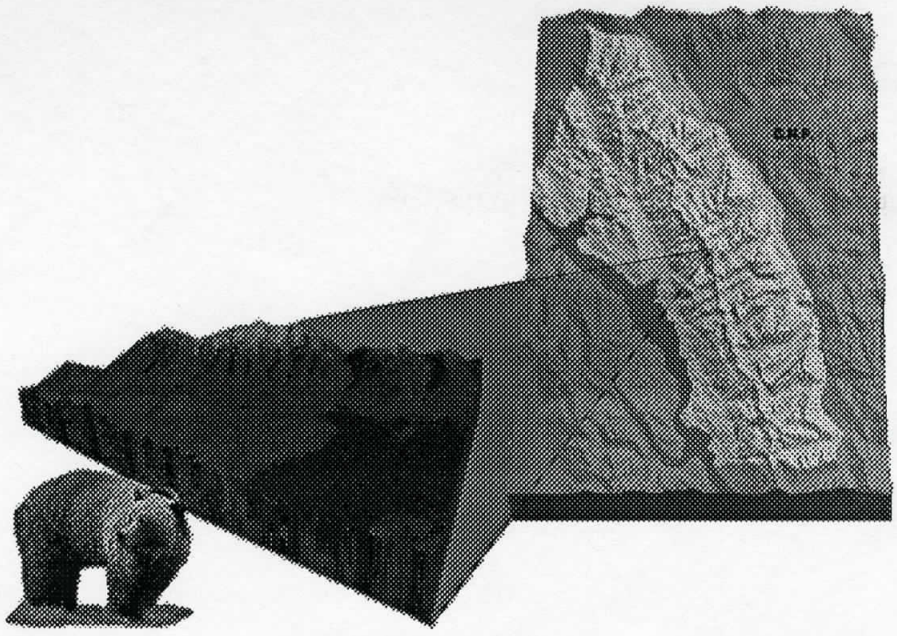
Sixth Annual
Montana GIS Conference

EXPANDING HORIZONS THROUGH GIS

Cavanaugh's Convention Center
Kalispell, Montana
April 5 - 8, 1994



Promoting the Understanding and Utilization of Geographic Information Systems

1994 Montana GIS Conference

Planning Committee

Conference Chair:	***Don Krogstad,*** *GIS / REMOTE SENSING COORDINATOR Flathead National Forest*
Conference Vice-Chair:	***Jim Reid,*** *GIS Technician, Flathead National Forest* ***Dale Johnson,*** *Positive Systems Inc.*
Program Committee:	***Fred Gifford,*** *NRIS, Montana State Library* ***Don Cromer,*** *Terra West Technology* ***Ken Wall,*** *University of Montana* ***Stewart Kirkpatrick,*** *Butte-Silver Bow Planning Department*
Exhibits Coordinator:	***Dale Johnson,*** *Positive Systems, Inc.*
Poster Session Coordinator:	***Ken Wall,*** *University of Montana*
Other Committee Members:	***Sue Haverfield,*** *Flathead County Clerk, Recorder/Surveyor* ***Gael Bissel,*** *MT Dept. of Fish, Wildlife and Parks*

Special Thanks: The Planning Committee wishes to thank to Jeri Mae Rowley, Flathead Valley Community College Internship Coordinator, Patti Beach, Intern, for preparing the Conference Program, Vicki Bodquist and Jim Reid for the art work, Joe Kauffman for his extra help, and Flathead Convention Center for other materials.

The Montana GIS User's Group would also like to express appreciation to all the Sponsors for the Awards Presentation Gift Certificates.

We welcome you to the growing ranks of Montana GIS users, who share the details of many complex and fascinating projects undertaken in our state.

The 1994 convention is located in the beautiful Flathead Valley. With the theme "EXPANDING HORIZONS THROUGH GIS", the GIS user who is just starting will find significant information to promote their GIS use and understanding, and experienced users will find both interesting and highly technical subjects from across the state.

The Keynote speech, will be delivered by Representative Pat Williams, and Senator Conrad Burns will also be a guest speaker for our VIP luncheon scheduled for Wednesday at noon.

Other presentations are arranged into plenary sessions, concurrent sessions, and panel discussions. This year we hope you participate in our question and answer period after each session. Attendees may select from two concurrent tracks, depending on their area of interest. Subject matter for the two tracks are in area of Natural Resources, New Technology, or Urban Applications. Be sure to review the abstracts to determine which sessions best match your needs.

The conference also features a unique blend of commercial EXHIBITS of GIS related products and services, a POSTER competition, to be judged Wednesday Eve. at 6:00 by a panel of experts. Wednesday evening is PUBLIC NIGHT where conference members will be available to answer questions, and Thursday night is our FUN NIGHT. With the VIP dinner starting at 7:00 P.M., everyone will have a chance to meet and socialize.

The Conference Planning Committee has designed an exciting program, and look forward to your participation.

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All Montana GIS Conferences are sponsored by the Montana GIS Users' Group Inc., a statewide consortium of government agencies and businesses involved in GIS technology. Serving as hosts for this years conference are the following GIS Users in Kalispell, MT: Positive Systems, Flathead National Forest, MT Dept. of Fish Wildlife and Parks, and Flathead County Surveyor's office.

TUESDAY, APRIL 5, 1994

PRECONFERENCE WORKSHOPS	
9:00-4:00	**LOCAL GOVERNMENT APPLICATIONS** *Drs. John P. Wilson and Kenneth L. Weaver, University of Montana* **BIG SKY BALLROOM B**
9:00-4:00	**GEOGRAPHIC INFORMATION SYSTEMS: BASIC CONCEPTS** *Allan Cox, Director of Natural Resource Information Systems,* *Fred Gifford, GIS Coordinator, Natural Resource Info Systems,* **BIG SKY BALLROOM A**
8:00-12:00	**ARC/INFO TECHNIQUES, TIPS, AND TRICKS** *Montana Natural Resource Information System, Environmental Systems Research Institute, and the University of Montana* **LAKE MCDONALD/SWIFT CURRENT ROOM**
8:30-5:00	**LAND MANAGEMENT PLANNING - NATURAL RESOURCES APPLICATION** *Mark Teply and Dean Angelides, VESTRA Resources Inc.* **HANGING GARDENS ROOM**
8:30-12:00	**GPS #1: INTRODUCTION TO GPS: A STUDY OF THE CURRENT SYSTEMS** *Fred Gerlach', University of Montana* **GLACIER ROOM**
1:00-4:30	**GPS #2: FAMILIARIZATION AND FIELD OPERATION OF GPS RECEIVERS** *Fred Gerlach', University of Montana* **GLACIER ROOM**
9:00-4:00	**PRINCIPLES OF THEMATIC MAPPING FOR GIS USERS** *Paul Wilson, Robert Batchelder and Kurt Knowles, University of Montana.* **FOREST SERVICE BUILDING,(GIS LAB), 1935 3RD AVE E. KALISPELL, MT.**

