

Overview of BASINS

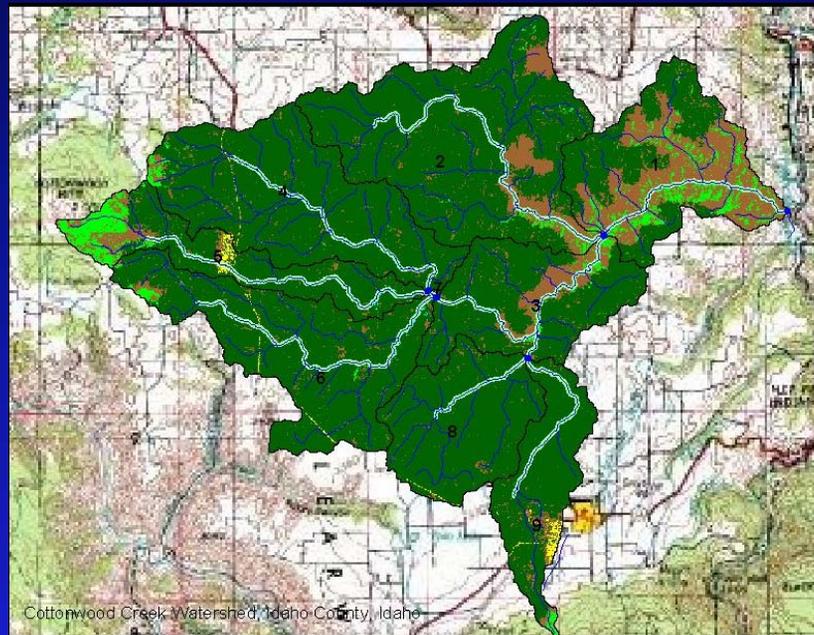
AG Drainage Water Quality Group
Model Development Workshop
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James N. Carleton
U.S. EPA, Office of Water,
Office of Science & Technology

What is BASINS?

Better Assessment Science Integrating Point and Nonpoint Sources

BASINS 3.1 is built on ESRI's GIS Platform: ArcView and Spatial Analyst



BASINS has made geo-spatial data layers readily available to the public

Includes GIS Tools such as:

- Watershed Delineator
- Watershed Characterization Reports
- Land Use/Land Cover Reclassification

Links the watershed data with the environmental models:

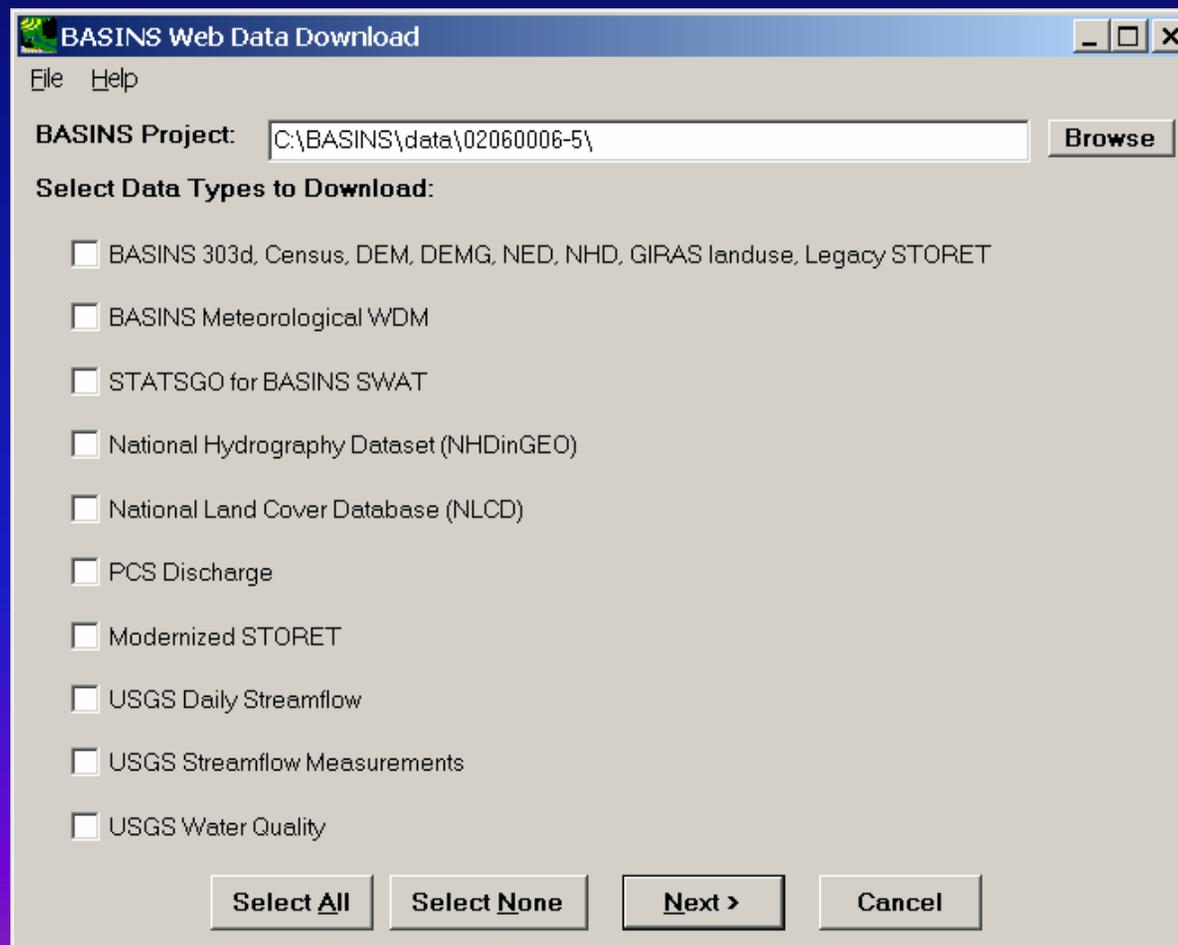
- HSPF, SWAT, PLOAD, AGWA, and AQUATOX*

BASINS Versions

- 1.0 – May 1996
- 2.0 – January 1999
- 3.0 – June 2001
- 3.1 – August 2004 incremental release
- 4.0 – Significant re-factoring

