

Key words: watershed assessment; hydrologic model; runoff; erosion; geographic information systems

Background

Planning and assessment in land and water resource management are evolving from simple, local-scale problems toward complex, spatially explicit, regional ones. Such problems have to be addressed with distributed models that can compute runoff and erosion at different spatial and temporal scales. The extensive data requirements and the difficult task of building input parameter files, however, have long represented an obstacle to the timely and cost-effective use of such complex models by resource managers.

The U.S. EPA Office of Research Development and the USDA-ARS Southwest Watershed Research Center have developed a tool to facilitate this process. A geographic information system (GIS) provides the framework within which spatially distributed data are collected and used to prepare model input files and evaluate model results.

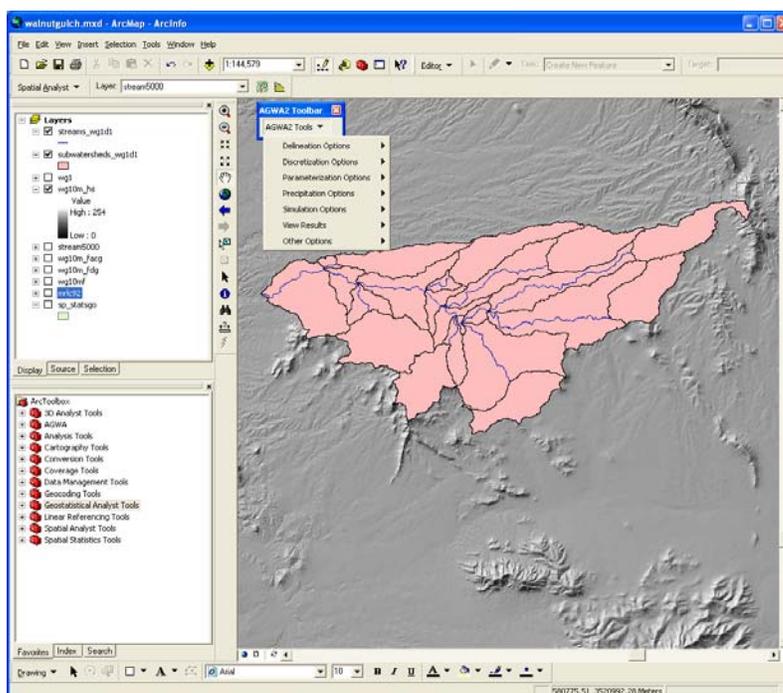
The Automated Geospatial Watershed Assessment (AGWA) tool uses widely available standardized spatial datasets that are readily obtained via the Internet. The data are used to develop input parameter files for two watershed runoff and erosion models: KINEROS and SWAT.

KINEROS

The Kinematic Runoff and Erosion Model is an event-oriented, physically based model developed at the USDA-ARS to describe the processes of interception, infiltration, surface runoff and erosion from small watersheds characterized by overland flow. The watershed is represented by a cascade of planes and channels, thereby allowing rainfall, infiltration, runoff, and erosion parameters to vary spatially. KINEROS can be used to determine the effects of various artificial features such as urban developments, small detention reservoirs, or lined channels on flood hydrographs and sediment yield. For more information on KINEROS, please visit www.tucson.ars.ag.gov/kineros.

