

Watershed Models: Linking Human Activities To Receiving Water Quality

1. What Are The Sources Of Nutrients Within A Watershed

- **Magnitude**
- **Location**
- **Land Use**

2. What Is The Expected Delivery From The Source To The Watershed Mouth? Fate And Transport Modeling.

- **What Is The Flowpath?**
- **What Are The Transformation Rates Of Different Environments Along The Flowpath?**
- **What Is The Residence Time In The Different Environments?**

3. Model Components

- **Hydrologic Pathway: Infiltration Or Overland Runoff?**
 - **Soils, %Impervious Cover**
 - **Climate (Rainfall Magnitude, Intensity, Evaporation)**
 - **Groundwater Permeability And Aquifer Characteristics**
- **Proximity To Surface Water**
- **Soil Retention (Mineralogy, Vegetated Cover, Disturbance)**
- **Wetlands Retention/Removal**
- **In-Stream Retention/Removal**

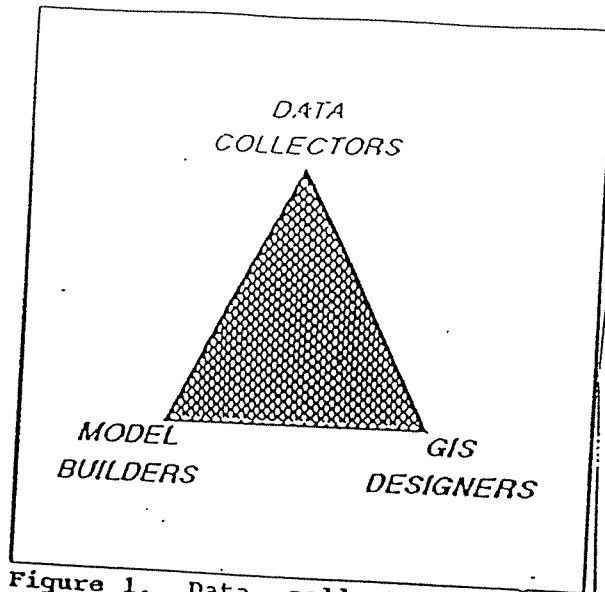


Figure 1. Data collectors, model builders and GIS designers often have different views of the world.

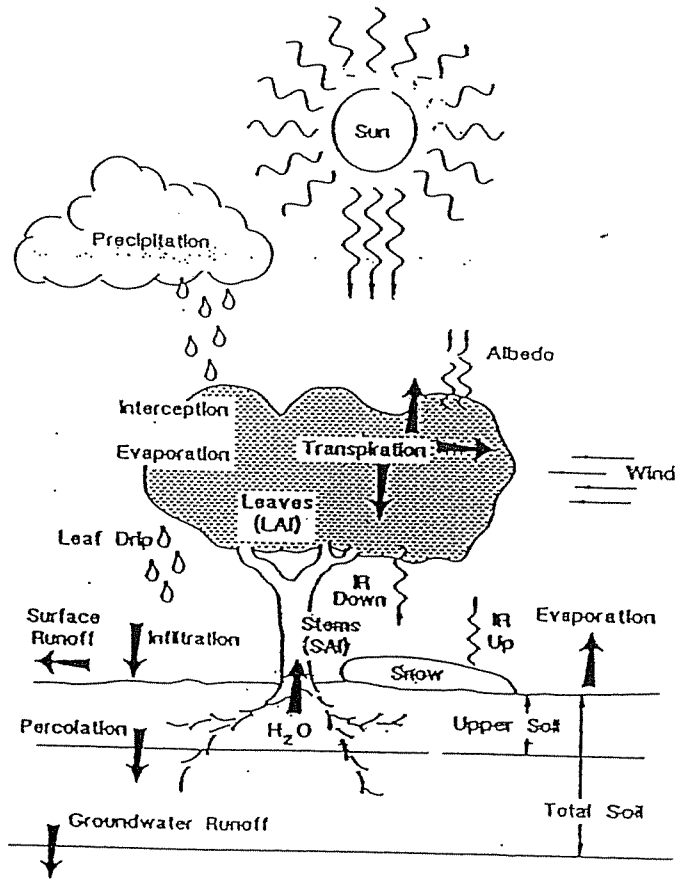


Figure 3-3: Some of the land surface processes used in land surface parameterizations (Source: Dickinson et al., (1986).