BASINS 3.1 Web Data Download Tool

Obtains a variety of data from sources on the Web



Connection Between BASINS And Watershed Models

GIS data layers provided for model setup

- Cataloging Unit Boundaries
 - *Used as a mask to delineate subwatersheds.*
- DEM (grid)
 - *Used to determine the boundaries of the subwatersheds when delineating.*
- Land Use (NLCD or GIRAS)
 - *Used to calculate land use distributions within each subwatershed.*
 - *Each land use is parameterized separately.*
- Reach File, Version 1 or NHD
 - *One representative reach is selected for each subwatershed.*
 - *Shapefile is used to determine some of the necessary inputs associated with the stream network setup within the model*

Models Under the BASINS 'Umbrella'

HSPF

- Continuous simulation model with fixed, user-selected, time steps
- Predicts loadings in mixed land use settings for nutrients, toxics, bacteria, sediment
- Considers point source and nonpoint source loadings
- Natural and developed watersheds and water systems
- Stream/lake hydraulics and water quality processes
- Time series data management and storage

HSPF

Infiltration and Runoff

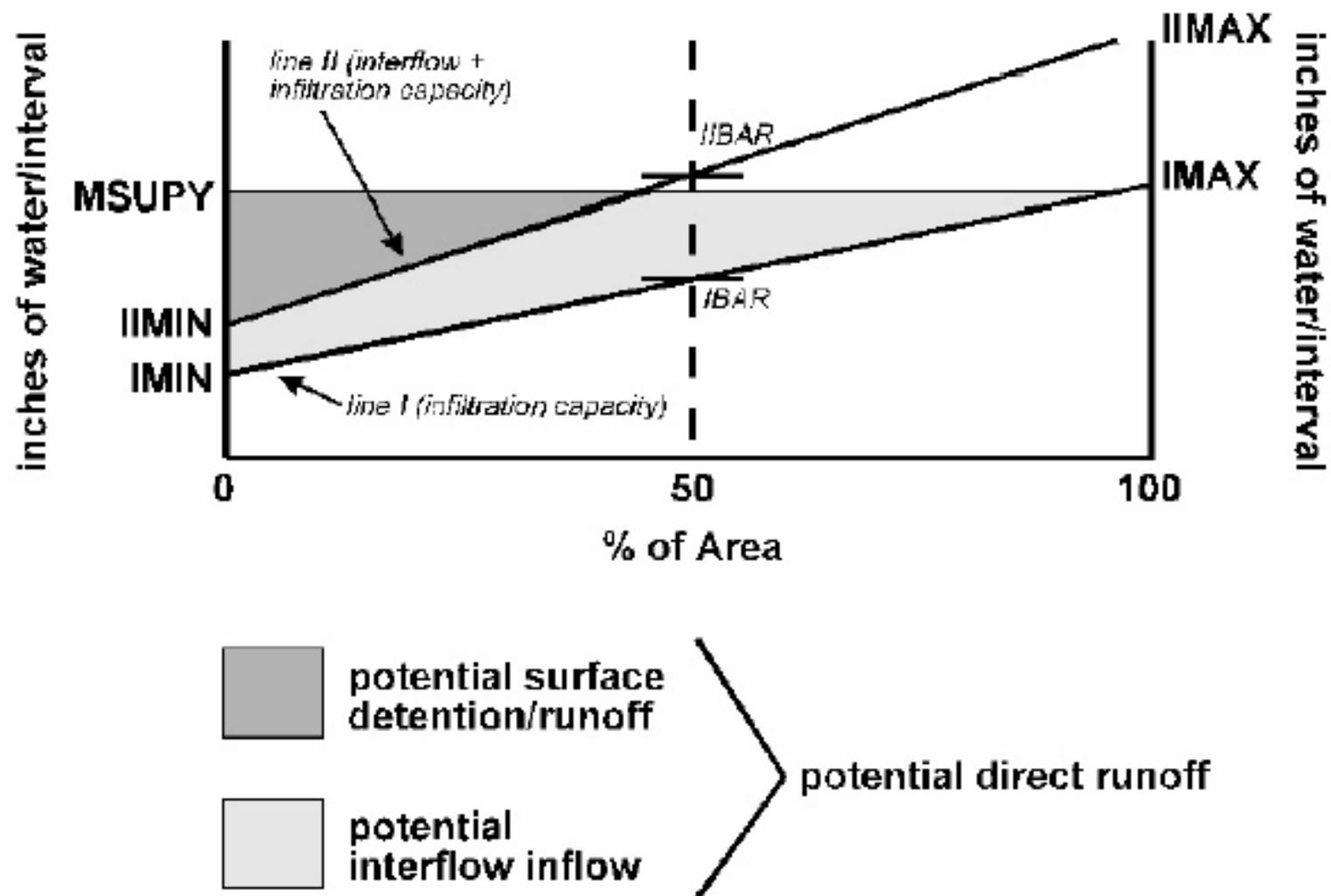


Figure 16: Determination of infiltration and interflow inflow

HSPF

Erosion and Sediment Transport

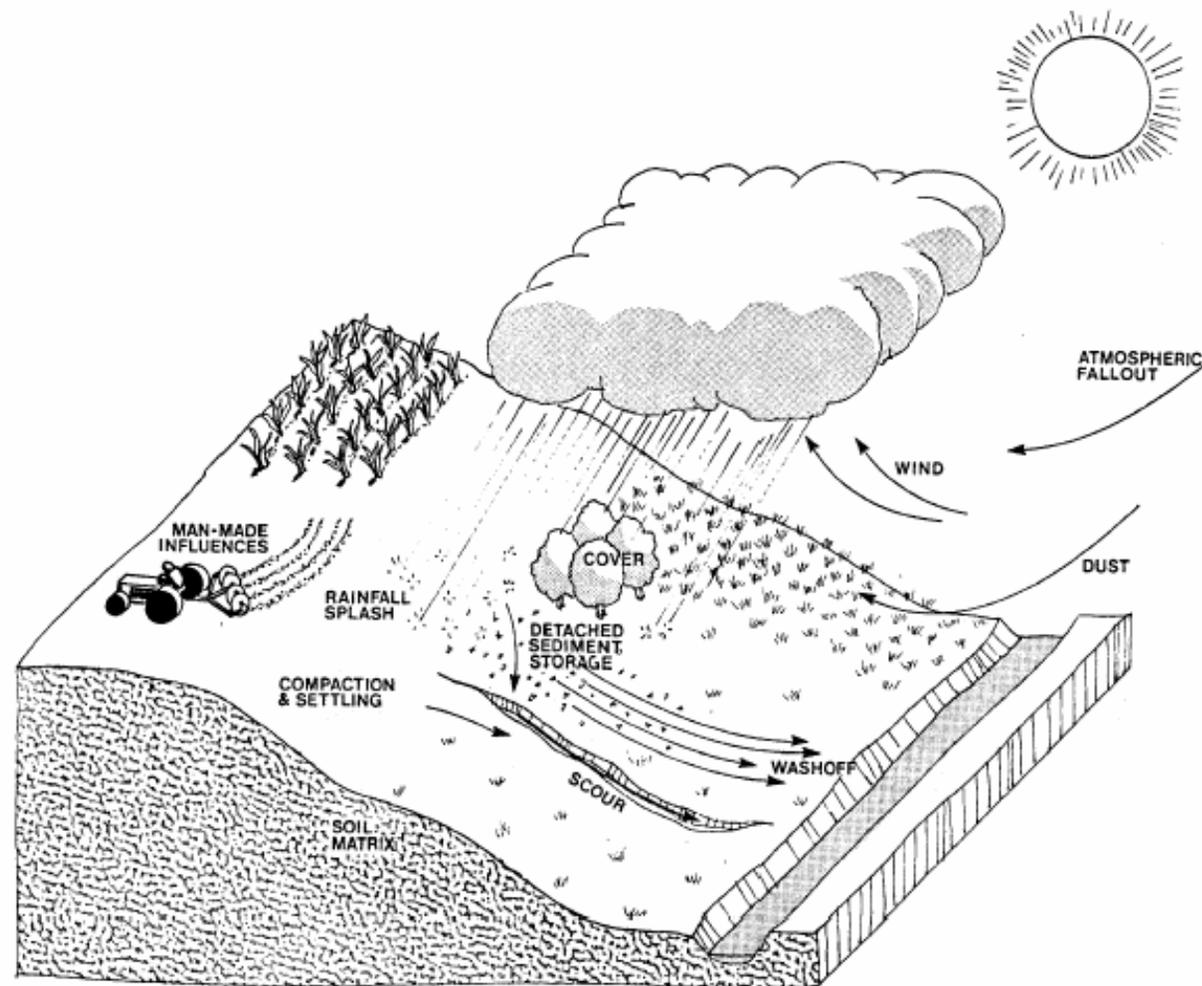
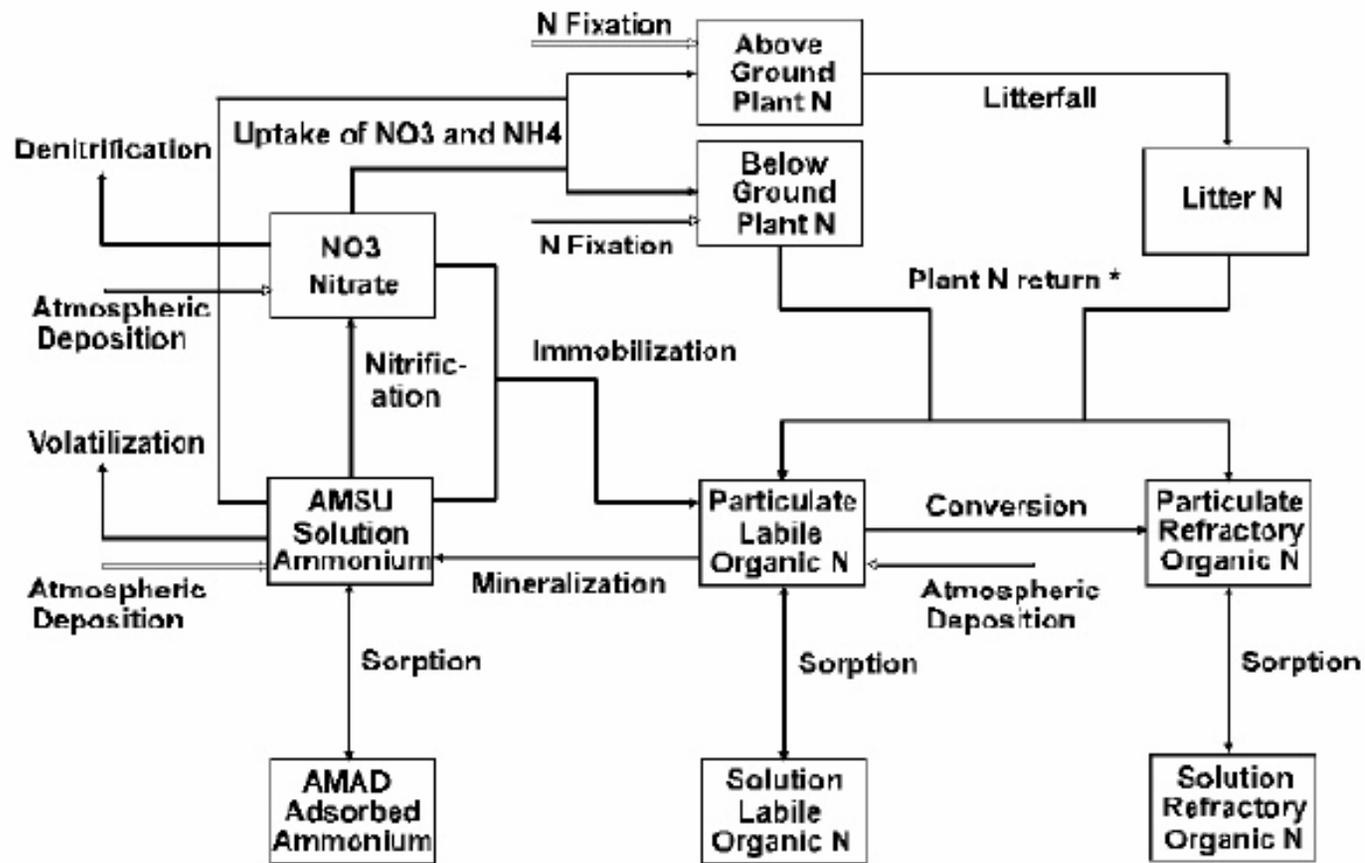