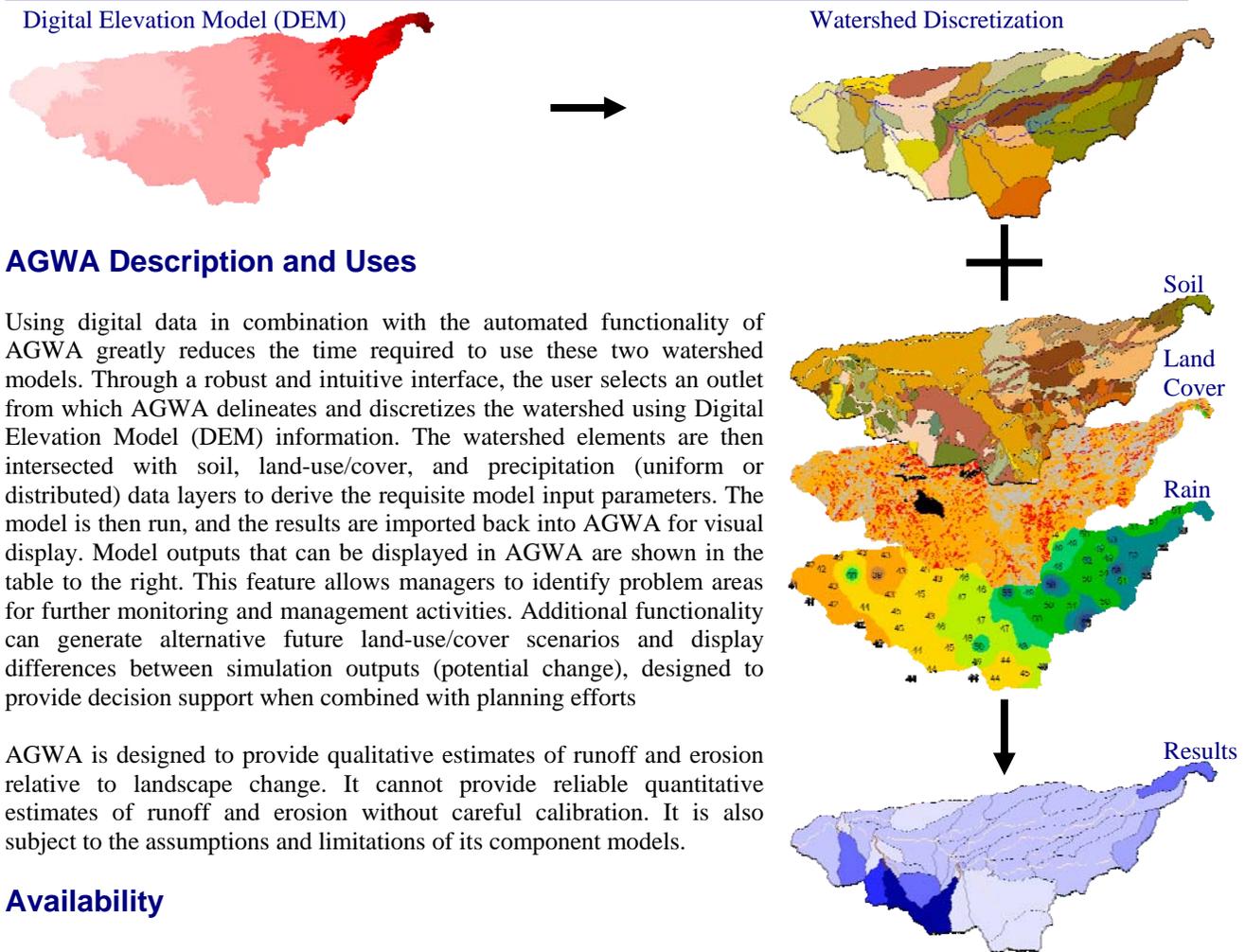
SWAT

The Soil and Water Assessment Tool is a quasi-distributed model developed at the USDA-ARS to predict the impact of land management practices on water, sediment and agricultural chemical yields in large, complex watersheds with varying soils, land use and management conditions over long periods of time (> 1 year). SWAT is a continuous-simulation model, i.e., a long-term yield model, using daily average input values, and is not designed to simulate detailed, single-event flood routing. For more information on SWAT, please visit www.brc.tamus.edu/swat.



Example of a watershed discretized by AGWA (Walnut Gulch, San Pedro River Basin, Arizona).

Automated Geospatial Watershed Assessment



AGWA Description and Uses

Using digital data in combination with the automated functionality of AGWA greatly reduces the time required to use these two watershed models. Through a robust and intuitive interface, the user selects an outlet from which AGWA delineates and discretizes the watershed using Digital Elevation Model (DEM) information. The watershed elements are then intersected with soil, land-use/cover, and precipitation (uniform or distributed) data layers to derive the requisite model input parameters. The model is then run, and the results are imported back into AGWA for visual display. Model outputs that can be displayed in AGWA are shown in the table to the right. This feature allows managers to identify problem areas for further monitoring and management activities. Additional functionality can generate alternative future land-use/cover scenarios and display differences between simulation outputs (potential change), designed to provide decision support when combined with planning efforts

AGWA is designed to provide qualitative estimates of runoff and erosion relative to landscape change. It cannot provide reliable quantitative estimates of runoff and erosion without careful calibration. It is also subject to the assumptions and limitations of its component models.

Availability

AGWA is publicly available for download in two different versions, AGWA 2.0 for ArcGIS and AGWA 1.5 for ArcView. Additionally, DotAGWA, an Internet version sharing the AGWA 2.0 codebase, is under development.

AGWA 2.0 requires ArcGIS 9.x, Spatial Analyst 9.x, and the .Net Framework. AGWA 1.5 requires ArcView 3.1 or later and version 1.1 of the Spatial Analyst extension.

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Output variables that can be displayed in AGWA

| KINEROS | SWAT |
|---------------------------------------|------------------------|
| Infiltration (mm, m ³ /km) | Precipitation (mm) |
| Infiltration (in, ac-ft/mi) | ET (mm) |
| Runoff (mm, m ³) | Percolation (mm) |
| Peak flow (m ³ /s, mm/hr) | Surface runoff (mm) |
| Sediment yield (kg/ha) | Transmission loss (mm) |
| Channel scour (mm/m ²) | Water yield (mm) |
| Sediment discharge (kg/s) | Sediment yield (t/ha) |



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