THURSDAY WORKSHOP, APRIL 7, 1994

9:00-4:00	*PROJECT MANAGEMENT FOUNDATION FOR SUCCESS* *Craig Gooch, Senior Project Manager, DMR Group* *Fred Gifford, GIS Coordinator, MT Natural Resources Info System* *GLACIER ROOM*

WEDNESDAY, APRIL 6, 1994

7:30-8:30	*CONTINENTAL BREAKFAST*	
9:00-9:30	*WELCOME ON BEHALF OF MONTANA GIS USERS GROUP* *FRED GIFFORD, NRIS, DON KROGSTAD, FNF* *WELCOME TO KALISPELL, MAYOR DOUG RAUTHE* — *BALLROOM A*	
9:30-10:00	*KEYNOTE ADDRESS: REPRESENTATIVE PAT WILLIAMS* — *BALLROOM A*	
ALL DAY	COMMERCIAL EXHIBITS OPEN — PREFUNCTION AREA	
10:00-11:30	*STATUS OF THE NATIONAL SPATIAL DATA STRUCTURE,A SPECIAL PRESENTATION BY GARY CHAPEL* *Federal Geographic Data Committee Secretariat, U.S. Geological Survey* *ALLAN COX - MODERATOR* — *BALLROOM A*	
12:00-1:30	*VIP LUNCHEON: SENATOR CONRAD BURNS* *(INCLUDED IN REGISTRATION) BALLROOM A&B*	
	TRACK I — BALLROOM A	**TRACK II — BALLROOM B**
	JIM REID-MODERATOR	**STEWART KIRKPATRIC-MODERATOR**
2:00-2:30	**NRT1/OPERATIONAL GPS** *FREDERICK L. GERLACH', SCHOOL OF FORESTRY*	**UNT1/GIS ADVOCATE FOR COMMUNITY VALUES, CASE STUDY FLATHEAD VALLEY** *STEVE MULLEN, DESIGN WORKSHOP*
2:30-3:00	**NRT2/MAPPING IN GREAT BEAR WILDERNESS** *DAN SMILEY, FLATHEAD NATIONAL FOREST*	**UNT2/GIS AND WILDFIRE AT THE INTERFACE - THE MISSOULA CO. PROJECT** *KELLEY CLOSE, SCHOOL OF FORESRTY, UM*
3:30-4:00	**NRT3/CAPITALIZING ON THE USE OF HIGH-WING AIRCRAFT** *W. DOUG HARRISON, USDA SOIL CONSERVATION SERVICE*	**UNT3/GIS IN RURAL PLANNING** *KEN WALL, GEODATA SERVICES INC., AND PAT O'HERREN, RURAL PLANNER, MISSOULA, COUNTY*
4:00-4:30	**NRT4/REVERSE PHOTOGRAMMETRYII - SPACE RESECTION** *R.A. BOLLER, BOLLER GEODETICS*	**UNT4/GIS LANDBASE CONSTRUCTION** *DANIEL ROSS, ADR*
4:30-5:00	**NRT5/RIVER REACH FILE 3 THE FUTURE IN MANAGING AMERICA'S WATERS** *FRED GIFFORD, NRIS, MT ST. LIBRARY*	
6:00-9:00	**PUBLIC NIGHT - POSTER SESSION - HORS D'OEUVRES** — **PREFUNCTION AREA**	

THURSDAY MORNING, APRIL 7, 1994

7:30-8:30	*CONTINENTAL BREAKFAST*	
ALL DAY	*COMMERCIAL EXHIBITS OPEN*	PREFUNCTION AREA
	TRACK I **BALLROOM A**	**TRACK II** **BALLROOM B**
	DALE JOHNSON-MODERATOR	**SUE HAVERFIELD-MODERATOR**
8:30-9:00	**NRT6/MAPPING MONTANA'S PRIVATE FOREST LANDS WITH GIS** **Ken Wall, University of Montana**	**UNT5/PREDICTING CONFLICTS BETWEEN LAND USE AND LAND SUITABILITY** **Candis A. Van der Poel, Land use Planning Consultant**
9:00-9:30	**NRT7/USING GIS FOR SUPPORT OF TIMBER SALES EFFECTS ANALYSIS** **Donna Leeper, Division of Forestry, MT Dept. of State Lands**	**UNT6/FLATHEAD COUNTY GIS: UTILIZING INTER-GOVERNMENTAL COOPERATION** **Rick Breckenridge**
9:30-10:00	**NRT8/APPLYING GIS TO A FOREST - WIDE OIL AND GAS LEASING EIS** **Loren Inverson, Beaverhead National Forest**	**UNT7/USING GIS WHEN YOU ARE NOT A GIS EXPERT: TIPS FROM THE WATER INFORMATION SYSTEM** **Val Jaffe, Water Information Specialist**
	KEN WALL-MODERATOR	**ALLEN COX-MODERATOR**
10:30-11:00	**NRT9/AN EVALUATION NDVI FOR MONITORING VEGETATION MOISTURE** **Colin Hardy, USDA Forest Service**	**UNT8/NEW SPATIAL INTERPOLATION METHODS** **John P. Wilson, Dept. of Earth Science, MT State University**
11:00-11:30	**NRT10/REMOTE SENSING UTILIZED TO MONITOR FOREST AND FOREST FIRE POTENTIAL** **Dale Johnson, Positive Systems Inc.**	**UNT9/AN INTRODUCTION TO THE NATIONAL GEOSPATIAL DATA CLEARINGHOUSE** **Gary Chapel, US Geological Survey, Reston, VA**
11:30-12:00	**NRT11/LANDSCAPE ASSESSMENT ON THE DECLINE OF WHITEBARK PINE** **Robert E. Keane, Bob Marshall Wilderness**	**UNT10/FOREST SERVICE PROJECT 615 PROCUREMENT** **Bill Tanke, USFS, Region 1, Missoula**
12:00	*LUNCH BREAK, COURT YARD BBQ (INCLUDED IN REGISTRATION)*	

