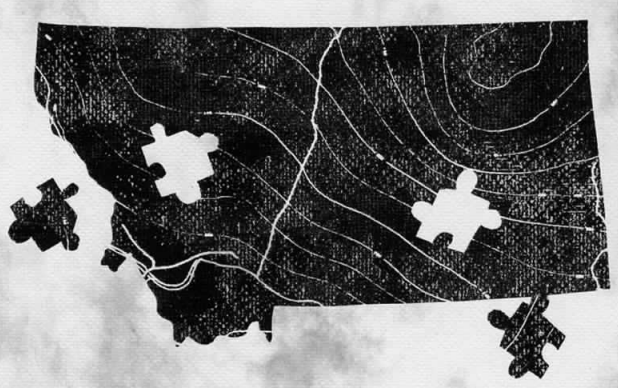
CONFERENCE PROGRAM

MONTANA GIS:

TOOLS FOR ANALYSIS AND MANAGEMENT

FIFTH ANNUAL MONTANA GIS CONFERENCE



COPPER KING INN

BUTTE, MONTANA

NOVEMBER 30 - DECEMBER 2, 1992

1992 Montana GIS Conference

Planning Committee

Conference Chair:
Stewart Kirkpatrick, Butte-Silver Bow Planning Department

Conference Vice-Chairs:
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Sharon Burt, Montana Bureau of Mines and Geology/Montana Tech

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Don Cromer, Montana Department of Transportation
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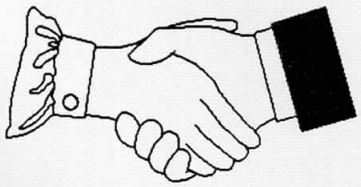
Poster Session Coordinator:
CloAnn Villegas, Confederated Salish and Kootenai Tribes

Special Interest Groups (SIG) Coordinator:
Mary Jo Smith, Bozeman, MT

Other Committee Members:
Dale Johnson, Positive Systems, Inc.
Dan Olson, Information Systems, Inc.
Ken Wall, University of Montana, Forestry School
John Wilson, Montana State University, Earth Sciences Department
Allan Cox, NRIS, Montana State Library

Special Thanks: *The Planning Committee wishes to thank* ***Debbie Alt from the Butte Planning Department*** *for her administrative and logistical support,* ***Pam Smith, NRIS,*** *for preparing the Conference Program, and* ***Elaine Locati,*** *for the art work for conference materials.*

The Montana GIS Users' Group also expresses appreciation to ***GGI, Inc. and Electronic Data Solutions*** *for their generous contribution to help pay for the food during our Tuesday evening social.*



Welcome

to the

1992 Montana GIS Conference: Tools for Analysis and Management

Without question, GIS use in Montana is expanding, both in project purpose and level of sophistication. Statewide, there are dozens of applications where project managers rely on the vast array of GIS tools to solve spatial problems.

All Montana GIS conferences are sponsored by the **Montana GIS Users' Group, Inc.**, a statewide consortium of government agencies and businesses involved with GIS technology. Serving as hosts for this year's conference are the **Butte-Silver Bow County Government**, the **Montana Bureau of Mines and Geology**, and the **Montana College of Mineral Science and Technology.**

The themes of past conferences reflect the evolution of GIS work in Montana: In Helena (1988) -- What is GIS? In Billings (1989) -- What Are Montanans doing with GIS? In Missoula (1990) -- Toward A Better Understanding. In Bozeman (1991) -- From Plans To Practice.

This year in Butte, presentations will focus on the specifics of **how** GIS applications are being implemented. For GIS veterans and new users alike, the experiences conveyed can provide valuable guidance in deciding when and how to apply GIS to your work.

The keynote speech, *GIS & Infrastructure: Seas of Change*, will be delivered by Nancy Tosta, Chief of the Branch of Geographic Data Coordination of the National Mapping Division, U.S. Geological Survey, Reston, Virginia. Ms. Tosta is currently working with all 50 states on a variety of initiatives that hold great promise to increase the utility of GIS for all of us.

Another 36 presentations have been arranged into a panel discussion and three concurrent session tracks. This year, concurrent tracks have been grouped by topic: Natural Resource Applications, Urban Applications, and a special 'New Technology' track. Be sure to review the abstracts to determine which sessions best match your diverse interests.

The conference also features several commercial **Exhibits** of GIS-related products and services, a **Poster** competition (all posters will be judged by a panel of experts), and of course, our annual **Evening Social**, to give everyone a chance to meet the non-GIS side of all of us.

The Conference Planning Committee has designed an exciting program. We hope you enjoy it and look forward to your participation!

MONDAY, November 30, 1992

PRECONFERENCE WORKSHOPS	
8:00-5:00	*Land Management Planning* Mark Tepley, VESTRA Resources, Inc. ANESLMO ROOM
9:00-4:30	*Introduction to GIS: Basic Concepts* Allan Cox, Montana State Library BADGER ROOM
8:00-12:00	*Cartography and GIS* Dr. Lawrence Carstensen, Virginia Polytechnic Institute and State University MT. CON ROOM
1:00-5:00	*Global Positioning Systems and GIS* Tom Lyman, GeoResearch, Inc. MT. CON ROOM
8:00-12:00	*Terrain Analysis and GIS* Michael Blongewicz, ESRI Olympia; Janell Jersey and Dr. John Wilson, Montana State University; and Douglas Written, Advanced Data Concepts ORPHAN GIRL ROOM
1:00-5:00	*Remote Sensing and GIS* Cody Benkelmen and Ron Behrendt, Positive Systems; and Janell Jersey and Dr. John Wilson, Montana State University ORPHAN GIRL ROOM
7:00-9:00	COMMERCIAL EXHIBITS OPEN
7:00-9:00	GIS PUBLIC NIGHT - BALLROOM Workshop - *What is GIS*, 7:00 - 7:30 - NO NAME/KELLEY ROOM

