



## Tribal Emphasis on Land Use and Heritage Sparks Growing Use of GIS Technology

*Ever conscious of preserving their heritage and their lands, American Indian tribes are increasingly using geospatial technologies such as geographic information systems (GIS), global positioning systems (GPS), and remote sensing to manage their land and take stock of their natural and cultural resources. To increase awareness of the benefits of these technologies throughout Indian Country, the Southwestern Indian Polytechnic Institute (SIPI) in Albuquerque, New Mexico, and the National Consortium for Rural Geospatial Innovations (RGIS), are extending the word via outreach programs such as satellite presentations, short courses, conferences and classes focusing on geospatial-related issues. In this bulletin, we offer a sampling of ways that geospatial technology is helping tribal leaders, environmental staffers and students learn about, and manage, tribal lands.*

National efforts to accumulate geodata would be incomplete without including the nation's vast tribal lands and resources. But often, America's Indian tribes have different priorities than does the dominant American culture—such as preserving their heritage and re-energizing the traditional use of tribal lands.

### The Beginnings of GIS

Historically, taking legal measurements of the land was a European concept. Early surveyors of the Southwest used a 66-foot chain; the measurements eventually became the Public Lands Survey System (PLSS), which covers the western United States and still includes information from the 1800s in grid form, showing townships and section maps. The Geographic Coordinate Data Base (GCDB), developed by the Bureau of Land Management (BLM), now portrays these surveys in a digital format. Measurements taken from the original plats and notes of the U.S. government surveyors were used to produce geographic coordinates (latitude and longitude) for all corners within the PLSS. These coordinates comprise the foundation data that are being used to build the BLM's GIS. (The original data as well as the final ARC/INFO (software) coverages can be accessed and downloaded at no cost from: [www.blm.gov/gcdb](http://www.blm.gov/gcdb)).

Tribal leaders realize that useful information can be gleaned from the blending of tradition with advancing technologies such as GIS. For example, legacy information (which refers to historical records and information that are not in a standardized or relational format) from the 1800s in New Mexico, in conjunction with GIS, recently helped unearth a pueblo along the San Juan River on the Navajo Reservation.



## About RGIS

The National Consortium for Rural Geospatial Innovations–Tribal Technical Center is located at the Southwestern Indian Polytechnic Institute in Albuquerque, New Mexico. It is a USDA program designed to promote the use of geospatial information and technologies by communities in rural America. RGIS is dedicated to helping communities understand the concepts and benefits of using geospatial data as well as assisting them in all aspects of GIS development.

Today, GIS is used in many branches of tribal government in support of tribal priorities. Up-to-date survey information is critical in helping tribal land managers make decisions. Because GIS is becoming such an important tool, RGIS–Tribal Technical Center at the Southwestern Indian Polytechnic Institute (SIPI) is helping to increase awareness of GIS through outreach efforts such as satellite presentations and community education classes. These efforts are aimed at tribal leaders, environmental professionals and students.

## Geospatial Technology and Heritage Preservation

The preserved ruins at Chaco Culture National Historical Park, located in northwestern New Mexico, provide a vital link to understanding the past for a number of Southwest tribes. A recent satellite presentation, entitled "Update on the use of GIS by the Navajo Chaco Protection Sites Program," focuses on the use of GIS for managing preserving, protecting, researching and interpreting the pre-Columbian landscape. Approximately one-half of the authorized Chaco protection sites (20) are located on Navajo Nation lands, but hundreds of similar sites and related landscape features are located throughout the approximate 17.5 million acres of Navajo lands.

Among the sites of interest: pre-Columbian Chaco Canyon greathouses, which were designed to reflect the cosmology of celestial and terrestrial landscapes to calculate the equinox and the solstice. Specific satellite imaging focused on the Two Grey Hills area, outlying Chaco Canyon. In order to integrate regional scale into the maps, ridged geometrical forms were added to contrast with the natural landscape. As a result, the earthwork surrounding the greathouses was visible as modifications of the landscape.

Along with the Newcomb Greathouse, Crumble House and Skunk Springs (a site used for winter solstice alignment computation), the role of nearby Hwiish tt' a'h Peak in relation to the greathouses was also examined. The peak was used to determine the date of the solstice by reflecting an image of the rising sun on a certain part of the structure. To obtain more revealing photos, the scientists used a low-level flier, which resembles a large remote-controlled model plane.

The great value of geospatial technologies is that they enable a small staff to collect spatial information accurately and on a very large scale for interpreting and managing the pre-Columbian landscape.

Students at SIPI receive instruction on how to operate hand-held GPS (global positioning system) units



Funding for the Navajo Nation Historic Preservation Department–Chaco Protection Sites Program, is authorized by Title V of P.L. 96-550 of 1980 as amended by P.L. 104-11, the "Chacoan Outliers Protection Act of 1995" and is administered by the National Park Service through a cooperative agreement. Additionally, the above legislation requires that the work conducted under this agreement is subject to the review of an oversight committee (the Interagency Management Group, or IMG) with representatives from the Bureau of Land Management, the National Forest Service, the state of New Mexico, the Navajo Nation and the National Park Service.

