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WATER QUALITY
RESEARCH PROGRAM

ASSESSING LANDSCAPES TO SUPPORT WATERSHED MANAGEMENT

Issue

As we change the face of the landscape in the United States with urban development and agriculture practices, the alterations can cause stormwater runoff, soil erosion and water pollution. Therefore, evaluating or assessing natural landscapes and providing the tools to do the analysis are important to managing and protecting watersheds.

Scientific Objective

Researchers now have advanced technologies that enable them to measure and reliably forecast landscape changes and determine trends in ecological and hydrological conditions.These technologies include remote sensing, geographic information systems (GIS), and computer models.

Applying these technologies, researchers at the U.S. Environmental Protection Agency (EPA) are developing landscape analysis tools and methods for use by watershed managers to assess the impacts of future landscape changes. Identifying potential problems associated with landscape changes today can help environmental decision-makers avoid or mitigate them.

EPA's forecasting tools and methods will enable researchers to compare and display how potential growth scenarios will impact the watershed, especially with regard to runoff and water quality. Local planners can use these tools to evaluate alternative growth management strategies.

Tools that have been developed include the **Automated Geospatial Watershed Assessment (AGWA)** tool and the **Analytical Tools Interface for Landscape Assessments (ATtILA)**:

• The **AGWA** tool was developed by scientists at EPA, the U.S. Department of Agriculture and the Universities of Arizona and Wyoming. AWGA helps identify and prioritize potential problem areas at the watershed level. It can evaluate the effects of various land-use changes on water quality and identify locations where impacts are likely to be most significant. Model outputs for streams and upland areas (above the streamside or riparian corridor) can be quantified and mapped for comparison with other data and assessment results.

AGWA incorporates two watershed runoff and erosion models—the Kinematic Runoff and Erosion Model (KINEROS2) and the Soil and Water Assessment Tool (SWAT)—into GIS. KINEROS2 models the fate of precipitation and resulting erosion in watersheds characterized by overland flow.

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SWAT predicts the impact of land management practices on water, sediment and agricultural chemical yields in large, complex watersheds over long periods of time. By employing these two models, managers can use AGWA to conduct hydrologic modeling and watershed assessments at multiple time and spatial scales. AGWA can compare results from multiple simulations to examine relative changes under a variety of conditions or future scenarios.

• **ATtILA** is a user-friendly GIS extension that calculates many common landscape metrics. It is equally suitable across all landscapes, from deserts and forests to urban areas. ATtILA measures four types of characteristics:

- Landscape characteristics, such as percentage of grassland cover or number and size of grassland patches
- Riparian characteristics, which describe the land adjacent to or near streams
- Human activity characteristics, such as population increases, road building and land use practices
- Physical characteristics, which provide statistical summaries of attributes such as elevation and slope

Application and Impact

EPA scientists applied the AGWA and ATtILA tools on the San Pedro River Basin along the U.S.–Mexico border and the Willamette River Basin in Oregon. Approximately 84,000 people live in the San Pedro study area and 2.7 million within the Willamette.

Based on three development scenarios—conservation; existing land-use trends; and full-open urban development—researchers generated land-use options and projected them to 2020 for the San Pedro and the year 2050 for the Willamette. Using AGWA, scientists evaluated the impact on water quality and quantity that would result from these options.

The results clearly demonstrated that changes associated with full-open development (e.g., additional roads and structures with added parking lots and other impervious surfaces) would substantially alter the watershed quality.

REFERENCES

Automated Geospatial Watershed Assessment (AGWA) Tool, www.epa.gov/esd/land-sci/agwa/index.htm *or* http://www.tucson.ars.ag.gov/agwa/

Analytical Tools Interface for Landscape Assessments (ATtILA) Tool http://www.epa.gov/esd/land-sci/attila/index.htm

EPA Council for Regulatory Environmental Modeling (CREM) Models Knowledge Base (http://cfpub.epa.gov/crem/knowledge_base/crem_report.cfm?deid=75821)

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