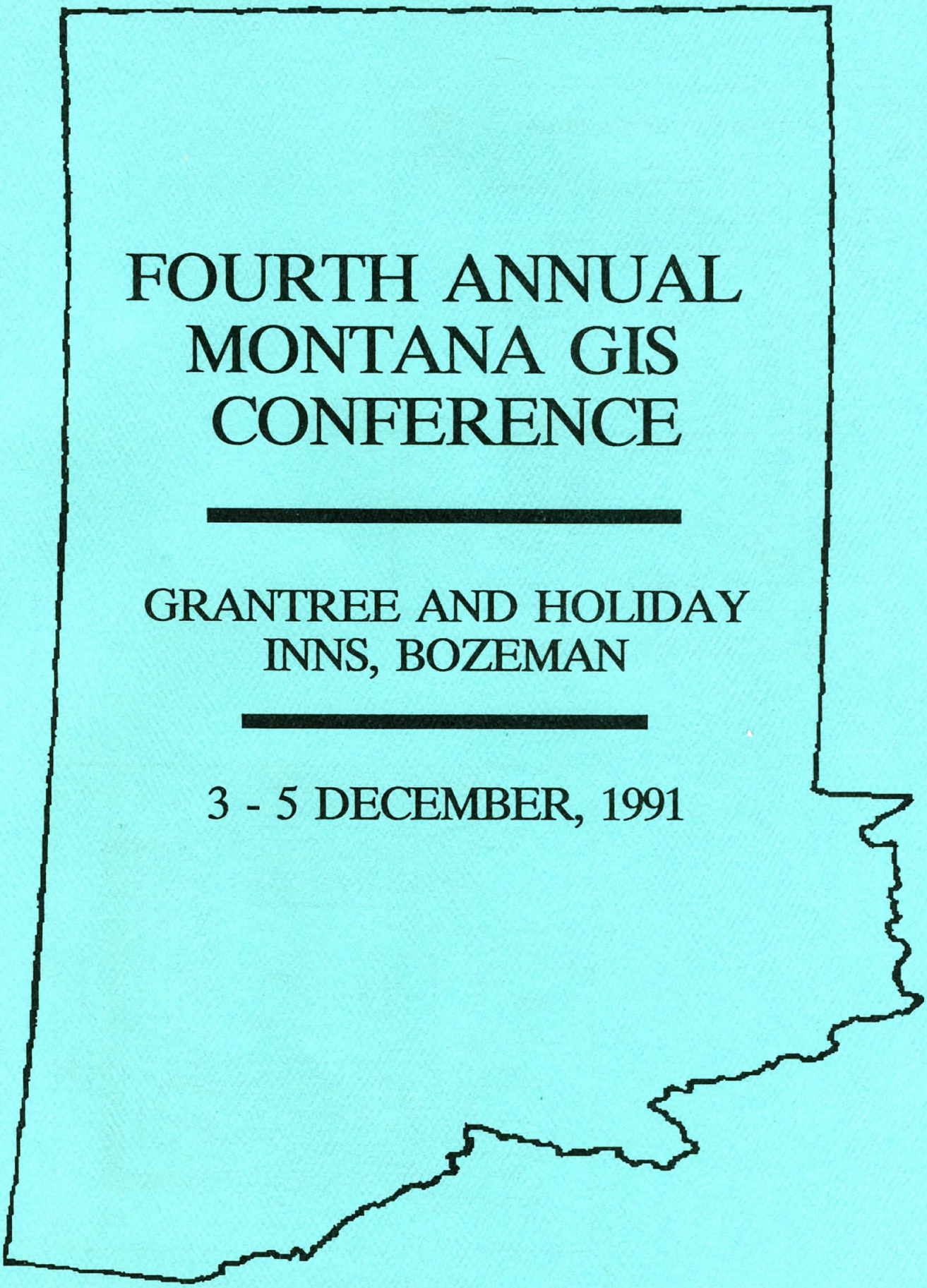
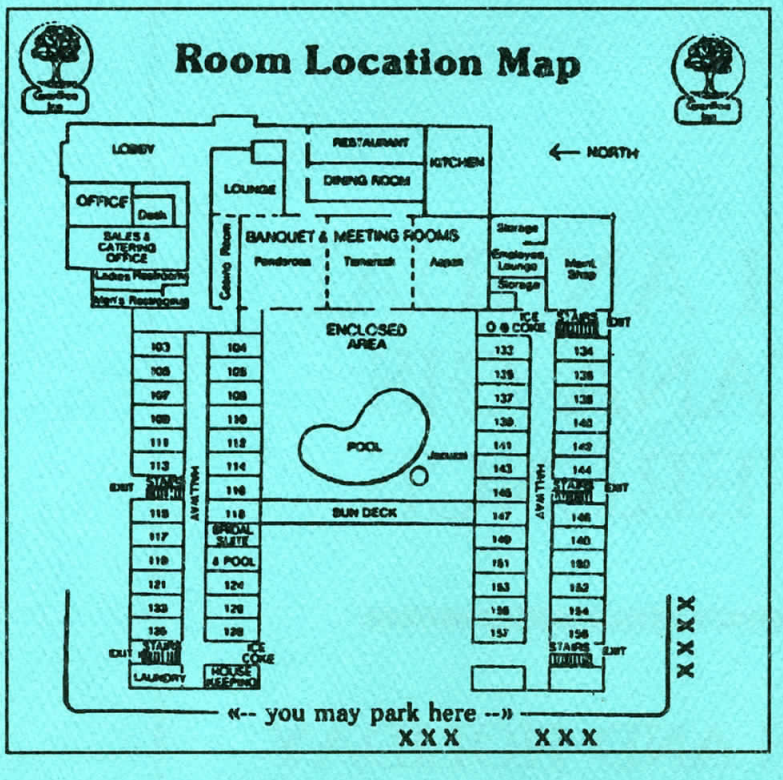
FOURTH ANNUAL MONTANA GIS CONFERENCE

