

# The San Pedro River Spatial Data Archive ...

## A Database Browser for Community-based Environmental Protection

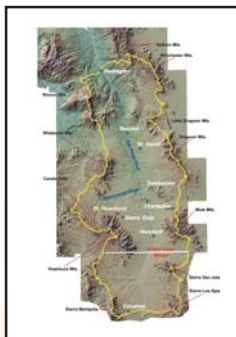


EPA/600/C-03/008  
ARS/152432

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### Abstract

It is currently possible to measure landscape change over large areas and determine trends in ecological and hydrological condition using advanced space-based technologies accompanied by geospatial data. Specifically, this process is being tested in a community-based watershed in southeast Arizona and northeast Sonora, Mexico using a system of landscape pattern measurements derived from satellite remote sensing, spatial statistics, process modeling, and geographic information systems technology. These technologies provide the basis for developing landscape composition and pattern indicators as sensitive measures of large-scale environmental change and

thus may provide an effective and economical method for evaluating watershed condition related to disturbance from human and natural stresses. This project utilizes spatial data from a number of sources. The information has been modified to fit the watershed project area, assembled into a database browser, and combined with two GIS-based assessment tools. We have produced all spatial data into a one-stop, easy-access product that will be useful to all others who utilize geographic information systems and could benefit from the information in regard to research, natural resource management, human-use planning, and policy development. The San Pedro Data Browser is currently available on-line via the EPA server (<http://www.epa.gov/nerled1/land-sci/san-pedro.htm>) and distributed as CD-ROMs. The purpose of the database is to disseminate available data that could be used by the stakeholder community to address environmental issues and improve environmental decision-making.

**Key words:** San Pedro River; community assessment; geographic information systems; landscape characterization; landscape ecology; remote sensing; geospatial data; hydrological modeling.

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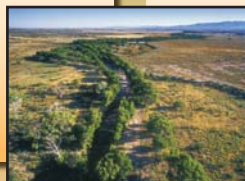


### Introduction

The San Pedro River Geo-Data Browser, a GIS database which contains software extensions for hydrologic model and landscape assessment, was jointly developed by the Landscape Ecology Branch of the U.S. Environmental Protection Agency (Las Vegas, NV) and the USDA Agricultural Research Service (Tucson, AZ). The combined research of both federal agencies is intended to improve decision-making relative to natural and human resource management through the development of an integrated system of landscape and hydrological indicators and models. The program has proceeded simultaneously along two lines: 1) a research component to develop and test landscape indicators, hydrological process models, and assessment protocols, and 2) an implementation component to demonstrate the application of landscape analysis protocols to ecological and hydrological assessments via a number of geographic initiatives.

Acquisition of primary data and database development is an initial feature of any landscape indicator and assessment project. The San Pedro River Geo-Data Browser provides spatial data in user-friendly on-line and CD-ROM formats. Additionally, two ArcView analysis extensions have been added to the Geo-Data Browser. These are custom tools developed by EPA and USDA/ARS which utilize the database spatial coverages as input data. The Analytical Tools Interface for Landscape Assessments (ATILA) tool provides the ability to generate commonly used metrics to examine interactions between landscape pattern and distribution relative to ecological processes. The Automated Geospatial Watershed Assessment (AGWA) tool has been designed to investigate the hydrologic impacts of land cover change over time and utilizes two watershed runoff and erosion models, i.e. KINEROS and SWAT. Both extension tools operate through an intuitive interface requiring relatively little Geographic Information System, ecological or hydrologic expertise. Their purpose is to provide managers and scientists with easily applied tools for planning, management, and research applications.

The purpose of the San Pedro geographic initiative has been to measure land cover change and characterize relative vulnerability of natural resources in a semi-arid environment. It is the hypothesis of this project that landscape composition and pattern measures are diagnostic of environmental and hydrological condition and can be quantitatively measured using advanced technologies. Acquisition of primary spatial data is the first step of the research process.