THURSDAY AFTERNOON, APRIL 7,1994

	TRACK I BALLROOM A	TRACK II BALLROOM B
	GAEL BISSEL-MODERATOR	**DON CROMER-MODERATOR**
1:30-2:00	NRT12/MODELING WILDLIFE HABITATS ON THE FLATHEAD NATIONAL FOREST Nancy M. Warren, Flathead National Forest	UNT11/ Bob LaPedus, USGS
2:00-2:30	NRT13/USING GIS TO MODEL SPATIAL/TEMPORAL PATTERNS OF SNOW MELT Rick Mace, MT Dept of Fish, Wildlife and Parks	UNT12/WHAT YOU NEED TO KNOW ABOUT MAP PROJECTIONS Gerry Daumiller, NRIS, MT State Library
2:30-3:00	NRT14/Phantom Forest Revisited Jiri Doskocil, Ecology Center	UNT13/GEOGRAPHIC INFORMATION SYSTEMS APPLIED TO SLOPE STABILITY ANALYSIS E.J. DeYoung, Montana State University
	DON KROGSTAD-MODERATOR	**JIM REID-MODERATOR**
3:30-4:00	NRT15/FOREST ROAD SYSTEMS INVENTORIES Thomas Platt, The Ecology Center	UNT14/MAPPING USING DATA DICTIONARIES WITH MULTIPLE ATTRIBUTES Mary T. Manydeeds, Water Resources, Billings
4:00-4:30	NRT16/GIS AND THE PROGRESSIVE SOIL SURVEY Tom Potter, Bozeman Soil Survey, USDA-SCS	UNT15/COMPREHENSIVE GIS DATABASE FOR THE ROCK CREEK DRAINAGE William Haskins, The Ecology Center
4:30-5:00	NO HOST BAR	
7:00-12:00	DINNER, FUN NIGHT	

FRIDAY, APRIL 8, 1994

8:30-10:00	*MONTANA GIS USER GROUP MEETING FOLLOWED BY INTERAGENCY TECHNICAL WORKING GROUP (ITWG) MEETING*

PUBLIC NIGHT (Wednesday, 6pm)

A public night will be held again this year in conjunction with the GIS conference. The event is scheduled for Wednesday April 6, from 6:00 to 9:00 pm. Public night gives Montana citizens a unique opportunity to gain hands-on experience with a new technology at no cost.

The night will begin with a lecture from Montana State Library on basic concepts of GIS. Vendors and Poster presenters have been invited to set up for public presentation, and will be available to give demonstrations and answer questions throughout the evening.

GIS Public Night is being presented by the Montana GIS Users Group, a statewide consortium of more than 300 people from government agencies, universities and businesses who are involved with GIS technology. If you would like more information or would like to be involved next year, contact the Natural Resource Information System, Montana State Library, 1515 East Sixth Avenue, Helena, MT 59620-1800, 444-5354.

KEYNOTE ADDRESS (Wednesday, 9:30am)

VIP LUNCHEON (Wednesday, 12:00)

Representative Pat Williams will be the Keynote Speaker, scheduled for 9:30 A.M. and the topic will be announced.

Senator Conrad Burns will speak at the VIP Luncheon. The topic will be the " The role of technology and the ever advancing use of information by private, academic, and government organization".

ABSTRACTS

WEDNESDAY

TRACK I

NATURAL RESOURCES TRACK (NRT)

NRT-1

OPERATIONAL GPS

FREDERICK L. GERLACH', SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA

This paper discusses the current condition and the impending declaration of an operational GPS. How this change in status may affect the users of GPS data is noted. The integration of GPS in surveying, photogrammetry, imagrammetry, remote sensing and GIS is progressing at an increasing rate, but selective availability is still an issue. New developments in air and sea navigation are considered for the potential improvement of land navigation and field digitizing. However, the user's responsibility for the recognition of the system's operating characteristics and the continuance of quality control in GPS position data is again emphasized.

NRT-2

GPS MAPPING IN GREAT BEAR WILDERNESS

DAN SMILEY, FLATHEAD NATIONAL FOREST

GPS mapping in Great Bear Wilderness is a report on locating features for wilderness management and for revision of quad maps and CFF'S. Logistics of operating in remote area without electric power or mechanical transportation. Post processing considerations of combining geographically and cartographically referenced data.

NRT-3

CAPITALIZING ON THE USE OF HIGH-WING AIRCRAFT, GLOBAL POSITIONING SYSTEMS (GPS) AND SMALL FORMAT AERIAL PHOTOGRAPHY TO COLLECT FARMLAND STATUS INFORMATION NEEDED FOR DETERMINING FSA CONSERVATION COMPLIANCE.

W. DOUG HARRISON, USDA SOIL CONSERVATION SERVICE

In Montana, the Soil Conservation Service (SCS) invests hundreds of hours yearly conducting on-site status reviews of farmland tracts as required under the conservation compliance provisions of the 1985 Food Security Act (FSA). An automated inventory method was tested during 1993 that capitalized on te speed and agility of high-wing aircraft, to navigational capability of a GPS, GPS-based automated data collection tools and 35mm aerial photography to inventory FSA status review tracts. Farm tracks were located, documented and photographed during a single aerial visit. It was determined that about 80 percent of the FSA status review tracts could be assessed using the described automated inventory method, resulting in about a 50 percent reduction in SCS field staff time traditionally dedicated to this work.

NRT-4

REVERSE PHOTOGRAMMETRY II - SPACE RESECTION

R. A. BOLLER, BOLLER GEODETICS

Space resection, used for determining the camera station coordinates from an oblique terrestrial or aerial photograph taken with low-cost, non-metric, cameras, is discussed. This application uses photos taken from a helicopter of a marijuana growing operation to obtain a search warrant. Calculating the height above ground of the helicopter to determine if a violation of privacy had taken place, precipitated this development effort.
The quality of the photos, as well as the ground control, gave unsatisfactory results when space resection alone, without graphics, was attempted. Plan views, elevations, and perspective photo overlays provided convincing evidence to laymen at a hearing on suppression of evidence.

