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Paul B. Duda

AQUA TERRA Consultants, USA

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Software Support for Watershed Modeling: The BASINS Experience

Paul B. Duda, AQUA TERRA Consultants
150 E. Ponce de Leon Ave.
Decatur, GA 30030
pbduda@aquaterra.com



Abstract

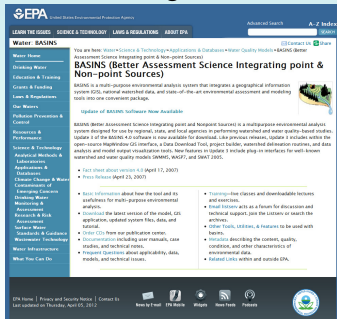
The U.S. Environmental Protection Agency's (EPA's) Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) is a multipurpose environmental analysis system designed for use by regional, state, and local agencies performing watershed and water quality-based studies. It was developed by the EPA's Office of Water to facilitate examination of environmental information, to support analysis of environmental systems, and to provide a framework for examining management alternatives. BASINS integrates environmental data, analytical tools, and modeling programs under a Geographic Information System (GIS) environment to support development of solutions to watershed management problems and environmental protection.

The first release of BASINS, in 1996, followed more than two decades of development of watershed models, along with rapidly expanding public databases and more recently developing GIS technology. Through the early 1990s researchers at institutions around the world recognized the potential for linking watershed models with GIS systems and databases. Concurrently, awareness of water quality issues and needs was growing through enforcement of the Clean Water Act. BASINS was conceived during that time as a system that could combine models and data through GIS to make watershed assessment and simulation of management alternatives more accessible for agencies across the United States.

The current release of BASINS is based on a non-proprietary, open-source GIS foundation. The open-source framework of BASINS is designed around an extensible architecture that readily allows for the addition of new capabilities. BASINS encompasses a growing suite of watershed and water quality models, from sophisticated broad-spectrum watershed models to agricultural models to planning and management level models. New data types and analysis tools also continue to be added to BASINS.

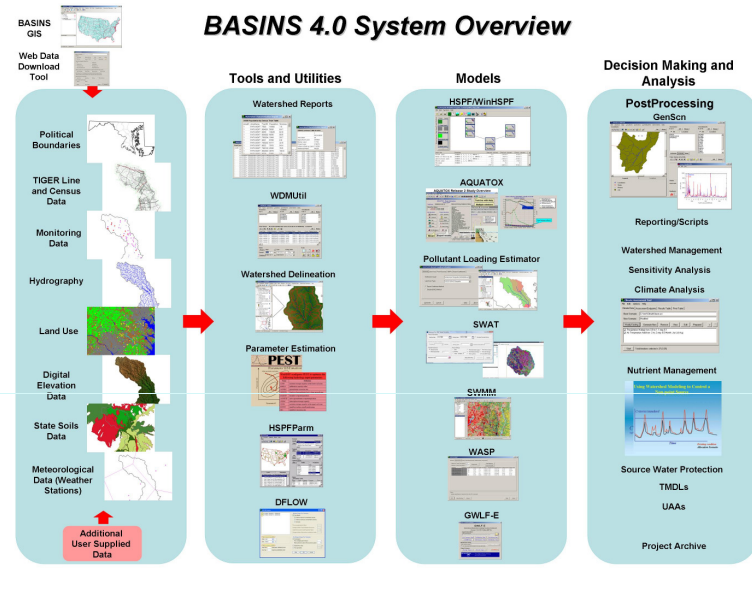
Some of the challenges facing BASINS now and in the future include model connectivity, maintaining reproducibility of model results, and synchronizing local and server databases. In addition, system developers are challenged with making tools that support a wide range of model users, ranging from beginner to advanced and highly sophisticated. The flexible architecture of BASINS enables it to continue evolving to meet the developing needs of the watershed modeling user community.

Obtaining BASINS

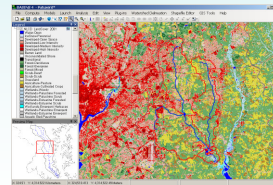


<http://water.epa.gov/scitech/datait/models/basins/>
<http://www.aquaterra.com>

BASINS 4.0 System Overview



Open Source GIS Foundation:



MapWindow GIS

Supporting an Expanded Suite of Models:

- For the model champion, the model becomes easier to use by a wider audience
- Increased flexibility for the model user, providing the right tool for the job
- Collaborative efforts between BASINS and the model development teams
- With "loose coupling", core models continue to be maintained by the corresponding model's development team
- BASINS data download capabilities assist in model setup

Generic Time Series:

- BASINS time series components translate all known time series types into a common internal data structure
- All analysis tools interact with the generic time series types
- BASINS can accommodate many unique time series types and data formats

Ongoing Challenges:

- Model connectivity
- Reproducibility
- Synchronizing local and server databases
- Supporting a range of model users

BASINS Development Philosophy

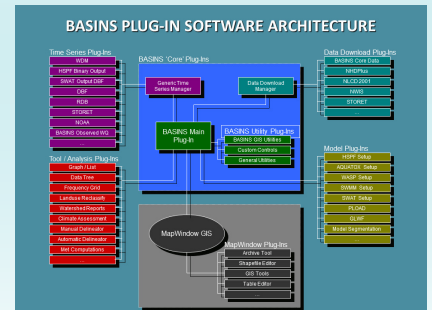
- Build on existing, documented technology
- Integrates existing models (i.e., HSPF, SWAT)
- Incorporates national derived data layers (i.e., PCS, STORET...)

Ease of use

- GIS technology supports organization, display, selection, and analysis of information
- Windows technology provides graphical user interfaces (GUI) that facilitate interaction with the data and analytical tools
- Automatic linkage streamlines the flow of information

Open platform

- Open Source
- Extensible architecture based on robust objects
- 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
- Open framework readily allows for inclusion of additional data/models/tools



Take Home Messages

- BASINS open, extensible architecture:
 - Leverages an Open Source GIS
 - Supports the addition of new models, data types, and analysis tools
 - Encourages collaborative efforts
 - Provides the user increased flexibility for choosing the tools best suited for a particular purpose
 - Architecture allows greater flexibility and options for future upgrades
- And thus, BASINS continues to grow...