



The Automated Geospatial Watershed Assessment Tool Watershed Management and ArcGIS: The Release of AGWA 2.0

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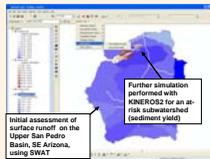
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Introduction

Focusing time, energy, and money where it can be best utilized is in the best interest of land and water resource managers everywhere. Managers, scientists and stakeholders who have access to tools that facilitate the identification of potential problem areas can more effectively focus additional monitoring and/or mitigation activities. Hydrologic models are commonly utilized in this planning and assessment process. The Automated Geospatial Watershed Assessment tool (AGWA) is a GIS interface for data organization and parameterization, integration, and visualization of two watershed runoff and erosion models, the Soil & Water Assessment Tool (SWAT) and the Kinematic Runoff and Erosion (KINEROS2) model.



Initial assessment of surface runoff on the Upper San Pedro Basin, SE Arizona, using SWAT

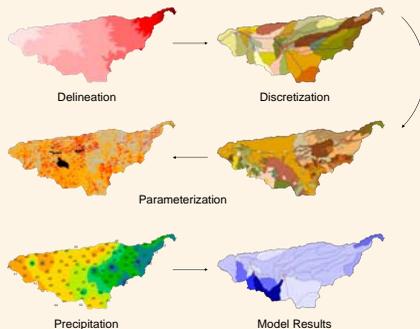
Further simulation performed with KINEROS2 for an at-risk subwatershed (sediment yield)

AGWA was developed under the following guidelines:

- Provide simple, direct, and repeatable method for hydrologic model parameterization
- Use only basic, obtainable GIS data
- Be compatible with other geospatial watershed-based environmental analysis software
- Be useful for scenario and alternative futures simulation work at multiple scales

The utility of AGWA in joint hydrologic and ecological investigations has been demonstrated on such diverse landscapes as southeastern Arizona, southern Nevada, central Colorado and upstate New York.

Using AGWA



KINEROS2

The KINematic Runoff and EROsion model, KINEROS2, is an event-oriented, physically-based model developed by the USDA-ARS to describe the processes of interception, infiltration, surface runoff and erosion from small watersheds (< 100km²). Watersheds are represented by a network of planes and channels, allowing rainfall, infiltration, runoff, and erosion parameters to vary spatially.

KINEROS2 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.

SWAT

The Soil 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 (basin scale), complex watersheds with varying soils, land use and management conditions over long periods of time (> 1 year).

SWAT is a continuous, i.e. a long-term yield model, using daily average input values; it is not designed to simulate detailed, single-event flood routing. Major components include hydrology, sedimentation, crop growth, nutrients, pesticides, and agricultural management.

Availability

AGWA is publicly available for download in two different versions: AGWA 2.0 for ArcGIS 9.x and AGWA 1.5 for ArcView 3.x. Additionally, DotAGWA, an internet version sharing the AGWA 2.0 codebase, is under development.

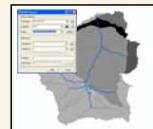
AGWA 2.0 requires ArcGIS 9.x, Spatial Analyst 9.x, and the .Net Framework. AGWA 1.5 requires ArcView 3.1 or later and version 1.1 of the Spatial Analyst extension.

<http://www.tucson.ars.ag.gov/agwa>

TMDL Analysis

AGWA now supports TMDL analysis for nutrient loading through nitrogen and phosphorus modeling in SWAT. Different scenarios can be defined by modifying the land management parameters. AGWA provides two methods of doing this—setting the management parameter for a subwatershed based on the dominant land cover type or by manually entering a management parameter value for each subwatershed. Nitrogen and phosphorus outputs are available through the results dialog. Available outputs include:

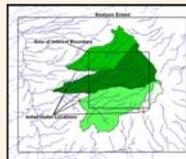
- Sediment Yield (t/ha)
- Organic Nitrogen (kg)
- Organic Phosphorus (kg)
- Mineral Phosphorus (kg)
- Surface NO₃ (kg/ha)
- Soluble Phosphorus (kg/ha)
- Nitrate/Nitrite
- Ammonium concentrations



Watershed Groups

A watershed group is a collection of AGWA watersheds, for either KINEROS or SWAT, that is discretized, parameterized, and simulated as a unit. The group can be defined explicitly using multiple, existing outlet locations or through AGWA with Area of Interest outlet location.

Potential outlets are identified using the stream network and boundary of the area of interest. These outlets are adjusted until the entire area is contained within a watershed. AGWA locates outlets so that the area is contained in the fewest number of watersheds without creating excessively large watersheds.

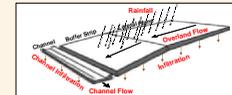


AGWA Outputs

KINEROS	SWAT
Channel Infiltration (m ³ /km)	Precipitation (mm)
Plane Infiltration (mm)	Evapotranspiration (mm)
Runoff (mm or m ³)	Percolation (mm)
Sediment Yield (kg)	Surface Runoff (mm)
Peak Flow (m ³ /s or mm/hr)	Transmission Loss (mm)
Channel Scour (mm)	Water Yield (mm)
Sediment Discharge (kg/s)	Sediment Yield (t/ha)
Peak Sediment Discharge (kg/s)	
Percent Error	

Riparian Buffers

The most common best management practice, riparian buffer strips, can now be discretized and simulated using AGWA and KINEROS. Buffers can be added to any channel segment; the basic steps for creating riparian buffers include defining buffer strip endpoints along the channel and buffer strip width.



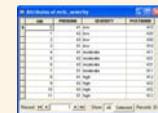
AGWA can simulate pre- and post-installation watersheds. Land cover characteristics can be set for each buffer element using pre-defined land covers or custom land covers. Slope can also be set for each buffer.



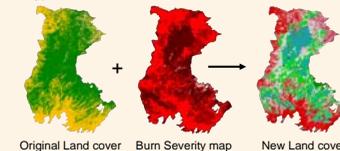
Pre- and post-establishment of a riparian buffer.
Photos courtesy of <http://www.iowadnr.com/forestry/bufferphotos.html>

Burn Severity Land Cover Change

The Land Cover Modification Tool provides an option to create new land cover grids to study the impacts of fire. Using the Burn Severity component, AGWA users can create a new surface with land covers based on explicit transitions from one land cover type to another based on burn severity.



First, a custom land cover lookup table is created containing pre- and post-burn land cover characteristics. Then, using burn severity descriptors, i.e. low, moderate or high, a change table is created defining the transitions from pre-burn land cover type to post-burn land cover type.



These tables and the burn severity polygon map are used as inputs in the Land Cover Modification Tool to generate a new land cover based on the combination of burn severity and the defined transitions.



Land cover condition two months post-fire.
Aspen Fire, Coronado National Forest.
Photo taken August 5, 2003.



Land cover condition 18 years post-fire, Yellowstone
Fires of 1988, Yellowstone National Park.
Photo taken August 30, 2006.