NRT-5

RIVER REACH FILE 3 THE FUTURE IN MANAGING AMERICA'S WATERS

FRED GIFFORD, NRIS, MONTANA STATE LIBRARY

River Reach File 3 (RF3) is a digital GIS database of hydrographic features developed by the Environmental Protection Agency. RF3 is based on the hydrography found on the USGS 100k scale map series. Each river reach has been assigned a unique identifier allowing database systems using the identifier to be indexed spatially and linked to other geographically indexed data.
The federal government has mandated that federal agencies (USGS, EPA,USFWS, USSCS, etc) index their water and other natural resource databases to RF3. The State of Montana has formed an RF3 Users Group to encourage State Agencies and other interested parties to do same.The State of Montana is currently cross referencing fisheries data, wildlife data, recreation and geologic data from the Montana Rivers Information Systems to RF3. The potential uses in water quality monitoring and tracking, water rights, floodplain protection, stream flow monitoring, water availability, groundwater and surface water interaction, land ownership and public access to the states waters (to name a few) are endless.This presentation will provide a brief history of RF3, status of RF3 development in Montana, and an overview of current and potential uses of RF3 in the Federal, State, and private sectors.

ABSTRACTS

NOTE: These abstracts were inadvertently left out of the program at time of printing. Our apologies to the authors of the following papers.

TRACK II BALLROOM B

UNT4 4:00 - 4:30 Wednesday, April 6, 1994

GIS LANDBASE CONSTRUCTION
DANIEL ROSS - AERIAL DATA REDUCTION

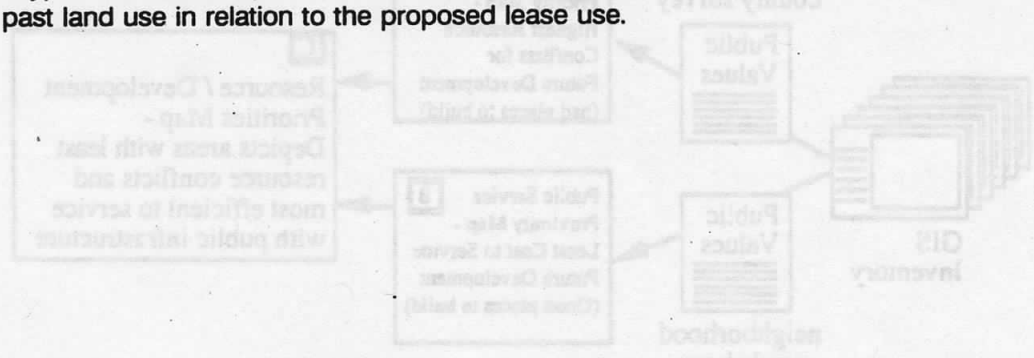
This talk will cover the use of Aerial Photography, Ground Control Survey, G.P.S., Digital Photogrammetric techniques, Digital Orthophotography and GIS applications are impacting the way cities, counties and utility companies are looking at the way and expense of building a landbase.

TRACK II BALLROOM B

UNT11 1:30 -2:00 Thursday, April 7, 1994

OIL AND GAS EIS ANALYSIS
Halcyon LaPoint, BLM

Two major Oil and Gas leasing EIS have been recently completed on the Custer National Forest using GIS technology. With the BLM as co-cooperators, issues were identified, translated into themes and analysed using MOSS/MAPS. Different approaches and techniques were applied to each EIS. Models that were used include: riparian, wolf, cultural resource probability and woody draws. Remotely sensed data and digitial elevation models were used in constructing the riparian and woody draw models. Alternatives were than formulated and assessed. results of these analyses are used in the Record of Decision (ROD), monitoring of decision, and to form baseline data for the Forest Plan revisions. The beartooth EIS, located west of Red Lodge, Mt. along the Absaroka mountain range encompassed 570,000 acres and the South Half EIS, located in southwestern North Dakota badlands and prairie encompassed 780,000 acres. For the Beartooth EIS cartographic models were used to define riparian areas, areas of archaeological site location and probability, and wolf habitat. The South Half EIS incorporated remote sensing data to refine woody draw vegetation and landtype assocation maps and also locate areas of remnant prairie. This model was used to assess the effects of past land use in relation to the proposed lease use.



TRACK II BALLROOM B

UNT1 2:00-2:30 Wednesday, April 6, 1994

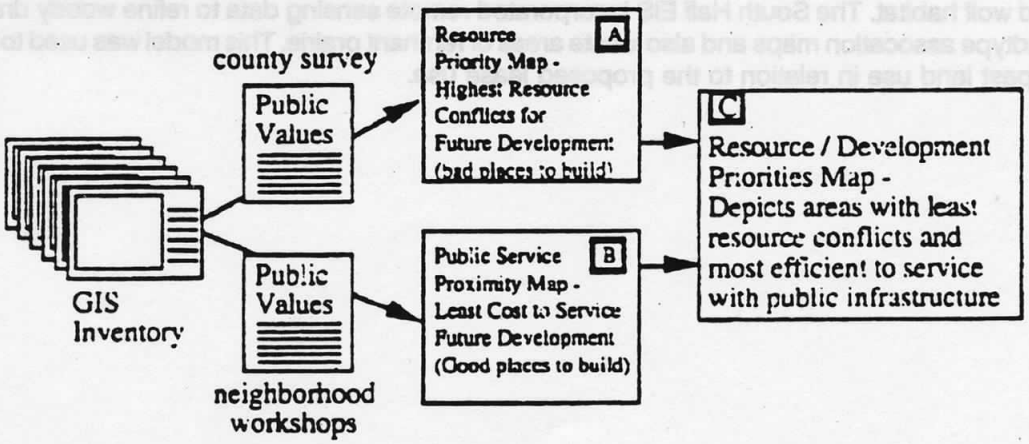
GIS as Advocate for Community Values
Case Study - Flathead County Master Plan Update
Steven B. Mullen
Design Workshop, Inc. March 1994

Materializing vivid values is the essence of the design process. Its implicit therefore that in a public landscape that it be public values that structure that design. Using GIS technology within a well conceived process it is possible to quantify qualitatives values about the landscape from a informed public and use those values to construct a defensible methodology to safeguard public values about the land.

The Flathead Master Planning Process aspires to protect those qualities within the county that make it unique, while simultaneously defining areas where growth is most appropriate and the inherent impacts of growth would be minimized.

This paper demonstrates how regional planning scales can benefit from a structure approach to public value quantification in combination with the GIS technology to produce map products that are both defensible as well as have a high degree of confidence and ownership by the participating public.

The combination of GIS maps utilizing public values a weighting factors, became a literal interpretation of community values for the land. The areas most sensitive to development (Resource Priority Map) were defined using community values derived from a general public survey. Needed public services and their relative importance were defined using public values from neighborhood workshops and then combined (Public Services Proximity Map) to depict areas were development could occur with the least fiscal impact on local citizens. The combination of the Resource Priority Map and the Public Services Proximity Map yielded a map depicting locations that development could occur in a manner that minimized the impact on important natural and cultural resources, while simultaneously maximizing the availability of public services and infrastructure.



