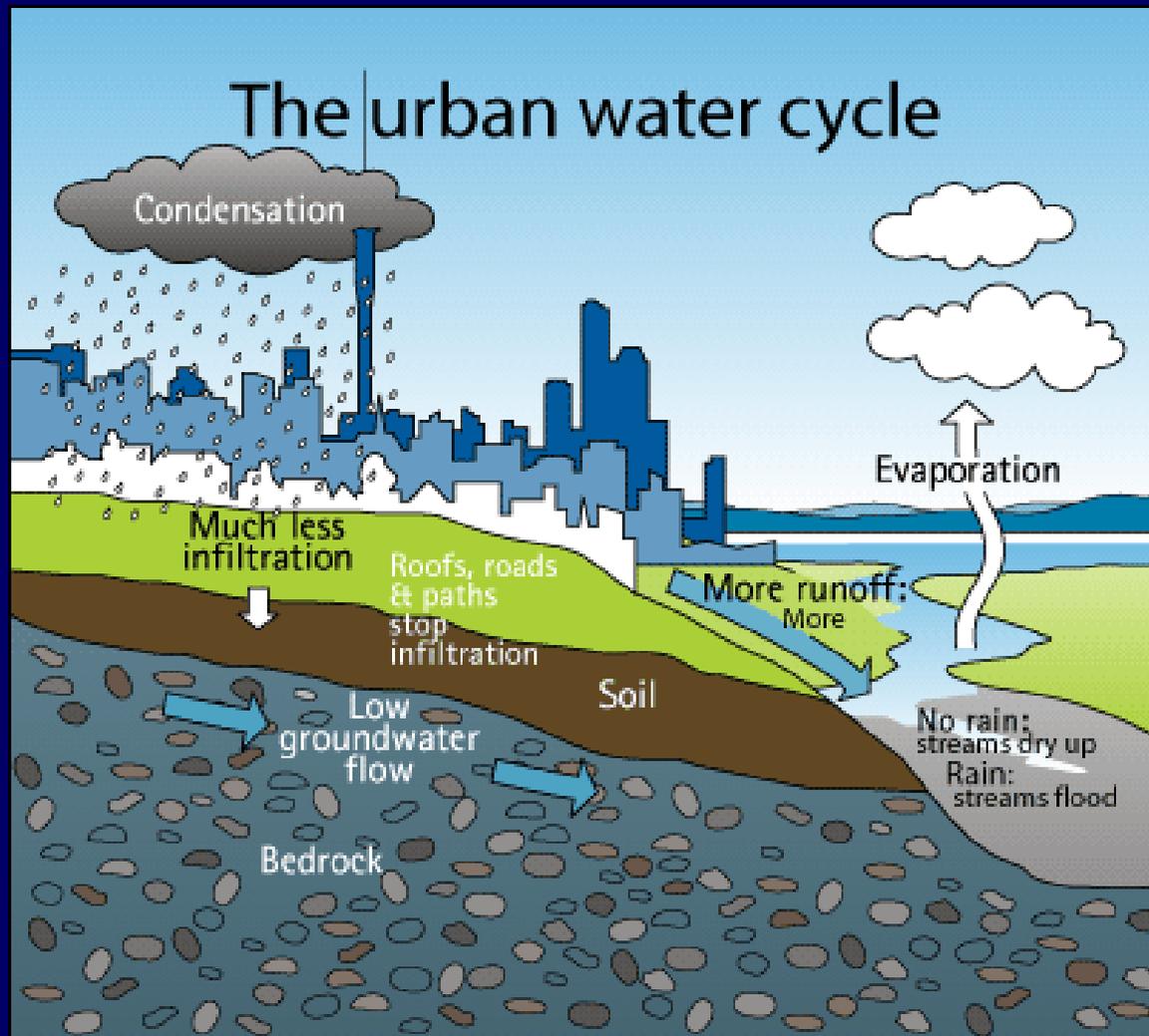
Mud season only really ends in the woods when the “trees start sucking water out of the ground”

The Forest Floor

- Slows water down and allows it to infiltrate into the soil
- Covers exposed soil limiting or preventing erosion