Figure 22: Erosion processes

HSPF

Nitrogen Cycle Components



* return of above ground plant N and litter N occurs to surface and upper zones only

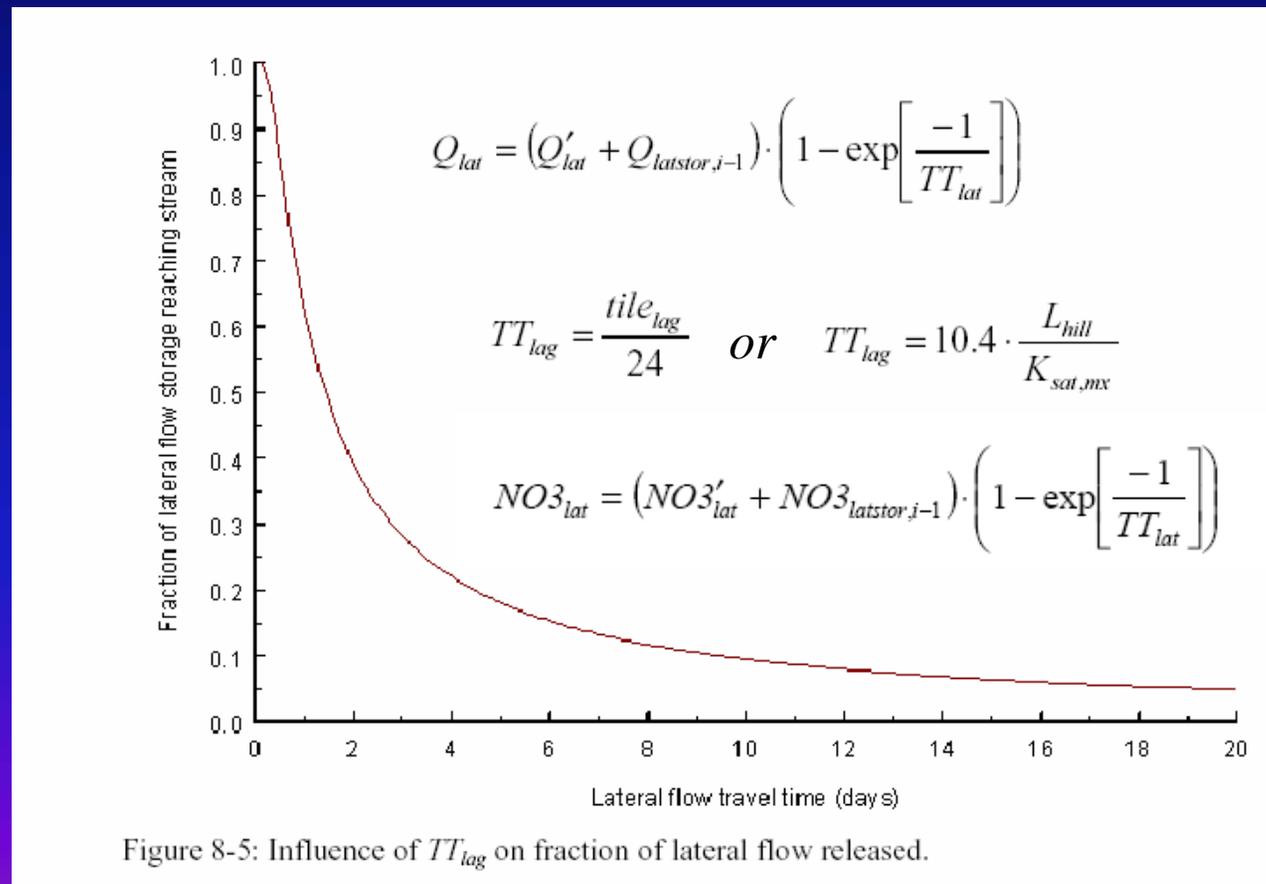
Figure 28: Flow diagram for nitrogen reactions