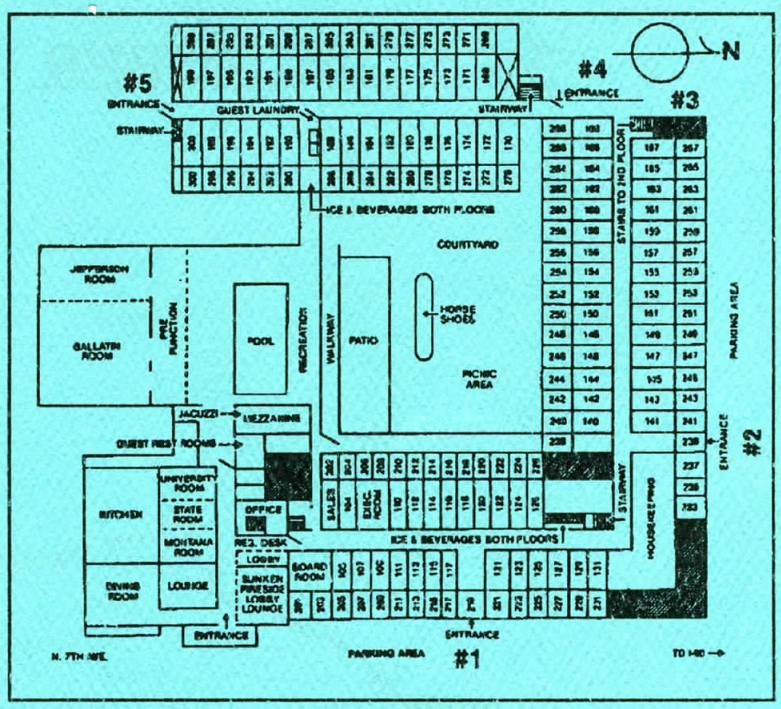
GRANTREE AND HOLIDAY INNS, BOZEMAN

3 - 5 DECEMBER, 1991





GRANTREE INN, BOZEMAN



HOLIDAY INN, BOZEMAN

Table of Contents

1991 Montana GIS Conference Planning Committee

Conference Chairperson:

John Wilson, Department of Earth Sciences and Geographic Information and Analysis Center, Montana State University

Conference Coordinator:

Diana Cooksey, Department of Plant and Soil Science, Montana State University

Planning Committee:

Craig Bacino, Montana Department of Natural Resources and Conservation
Allan Cox, Natural Resource Information System, Montana State Library
Don Cromer, Program Development Division, Montana Department of Transportation
Darl Enger, Northern Region, USDA-Forest Service
Kristin Gerhart, State Office, USDA-Soil Conservation Service
Jeff Jacobsen, Department of Plant and Soil Science, Montana State University
Valerie Jaffe, Unionville, Montana
George McKay, USDI-National Park Service
Jon Sesso, Butte-Silver Bow Planning Department
Cliff Sisko, USDI-Bureau of Land Management
Ken Wall, School of Forestry, The University of Montana

Special Thanks: The Planning Committee wish to thank Sara Anderson and Ann Parker, Department of Earth Sciences and Debi Duke, Department of Plant and Soil Science, Montana State University for their administrative and logistical support, and Lisa Landenburger, for the cover art for this program and the conference brochure.

Welcome

to the

1991 Montana GIS Conference: From Plans to Practice

WHAT IS GIS?