TUESDAY, December 1, 1992

7:30-8:30	**CONTINENTAL BREAKFAST** (Included in registration fee)		- **FOYER ADJACENT TO BALLROOM**
8:30-10:00	**WELCOME:** **Jon C. Sesso, Butte-Silver Bow Planning Department** **KEYNOTE ADDRESS:** *GIS & Infrastructure: Seas of Change* **Nancy Tosta**		- **BALLROOM**
ALL DAY	**COMMERCIAL EXHIBITS OPEN**		- **BALLROOM**
	NATURAL RESOURCES TRACK **ANSELMO/BADGER ROOM**	**NEW TECHNOLOGY TRACK** **NO NAME/KELLEY ROOM**	**URBAN APPLICATIONS TRACK** **ORPHAN GIRL/MT. CON ROOM**
	Cathy Maynard - MODERATOR	**Dean Chaussee - MODERATOR**	**Stewart Kirkpatrick - MODERATOR**
10:30-11:00	NRT-1/ *Timber Availability Study* Fred D. Hodgeboom	NTT-1/ *GIS as a Management Tool for a Major Pipeline* Doug Clark	UAT-1/ *CAD-GIS Issues* H.E.Wilkerson
11:00-11:30	NRT-2/ *Post Processing Natural Resource Data from GIS to Plan Timber Harvest* Frederick T. Bower	NTT-2/ *GIS Applications for Technology Transfer and Precision Farming* Gerald A. Nielsen	UAT-2/ *Developing the GIS-911 Link in Ada County, ID* Andy Little
11:30-12:00	NRT-3/ *Mineral Inventory and Availability Studies in Montana* Paul Hyndman	NTT-3/ *Using a Combination of GPS and GIS to Map the Oakland Fire* Don Cromer	UAT-3/ *GIS and Public Safety* Tom Wallace
12:00-1:00	**LUNCH BREAK** (Included in registration fee)		
	Kristina Sacks - MODERATOR	**Dan Olsen - MODERATOR**	**Chuck Cmeyla - MODERATOR**
1:30-2:00	NRT-4/ *Spatial Analysis of the Relationships Between Rangeland Grasshopper Densities and Vegetation* Maria Marta Cigliano, et.al.	NTT-4/ *Automated Mapping Using GPS and GIS for Vegetative and Habitat-Type Mapping* Doug Richardson	UAT-4/ *The Use of Digital Orthophotography for Declination of Impervious Surfaces and Generation of Stormwater Billing* David Ward
2:00-2:30	NRT-5/ *Using Remote Sensing and GIS to Classify and Map Existing Vegetation in Montana* Roland L. Redmond, et.al.	NTT-5/ *Developing Geographic Data Bases and Information Systems* Lee W. Aggers	UAT-5/ *Land Records Modernization for Butte-Silver Bow County, Montana* Dawn Garrett
2:30-3:00	NRT-6/ *Mapping the Understory on a Timbered Big Game Winter Range* David DelSordo	NTT-6/ *Using GIS Graphics as a Convincing Project Proposal Tool* Richard Platt	UAT-6/ *County Redistricting with GIS: The Case of Big Horn County* Kenneth L. Weaver
	Duane Lund - MODERATOR	**Gerry Daumiller - MODERATOR**	**Dawn Garrett - MODERATOR**
3:30-4:00	NRT-7/ *GIS - Assisted Visual Analysis in Kootenai Country* Nancy K. Johnson	NTT-7/ *GIS Applications for Weed Control and Groundwater Protection* John P. Wilson	UAT-7/ *Beyond Mapping and Data Retrieval: GIS Applications in Urban Socioeconomic Systems* Jim Williams
4:00-4:30	NRT-8/ *GPS Collection of Digital Information for USDA Forest Service Fire Mapping and Forest GIS Users* Ronald A. Pearson	NTT-8/ *High Resolution Multispectral Image Data: Accuracies and Applications* Ron H. Behrendt	UAT-8/ *A Broader Application: local government tool* Monty Sealey
4:30-5:00	NRT-9/ *GPS Data Collection for Remote Natural Resource Applications* Mike Caprata	NTT-9/ *GPS/GIS Field Mapping Techniques Utilizing Integrated Laser Rangefinder Technology* Darrell Peterson	UAT-9/ *Implementing an AM/FM/GIS Project: Benefits, Trends, Life Cycle* Chuck Cmeyla
6:00-8:00	Poster Session - No Host Bar - Hors d'oeuvres provided by **GGI, Inc.** and **Electronic Data Solutions**		

WEDNESDAY, December 2, 1992

7:30-8:30	**CONTINENTAL BREAKFAST** (Included in registration fee) - **FOYER ADJACENT TO BALLROOM**		
8:30-10:00	**CONFERENCE ANNOUNCEMENTS** - **BALLROOM** **PANEL DISCUSSION:** *GIS Data Access Issues* **Allan Cox - MODERATOR** - George Ochenski, Natural Resource Lobbyist and Consultant; Bob Person, Executive Director, Legislative Council; Ray Hoem, Data Administrator, BLM		
10:30-3:00	**COMMERCIAL EXHIBITS OPEN**		
	NATURAL RESOURCES TRACK ANSELMO/BADGER ROOM	**NEW TECHNOLOGY TRACK** NO NAME/KELLEY ROOM	**URBAN APPLICATIONS TRACK** ORPHAN GIRL/MT. CON ROOM
	Jim Stimson - MODERATOR	**Regina Cromer - MODERATOR**	**Janet Cornish - MODERATOR**
10:30-11:00	NRT-10/ *Visualization of Water Information with Arc/Info* John Jarvie	NTT-10/ *Forestry Applications Utilizing High Resolution Multispectral Imagery Collected with the Adar System 5000* Dale R. Johnson	UAT-10/ *Use of Temporal Databases in GIS* Fred Gifford
11:00-11:30	NRT-11/ *Converting Legal Land Descriptions Into Coordinate System Features* Craig Bacino	NTT-11/ *Quantitative Geomorphological Models in GIS* Henry Shovic	UAT-11/ *1990 Census Data for GIS* Gerry Daumiller and Patricia Roberts
11:30-12:00	NRT-12/ *Analysis of Bull Trout Distribution and Determination of Protected Areas for Wildlife Species in Western Montana Using GIS Technology* Janet Decker-Hess and Gael N. Bissel	NTT-12/ *Systems Integration and Application* Richard Platt	
12:00-	Conference Business Luncheon Meeting (included in registration fee)		

December 3-5, 1992

POST-CONFERENCE WORKSHOP

Introduction to PC ARC/INFO

MSU Geographic Information and Analysis Center, 8:30 am to 5:00 pm, 3-5Dec., $495. For new or potential PC ARC/INFO users who have little or no experience with the software and who want to quickly obtain a basic knowledge of PC ARC/INFO in order to start building a successful GIS application. Sponsored by MSU Office of Extended Studies. See separate flyer for more registration details. Instructor: Dr. John P. Wilson, Montana State University.

ABSTRACTS

Abstracts are grouped according to Track

PUBLIC NIGHT (Monday, 7pm)

A public night will be held again this year in conjunction with the GIS conference. The event is scheduled for Monday, November 30, from 7:00 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 half-hour lecture by Allan Cox, Director of the Natural Resource Information System "What is 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. Computers will also be provided for the public to see and use. There will be information available on the census data, toxic waste sites, water rights, habitat protection, urban applications, and forest taxation to name a few applications.