Conversion to Non-Forest

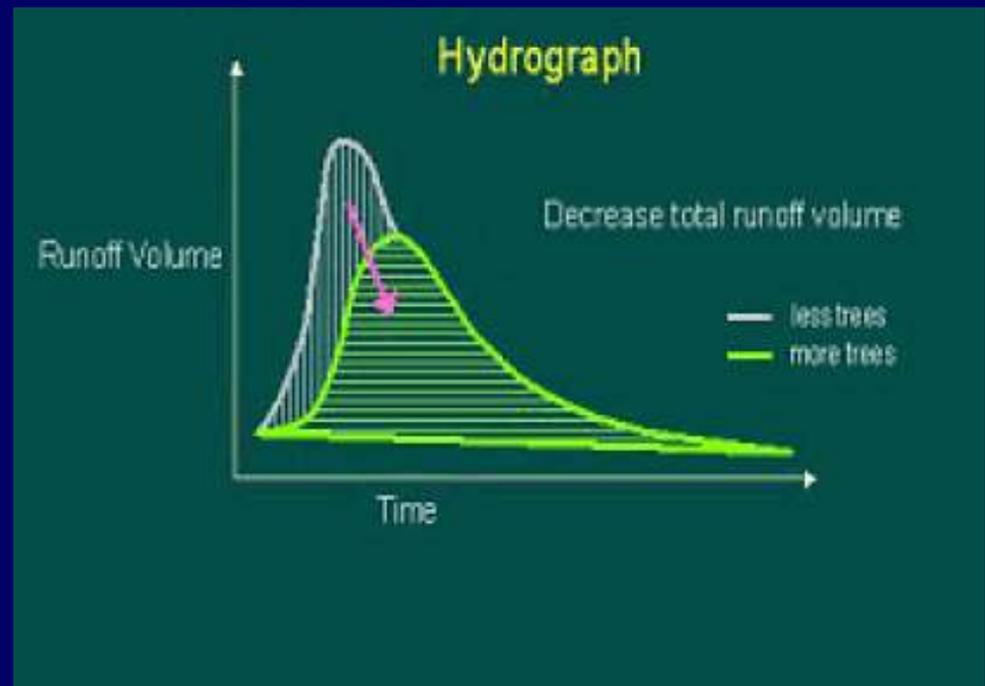


Effects on Stream Flows

- Less interception
 - More water reaches the ground
- Forest floor replaced by surfaces less able to infiltrate water
 - Water runs off more quickly
- Less ground water recharge

The Effect of Forests on Runoff

- Reduces total runoff volume
- Delays peak runoff time
- Spreads runoff out over time



Some Numbers

- In a 1 inch rainstorm over 12 hours, the interception of rain by the canopy of the urban forest in Salt Lake City reduces surface runoff by about 11.3 million gallons, or 17%.
- For every 5% of tree cover added to a community, stormwater runoff is reduced by approximately 2%.

This Knowledge Isn't New!



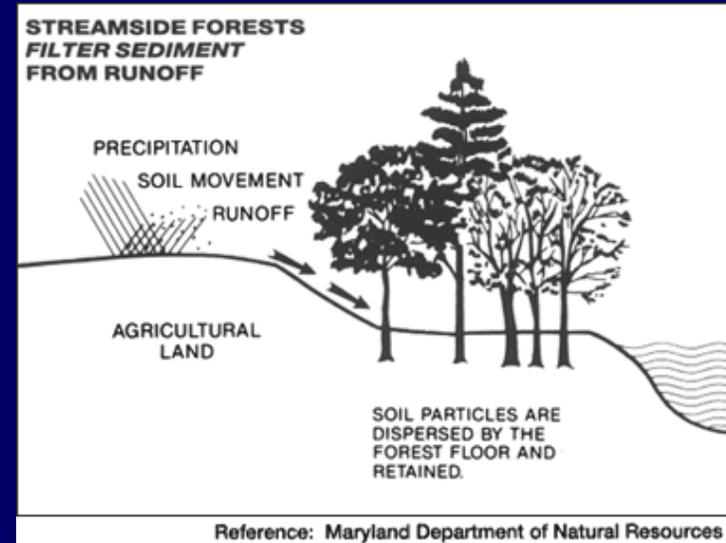
**First “Protection Forest” established in Switzerland
in 1342**

Forests Act as Pollutant Filters

- Forests facilitate removal of nonpoint source pollutants
 - Removal of surface-borne pollutants
 - Nitrate removal
 - Plant uptake of nutrients “vegetative sinks”
 - Microbial process