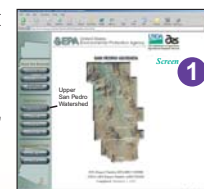


### Methods

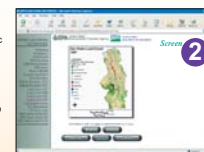
The study location originates in Sonora, Mexico and flows north into southeastern Arizona. The San Pedro River is an international basin with significantly different cross border legal and land use practices. The watershed embodies a variety of characteristics which make it an exceptional outdoor laboratory for addressing a large number of scientific questions in arid and semi-arid hydrology, ecology, meteorology, and the social and policy sciences. The Upper San Pedro Watershed represents a transition area between the Sonoran and Chihuahuan deserts and topography, climate, and vegetation vary substantially across the watershed. Elevation ranges from 900 - 2,900 m and annual rainfall ranges from 300 to 750 mm. Biome types include desertscrub, grasslands, oak woodland-savannah, mesquite woodland, riparian forest, coniferous forest, and agriculture. The upper watershed encompasses an area of approximately 7,600 km<sup>2</sup> (5,800 km<sup>2</sup> in Arizona and 1,800 km<sup>2</sup> in Sonora, Mexico). All geospatial datasets have been organized to the watershed bounded from its source near Cananea, Sonora to a pour-point associated with the U.S. Geological Survey gaging station located near Redington, AZ.

The spatial datasets and the supporting information (metadata) have been organized relative to their geographical availability and partitioned into three groups corresponding to either the entire watershed, Arizona portion only, or the Sonora portion only (refer to Screen 1). A variety of geographic themes have been developed and the datasets are available for download as zipped archives (refer to Screen 2). The information has been acquired from a number of sources and includes data generated within the EPA. The metadata comply with minimum Federal Geospatial Data Committee standards and include important information relative to acquisition, location, processing level, file size, format, and any relevant comments (refer to Screen 3).

The San Pedro River Geo-Data Browser and Assessment Tools (EPA/600/C-03/008 and ARS/152432) is currently accessible on-line at the EPA website (<http://www.epa.gov/nerled1/land-sci/san-pedro.htm>). Additionally a limited number of CD-ROM copies were produced and distributed. In regard to system requirements, the San Pedro River Geo-Data Browser CD-ROM will run on Microsoft Windows 95, 98, 2000, NT, ME, and XP operating systems with browser software. This includes both Microsoft Internet Explorer Version 3 and above and Netscape Navigator Version 3 and above. Current versions of both internet browsers can be downloaded on-line at [www.microsoft.com/downloads/](http://www.microsoft.com/downloads/) and <http://channels.netscape.com/browsers/>, respectively. The San Pedro River Geo-Data Browser contains links to other websites that require internet connection services to access the links. A free GIS data viewer (ArcExplorer) is provided on the CD and may be used to overlay data layers and build maps. ArcView GIS 3.X is needed to run the assessment tools (ATILA and AGWA).



1. Data organized into 3 geographic regions: entire basin, Arizona only, and Sonora only.



2. Datasets can be previewed and downloaded directly from the browser.



3. Metadata are provided for each dataset.

### Conclusions

Many communities do not have adequate information to understand and effectively plan improvements in their local environments. Information on environmental risks is most often delivered to communities as separate unrelated pieces. Without a more comprehensive and integrated view, communities will not be able to begin to address cumulative risk issues or set informed priorities for actions to improve their environments. The San Pedro River project has presented a number of effective examples, e.g. websites, bilingual fact sheets, and posters, for communicating science information to the public. Among the suggestions, the provision to develop an on-line and CD-ROM watershed database for all community members to unite and organize available data for the public and experts<sup>1</sup> was strongly recommended by members of the local and international stakeholder community. This product provides easy public access to a comprehensive, long-term database which can be used by the community stakeholders to help understand their environment, set priorities, and make decisions for improvement. The database can be easily updated to include new coverages as they become available and could be used as a prototype science communication tool for other community assessment initiatives.



### Acknowledgments

The geospatial data contained within the San Pedro Data Browser have been acquired from a number of sources including the Arizona State Land Department (Arizona Land Resource Information System), Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora (MADES), U.S. Department of the Interior (e.g. U.S. Bureau of Land Management and U.S. Geological Survey), U.S. Environmental Protection Agency, and others. We thank those agencies who readily made data available to us, encouraged our efforts, and reviewed our interim products. Users are advised that verification of the quality of and use of any data supplied via this product are the responsibility of the user.

See <http://www.epa.gov/nerled1/land-sci/san-pedro.htm> for more information