GIS Public Night is being presented by the Montana GIS User 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 (Tuesday, 9am)

GIS AND INFRASTRUCTURE: SEAS OF CHANGE
Nancy Tosta, Chief, Branch of Geographic Data Coordination, USGS

The evolution of GIS technologies is forcing change in the way we think about our "infrastructures". Our organizational infrastructures are changing as new technology tools are introduced into our agencies. We are thinking differently about our physical infrastructures such as roads and pipelines as we construct large, automated data bases related to them. And our concepts of ourselves as nodes in a human/community infrastructure are evolving as we become connected via electronic networks and as we enter into new kinds of agreements to exchange and develop spatial data. We need to better understand our roles and the local-global interactions in the infrastructures. This presentation will address these issues.

PANEL DISCUSSION (Wednesday, 9am)

GIS DATA ISSUES

Moderator: Allan Cox, NRIS Director, Montana State Library
Panelists: Robert Person, Executive Director, Legislative Council; Ray Hoem, Data Administrator, BLM; George Ochenski, Natural Resource Lobbyist and Consultant

Knowing your rights and responsibilities for gaining and providing access to information is a continually changing responsibility of vital importance to GIS practitioners.

This session is a panel presentation and discussion on issues related to GIS data access. The panelists will provide information on freedom of information laws and how they affect GIS data sharing. Specifically this panel will address how the Electronic information-public access law (MCA 2-6-110) enacted by the 1991 Montana legislature affects GIS data sharing.

NATURAL RESOURCE TRACK (NRT)

NRT-1.
TIMBER AVAILABILITY STUDY
Fred D. Hodgeboom, Planning Forester, Flathead National Forest

Geographic Information Systems (GIS), remote sensing, and relational data base technologies are used to quantify timber stands needed for non-timber purposes as specified by standards in the Flathead National Forest Land and Resource Management Plan (LRMP). This project uses a basic classified Landsat vegetation layer in a GIS along with standard stand exam data and topographic and planimetric map data to provide a forest-wide spatial inventory of vegetation. The basic land and vegetation data are then used to provide attribute layers needed to map and analyze various resource standards. Mapped vegetation attributes include forest structure, forest cover type, crown canopy closure, and merchantable volume. Vegetation attribute layers are combined as specified by LRMP wildlife habitat standards to derive maps and reports for forage/cover classes for deer, elk, and grizzly bears, and habitat networks for management indicator species. Existing conditions are compared to the desired future condition specified by individual resource standard and the stands needed to comply with the standard are identified. Stands needed to comply with each successive standard are added to a "no available" layer. Stands are co-located to meet multiple standards to the extend possible. Results of this ongoing study are intended to provide a factual basis to determine if compliance with the LRMP standards makes achievement of the ASQ (allowable sale quantity) feasible.

NRT-2.
POST PROCESSING NATURAL RESOURCE DATA FROM GIS TO PLAN TIMBER HARVEST
Introduction to the Scheduling and Network Analysis Program
Fred Bower, Transportation Analyst, U.S.D.A. Forest Service

Implementing a Forest Plan can be a very complex task. Forest managers must determine the "what", "where", and "when" management activities will occur. The Scheduling and Network Analysis Model (SNAP II) is a microcomputer-based program to assist forest managers in preparing tactical harvest plans that meet wildlife, water quality, and other management objectives. Analysis areas of between 5,000 to 80,000 acres are modeled to generate possible management scenarios, to demonstrate that ecological systems can be sustained, and to perform environmental effects analysis. Natural resource data from the GIS is first used to develop suitability layers for various management activities. Then polygons are developed that would receive uniform treatment. Vegetative and topological data for each of these polygons is imported from the GIS for additional processing. SNAP II utilizes a heuristic to select silvicultural treatments, logging systems, and road access options subject to user defined constraints. Graphics output from solutions can be generated in the program or by exporting the results to the GIS for display.

NRT-3.
MINERAL INVENTORY AND AVAILABILITY STUDIES IN MONTANA
Paul Hyndman, US Bureau of Mines

The U.S. Bureau of Mines is conducting forest-wide mineral inventories in the Beaverhead, Custer, and Gallatin National Forests. The information gathered helps identify the extent and potential of mineral resources. The Bureau is also conducting an inventory of legal and management constraints on the business sector regarding access to the Federal mineral domain. The information from the two inventories provides one view of the "health" of the mineral industry in Montana.

NRT-4.

SPATIAL ANALYSIS OF THE RELATIONSHIPS BETWEEN RANGELAND GRASSHOPPER DENSITIES AND VEGETATION

Maria Marta Cigliano, U.S.D.A. Agricultural Research Service, Rangeland Insect Laboratory, Montana State U.
William P. Kemp, U.S.D.A. Agricultural Research Service, Rangeland Insect Laboratory, Montana State U.
Thomas Kalaris, U.S.D.A. Agricultural Research Service, Rangeland Insect Laboratory, Montana State U.

Host plants may contribute much to grasshopper dynamics through their influence on key population parameters, determining not only the presence of a species in an area, but defining its overall community abundance. A study was conducted to analyze the spatial variability of adult rangeland grasshopper densities during outbreak years and non-outbreak years for the state of Montana in relation to the general vegetation type. GIS techniques were used to develop outbreak year and non-outbreak year maps and to overlay these with a vegetation type map.

NRT-5.

USING REMOTE SENSING AND A GIS TO CLASSIFY AND MAP EXISTING VEGETATION IN MONTANA

Roland L. Redmond, Zhenkui Ma, and Melissa Hart, Montana Coop. Wildlife Research Unit, U.of Montana
Steven W. Running, Robert D. Pfister, Paul L. Hansen, and Tobin M. Kelley, School of Forestry, U. of Montana
Raymond F. Ford, Jr. and Ronald L. Righter, Department of Computer Science, U. of Montana

As part of the U.S. Fish and Wildlife Service's Gap Analysis Program, we are mapping existing vegetation across the state to identify cover types, and ultimately areas of high animal species richness, that lack adequate protection under current land ownership and management regimes. The vegetation map is being developed from a digital classification of Landsat TM data in a GIS. Statewide, the scale will be 1:100,000, with a minimum mapping unit of 100 ha. The general classification process involves mimicking a false color composite based on TM bands 4,5, and 3 (RGB). Existing vegetation maps, aerial photographs, and ground-truth data are used to label the resulting spectral signatures and to determine the limits of the TM data. To extend these limits and finalize the land cover classification, the spectral data are integrated with ancillary biophysical data (e.g., slope, elevation, aspect, temperature, precipitation) in an expert systems model. Details of the process will be described, along with preliminary results from a 3500 km^2 pilot study area in the Seeley-Swan Valley of western Montana.

NRT-6.

MAPPING THE UNDERSTORY ON A TIMBERED BIG GAME WINTER RANGE

David Delsordo, Research Specialist, School of Forestry, University of Montana

Geographic Information Systems (GIS) are being applied to more and more situations in natural resource management. GIS provides the ability to analyze large amounts of data quickly and in great detail. This project involves mapping the vegetation on the Blackfoot/Clearwater Wildlife Management Area of western Montana.

