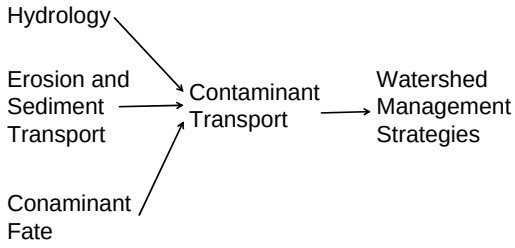
Pollutant Fate and Transport

Who Cares?

- How do contaminants get into the watershed?
- How do contaminants leave the watershed?
- How do contaminants move around?

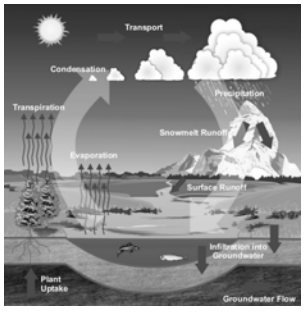
- Understanding these processes will help you determine how to manage your watershed

The Big Picture



Hydrology

- Driving force for nonpoint source pollution
- Helps transport constituents released with point sources



www.atmos.uiuc.edu

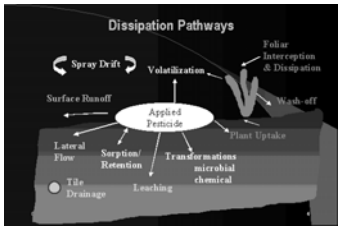
Erosion and Sediment Transport

- Eroded sediment can be an important constituent
- Three basic processes:
  - Detachment
  - Transport
  - Deposition
- Sediment may serve as a transport medium for other constituents

Photo: www.nrcs.usda.gov

Contaminant Fate

Contaminant Fate



- What happens to chemicals when they are in the environment?

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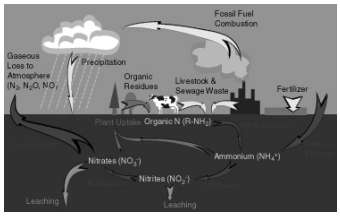
Degradation

- Break-down of contaminant
  - Biological
  - Chemical
  - Photochemical
- Depends on chemical, temperature, moisture content, nutrient avialibility
- "Daughter" compounds may also be problematic

Transformation

- Change from one chemical form to another
- Forms may behave differently in the environment



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Biological Uptake

- Incorporation of compounds into the tissue of living organisms
- May be released back into the environment through decay of dead tissue or release of wastes
- If tissue is removed from watershed, absorbed compounds will leave with it

Partitioning Between Phases

Partitioning

- Movement of constituents between soil particles, water, and air

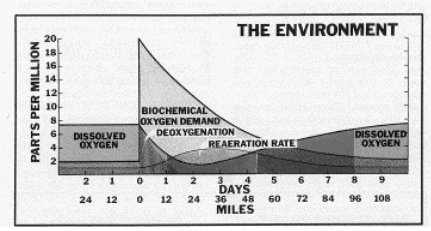
Soil → Air	Volatilization
Water → Air	Volatilization
Air → Water	Gas Absorption
Air → Soil	Sorption
Water → Soil	Adsorption
Soil → Water	Desorption

Volatilization

- Evaporation of compounds into the air
- Depends on compound, climatic conditions, placement of compound
- Often represents a true loss of material from the watershed

Gas Absorption

- Not that important for many constituents
- Very important for dissolved oxygen



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Adsorption/Desorption

- Adsorption: constituents cling to the surface of soil particles
- Desorption: constituents are released back into water
- Depends on:
  - Constituent properties—typically low solubility compounds adsorb readily, highly soluble do not
  - Soil characteristics—adsorption more likely on clay and organic matter

Transport Processes

Sources

- How do constituents get into the watershed?
  - Natural sources
  - Intentional application
  - Permitted discharges
  - Unintentional release
  - Atmospheric deposition
  - Wear of man-made materials

Sinks

- How are materials removed from the watershed?
- Degradation and transformation
- Air-borne losses
- Transport with water downstream
- Downward percolation (may come back)
- Biological uptake
- Physical removal

Transport Mechanisms

- Some constituents will tend to move dissolved in water
- Some constituents will adsorb onto soil particles and move with them

Watershed Management

- Three possible strategies:
- Limit sources of constituent in the watershed
- Increase sinks of constituent to get it out of the watershed
- Interfere with transport of the constituent