WEDNESDAY

TRACK II

URBAN/NEW TECHNOLOGY TRACK (UNT)

UNT-1
GIS ADVOCATE FOR COMMUNITY VALUES , CASE STUDY FLATHEAD VALLEY MONTANA
STEVE MULLEN, DESIGN WORKSHOP

This abstract is not available at this time.

UNT-2
GIS AND WILDFIRE AT THE INTERFACE -- THE MISSOULA COUNTY PROJECT
KELLY CLOSE, SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA

Every year, hundreds of homes are destroyed or damaged by wildfires. The "wildland/urban interface" is a critical problem for fire protection needs because of the divergent fire suppression capabilities required to deal simultaneously with structure fires and wildland fires. This problem, while not a new one, is an ever-increasing thread in Missoula County.
This project uses a GIS to perform spatial rist and hazard analysis of "interface" areas. High-priority zones areas are being delineated and characterized based on the interrelationship of topography and vegetation, fire occurrence, characteristics of wildland and structural fire protection jurisdictions, road locations and types, and demographic information. The analysis is being performed at two levels of resolution--a "broad-brush" assessment of the entire county and a detailed evaluation of a single drainage, the Rattlesnake Valley, near Missoula. Current and potential problem areas have been identified and characterized, focusing on spatial risk, hazard analysis, fire protection systems, and hazard mitigation needs.
Used as a baseline for pre-suppression and prevention planning, the results of this analysis will potentially help local fire managers reduce the occurrence and intensity of wildfires by targeting specific areas for fire prevention and hazard mitigation programs, and by facilitating effective contingency planning for initial response to wildland/urban interface fires.

UNT-3

GIS IN RURAL PLANNING

KEN WALL, GEODATA SERVICES INC., AND PAT O'HERREN, RURAL PLANNER, MISSOULA COUNTY

This paper describes a unique use of GIS to assist the County Commissioners in Missoula and their staff in assessing the natural and cultural resources in the county and analyzing the carrying capacity of growth and development on several resources in the county. The Missoula County rural planning office contracted with a Missoula GIS Consulting firm to develop a 55 layer digital data set composed of public domain data such as digital elevation models, roads, trails, hydrography and powerlines, combined with natural resource layers for big game, threatened and endangered and other sensitive species, soil conservation concerns, educational and recreational resources, census data and county surveyors plat maps of land ownership and subdivisions. The County also contracted with the Montana Gap Analysis Project do derive a vegetative land cover map for the county from satellite imagery to be combined with the other map layers. Coupled with a user friendly map viewing package, the multiple resource overlays provide county planners with a powerful map overlay and query capability for current and future planning efforts.

Ken Wall will describe the development of the digital data and summarize the subsequent GIS analysis that was requested by county planners to assist in developing their carrying capacity regulations. These include complex overlays, corridor and riparian analysis, line of sight and viewshed mapping, demographic projections, modeling of areas with high growth potential and impact of urban development on sensitive plant and animal species.

We will also give a live demonstration of the ways that planners can use the system to provide site specific resource checklists, resource reports and maps to assist developers on identifying the advantages of some areas for development and the potential problems with others.

UNT-4

GIS LANDBASE CONSTRUCTION

DANIEL ROSS, ADR

This abstract is unavailable at this time.

THURSDAY
TRACK I

NRT-6

MAPPING MONTANA'S PRIVATE FOREST LANDS WITH GIS

KEN WALL, UNIVERSITY OF MONTANA

In 1991 the Montana Legislature passed HB 340 mandating a new method of taxing private forest lands, switching from a system based on timber stand inventories to one based on estimating potential forest productivity. In the fall of 1991, the Montana Department of Revenue contracted with the University of Montana School of Forestry to develop a methodology to inventory and map the potential forest productivity for forest lands. This describes the GIS methods used in the School's two and a half year effort culminating this spring with the plotting of approximately 3,500 township maps for private forest lands throughout the state. This project represents the most extensive GIS project ever undertaken in Montana. It involved natural resource modeling of soil, climate and elevation parameters to predict forest productivity, and satellite image analysis to identify and map existing forest and non-forest vegetation cover. Project staff were also responsible for compiling and edgematching several statewide digital cartographic data sets from several state and federal agencies including roads, hydrography and the public land survey system. Ken Wall will represent the 20 staff members at the University who contributed to this project. He will summarize the data derived during the project that is now available in the public domain. He will also provide tips and insights gathered in the process of putting together geographically extensive digital data sets from multiple sources. Arc/Info and Pamap macros and techniques used during the project will also be summarized.

NRT-7

USING GIS FOR SUPPORT OF TIMBER SALES EFFECTS ANALYSIS

DONNA LEEPER, DIVISION OF FORESTRY, MT DEPT. OF STATE LANDS

Montana Department of State Lands has been using GIS in it timber management program for the last three years. In addition to keeping inventory records on availability and condition of existing timber, we have recently began to use GIS technology in a supporting role in the Environmental Assessment process. Currently we are using our system for such diverse types of analyses as wildlife effects, watershed cumulative effects assessments, viewshed and growth management. GIS produced data for wildlife analysis have included : proportion of habitat available for seasonal use by grizzly bears, acreage of foraging habitat in a given study area, location of travel corridors for large game animals, amount and location of thermal and hiding cover, road density estimates, and locations of species of special concern. Information compiled for watershed analysis have included: location and extent of timber harvest by harvest method within a given watershed and road location by land type and precipitation zone. This information was provided in a format compatible with the watershed model. GIS output is commonly presented in either table form or in full-color map format. Field personnel and resource specialists can easily interpret the results for use in their analyses. Evaluation of alternatives is more efficient and simplified due to ease of data manipulation. GIS products are also used as visual aids at public meetings and legal proceedings.

NRT-8

APPLYING GIS TO A FOREST-WIDE OIL AND GAS LEASING EIS

LOREN IVERSON, BEAVERHEAD NATIONAL FOREST

The Beaverhead National Forest began a forest-wide Oil and Gas Leasing EIS in fiscal year 1993. Because of the requirement to analyze several different leasing stipulations on such a large area, approximately 2.25 million acres, the forest determined that utilizing GIS technology was essential to efficiently evaluate the EIS's alternatives. However, when the project started the forest had only limited coverage from existing GIS data. So before any alternative leasing stipulations could be analyzed the forest had to acquire the GIS data for the layers of information needed in the analyses. This presentation will cover how the forest identified the required GIS data and organized to develop or acquire the data. It will also discuss the GIS systems used for specific phases of GIS development. The majority of the presentation will focus on how the GIS system was used to evaluate alternative leasing proposals and the problems and "lessons learned" encountered during the project.