The Blackfoot/Clearwater is a timbered winter range used by elk, mule deer, and white tailed deer. The study area covers over 10,000 hectares. A scale of 1:24,000 was used for all maps and analyses. The relationship between timber canopy coverage, topography, and the abundance of browse was determined. A model describing this relationship was developed based upon the results of 204 vegetation sample plots. This model and the sample data were used to classify a Landsat Thematic Mapper satellite image. The classified image was imported as a layer into the GIS database. The classified image forms the base map for displaying the distribution and abundance of the various classes of vegetation types in the study area. The range condition for wintering ungulates was determined from these results.

This project demonstrates the application of GIS to the analysis of wildlife habitat. A procedure was developed which efficiently and economically mapped the habitat of the study area. The methods used provided the detail needed to do landscape scale management. Similar methods could be applied to many types of wildlife habitat.

NRT-7.

GIS-ASSISTED VISUAL ANALYSIS IN KOOTENAI COUNTRY

Nancy K. Johnson, Environmental Specialist, Department of Natural Resources and Conservation

A proposed transmission line rebuilt through the scenic Kootenai River canyon west of Libby, Montana necessitated a detailed visual analysis of alternative line locations. While some alternatives were proposed for the floor of the canyon, other alternatives climbed steep mountainsides flanking the canyon to elevations more than 3,000 feet above the valley floor. Visual analysis of proposed alternatives was assisted with a geographic information system through generation of viewsheds, reverse viewsheds, and perspective plots for alternative line locations above the canyon floor.

More that 15 viewsheds - areas seen from any single viewpoint or set of viewpoints - were developed using digital elevation models. Viewsheds were generated for viewer observation points such as lookouts within the Cabinet Mountain Wilderness Area immediately south of the study area, U.S. Highway 2 through the canyon, the area surrounding Kootenai Falls, and Libby. Reverse viewsheds--areas having potential views of project alternatives--were generated by using structure locations on prominent ridgelines and highly visible portions of corridors located on mountainsides as viewpoints. Perspective views that incorporated right-of-way location and width, structure and access road locations and vegetation patterns were used to compare project alternatives on Flagstaff Mountain, a prominent mountain west of Libby. This GIS-assisted analysis allowed a detailed comparison of the potential visibility of alternatives and identification of areas with high and low visual impact for this project.

NRT-8.

GPS COLLECTION OF DIGITAL INFORMATION FOR U.S.D.A. FOREST SERVICE FIRE MAPPING AND FOREST G.I.S. USERS

Ronald A. Pearson, Registered Land Surveyor, Kootenai National Forest, U.S.D.A. Forest Service

The Global Positioning System (GPS) has proven itself as a viable means of obtaining positioning data used to map boundaries and areas of forest wild fires. The GPS system has proven itself as an accurate, time saving method of collecting digital data. This information is used for fire updates, changes in boundaries, area, and other information needed immediately by fire resource teams. The information not only satisfies present fire information needs but also has been successfully transferred to a Geographic Information System (GIS). Forest GIS users display the digital information using SPATIAL. In combining GPS information with Cartographic Feature Files (CFF) forest users display various information layers; DEM contours, drainages, roads, and land ownership. Additional report information has been generated through an analytical program called DWRIS. Reports of acreages by ownership, slope aspects, timber compartments, and information needed for future rehabilitation. It has been demonstrated that GPS is a very powerful tool for digital information data collection. The forest GPS users have in many cases learned new techniques acquiring skills to recognize GPS relationship to GIS and how important the technology development is to the future data base. The intent of this forest is to integrate GPS into the work force through training and hands-on experience. The Kootenai National Forest is actively involved with novice GPS users evaluating new techniques for the collection of data by all resources managers on the forest.

NRT-9

GPS DATA COLLECTION FOR REMOTE NATURAL RESOURCE APPLICATIONS

Michael W. Caprata, Natural Resource Specialist, Bureau of Indian Affairs, Crow Indian Agency

We all saw the Global Positioning System demo. All we had to do was get in a vehicle, turn on the machine, traverse the area and import the file into a Geographic Information System. What do you do when there are no roads and you are expected to go where no man, horse, truck or four wheeler has gone before? Different data collection techniques are discussed for walking to flying with the post-processing problems they generate. The subject sites are a number of areas from 200 to 18,000 acres in size.

NRT-10.

VISUALIZATION OF WATER INFORMATION WITH ARC/INFO

John O. Jarvie, GIS Information Specialist, Montana State Library, Natural Resource Information System

The ARC/INFO (Environmental Systems Research Institute, Inc.) geographic information system software package provides a set of tools for displaying attribute data on base map themes in a variety of ways. These tools can be used to effectively display water resource information to a particular audience. Considerations in the application of these tools are discussed and results of these applications are presented. The applications involve the visualization of water quality data, water quantity data, and drought indices. The visualization methods include shading, variable and constant sized spots, variable and constant sized buffers, line graphs, bar charts, and pie charts.

NRT-11.

CONVERTING LEGAL LAND DESCRIPTIONS INTO COORDINATE SYSTEM FEATURES

Craig C. Bacino, Information Specialist, Reserved Water Rights Compact Commission (RWRCC), Montana Department of Natural Resources and Conservation

The location and extent of features such as land ownership, water rights, and wells, are listed in legal land descriptions of the U. S. Public Land Survey System. This system has been used successfully since its inception in 1785 to locate and plot features with manual cartographic techniques, but it is not well suited to GIS functions. Analyses of existing state water rights data has become crucial to the negotiations of federal reserved water rights. The DNRC maintains a database of state water rights claims information, with locations defined by legal land descriptions. To use this data, RWRCC staff developed a method for converting legal land descriptions of point and areal water rights features into UTM coordinates.

The basis for computing coordinates from legal land descriptions is a relational database file containing coordinates of the southeast corner of townships and the assumption of uniform sections within orthogonal townships. During the evolution of the method, several steps were added to insure orthogonal calculations and to compensate for convergence of meridians towards the poles. The results of the method are GIS point and area feature files and associated attribute files defining the wells, reservoirs, diversions, and places of use of water rights claims. Analyses of the data by attribute and/or spatial location is made possible having converted the data.

NRT-12.

ANALYSIS OF BULL TROUT DISTRIBUTION AND DETERMINATION OF PROTECTED AREAS FOR WILDLIFE SPECIES IN WESTERN MONTANA USING GIS TECHNOLOGY

Janet Decker-Hess and Gael N. Bissell, Montana Rivers Information System, MT. Dept. of Fish, Wildlife and Parks

GIS technology combined with the Interagency Fisheries Data Base is being used to map and analyze historic and present distribution of bull trout in western Montana. Analyses has included population status and current abundance, location of brook trout populations, and identification of natural and artificial barriers that affect movement and introgression. Distribution losses have been quantified; populations at risk to hybridization with brook trout have been determined; and barrier maintenance and removal have been identified. Results are being used to support activities of the Interagency Bull Trout Task Group, a committee from states in the Pacific Northwest formed to determine current bull trout status, limiting factors to the population, and management recommendations.

