GIS NEWS - WINTER 1994

GEOGRAPHIC INFORMATION SYSTEMS AND ARCHAEOLOGY IN MONTANA<

By Dave Schwab, Archeological Consultant

Prehistoric archaeologists are at a disadvantage over other researchers of human behavior due to very limited categories of data to work with. This limitation is especially true in Montana where prehistoric hunter-gatherers were so efficient they left very little cultural remains behind. A typical prehistoric site in Montana contains a scatter of chipped stone debris, some broken and burned bone, a few worked tools, perhaps a fire pit, and sometimes stone features such as tipi rings or rock piles.

The efficient hunting and gathering peoples who roamed Montana's landscape for over 11,000 years were intimately familiar with their surrounding environment and took full advantage of the opportunities provided to them. Their knowledge of animal behavior and native plants would probably dazzle modern zoologists and botanists. Yet we know very little about them, and are only beginning to understand the lessons they have to teach us.

We do believe that the placement of early hunter-gatherer camps, kill sites, mining sites and ritual locations can be explained, in large measure, by local resources and topography. In the past it has been impossible for archaeologists to consider the full range of natural resource factors which effect decision-making by prehistoric peoples. GIS technology now provides the opportunity for archaeologists to test models of human adaptation to current and past environments using a wide range of natural resource data. GIS technology allows researchers to comprehensively address basic questions in archaeological research and analysis: What economic resources were available to prehistoric people in a camp site location? Which areas contain intact soil deposition favorable for the preservation of the oldest human occupation sites? Where are the most likely routes of human travel, trade and interaction? How did environmental changes affect the distribution and productivity of economic resources important to prehistoric people and how did they respond? What role does topography, viewshed, and aspect play in seasonal movement of peoples? Coupled with intensive archaeological investigations, these and many other questions can be answered with the help of GIS.

Very little archaeological research using GIS technology has been done to date. The Montana State Historic Preservation Office (SHPO) has used GIS to create maps showing the distribution of certain site types in the state. The SHPO also began implementing a small GIS system for archaeological research on the Flying D Ranch in southwestern Montana in 1992. Recently, the Bureau of Indian Affairs used Global Positioning System and GIS technology to map archaeological sites in eastern Montana.

The modelling of current and past environments and analysis of relationships of natural resources to areas of prehistoric human activity has not yet come to fruition in Montana. When the full potential and power of GIS technology is brought to bear on problems of archaeological research in our state, we can expect to reach a new level of understanding and appreciation for the knowledge and sophistication of our prehistoric predecessors.

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The Montana River Reach Project<

By Peter Langen, Natural Resource Information System

The Montana Natural Resource Information System, under contract with the Montana Department of Fish, Wildlife and Parks (FWP), has initiated development of a state-wide GIS river reach database. A river reach database is composed of streams and rivers that are segmented between confluences. Each segment is assigned a unique identification number that can be used to link the segment with descriptive information. A GIS river reach database provides a vehicle for managing, accessing, and analyzing a wide variety of water related information.

One objective for meeting this goal is to base the Montana River Reach database on, and make it completely compatible with, the Environmental Protection Agency (EPA) Reach File Three (RF3) database.

"RF3 is a hydrographic database of the surface water of the continental United States. Elements within the database were created for the express purpose of performing hydrologic routing for modeling programs, identifying upstream and downstream elements, and providing a method to uniquely identify any particular point associated with surface waters. This list names only a few of the capabilities inherent to the database components. The unique identifier has been put to use in associating other EPA national databases to surface waters: STORET, DRINKS, IFD, GAGES, WBS AND DAMS. Any point within any of these databases can be associated with, and identified by, a specific location on any surface water element: reservoir, lake, stream, wide river or coast line. The Reach File, then, can be defined as the U.S. Surface Water Hydrographic Identification Database.(Technical Description of the Reach File' June 19, 1991, Horizon System and EPA) The federal government has mandated that all federal agencies involved with surface water cross-index their data to RF3.