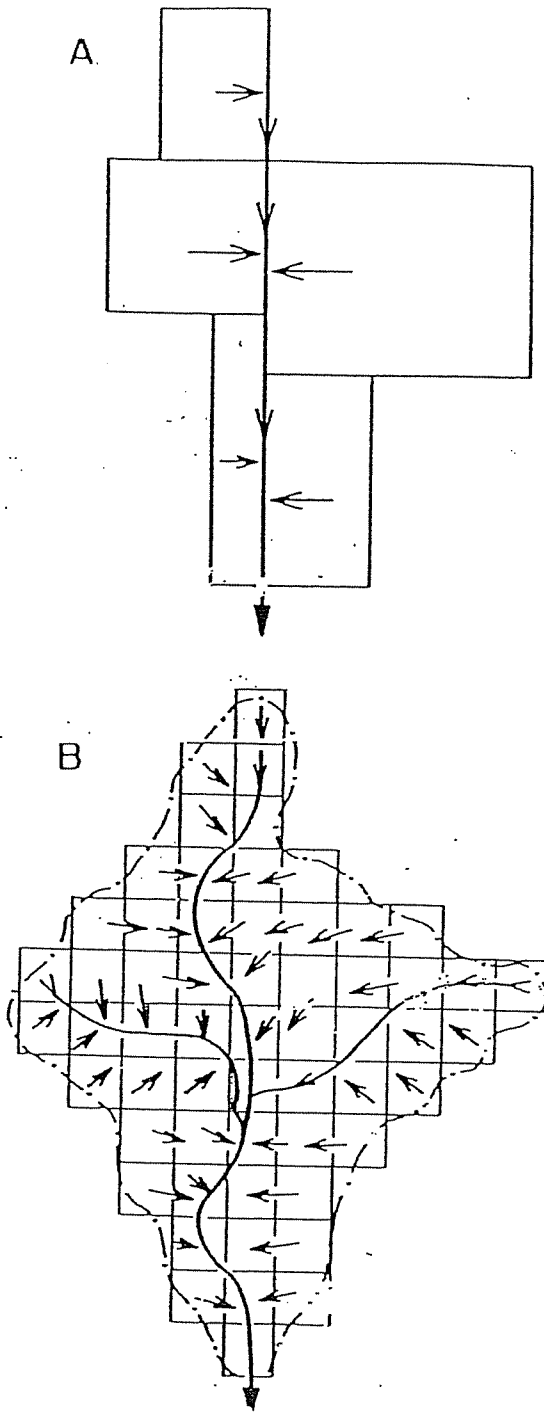


Figure 2. Basic representations of sediment transport models: A, a lumped parameter model and B, a distributed parameter model.