GIS technology is also being used to track and modify streams listed for wildlife protection under the Northwest Power Planning Council's protected areas program. We buffered western Montana hydrography and overlayed this layer with big game winter ranges and the Heritage Program's element occurrence layers to determine which streams intersect these important wildlife habitats. By comparing this product with streams formerly listed as protected, we identified additional streams which meet protected areas criteria. This system will be used to update and modify the protected areas program over time as well as provide input for other similar applications.

NEW TECHNOLOGY TRACK (NTT)

NTT-1.
GIS AS A MANAGEMENT TOOL FOR A MAJOR PIPELINE
Doug Clark
This abstract is unavailable at this time.

NTT-2.
GIS APPLICATIONS FOR TECHNOLOGY TRANSFER AND PRECISION FARMING
Gerald A. Nielsen, Montana State University, Bozeman

Farming and other land-use enterprises fail when management practices, new technologies or the genetic potentials of crops and livestock are poorly matched with the specific attributes of the land and climate that sustain them. Geographic Information System(GIS) technologies can be used to support better matching and sustainable land use. Precision farming precisely matches fertilizer, seed varieties and other management inputs to land capabilities. Precise matching can provide economic and environmental benefits including ground water protection. this presentation illustrates the Montana State University experience with state-wide technology transfer GIS, on-farm field scale GIS, global positioning system (GPS), remote sensing technologies, and soil/climate databases for precision farming. GPS/GIS based terrain models offer exciting new possibilities for enhanced soil attribute maps and for high precision predictions of soil, microclimate and hydrologic attributes.

NTT-3.
USING A COMBINATION OF GPS AND GIS TO MAP THE OAKLAND FIRE
Don Cromer, Terra West Technology, Inc.

On October 21, 1991 the most devastating fire in U.S. history swept through the Oakland Hills east of San Francisco Bay, ravaging almost 3,000 homes, leaving some 5,000 people homeless and 25 dead. This disaster taxed all the available resources to their limits. Fortunately, officials were able to benefit from accurate, up to the minute assessment of information from data collected with a global positioning system (GPS) pathfinder receiver. The data provided fire fighters with a quick map of the fire area, and later helped expedite damage assessment needed for attaining disaster relief funds. Insurance companies, builders, and the city governments wanted parcel maps with building code attribute data to help them determine whether certain building codes contributed to the disaster. Finally, city, county and state emergency response officials required maps that would allow them to better deploy emergency teams and determine escape routes. The narrow, winding streets in the hills were a major hindrance to firefighters and to those trying to escape the fire. In short, massive amounts of information were required to clear and rebuild the hill area to limit the possibility of such a catastrophe from happening again, and to mitigate the damage if anything comparable does occur.

NTT-4.
AUTOMATED MAPPING USING GPS AND GIS FOR VEGETATIVE AND HABITAT-TYPE MAPPING
Dr. Douglas Richardson, President, GeoResearch, Inc.

This presentation features detailed background on several application examples developed using a GPS (Global Positioning System) based field mapping system to input spatial graphic data and automatically geo-referenced attribute data into GIS for vegetative and habitat-type mapping projects.

GPS/GIS applications featured in the presentation include descriptions of numerous mapping projects for the U.S. Forest Service, habitat-type mapping for the Salish-Kootenai Indian Tribe, and GPS/GIS vegetative and habitat mapping projects conducted for the National Park Service and environmental impact statements.

NTT-5.
DEVELOPING GEOGRAPHIC DATA BASES AND INFORMATION SYSTEMS
Lee W. Aggers, Special Assistant, U.S. Geological Survey, National Mapping Division

In order to meet the increasing number of state and federal needs for spatial data, the National Mapping Division has established a program for "innovative partnerships" that is aimed at utilities and other industries that are preparing digital line graph (DLG) data from USGS 7.5' Quadrangles in support of their own mapping needs. Through this program USGS will enter into partnerships to prepare data to a full DLG. USGS has placed notices in both the Federal Register and the Commerce Business Daily inviting proposals for cooperative DLG production.

The National Mapping Division has also accelerated the completion of the digital production of the 1:100,000 scale maps for the United States. Based on meetings, requests by federal agencies/states and A-16 information, USGS will complete the digital collection of the boundary, Public Land Survey System, and hydrography files by Dec/95.

They have changed the A-16 process to realistically reflect the requirements of the state/federal sector and the production capacity of USGS. Future A-16 activity with the states will not only look at state/federal requirements but examine possible cooperative efforts to meet state/federal needs and potential partnerships.

NTT-6.
USING GIS GRAPHICS AS A CONVINCING PROJECT PROPOSAL TOOL
Richard Platt
This abstract is unavailable at this time

NTT-7.
GIS APPLICATIONS FOR WEED CONTROL AND GROUNDWATER PROTECTION
John P. Wilson, Montana State University

The Chemical Movement through Layered Soils (CMLS) model was modified and combined with the USDA-SCS State Soil Geographic Database (STATSGO) and Montana Agricultural Potentials System (MAPS) digital databases to assess the likelihood of groundwater contamination from selected herbicides in Teton County, Montana. The STATSGO and MAPS databases were overlaid to produce polygons with unique soil and climate characteristics and attribute tables containing only those data needed by the CMLS model. The Weather Generator (WGEN) model was modified and used to generate daily precipitation and evapotranspiration values. A new algorithm was developed to estimate soil carbon as a function of soil depth. The depth of movement of the applied chemicals at the end of the growing season was estimated with CMLS for each of the soil series in the STATSGO soil mapping units and the results were entered into ARC/INFO to produce the final hazard maps showing the best, weighted average, and worst case predictions. County leafy spurge maps were digitized and overlaid in ARC/INFO with the CMLS model results for PICLORAM to illustrate how the results might be used to evaluate the threat to groundwater posed by current herbicide applications.

NTT-8.
HIGH RESOLUTION, MULTISPECTRAL IMAGE DATA: ACCURACIES AND APPLICATIONS
Ron H. Behrendt, Positive Systems, Inc.

Raster image data is fast becoming a viable and required data set for anyone involved in Geographic Information Systems (GIS). Raster images provide a realistic view of the ground area being mapped or analyzed, and are quickly becoming much easier to use because of new hardware and software capabilities. High resolution multispectral image data, such as the type produced by the ADAR System 5000, provides an image data set that before now was not readily available for use in GIS applications. This paper will define high resolution multispectral image data and examine the potential spatial accuracies based on differing image control methods. This paper will also discuss the potential applications for this newly emerging set of raster data, such as forestry, urban planning, and environmental assessment.