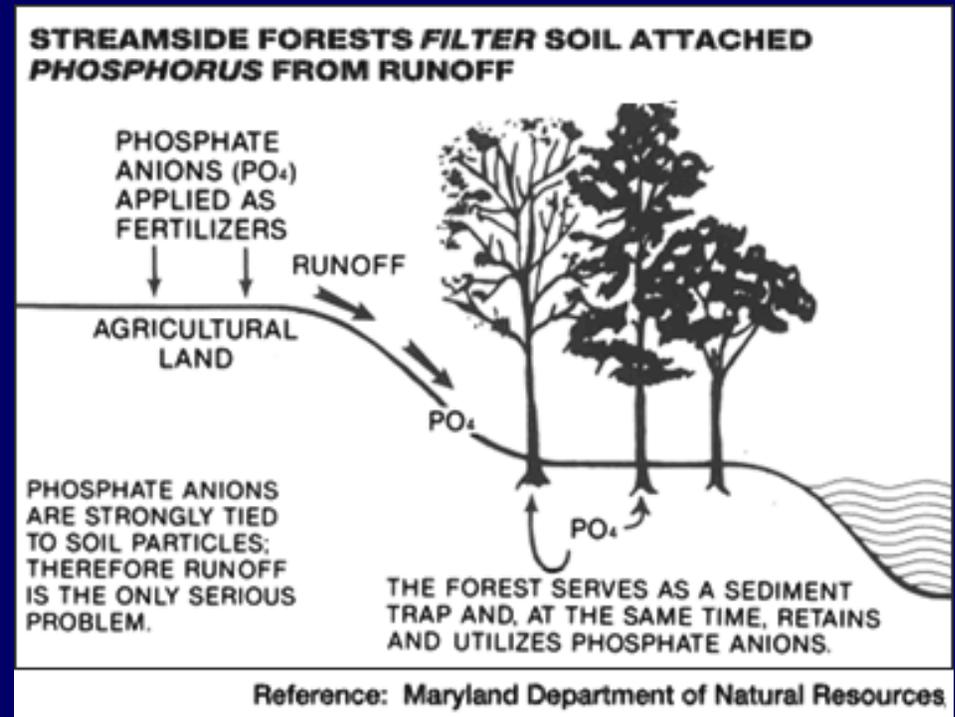
Surface Pollutants

- Sedimentation – A major pollutant
 - Canopy and forest floor all cause moving water to lose energy
 - Logging BMPs prevented sediment from entering the waterbody in 87% of cases
 - Reduced peak stream flows = less erosion along stream banks



Forests Act as Pollutant Filters

- Riparian vegetation can remove metals, nutrients, and other chemicals from runoff via plant uptake, and by facilitating bacterial transformation.
 - Studies have shown that buffers along streams can reduce Nitrogen and Phosphorous pollution by 80-90%