NRT-9

AN EVALUATION NDVI FOR MONITORING VEGETATION MOISTURE: FIELD APPLICATION OF LARGE SCALE IMAGERY

COLIN C. HARDY, ROBERT E. BURGAN, USDA FOREST SERVICE
DAVID DELSORDO, MICHAEL D. SWEET, UNIVERSITY OF MONTANA
CODY A. BENKELMAN, POSITIVE SYSTEMS, INC.

The first phase of a two year evaluation of the use of Normalized Difference Vegetation Index (NDVI) for monitoring changes in live vegetation moisture is presented. We hope to use AVHRR spectral data to develop and implement a dynamic, national fuels map in support of new generation fire danger and fire behavior models. However, the 2 km scale resolution of the AVHRR precludes field verification of changes in vegetation moisture. Therefore, live vegetation moisture was sampled on three vegetation complexes simultaneously with deployment of a 0.5 meter resolution multispectral imaging system on a fixed-wing aircraft. Data evaluation for this first phase has allowed us to describe an appropriate, effective study design for the second phase.

NRT-10

REMOTE SENSING UTILIZED TO MONITOR FORESTS AND FOREST FIRE POTENTIAL

DALE R. JOHNSON, POSITIVE SYSTEMS INC.

General Forestry Applications: Judging the health and productivity of public and private forest land has been on going since the beginning of mankind's use of timber products. In recent times, foresters and ecologists have turned to remote sensing tools to help judge the various productivity issues associated with the forest environment. Positive Systems' Airborne Data Acquisition and Registration (ADAR) System has performed many different types of remote sensing applications for various public agencies and private timber companies. The first half of this paper will address the image collection technology as well as and example of analysis performed on the imagery.
The second half of the paper will discuss a case study using various types of remote sensing technology to help develop a "Wildland Fire Assessment System".

NRT-11

LANDSCAPE ASSESSMENT OF THE DECLINE OF WHITEBARK PINE IN THE BOB MARSHALL WILDERNESS COMPLEX, MONTANA, USA

ROBERT E. KEANE, BOB MARSHALL WILDERNESS COMPLEX

Whitebark pine (Pinus albicaulis) provides important food for wildlife and important cover for snow retention and watershed protection in high-elevation ecosystems of the northwestern United States. In the northern Rocky Mountains, this species being reduced at accelerated rates by blister rust (Cronartium ribicola), mountain pine beetle (Dentroctonous ponderosae), and advancing succession resulting from fire exclusion. This study evaluates the extent and severity of the decline of whitebark pine in the Bob Marshall Wilderness Complex (BMWC) of Montana. Results of an extensive field survey of various whitebark pine communities were used to evaluate past and current whitebark pine population levels. Satellite imagery (LANDSAT TM) data were classified with the field data to map 14 BMWC subalpine cover types and to detect extent of whitebark mortality in the study area. Results indicate whitebark pine population levels are rapidly decreasing, mostly as a result of the exotic disease blister rust. Field results show 83% of the 2503 sampled whitebark pine trees are infected with blister rust and an average of 33% of their crowns have been killed by the disease. Results of the satellite image classification show whitebark pine dominant on 43% of the 310,844 hectares compromising the BMWC subalpine analysis area. Subalpine fir dominated a high proportion (13%) of this landscape, about 7% greater than its historical landscape composition. Approximately 29% of this landscape containing whitebark pine is now experiencing high mortality and 36% is experiencing moderate mortality. Classification accuracy was 60% for the vegetation cover types and 78% for the mortality classes.

NRT-12

MODELING WILDLIFE HABITATS ON THE FLATHEAD NATIONAL FOREST, MONTANA

NANCY M. WARREN, WILDLIFE BIOLOGIST, FLATHEAD NATIONAL FOREST

A Geographic Information System is being used to model habitat for a variety of wildlife species. The process of creating habitat maps involves four steps: (1) review and synthesis of literature, to identify important habitat parameters and criteria used to define suitability; (2) review and updating of available GIS map layers to verify their acceptability for modeling; (3) developing and documenting specific procedures used to create the modeled habitat layer; and (4) assessing the correlation between predicted habitat and actual records of wildlife observations. Examples of habitat maps for grizzly bear, fisher, and boreal owl are shown for the Swan Valley portion of the Flathead National Forest.

NRT-13

USING GIS TO MODEL SPATIAL AND TEMPORAL PATTERNS

RICK MACE, MT DEPT. OF FISH WILDLIFE AND PARKS

Many research and management programs concerning wildlife habitat selection in mountainous terrain ignore snow pack as a variable affecting seasonal availability of covertypes for animals who forage on green vegetation. For example, habitat groups depicted on GIS maps are often considered usable in the early spring even though vegetative food plants may be 15 ft. under snow. A long term study of grizzly bear habitat selection in the Swan Mountains of Montana has demonstrated the need to assess annual patterns of snow melt for this species. Using multiple GIS map layers in conjunction with photographic interpretation points, I describe a preliminary modeling process to build a single map which estimates the spacial and temporal (weekly) patterns of snow melt in rugged topography over large analysis areas.

NRT-14

PHANTOM FORESTS REVISITED

JIRI DOSKOCIL, UNIVERSITY OF MONTANA AND THE ECOLOGY CENTER

This study is tracing steps in the forest planning process on the Kootenai National Forest (KNF) with a particular focus on timber inventory used in generation FORPLAN models. The Yaak EIS decision area has been selected for this study because of available information and the feasible amount of work involved. Up-to-date TSMRS data and habitat type maps have been used to recalculate the inventory to one point in time (1973) and characterize stands with missing information. Management activity data and LANDSAT imagery was also used to account for timber harvest over time. All steps in data grouping used in generating FORPLAN matrices were simulated as closely as possible. Calculations of timber volumes and acreage were followed through time for several alternative scenarios focussing on key dates in the planning process, (1973-original inventory, 1980-beginning of planning process, 1987-publications of the forest plan). Comparing our results with forest plan documents illustrates the most probable series of decisions leading to a final formulation of FORPLAN model and calculation of the ASQ.