Table 9.6 Effort and Output for Simple, Mid-Range and Complex Models

	Effort/ Input	Example Output	Reliability of Outp
Simple	<ul style="list-style-type: none"> • About 2-4 hours • Drainage area • Single parameter describing the drainage area • Generalized land use • One rainfall volume (event or annual) • Pollutant concentrations in runoff • Pollutant loading factor 	<ul style="list-style-type: none"> • Peak flow for an event • Fraction of rainfall converted to runoff • Annual or event pollutant loads 	Moderate
Mid-Range	<ul style="list-style-type: none"> • About 1-2 weeks • Land use/ cover data • Drainage area parameters • Basic soils data • BMP efficiencies • Continuous daily rainfall • Pollutant concentrations • Pollutant "build-up" and "wash off" functions. • Soil transport factor • Calibration data (limited) 	<ul style="list-style-type: none"> • Peak flows for storm events • Daily flow volumes • Groundwater recharge volume or subsurface flow • Daily pollutant/ sediment loads 	Moderate to High
Complex	<ul style="list-style-type: none"> • About 3-6 months • Detailed land use data • Detailed soils data (e.g., soil profile) • Channel characteristics • Storm sewer map • BMP design features • Hourly rainfall data • Pollutant "build-up" and "wash off" functions. • Soil transport factor • Calibration data (extensive) 	<ul style="list-style-type: none"> • Hydrographs and pollutographs, at various points in the stream • Sediment transport, routed through the stream system • Subsurface flow contributions • Daily pollutant loads 	High

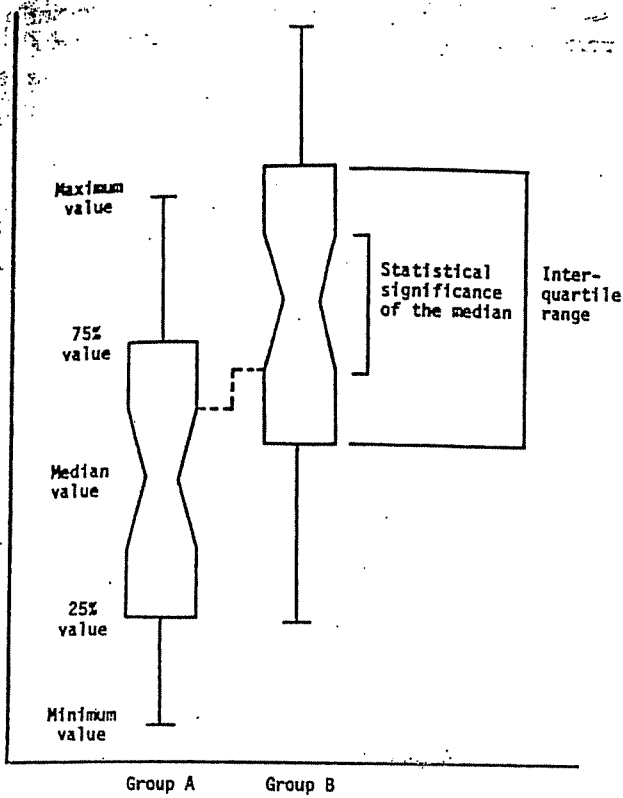


Figure 3. The Basic Configuration of a Box Plot and Comparison of Two Plots Possessing Significantly Different Medians.

pacific northwest) are associated with high productivity, high storm water flow, and high phosphorus flux. Variations in the magnitude of nitrogen export from undisturbed forests are more difficult to interpret. Since nitrogen is often the most limiting nutrient (for terrestrial plant growth), it is a more sensitive indicator of biological activity than is phosphorus. Because of this sensitivity, readily observable relationships between nitrogen flux and climatic or physiographic factors may be overshadowed by subtle local differences in the supply and demand for nitrogen by growing vegetation.