## GIS and Land Use

While many Rio Grande pueblos in New Mexico enjoy a measure of geographic isolation, Sandia Pueblo, just north of Albuquerque, is surrounded by the burgeoning communities of Albuquerque, Rio Rancho and Bernalillo. Pueblo leaders are concerned about protecting sacred locations, sometimes just a stone's throw from urban sprawl. At the same time Sandia, itself, is developing a major new casino across the freeway from the old pueblo.

## Available Satellite Broadcasts:

**GIS in Indian Country**, March 1999

**Tribal and Government Agencies on the Cutting Edge of GIS**, May 1999

**Tribal Update on GIS**, November 1999

**Water Management in Indian Country Using Geospatial Technology**, March 2000

**Rural Applications of GIS**, November 2000

For a copy of these broadcasts, or further information concerning RGIS geospatial programs at SIPI, contact:

RGIS Tribal Technical Center at SIPI  
Monte Monteith or Nadine Scala  
P.O. Box 10146  
Albuquerque, NM 87184  
505-346-7742  
monteith@sipi.bia.edu  
nscala@sipi.bia.edu

Sandia Pueblo has been using GIS data since 1996 for such purposes as community planning, and to pick a site for the new casino, which is planned for the east side of Interstate 40, across from the pueblo. A recent satellite presentation, "Using Digital Orthophotography to Build Coverages at the Sandia Pueblo," discussed various uses for GIS at Sandia Pueblo, which include:

- Managing natural resources
- Emergency response
- Economic development
- Community development and planning
- Mapping water discharge spots on the Rio Grande.

## Environmental Programs

GIS also enables tribes to have control over a variety of environmental programs. For example, the Santee Sioux Tribe of Nebraska was the focus of a recent RGIS land-use study by the University of Arkansas. Located in Knox County, Nebraska, this reservation covers 147 square miles. The study, called "Enhanced Resource Management within Tribal Lands Utilizing GIS and GPS," addressed the following issues:

- **Riparian areas:** Cross sections were taken delineating three buffer zones for each section: the active channel, the flood plain, and the riparian zones.
- **Wetlands inventory:** Using the National Wetland Inventory Maps, local information was verified. These maps were digitized and areas were added as needed. This produced an acreage and linear footage for the wetland types for the whole reservation.
- **Development of a source water protection plan:** The purpose of this was to prevent pollution that could potentially cause health problems, and lessen the impact of contaminants from fuel storage tanks, septic tanks, abandoned water wells, and animal feeding operations.
- **Producing maps:** The purpose was to locate potential contaminants, roads, wells and other features of interest. They used GPS units to collect data for water source areas, and the data were brought into ArcView and added to the coverage of the area. Roads and other needed data, such as well locations, were also added. The resulting map identified potential contaminant locations.

Funding and resources were provided by the tribe, University of Arkansas, and the U.S. Environmental Protection Agency. Technical assistance was provided to reservation personnel as needed, and the end product was a database that can be updated and can grow with the reservation. Additional information and links to tribal programs are available at [http://www.cast.uark.edu/tribal\\_lands](http://www.cast.uark.edu/tribal_lands) and at <http://www.epa.gov/indian>.

## Federal Leadership

Much of the GIS work affecting Indian lands is being done by the Federal Geographic Data Committee (FGDC) at USGS headquarters in Reston, VA. Bonnie Gallahan, a member of the Lumbee Tribe, is the American Indian liaison for the FGDC ([www.fgdc.gov](http://www.fgdc.gov)) in Reston. Her work focuses on building partnerships among tribal, federal, state, local and academic entities to harmonize and standardize data for the National Spatial Data Infrastructure (NSDI). According to Ms. Gallahan, "The outreach to the American Indian includes hydrography, flora and fauna, water quality, and sharing knowledge.

## Additional Resources

The **Inter-tribal Geographic Information System Council (IGC)** builds inter-tribal cooperation to manage native land and resources. For more information: IGC, 231 SE Beyers Ave., Pendleton, Oregon, 97801; (591) 966-9097 or [www.itgisc.org](http://www.itgisc.org).

The **National Inter-tribal Law Enforcement Association (NAALEA)** provides training and education for Indian students interested in law enforcement careers. Scholarships are available for the first time this year. For more information about NAALEA and other programs and resources, call Bonnie Gallahan at 703-648-6084, or email her at [bgallahan@usgs.gov](mailto:bgallahan@usgs.gov).

At present, USGS is working with over half of the tribes to increase training, environmental studies, and the planning for metadata and common protocols using a clearinghouse. There are opportunities for resources and partnerships, and these will assist tribes in becoming even more self-sufficient."

### The FGDC sponsors the following events of interest to the GIS community:

- GIS/Metadata training for American Indians involved with GIS and coastal issues. Training is hosted and instructed by the National Oceanic & Atmospheric Administration (NOAA) at the Coastal Training Center in Charleston, S.C.
- Regional Forums with tribal governments and universities, beginning in Summer 2001, sponsored by FGDC and the National States GIS Council. The forums will begin a dialogue with state and tribal geographic information coordinators to offer perspective and help enhance the National Spatial Data Infrastructure (NSDI).

Contact Bonnie Gallahan for more information: 703-648-6084;  
email: [bgallahan@usgs.gov](mailto:bgallahan@usgs.gov).

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**RGIS—Tribal Technical Center**  
**Southwestern Indian Polytechnic Institute**  
**9169 Coors Rd, NW**  
**PO Box 10146**  
**Albuquerque, NM 87184**