NRT-15

FOREST ROAD SYSTEMS INVENTORIES

THOMAS PLATT, THE ECOLOGY CENTER

In order to assess the accuracy and completeness of Forest Service road system inventories in the Kootenai and Idaho Panhandle National Forests, the Ecology Center has compiled a database in PC ARC/INFO of Federal GIS road location data. Using this database and current Road Management System maps, Ecology Center researchers examined current aerial photographs and orthophoto quad maps to annotate the federal RMS maps with road segments not recorded in the federal inventory. With these annotated maps, researchers ground-truthed selected forest areas on the KNF and IPNF to assess the accuracy of the lab annotations, Ecology Center staff added un-inventoried road segments to the existing GIS database and recalculated the forest road densities in the study areas using standard calculation techniques (overall area/density calculations density by Forest Plan Management Area, and the roving window method). Where recalculated densities exceed the maximum permissible under existing federal laws and regulations, managers will be challenged to bring road network densities into compliance with federal laws that direct public land management standards and endangered species protection.

NRT-16

GIS AND THE PROGRESSIVE SOIL SURVEY

TOM POTTER. BOZEMAN SOIL SURVEY, USDA-SCS

In 1990, the Soil Conservation Service in Montana received national funding to begin a pilot project studying the usefulness of a GIS on an on going soil survey. Existing surveys were currently being digitized, but using a GIS to support ongoing field mapping was something new. Gallatin County soil survey, which had been started in 1987, was chosen as the test site. Digital database development began in the summer of 1991. Approximately 2/3 of the country had already been mapped, so there was some catching up to do. Field mapping was being done on 1:24000 aerial photos. These were compiled onto 7.5' orthophotos and digitized using LT-Plus software. USGS 7.5' DLG's were not available for this area, so base maps such as hydrography, transportation, geology and pls were also digitized. Digital data was then exported to GRASS 4.0 for analysis. Some of the projects we've developed include premapping analysis, progress tracking, quality control, and map unit correlation. The ever growing database has resulted in several spin-off projects for other government agencies and local planning boards. In addition, this soil survey should be ready for the printer by the time the soil scientists leave the field, greatly increasing the quality and cutting years off of publication time.

THURSDAY

TRACK II

UNT-5

PREDICTING CONFLICTS BETWEEN LAND USE AND LAND SUITABILITY - RATTLESNAKE VALLEY, MISSOULA, MT

CANDIS A. Van der POEL, LAND USE PLANNING CONSULTANT, MISSOULA,MT

The versatility of raster GIS can help planners forecast future development patterns adjacent to established urban centers (buildout) and evaluate the associated risks. Proposed land development often raises concerns about risks to public health and safety and increased costs to society. These concerns are valid if conflicts are anticipated between projected land use and unsuitable site conditions. Predicting potential conflicts allows the land use planner to direct development to more suitable sites, this reducing risks. Prediction requires comparing projected buildout with an assessment of land suitability. The method described in this presentation was tested in the Rattlesnake Valley, an expanding neighborhood along the northeast edge of Missoula, Montana. A raster-based GIS was used to model buildout, based on existing land use controls and relative building costs, to establish development potential. The model was cross-tabulated with a raster image of suitability ranks to determine the degree and location of potential conflicts. Criteria for suitability analysis were based on residential building requirements. The results supported recommendations for more land-sensitive development guidelines and regulations. The buildout model and suitability analysis can be performed independently and used separately for developing comprehensive plans, capital improvements plans, or resource protection policies. Criteria used to model buildout, and attribute data required for suitability analysis can be readily adapted to local conditions.

UNT-6

FLATHEAD COUNTY GIS: UTILIZING INTER-GOVERNMENTAL COOPERATION

RICK BRECKENRIDGE, FLARHEAD COUNTY GIS SPECIALIST

The Flathead County GIS program has adopted a unique approach in building the county wide (5,137 sq. miles) base map. Incorporating elements from all strata of government has reduced duplication of efforts which then best utilizes limited available resources. The Geographic Coordinate Data Base Measurement Management (GMM) programs developed by the Bureau of Land Management and the University of Maine along with land data information maintained by the Montana Department of Revenue has created a sling-shot effect which has propelled this project from theory into a useable and expanding operation with real time results and applications.

UNT-7

USING GIS WHEN YOU ARE NOT A GIS EXPERT: TIPS FROM THE WATER INFORMATION SYSTEM

VAL JAFFE, WATER INFORMATION SPECIALIST

How to produce basic maps using GIS when you are not a GIS Specialist, but know enough about computers and programming to be dangerous. A light-hearted and anecdotal approach to a potentially time-consuming and expensive endeavor. First-hand experiences from the Water Information System, NRIS.

UNT-8

NEW SPATIAL INTERPOLATION METHODS

JOHN P. WILSON, DEPARTMENT OF EARTH SCIENCES, MT STATE UNIVERSITY, BOZEMAN, MT

Many environmental management and hydrologic modeling applications require spatially variable inputs across data sparse regions. However, there are significant problems concerned with scale and spatial interpolation in applying distributed parameter, physically-based hydrologic models at the hillslope and catchment scale. This presentation describes some of the new techniques that have been proposed by Moore and Hutchinson (1992) for characterizing the spatial variability of selected terrain and climate variable. These methods have been applied in Montana to interpolate (1) gird-DEMs from scattered GPS surface-specific point elevation data and stream lines in selected farm fields, and (2) mean annual values of precipitation across the Billings and Bozeman 1 and 2 degree topographic quadrangles for the period 1961-1990. The DEM work uses the ANUDEM and TAPES software packages and the climate modeling work uses the ANUSPLIN software package. ANUDEM and TAPES incorporate methods based on the geomorphology of natural landscapes and they demonstrate how the incorporation of some elementary physical principles can produce improved spatially interpolated DEMs. ANUDEM will be available in the next release of ARC/INFO and is particularly innovative in that it includes a drainage enforcement algorithm that ensures fidelity with the stream network. The ANUSPLIN output is favorable compared to hand-contoured maps of mean annual precipitation prepared by Farnes for the same period. The success of this climate interpolation technique is due primarily to its incorporation of significant dependencies of the interpolated climate variables on elevation.