NTT-9.

GPS/GIS FIELD MAPPING TECHNIQUES UTILIZING INTEGRATED LASER RANGEFINDER TECHNOLOGY

Darrell E. Peterson, GeoResearch, Inc.

The ability to map remote objects without having to travel to them has created widespread interest within several mapping applications including utility distribution systems, natural resource management, construction, and mining. The Geolink Mapping System, combined with the Geolink-XDS module and a laser rangefinder enables users to simply point at any object from a distance of up to 2000 feet, and quickly geo-reference features to GPS coordinates. Attributes and position data may then be easily translated into several GIS and CAD systems. Ideally suited for anyone who needs to log and map features in rough terrain, the system makes data collection for mapping and resource management as easy as "point and shoot".

This presentation describes the digital data acquisition and management system as related to specific field mapping applications.

NTT-10.

FORESTRY APPLICATIONS UTILIZING HIGH RESOLUTION MULTISPECTRAL IMAGERY COLLECTED WITH THE ADAR SYSTEM 5000

Dale R. Johnson, Positive Systems, Inc.

This paper discusses the features and applications of the Airborne Data Acquisition and Registration (ADAR) System 5000. The ADAR System 5000 is a multispectral imaging system which integrates charge-coupled device (CCD) or platinum silicide (PtSi) sensors with advanced computer technology and position data provided by the global positioning system (GPS). This digital imaging system provides four user-selectable spectral bands within the visible/near infrared range (400-1000 nm) or a combination of thermal and visible sensors to include imagery in the high temperature thermal infrared band (wavelengths between 3 and 5 microns). The ADAR System 5000 has been used successfully in a variety of forestry applications. Projects focusing on monitoring the health of the forest have shown the ability to identify individual trees affected by the bark beetle infestation and root rot. An overview will be presented of this and other projects which capitalize on the ability to observe individual tree crowns in custom spectral bands.

NTT-11.

QUANTITATIVE GEOMORPHOLOGICAL MODELS IN GIS

Henry Shovic, Soil Scientist/Party Leader, Yellowstone National Park

The goal of this work is to support the GIS based soil survey of Yellowstone National Park with the creation of a landform/soil matrix data coverage. The objective of this pilot portion is to develop techniques for the Mammoth 15' Quad to apply park-wide. Landform/soil matrix map units are delineated on a 1:62,500 surficial geology map using aerial photography and field verification. The data is digitized and overlaid on grid coverages for elevation, slope, aspect, wetness index, and slope shape, based on a 30 M DEM coverage and a set of interpretive programs available at MSU. ARC is used to display selected delineations overlaid on a three dimensional surface based on any of the above coverages. Statistics are generated for the above by delineation and by map unit. Both techniques are used to quantitatively differentiate map units, to support quality control and legend development, and to produce maps for editing and field use. The park-wide coverage will provide a digital base for development of soil survey map units, publication quality maps and three dimensional displays of map units, and quantitative parameters for external scientific work requiring knowledge of park landscapes.

NTT-12

SYSTEMS INTEGRATION AND APPLICATION

Richard Platt

This abstract is unavailable at this time.

URBAN APPLICATIONS TRACK (UAT)

UAT-1.
CAD-GIS ISSUES
H.E. Wilkerson

This abstract is not available at this time.

UAT-2.
DEVELOPMENT OF DATA FOR THE ADA COUNTY CAD-RMS SYSTEM
Andy Little, GIS Operations Manager, GGI, Inc.

As we approach the twenty-first century, the need for timely analysis of spatially related data becomes critical. As population increases and new development changes the face of our landscape, public safety requirements also change. Using GIS, it is possible to incorporate spatial analysis in allocation of resources for public safety. One such application is through Computer Aided Dispatch Records Management System (CAD-RMS). The CAD-RMS system incorporates local geography with telecommunications systems.

This presentation will discuss the development of digital geographic data layers for use in a CAD-RMS system for Ada County, Idaho. A digital base map of center lines for each street and road in the county was the primary data layer developed. The county contains both urban and rural areas. Urban area street center lines were developed from coordinate geometry data obtained from subdivision plats. Rural street center lines were developed from a combination of TIGER file and other data. The street center line data was used as a digital base map to constrict other data layers.

Digital maps were developed showing law enforcement, fire department, and emergency medical jurisdictions. Law enforcement and fire department jurisdictions were divided into respective agency reporting districts. An overlay routine was developed to attribute each segment in the street center line file based on which law enforcement or fire reporting district the segment was in. Data depicting location and characteristics of fire hydrants were developed. Other data layers showing water features, bike paths, railroads, railroad crossings, and airport features were developed. A data layer depicting the location of commonly known places was also developed.

The Ada County CAD-RMS system (as of 1992) is still in the development and testing stage.

UAT-3.
GIS AND PUBLIC SAFETY
Tom Wallace, Environmental Systems Research Institute (ESRI), Redlands

The integration of GIS and public safety systems has recently generated a lot of interest in both fields of technology. Public safety organizations have long relied on accurate maps for planning as well as dispatch functions. GIS technology offers public safety organizations tools for: preparing and maintaining base maps, analyzing incidents, emergency planning, and support during the dispatch process. Several methods exist for integrating GIS technology with public safety systems.

UAT-4.
THE USE OF DIGITAL ORTHOPHOTOGRAPHY FOR DECLINATION OF IMPERVIOUS SURFACES AND GENERATION OF STORMWATER BILLING
David J. Ward, Regional Manager, GIS, David Evans and Associates, Inc.

Spokane County, Washington, needed a fast and accurate method of identifying, classifying, and measuring impervious surfaces on commercial and industrial parcels in the county.

The first portion of the project consisted of 107 quarter sections in the Spokane Valley. This area was premarked and aerial photography was flown at a scale of 1:800. Survey control was established, aerotriangulation was completed, and a Digital Elevation Model (DEM) was developed of the area. The film diapositives were scanned and digitized. Using the information from the DEM, digital orthophotos were created using Intergraph's soft copy orthophotography system. The finished orthophotography was delivered in digital form.

A custom database and menu system was developed in ARC/INFO 6.01. This created a "point and click" environment that enabled entry level employees to successfully operate in the ARC/INFO environment. Once the impervious surfaces were delineated, parcel-by-parcel measurements were created and the assessment was determined.

An accuracy assessment of this approach was done using traditional photogrammetric techniques. Results of this comparison will be presented.

UAT-5.
LAND RECORDS MODERNIZATION FOR BUTTE-SILVER BOW COUNTY, MONTANA
Dawn Garrett, Project Manager, GGI, Inc.