Models Under the BASINS 'Umbrella'

- **SWAT**
 - Physical based, watershed scale model
 - Developed to predict impacts of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds

SWAT

Soil Water Discharge to Channel as Function of Subsurface Lateral ‘Travel Time’:



SWAT

Nitrogen Cycle Components

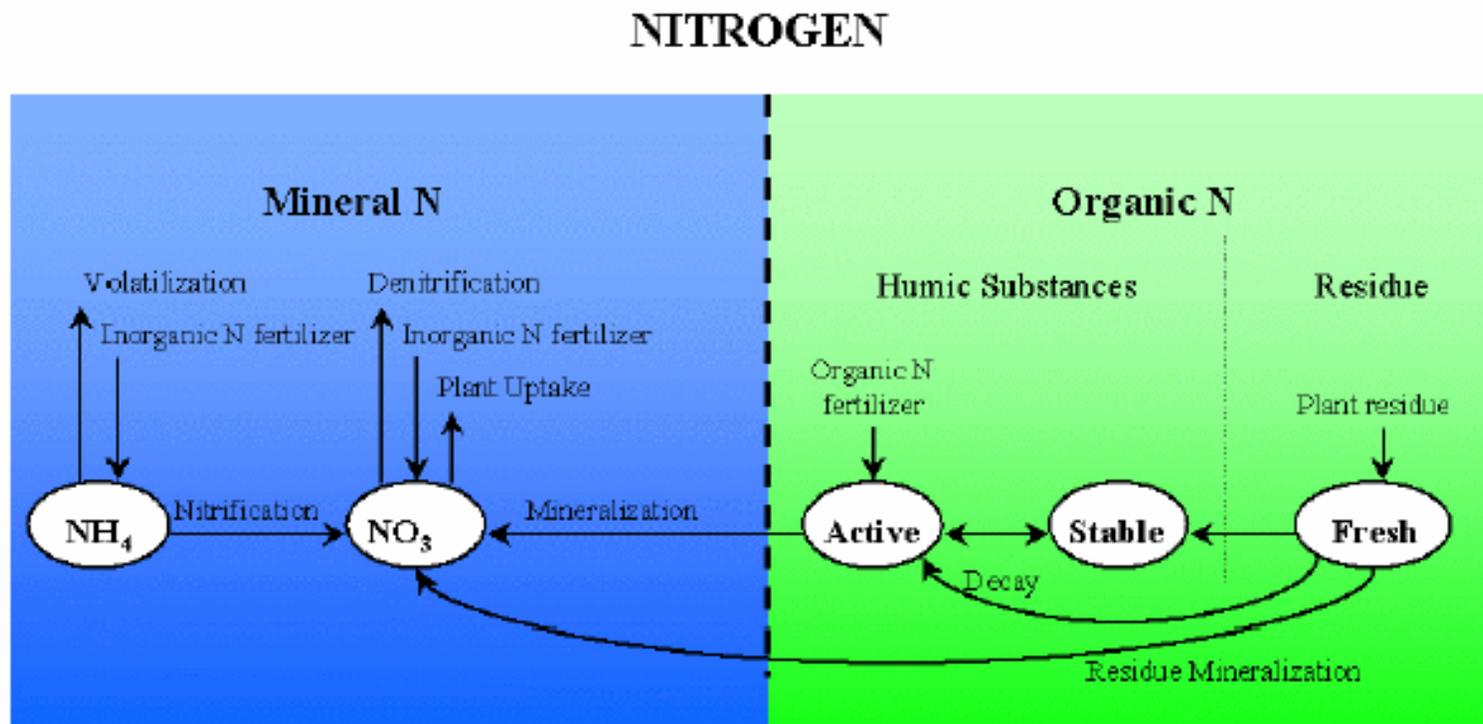


Figure 1.6: Partitioning of Nitrogen in SWAT

SWAT

In-Stream Processes

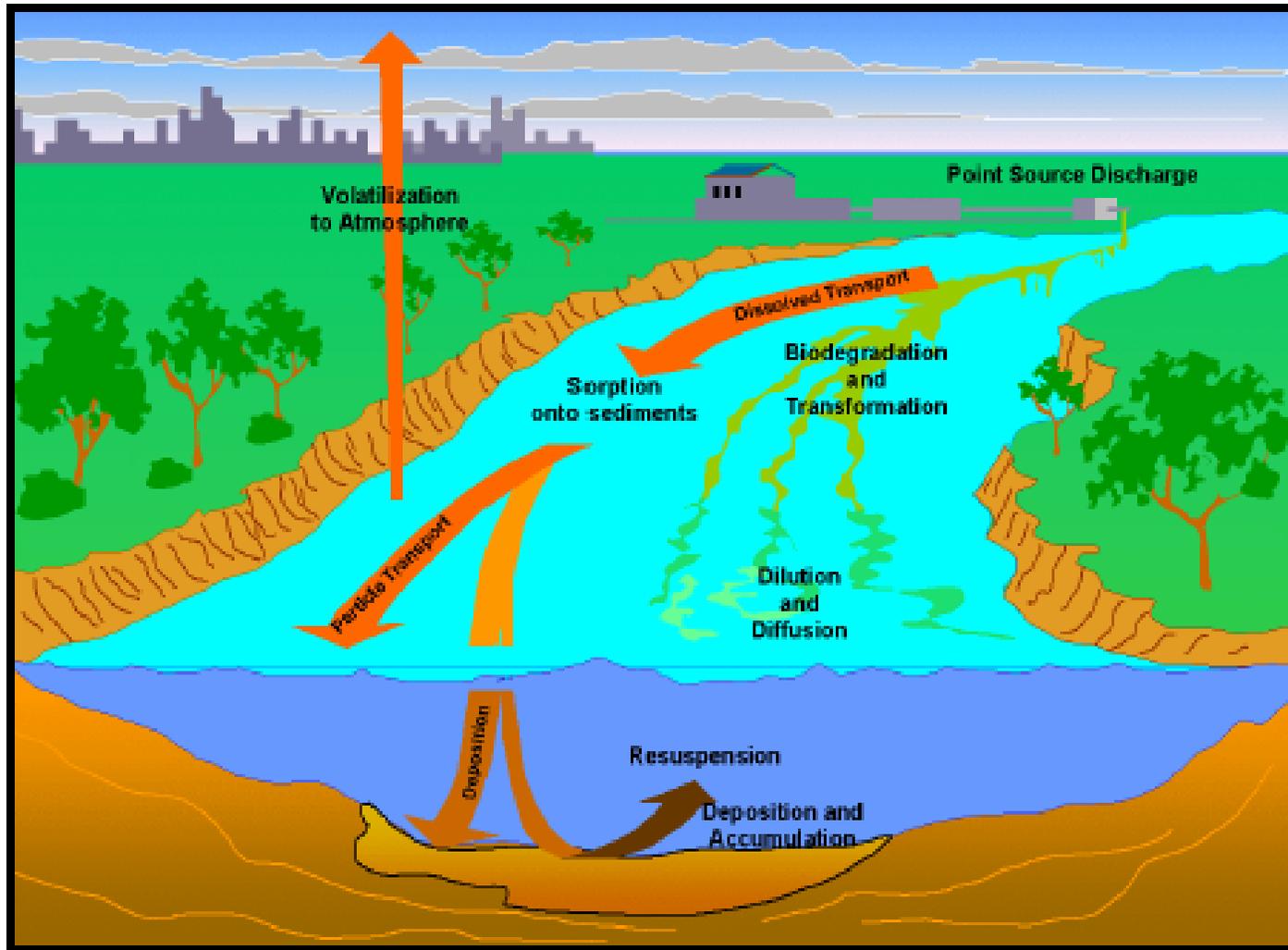


Figure 1.9: In-stream processes modeled by SWAT

Models Under the BASINS 'Umbrella'

- PLOAD
 - Screening tool
 - Provides estimates of nonpoint sources of pollution on an annual average basis
 - Models any user-specified pollutant
 - Uses either the export coefficient or simple method approach

PLOAD

Export Coefficient Table

TABLE 6.3
An Example Export Coefficient Data Table

LUCODE	LEVEL2	BOD
11	RESIDENTIAL	42.10
12	COMMERCIAL AND SERVICES	53.90
13	INDUSTRIAL	46.80
14	TRANS, COMM, UTIL	87.40
15	INDUST & COMMERC Cmplxs	46.80
16	MXD URBAN OR BUILT-UP	46.80
17	OTHER URBAN OR BUILT-UP	46.80
21	CROPLAND AND PASTURE	16.03
22	ORCH,GROV,VNYRD,NURS,ORN	16.03

Models Under the BASINS 'Umbrella'

- **AGWA**
 - developed by the U.S. Agricultural Research Service's Southwest Watershed Resource Center
 - multipurpose hydrologic analysis system for performing watershed- and basin-scale studies
 - provides the functionality to conduct a watershed assessment for two watershed hydrologic models: KINEROS2 (designed for small semi-arid watersheds) and SWAT.

Models Under the BASINS 'Umbrella'