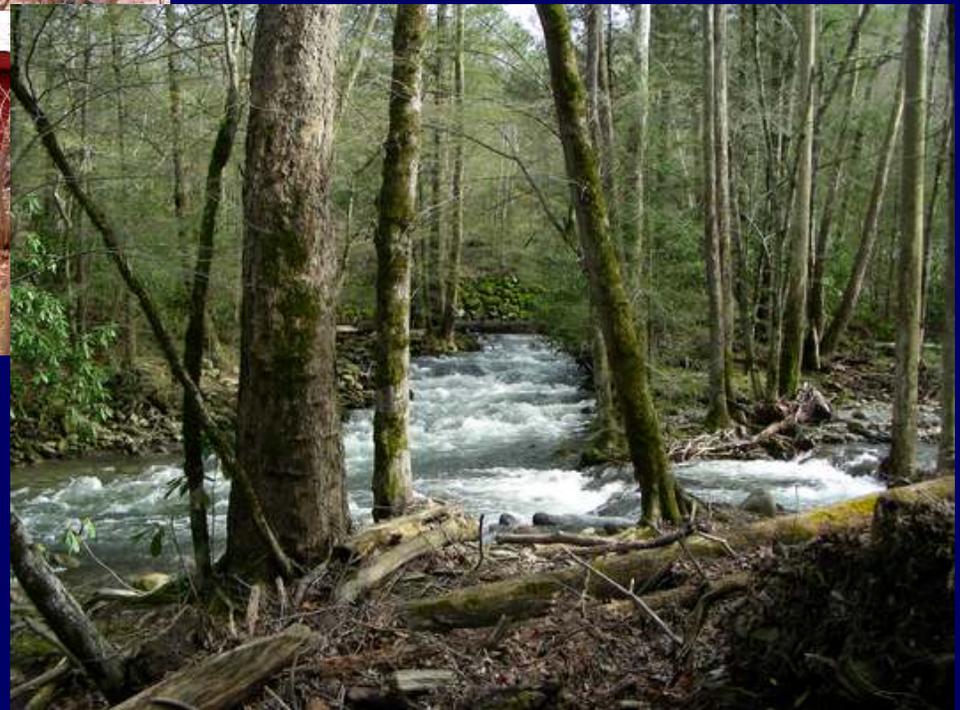


Different Watersheds in Spring Flood



**Agricultural
Watershed**

**Forested
Watershed**



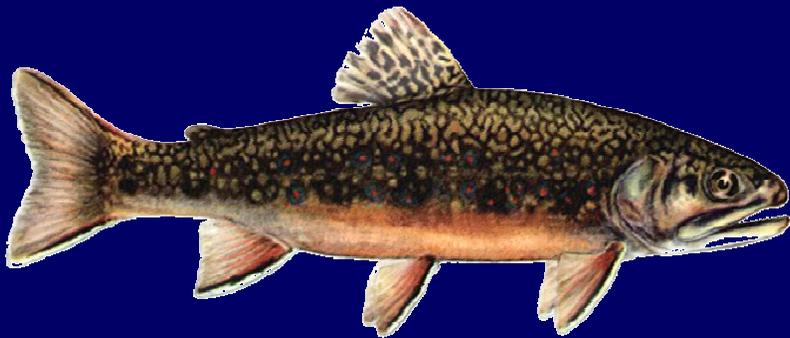
Forests Reduce Public Drinking Water Costs

- For every 10% increase in forest, treatment costs are reduced 20%.
- Many water supplies with healthy forests in the watershed do not need EXPENSIVE treatment plants!
 - Portland ME, New York City
- Water supplies with <75% forest often require treatment plants

**Protecting the Source: Land Conservation as a Drinking Water Protection Tool by Caryn Ernst, Trust for Public Land et al, 2003*

Effects on Water Temperature

- Trees shade streams lowering water temperatures
 - Very important for some wildlife
 - Brook trout start to have problems at 68° F Atlantic salmon 71° F
 - Infiltrated water enter streams at lower temperatures than surface runoff over paved areas



Other Temperature Benefits

- Significant energy savings in cities
 - Lower temperatures by transpiring water and shading surfaces
 - Effect of well-positioned trees on energy savings - between 20-25% when compared to a house in a wide-open area.



Forest Management

- Forests can be managed for other products and still provide clean water
- The same forests that provide Maine's clean water also sustain the forest products industry.



Timber Harvesting vs. Removal of Forests

- Timber harvesting is temporary – Trees grow back
 - Properly planned timber harvesting leaves the forest floor intact
- Removal of trees for development is not forest management
 - Development replaces the forest floor and canopy with roofs, lawn, roads etc.

Logging followed by regrowth

Retains the forest floor and infiltrates water

Flood Peaks

Hornbeck 1997

<i>Year after harvest</i>	<i>Growing season peak flows</i>		<i>Dormant season peak flows</i>	
	<i>mm/day</i>	<i>% change</i>	<i>mm/day</i>	<i>% change</i>
1	66	+18%	45	+15%
2	107	+63%	193	- 2%
3	53	+31%	336	- 2%
4	86	+19%	40	- 30%
5	30	+15%	167	+10%
6	47	0	163	- 12%
Av	65	+24%	157	- 3.5%

More than 25% of the trees must be cut on a watershed to make a measurable change

Agriculture example

CORN HARVEST



A corn harvest seems normal to people. The farmer placed a silt fence to protect the pond, but the fence has failed. The USDA considers a soil loss of 1 to 4 tons/ac/year normal for cropland.

CLEAR-CUT REMOVAL



The forest floor is not disturbed because slash (tree tops and branches) have been left on the surface. Soil losses from timber harvests rarely exceeds 100 lbs/ac/year.