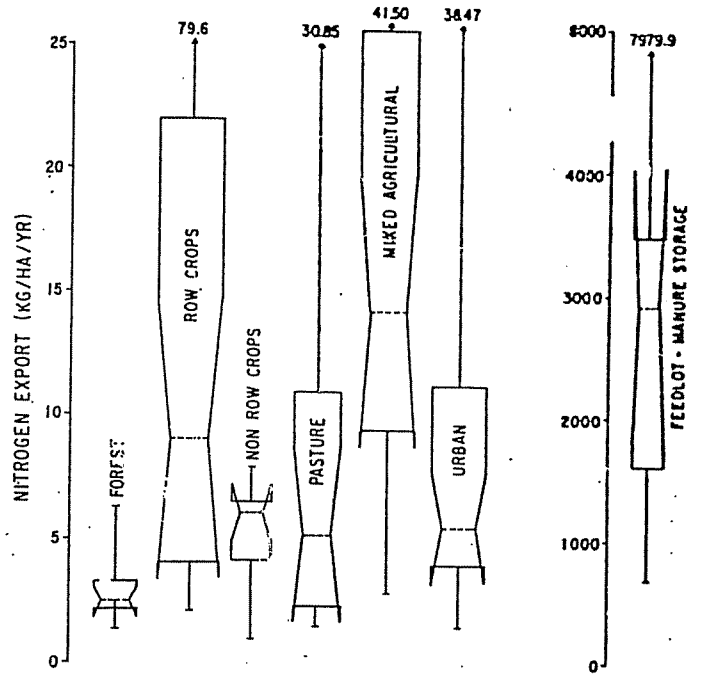


Figure 5. Box Plots of Nitrogen Export Coefficients From Various Land Uses.

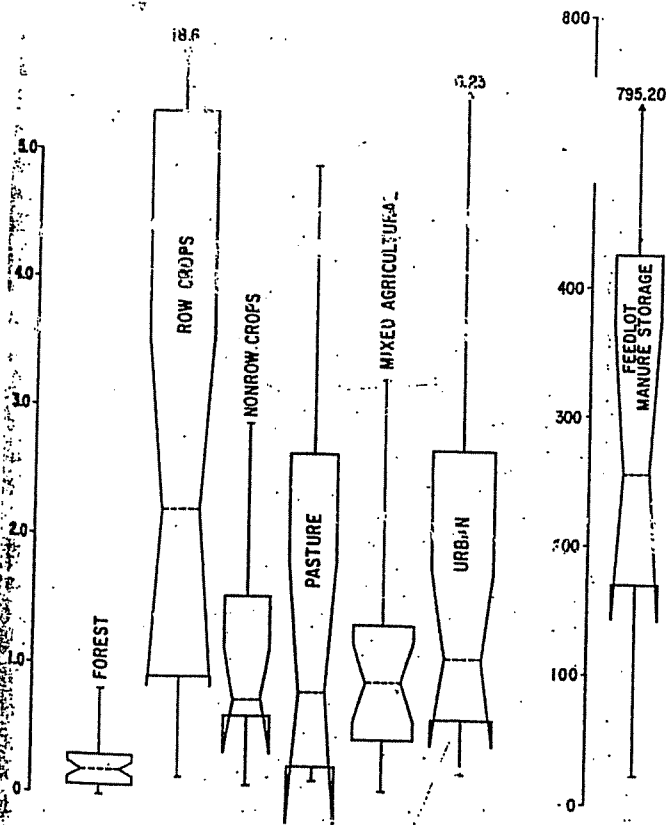


Figure 4. Box Plots of Phosphorus Export Coefficients From Various Land Uses.

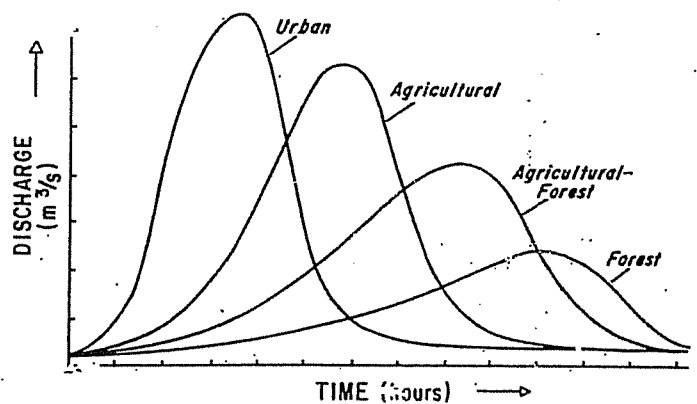


Figure 5. Hydrographic Response of Varying Land Uses to a Storm Event