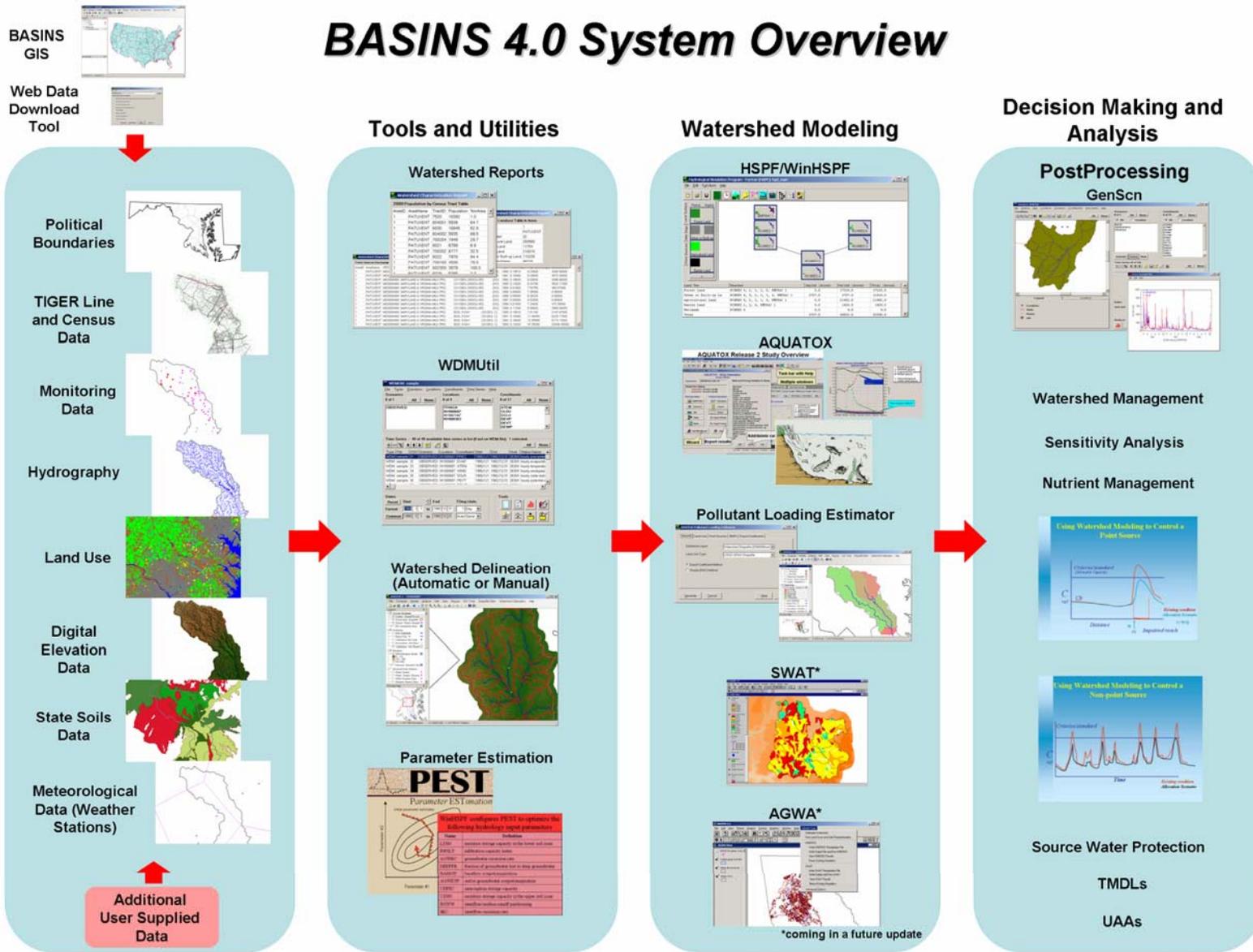
- **AQUATOX**
 - Simulation model for aquatic systems
 - Predicts the fate of various pollutants, such as nutrients and organic chemicals, and their effects on the ecosystem, including fish, invertebrates, and aquatic plants
 - Tool for performing ecological risk assessments for aquatic ecosystems
 - Distributed separately from BASINS

Major Changes for BASINS 4.0

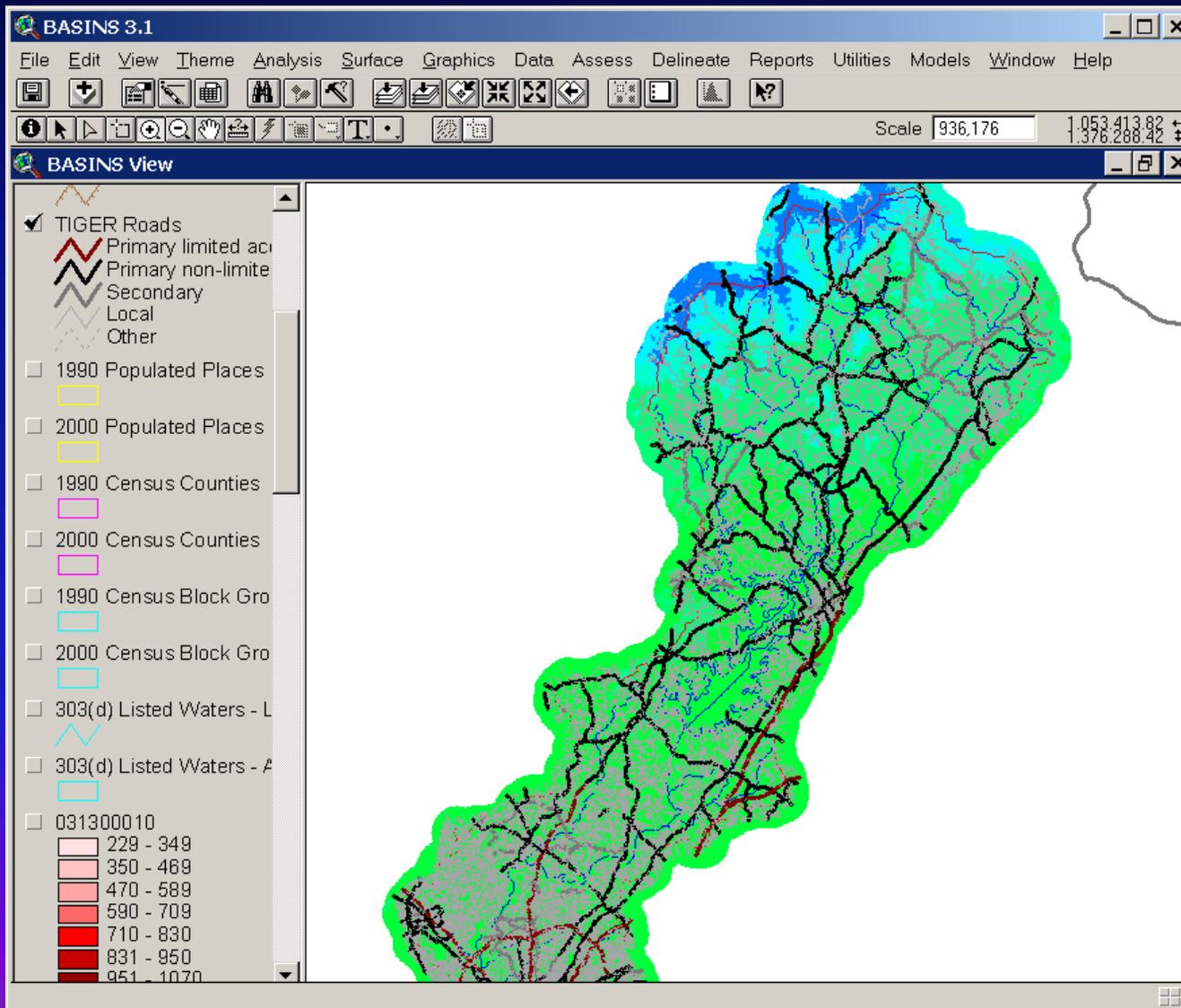
- Uses open-source GIS tools and non-proprietary data formats
- The core of BASINS becomes independent of any proprietary GIS platform
- BASINS still accommodates users of several different GIS software platforms
- Major New Feature: **The Climate Assessment Tool**