Poor Harvesting Practices

Risk to water quality comes from poor harvesting practices

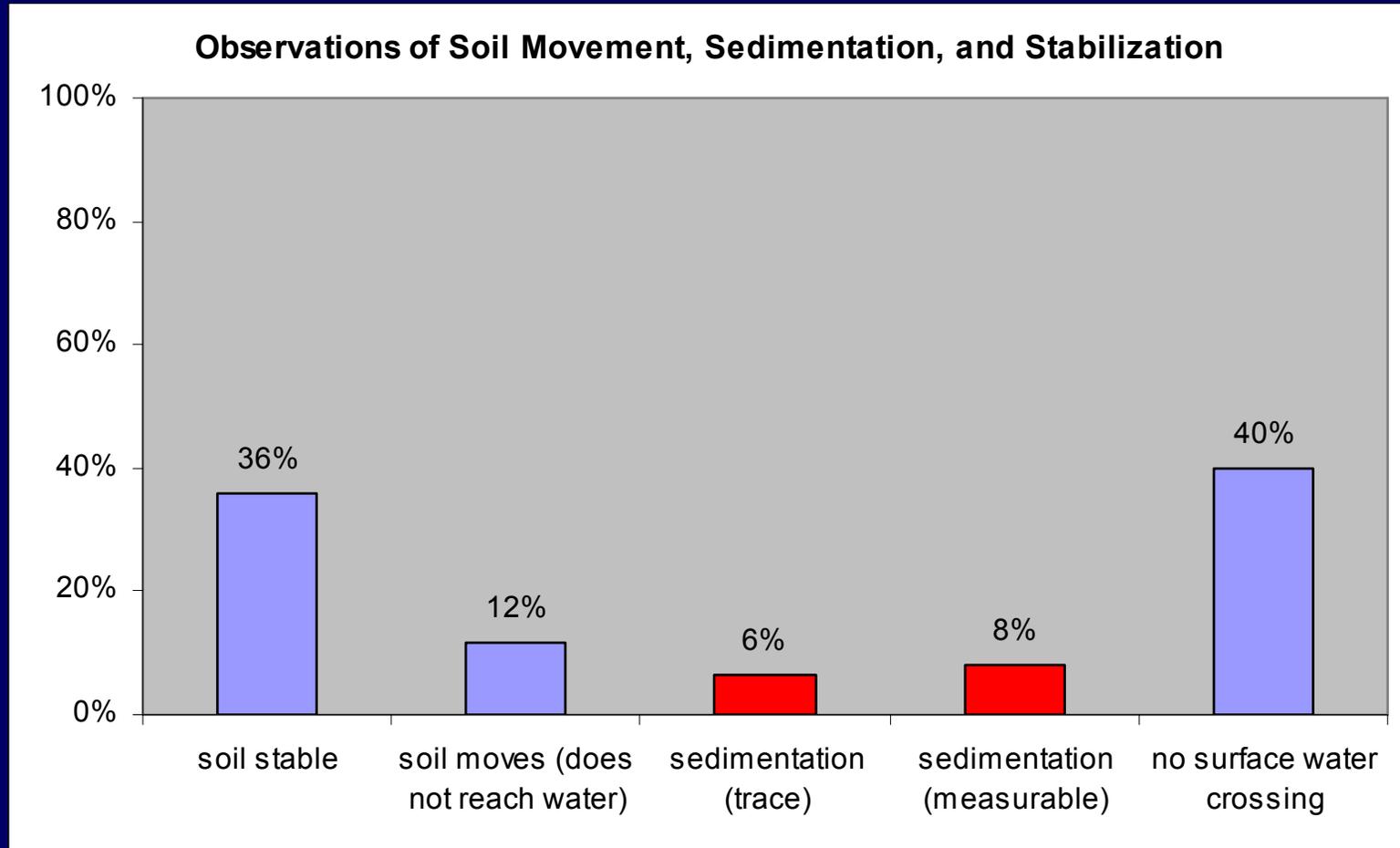


Logging “Best” Management Practices

- Protect Water Quality by
 - Minimizing disturbance to the forest floor
 - Protecting the integrity of water bodies
 - Leaving buffers along streams to filter sediment
 - Understanding and managing water flow harvest



Logging BMPs Are Effective



Observations of soil movement, sedimentation and stabilization for all sample units surveyed 2005-2009 n=2500.

Conclusion

- Clean water is one of many products produced by Maine's forests
- The more forests in the watershed the better water quality is likely to be