The main reasons for selecting RF3 as the foundation for the Montana River Reach database are: adherence to a national standard, linkage with major databases, documented structure and lineage, similarity to hydrography layer, and usefulness in meeting expected user requirements.

A second major project objective is to cross-index RF3 with the Montana Rivers Information System (MRIS). MRIS is a tabular database indexed with it's own river reach numbers. MRIS contains extensive information on fisheries, natural features, wildlife, cultural features and recreation. Currently, MRIS has more than 8800 stream reaches. Indexing MRIS to RF3 makes it possible to link each MRIS record to the additional water information available in other state and federal databases which are linked to RF3.

River Reach File Three is derived from four sources: River File 1 (RF1), River File 2 (RF2), the Geographic Names Information System (GNIS) and the USGS 1:100,000 scale Digital Line Graph (DLG) hydrography. RF1 was developed in 1982. The features were based on 1:500,000 scale NOAA aeronautical charts. There were approximately 68,000 reaches in RF1. In 1988, RF2 was implemented doubling the number of reaches. The inclusion of the 100K DLG hydrography in RF3 has greatly increased the resolution and feature density of the database. The feature attributes associated with the 100K DLG files are also included in RF3. With the addition of the GNIS, over 10,000 named hydrographic features within Montana are now part of RF3.

Many problems must be resolved for RF3 to be used as the base for the Montana River Reach project. Many problems are specific to Montana and some are based on how RF3 was developed. The "final" version of RF3 has not been released by EPA and the "draft" version contains significant errors which must be corrected by EPA. When EPA processed the 100K DLG data they discarded some of the spatial accuracy and some of the descriptive information in the DLG database. EPA has indicated that these problems will be fixed and a new version of RF3 will be released by mid 1994.

In addition to these problems there are many errors in RF3 that will have to be fixed manually. Some of these errors are the result of using the DLG data, which is a cartographic representation of the hydrography, as the basemap for RF3. Some were introduced by EPA when they added the reach numbers to the DLG data. Examples of errors include: reaches in the wrong hydrologic unit, line work not connected at map edges, duplicate line segments, and coding errors. EPA will not make these types of corrections, so the users of RF3 will have to.

Another aspect of making the Montana River Reach Database a viable, dynamic tool is the development of standards and procedures for enhancing the database. These enhancements could include adding additional features to the database such as dams, new reaches or the splitting of existing reaches; or adding additional attribute information, such as named hydrographic features not in GNIS. These types of changes must be well documented. Any changes made to the original RF3 must be submitted to EPA for inclusion in the national RF3 database. If new releases of RF3 are made. Coordinating who makes changes to RF3 in Montana and how the changes are made will facilitate this process and insure users of RF3 and the Montana River Reach Database the highest quality data possible.

To ensure the value of the Montana River Reach Database and RF3, they must be continually maintained. Who makes changes, how they are made, how they are disseminated, and who funds the maintenance are all issues that must be addressed for the long term viability of the database. The Montana River Reach Database has many potential uses. It is vital to obtain input from as many potential users as possible to assure that the final database structure meets their requirements. To fulfill these needs, an adhoc sub- committee of the Montana Interagency Technical Working Group (ITWG) was formed to work on RF3 issues. This group will set direction of the development of the Montana River Reach Database.

The first meeting of the River Reach Technical Working Group (RRTWG) was held in April 1993, the second meeting was held this last November. Both meetings were well attended and received. State, federal and private organizations participated. The biggest concerns of the group are the slowness of EPA in delivering a final version of the RF3 database, and EPAs adherence to a schedule for all future RF3 work. The group is also actively seeking formal recognition from EPA for communication and consultation on future RF3 enhancements. Other key issues for the group include: development of systems and procedure for transferring corrections to RF3 made in Montana to the national RF3 database, acquiring funding for database upgrade and maintenance, and outreach and education to those agencies, groups and individuals within Montana who may benefit from the development of the Montana River Reach Project. The RRTWG is also currently distributing a 'Montana River Reach Database User Requirements Survey.' If you are interested in the Montana River Reach Project and RF3, and would like to participate in the River Reach Technical Working Group or complete a user requirements survey, contact Pete Langen (406-444-0539) or Fred Gifford (406-444-5357), or write to: Natural Resource Information System, Montana State Library, 1515 East Sixth Ave, Helena, MT 59620-1800.