BASINS 4.0

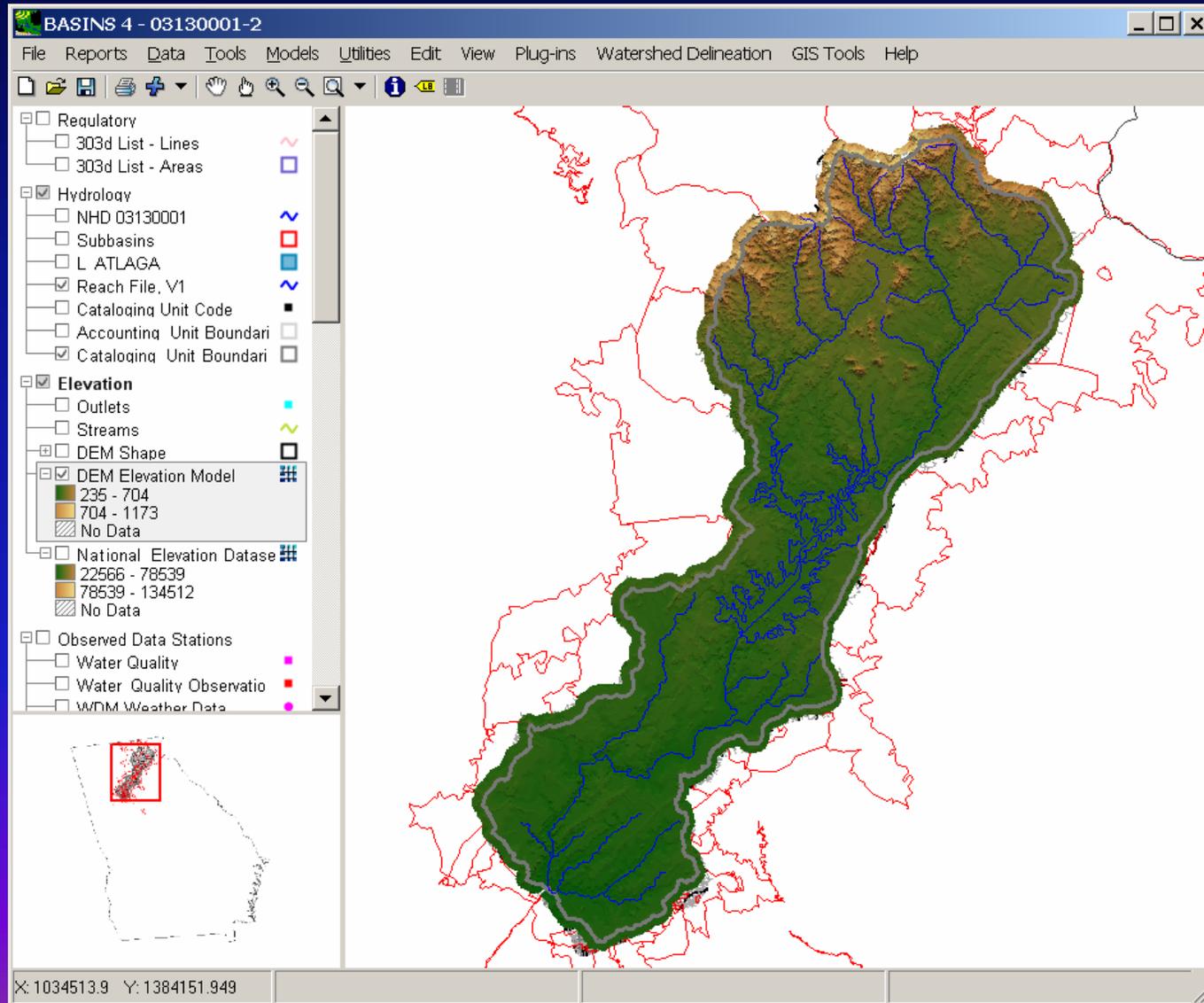
BASINS 4.0 System Overview



BASINS 3.1 Interface



BASINS 4.0 Interface



Open Source Advantages

- No need to purchase expensive proprietary GIS products
- Source code for all components, including the foundational GIS software, will always be available to end users and the federal government
- Provides greater stability and transparency