Butte-Sliver Bow County is currently modernizing their land records. This endeavor, not a simplistic one, consists of establishing geodetic control, converting assessor hard copy base maps into digital format, and repositioning cadastral features to geo-reference with planimetric features. Prior to commencing a full scale modernization effort, a two (2) square mile project area was converted. Upon analysis of the results from the pilot project area, control acquisition, digitizing methodologies and coordinate transformation steps were modified and refined for utilization in the full scale modernization efforts. This presentation will examine the techniques used to create the land records boundaries from source maps which contain various inconsistencies and also address methods used to spatially orient these features to reference the photogrammetrically compiled planimetric features.

UAT-6.
COUNTY REDISTRICTING WITH GIS: THE CASE OF BIG HORN COUNTY
Kenneth L. Weaver, Associate Professor, Local Government Center, Montana State University

This presentation will highlight the outcomes and lessons learned in applying GIS technology (ARC/INFO) to 1990 Federal Census TIGER and PL 94-171 Digital Data Files in the redistricting of Big Horn County. This case is of special significance because the Big Horn County Commission and School District are under Federal Court order to insure that the single member representative districts of both governmental entities do not dilute the voting rights of Native Americans who comprise 54% of the County's population. The task was complicated by the level of detail applied by the 1990 census in Big Horn County which resulted in some 1,200 census blocks requiring 78 standard TIGER FILE maps to display the data. The presentation will include a comparison of the same task accomplished manually in 1986 using the 1980 Federal Census.

UAT-7.

BEYOND MAPPING AND DATA RETRIEVAL: GIS APPLICATIONS IN URBAN SOCIOECONOMIC SYSTEMS

Jim Williams, President, Planning Information Corporation

Much current urban GIS are multi-year efforts to develop map coverages and attributed databases. But justification of GIS efforts in urban areas often requires near-term applications to management and policy-related topics - e.g., intercensal estimates of employment and economic activity, government demographic characteristics, small area estimates of employment and economic activity, government service requirements at the service-area level. This information can be generated with locally calibrated models for incorporation into attributed databases and retrieval through ARCVIEW or other visualization tools. The session will report on several such applications, as well as strategies for enabling communities to get to such applications in the "near" rather than the "long" term.

UAT-8.

GIS - A BROADER APPLICATION: Local Government Tool

Monty L. Sealey, Executive Director, Central Montana RC&D, Inc.

What if you were elected for County Commissioner in a rural county? Though you view your County Commissioner job as extracurricular to your regular job, people keep coming to you for well thought out decisions on a variety of subjects. You have to understand the issues yourself, but also must have a way to help the public understand them. Time and time again you have to come up with the answers.

As a local official you are required to deal with many types of issues/interests: i.e. public transportation systems, utility companies, state and federal agencies, residential and commercial development, emergency services, legislative compliance, health and safety, etc.

Land is being subdivided at a rate of about one township per year. Tax levies are maxed out. Real economic growth has been slightly negative for about eight years. Along comes a large company who would like to develop a major coal mine in your county. The project could potentially create significant changes, both positive and negative.

To understand and react to the impact of those changes, you have a definite need for information; information covering many subjects from many sources.

The above scenario led to the development of an automated GIS in Musselshell County, Montana. This presentation will discuss the scope of that project, obstacles, funding, staffing and training. It is concluded with other potential applications at the local government level.

UAT-9.

IMPLEMENTING AN AM/FM/GIS PROJECT: BENEFITS, TRENDS, LIFE-CYCLE

Chuck Cmeyla, Executive Consultant, PlanGraphics, Inc.

This session will address issues for implementing an AM/FM/GIS project. The intent is to "scratch the surface" of benefits, trends, and the typical life-cycle of a project. Many agencies realize they will be implementing an AM/FM/GIS project in the future but do not know what to expect. This session will give a snap shot of what to expect in terms of benefits, trends in project justification and what steps are necessary to take to implement a project. Also, a discussion about the basic components of GIS software and the technology will take place.

UAT-10.
USE OF TEMPORAL DATABASES IN GIS
Fred Gifford, GIS Manager, NRIS, Montana State Library

As GIS matures users are looking for more sophisticated applications to harness the potential of high powered, high cost, systems. These users are discovering problems inherent with technology that relies on magnetic media for storage of graphical information critical to their organizations mission. Furthermore, instead of fulfilling new needs, many systems have simply automated tasks which were formally performed manually.

These problems do not necessarily stem from deficiencies in the technology but rather in the implementation of it. This presentation will focus on the use of database design and temporal data structures to help GIS applications realize their true potential. Temporal data structures will be discussed as they relate to specific problems encountered by users of GIS. A conceptual outline of database designs and system requirements will be presented to show how temporal structures can be implemented.

UAT-11.
1990 CENSUS DATA FOR GIS
Gerald J. Daumiller, NRIS, Montana State Library and Patricia A.B. Roberts, Census and Economic Information Center, Montana Department of Commerce.

We will present a list of types of data available through the Census and Economic Information Center which can be utilized in a GIS with a particular focus on 1990 Census data. We will discuss GIS layers and attributes that are necessary for relating Census data to geographic areas.

Availability of TIGER, P.L. 94-171 (population), and legislative district data files, both raw and GIS ready, will be discussed. The wealth of 1990 Census data includes age, sex, household and family composition, value of housing, water supply, journey to work, income, poverty, house heating fuel and shelter costs. Examples of GIS analyses using Census data will be shown.

ANNUAL MEETING

MONTANA GIS USERS' GROUP, INC.

December 2, 1992
Copper King Inn, Butte, Montana
Noon -- 2:00pm

AGENDA

1. **Welcome and Agenda Review**

2. **Conference Announcements: Announce Poster Session Winners**

3. **Announce Election Results: 1992-93 Board of Directors**
   (A ballot is included in your Conference packet;
   Be Sure To Vote by Wednesday morning!)

4. **Introduce new Board Members**

5. **Ratify Articles of Incorporation**
   (As printed, back side of this agenda)

6. **Ratify the Organization's Goals and Objectives**

7. **New Business: Next Conference?**

8. **Adjourn**

ARTICLES OF INCORPORATION OF MONTANA GIS USERS' GROUP, INC.

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned, citizens of the United States of America, and residents of the State of Montana, have on this date adopted Articles of Incorporation with the intent to create a non-profit organization under and by virtue of Title 35, Chapter Two, Montana Codes Annotated 1991, and Amendments thereto. We do hereby state and certify:

ARTICLE I.
NAME

The name of this Corporation hereby formed shall be and is "**Montana GIS Users' Group, Inc.**" It shall be a mutual benefit corporation and will have members.

ARTICLE II.
DURATION

The period for which this Corporation shall be in existence is Perpetual.

ARTICLE III.
PURPOSE

The purposes for which the corporation is formed and the object to be carried on by it are as follows:

Section 1. This corporation is not formed for any pecuniary gain, profit or benefit, and all property, proceeds and income of the corporation shall be devoted to the objects and purposes hereinafter set forth and shall nct at any time, either while doing business or in the event of voluntary or involuntary dissolution thereof, pass or revert to, or result in, pecuniary profit or gain to the Corporation, or to any member of members thereof.