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From the Editor

IMPLEMENTING GIS IN MONTANA - TAKING THE NEXT STEP<

Great strides in GIS use have been made in Montana. Organizations concerned with Montana's vast natural resources quickly recognized the utilities of GIS. Local governments are also starting to adopt GIS to help meet their oversight and management mandates. Evidence of the high level of GIS activity in Montana is shown by attendance at the annual GIS Users Group Conference, usually around 300, and the extent of the mailing list for the Montana GIS Users Group, over twelve hundred entries--both very high numbers for a state with a population of 750,000. Not only are these parties using GIS but they are excelling in it. Currently there are many GIS projects in Montana receiving national attention for their innovative technical applications, extensive

state and federal coordination, and broad consideration for data sharing and public access.

Yet with all the use of GIS in the state, I still feel we GIS practitioners are only scratching the surface of potential benefits obtainable from GIS. There are many organizations with clear needs for GIS which have not implemented a system. Other agencies are only able to get the support to partially implement a system. There are many data layers needed by multiple groups that have not been developed.

The GIS community in Montana should be concerned with this situation. We can all benefit by strong GIS programs in other organizations that are willing to share the data they create and maintain. We can all benefit from applications or projects which we can emulate or borrow from. When we advance as a community, we advance individually.

I think one of the factors preventing more and stronger GIS programs is lack of support from upper management. It appears to me that all the good work, activity, and progress happening at the technical level is not being adequately commuicated to those at the management level. This makes life very difficult for GIS professionals who need approval from their organizations to participate in collaborative efforts, acquire new equipment, attend training, hire people to get work done, or anything else that requires allocation of resources from their agencies. If the administrators don't know what benefits their agencies have been deriving from GIS, or haven't even heard of GIS they are not likely to support it.

If we want to lay a foundation that will support the continued expansion of GIS we must let nontechnical decision makers know what is happening and what the benefits are. I know, GIS professionals who are getting things done don't have much time or desire to put "real" work aside to do self-promotion. However, if the groundwork is not laid, then the likelihood of having resources made available to do more extensive and comprehensive GIS applications in the future is limited.

So, how do we start addressing the problem? Education and Communication. There are many ways to get information out about your program or project. Write an article for the Montana GIS News; we are constantly looking for good projects to showcase. Put on a seminar for your agency's managers; show them your equipment; the databases you've developed; have some fancy posters spread around the room; let them know there is a lot happening.

If you really don't have time yourself, you could invite them to attend some or all of the Montana GIS Users Conference. This year there will be a special focus on presentations that are relevant to nontechnical managers including an all-day workshop Thursday, April 7, on GIS project management and implementation.

Be creative, think of ways you can make GIS visible in your organization, and then take the time to make sure it happens.

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FOREST SERVICE/SPOT AGREEMENT

Regional Forester Dave Jolly has announced a new era in the sharing of Forest Service data with other government agencies and the public.

A pilot agreement has been reached with SPOT Image Corporation which will allow the Region 1 Forest Service to provide their SPOT copyright protected satellite data to anyone wanting a copy. Copyright protected data has previously been unavailable. The images may be provided as photocopies, photographic prints or in digital format.

Generally digital data will cost $55, paper copies $3, and photographic prints $48 for black and white and $92

for color.

Digital and photographic print copies will be available only at the Missoula Regional Office, though they may be ordered at any Region 1 Forest Supervisors office. Paper diazo and black and white 11"x 17" photocopy copies will be available on the Forest where the data is applicable.

Information on areas covered, available products, and their cost is available at the National Forest Supervisor's Offices, or the Regional Office. In Missoula, you may get the information by calling 406-329-3511.

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