UNT-9

AN INTRODUCTION TO THE NATIONAL GEOSPATIAL DATA CLEARINGHOUSE

GARY CHAPEL, FEDERAL GEOGRAPHIC DATA COMMITTEE, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA

The Federal Geographic Data Committee is sponsoring development of a "National Geospatial Data Clearinghouse" to offer improved means to find and obtain geospatial data contributed by government agencies (Federal, State, and Local), academic, and the private sector. As a major component of the National Spatial Data Infrastructure (NSDI), the Clearinghouse is envisioned as an on-line, distributed information resource for data documentation, search, query, and access. Contributors to the Clearinghouse document data holdings using the FGDC-endorsed Metadata Standard, while users of the Clearinghouse conduct electronic searches and register requirements for data via the Internet.

This session will provide and overview of the NSDI and the Clearinghouse, the use of the Metadata Standard, how to establish a Clearinghouse "mode" on the Internet, and the use of network information discovery tools, such as WAIS (Wide Area Information servers) and WorldWideWeb/Mosaic. In addition, the session will provide a perspective on the ways the NSDI and the Clearinghouse will affect GIS projects in the state of Montana as well as describe the plans in Montana for implementing Montana's portion of the Clearinghouse.

UNT-10

FOREST SERVICE PROJECT 615 PROCUREMENT

BILL TANKE, USFS, REGION 1, MISSOULA

Project 615 is the name given to the Forest Service procurement for computing hardware and software which will replace the current Data General MV series distributing processing system. The initial procurement under Project 615 includes three major areas of functionality: office automation technology,a relational database management system and a geographic information system.
Approval for the procurement of an Agency-wide GIS was given in 1988 by the Chief and Staff of the Forest Service - out of this approval come Project 615. The end of the procurement process is now in sight but it has been a long and at time frustrating process which included the writing of much documentation, Departmental and Congressional reviews, agreements and approvals, the review of vendor offers and live test demonstrations.
The implementation of Project 615 technology will be a major undertaking for the Forest Service and will significantly increase the Agencies ability to manage, process and analyze geographic and non-geographic information. This technological change will contribute to the overall environment of change occurring in the Forest Service. It provides an opportunity to help facilitate the more fundamental changes occurring in land and natural resource management by aligning the information systems to more closely match new ways of doing business.

UNT-11

BOB LAPEDUS, USGS

This abstract is not available at this time.

UNT-12

WHAT YOU NEED TO KNOW ABOUT MAP PROJECTIONS

GERRY DAUMILLER, NRIS, MONTANA STATE LIBRARY

Most people have heard that it is impossible to represent the curved surface or the earth accurately on a flat map. This fact has implications that users of Geographic Information Systems should be aware of. This paper will briefly explain what a map projection is, discuss the types of error that different map projections introduce on global, nationwide, and statewide maps and databases, and explain how to determine what the error is in the map projection you are using.

UNT-13

GEOGRAPHIC INFORMATION SYSTEMS APPLIED TO SLOPE STABILITY ANALYSIS, YELLOWSTONE COUNTY, MONTANA

E.J. DEYOUNG, MONTANA STATE UNIVERSITY

Slope stability modeling has relied on material strength rather than discontinuity orientation for slope failure prediction. In contrast the most significant factor in rock slope stability is the nature of discontinuities (Selby M.J., 1980). A GIS grid of bedrock structure enables incorporation of discontinuity orientation for comparison with topography as well as material properties to predict slope stability hazard.

Discontinuity orientation and slope stability in Yellowstone County, was rated as having moderate landslide hazard in the MT Dept. of Military Affairs Hazard and Vulnerability Analysis (Mills R.L., 1987); yet there are over 200 mapped slope failures.

Slope failure is predicted to be most likely where many planar discontinuities are orientated similar to the slope aspect are similar,just over 50 percent of the area, in the initial surface-discontinuity grid comparison, showed discontinuity dip (D.D.) equivalent or greater than the slope gradient.

Preliminary results in Yellowstone County indicate 22% of the land area meets the slope and discontinuity criteria. Further analysis continues to determine the effect of material properties and correlation with mapped landslides.

UNT-14

MAPPING USING DATA DICTIONARIES WITH MULTIPLE ATTRIBUTES

MARY T. MANYDEEDS, HYDROLOGIST, BIA-BILLINGS, BRANCH OF WATER RESOURCES

The Bureau of Indian Affairs (BIA), Billings Area Water Resources Office, plays a major role in providing technical assistance on Montana and Wyoming's Indian Reservations with both the water resource management and the irrigation systems. The BIA is inventorying irrigation systems starting with a pilot project on the Wind River Indian Reservation. Phase one of this pilot project data was data collection/input. The method of data collection involved using a GPS package called PathFinder Professional System with PATHLOG from Trimble Navigation. Collected were Line feature data describing the type and condition of specific irrigation ditches, the amount of vegetation along the ditches, and a identifying name for the ditches. There were also Point feature data describing irrigation structures along each ditch, the condition of the structures, and other data that might be of immediate use to engineers working on the project. ARC/INFO is used for the database destination and future data input. One goal has been to create a standard data dictionary for use by other BIA Irrigation Projects. Over an eight month period of collecting, correcting and converting data, the BIA has devised what we believe is an efficient data dictionary. This dat dictionary allows for the collection of multiple feature attributes. Problems encountered with data conversion to ARC/INFO were normally related to the data dictionary setup program and to the dictionary created for this job. This talk will highlight: 1) how the data dictionary was tailored to achieve our goal, and 2) some problems with solutions on using the PFinder data dictionary.

UNT-15

COMPREHENSIVE GIS DATABASE FOR THE ROCK CREEK DRAINAGE

WILLIAM HASKINS, THE ECOLOGY CENTER

The Rock Creek drainage in southwest Montana contains the state's only designated Blue Ribbon trout stream west of the Continental Divide. This relatively pristine drainage includes the Welcome Creek Wilderness and parts of the Anaconda Pintler Wilderness, as well as the Quigg Peak and Stony Creek Roadless Areas. In response to tremendous interest in protecting the area's unique values and uncertainly about whether current Forest Plans offer adequate protection of these values, the Forest Service has suspended building new roads and delayed consideration of new timber sales until a comprehensive, drainage-wide analysis can be completed. Using information supplied by the Forest Service, the Ecology Center has developed a comprehensive GIS database that will facilitate accurate depiction of current conditions and allow drainage-wide analysis and planning. Layers in the database include mineral potential, past timber cutting activity, land types, habitat type, grazing allotments, hydrography, roads, trails, management area designations, and old growth stands. These layers will be added to the following layers complied by the Montana Department of Natural Resources and Conservation: base contours, water rights/diversions, water quality monitoring sites, permitted mining, subdivisions, septic systems and historic sites.

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