Section 2. GIS (Geographic Information System) refers to the computer hardware, software, geographic data, and personnel whose function is to capture, store, update, manipulate, analyze, and display in various forms, geographically referenced information. The term 'GIS' is generic, and is not limited to any particular manufacturer or select group.

As ratified by its members, the charter of the Montana GIS Users' Group, Inc. is to:

1. Sponsor the annual Montana GIS conferences, including the handling of necessary fiscal matter;
2. Publish a quarterly newsletter; and
3. Support activities designed to share information on GIS.

This organization is organized exclusively for charitable purposes within the meaning of Section 501 (c) (3) of the Internal Revenue Code.

Section 3. No part of the net income of this foundation shall inure to the benefit of any member or individual having a personal or private interest in the activities of the Corporation not shall any part of the funds of the Corporation be used to carry on propaganda, or otherwise, to influence legislation; and said Corporation shall not participate in or intervene in, including the publishing of statements, any political campaign on behalf of any candidate for public office.

Section 4. At all times during the life of said Corporation all funds, property and other assets of the Corporation shall be impressed with trust for charitable and education purposes only. In the event of the dissolution of the corporation, after payment and satisfaction of all debts of the Corporation, the remaining assets and funds of the Corporation shall be conveyed or transferred to a corporation or organization or organizations, organized and operated exclusively for charitable, education, religious or scientific purposes as shall at the time qualify as an exempt organization or organizations under Section 501 (c) (3) of the Internal revenue Code as the Board of Directors shall determine. In no event shall any funds or property of this Corporation be distributed among or revert to any member, officer or trustee of this Corporation.

Section 5. Not withstanding any other provision of these Articles, the Corporation shall not carry on any other activities not permitted to be carried on by a Corporation exempt from Federal Income Tax under Section 501 (c) (3) of the Internal Revenue Code of 1954 or the corresponding provision of any future United States Internal Revenue Law.

Section 6. The above-named corporation will not discriminate against any person on the basis of race, creed, religion, color, sex, physical or mental handicap, age, or national origin.

ARTICLE IV.
POWERS

This corporation shall have each and every power granted by the Montana Code Annotated, Section 35-2-107 (1991), and shall be able to exercise the same in furtherance of any corporate purpose.

ARTICLE V.
DISSOLUTION

Upon the dissolution of the Corporation, the Board of Directors shall, after paying or making a provision for the payment of all of the liabilities of the corporation, dispose of all the assets of the corporation. The remaining assets and funds of the corporation shall be transferred, conveyed and/or distributed to a non-profit fund, organization, foundation or corporation organized and operated exclusively for charitable educational, religious or scientific purposes as shall at that time qualify as an exempt organization or organizations under Section 501 (c) (3) of the Internal Revenue Code, as the Board of Directors shall determine. In no event shall any funds or property of this Corporation be distributed among or reverted to any member, officer or trustee of this Corporation.

ARTICLE VI.
REGISTERED OFFICE AND AGENT

The Registered Office of the Corporation shall be at:

NRIS
Montana State Library
1515 E. Sixth Avenue
Helena, Montana 59620-1800

and the name of the initial Registered Agent for such Corporation is:

Fred Gifford

ARTICLE VII.
BOARD OF DIRECTORS

The number of Directors constituting the current Board of Directors is five (5).

ARTICLE VIII.
INCORPORATORS

The name and address of the Incorporator is:

Jon Sesso
Butte-Silver Bow Planning Dept.
Courthouse
155 West Granite
Butte, Montana 59701

ARTICLE IX.
LIABILITY

In accordance with Montana Code Annotated Title 35, Chapter 1, Section 202(2)(a)(v), no Director of this Corporation or member thereof shall have any personal liability for monetary damages, except as provided by statute.

ARTICLE X.
BY-LAWS AND AMENDMENTS

The Board of Directors of this Corporation shall have full power to adopt, amend or repeal the By-Laws of this Corporation, or to amend these Articles of Incorporation in accordance with the laws of the State of Montana; provided such By-Laws, amendments or changes in said Articles of Incorporation are not repugnant to the Constitution, or the laws of the State of Montana, and are consonant with the objects and purposes of this Corporation. All members of the Board of Directors are entitled to vote on amendments, changes of proposals.

IN WITNESS WHEREOF, I, Jon Sesso, as the incorporator of this non-profit corporation, have hereunto set our hands and seals this 26th day of August, 1992.

MONTANA GIS USERS' GROUP, INC.

/s/_____
JON SESSO

STATE OF MONTANA)
:
County of Silver Bow)

On this 26th day of August, 1992, before me, the undersigned, a notary public in and for the State of Montana, personally appeared Jon Sesso known to me to be the persons whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal on the day and year first-above written.

/s/ Sherri Kennedy_____
NOTARY PUBLIC FOR THE STATE OF MONTANA
(SEAL) RESIDING AT BUTTE, MONTANA
MY COMMISSION EXPIRES 12/18/94

1992 Montana GIS Conference

Exhibitor List

BOOTH NUMBER	
1	*GeoResearch, Inc.* *115 North Broadway* *Billings, MT 59101* *(406) 248-6771*
2	*Positive Systems, Inc.* *411 2nd Ave. West* *Kalispell, MT 59901* *(406) 257-7745*
3	*IBM Corporation* *100 North Park Ave.* *Helena, MT 59601* *(406) 444-5060*
4	*GGI, Inc.* *300 North Maple Grove* *Boise, ID 83704* *(208) 378-6307*
5	*PAMAP Technologies Corp.* *#200, 6772 Oldfield Rd.* *Victoria, BC V8X 3X1* *(604) 652-8895*
6	*Structured Data Systems* *210 N. Higgins, Rm. 218* *Missoula, MT 59801* *(406) 728-1987*
7	*Intergraph Corporation* *6041 S. Syracuse Way* *Suite 300* *Englewood, CO 80111* *(303) 796-4506*

BOOTH NUMBER	
8/9	*ESRI* *606 Columbia St., N.W., Suite 213* *Olympia, WA 98501* *(206) 754-4727*
10	*Terra West Technology, Inc.* *70 Forest Park Estates* *Clancy, MT 59634* *(406) 933-5641*
11	*Carpenter Dunlap Associates* *P.O. Box 716* *Eureka, MT 59917* *(406) 296-3216*
12	*Electronic Data Solutions* *610 S. Lincoln, P.O. Box 31* *Jerome, ID 83338* *(208) 324-8006*
13	*Vestra Resources, Inc.* *54 N. Last Chance Gulch* *Helena, MT 59601* *(406) 443-8888*
14	*Montana Bureau of Mines & Geology* *Montana Tech* *Butte, MT 59701* *(406) 496-4175*