An automated geographic information system (GIS) is a tool for managing geographic feature location data as well as data related to those features. A GIS provides the ability to input, edit, query, and output spatial data and their attributes. The map data are usually separated into common thematic data layers in a GIS and they can be manipulated to derive new data, to perform complex spatial analyses, and to generate maps and reports tailored to the specific needs.

It is clear as we approach this Fourth Annual Montana GIS Conference that GIS has emerged as a widely used tool in Montana. There are now more than 100 active GIS projects in the state and many of the projects and the organizations and individuals working on them are represented at this conference. There are still other organizations and individuals poised to adopt this technology for the first time and it is our hope that some of you are represented in the audience as well. Our focus this year is on past and present applications and how this experience can guide others in deciding when and how to apply GIS in their applications.

The keynote speech is titled "Public Access: The Next Revolution in GIS Technology" and will be delivered by Jack Dangermond, President, Environmental Systems Research Institute, Inc., from Redlands, California.

Another 32 presentations have been arranged into one plenary session and two concurrent session tracks. The three presentations that make up the plenary session were solicited by the Conference Planning Committee and are organized around this year's conference theme: "Montana GIS: From Plans to Practice". The presentations in the concurrent session tracks were selected by the Conference Planning Committee from abstracts submitted in response to a Call for Papers sent out in July of this year. These presentations are organized by topic.

The conference also features a panel discussion on the Montana GIS Standards Plan proposed by the Montana GIS Technical Working Group, informational posters about Montana GIS projects, exhibits of GIS-related products and services from vendors, facility tours, and a Wednesday evening social in the Exhibits Area.

This year's conference is sponsored by the Montana GIS Users Group, a statewide consortium of government agencies, universities and businesses involved with GIS technology. The meetings are being hosted by the Department of Earth Sciences, Department of Plant and Soil Science and Geographic Information and Analysis Center at Montana State University.

The Conference Planning Committee has designed an exciting and challenging program, and looks forward to your participation. Thank you for coming.

1991 Montana GIS Conference

Exhibitor List

Booth Number		
1	**IBM Corporation** 100 N. Park Ave. Helena, MT 59601	Phone: (406) 444-5060
2	**Great Divide Graphics** 324 Fuller Ave., Suite C-3 Helena, MT 59601	Phone: (406) 442-1018
3	**Electronic Data Solutions** P.O. Box 31 Jerome, ID 83338	Phone: (208) 324-8006
6	**Montana State University** MAPS Program, Dept. of Plant and Soil Science Bozeman, MT 59717	Phone: (406) 994-5684
7	**Geographic General, Inc.** 3350 Americana Terrace, Suite 370 Boise, ID 83706	Phone: (208) 343-1181
8	**Pacific Meridian Resources** 5200 SW Macadam Ave., Suite 570 Portland, OR 97201	Phone: (503) 228-8708
9	**Positive Systems, Inc.** P.O. Box 1551 Kalispell, MT 59903	Phone: (406) 257-7745
10/11	**Environmental Systems Research Institute, Inc.** 606 Columbia St., N.W., Suite 213 Olympia, WA 98501	Phone: (206) 754-4727
12	**GeoResearch, Inc.** 115 N. Broadway Billings, MT 59101	Phone: (406) 248-6771
13	**Silicon Graphics** 4600 South Ulster St., Suite 820 Denver, CO 80237	Phone: (303) 796-0022

1991 Montana GIS Conference

Workshops

1. Introduction to PC ARC/INFO

MSU Department of Earth Sciences, 8:30 a.m. to 5:00 p.m., 1-3 December.

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.

Instructor: Dr. John P. Wilson, Department of Earth Sciences and Geographic Information and Analysis Center, Montana State University

2. Introduction to GIS: Basic Concepts

Holiday Inn State Room, 9:00 a.m. to 4:30 p.m., 3 December.

For new or novice GIS users who want an introduction to the basic concepts of GIS. This workshop provides an overview of GIS as well as specifics related to cartographic data, database creation, spatial analysis and GIS functions.

Instructor: Allan Cox, Natural Resource Information System, Montana State Library.

3. Federal Spatial Data Transfer Standards

Holiday Inn Jefferson Room, 8:00 to 5:30 p.m., 3 December.

For GIS specialists interested in the Spatial Data Transfer Standard. This workshop will review the need for the SDTS, discuss the three parts of the standard and describe ongoing efforts to create accessible and user-friendly software tools to interface with the SDTS.

Instructors: Matthew McDermott and Phyllis Atheide, United States Geological Survey.

Workshops (cont.)

4. Cartography and GIS

MSU Department of Earth Sciences, 8:00 a.m. to 12:00 noon, 3 December.

For GIS users interested in obtaining an in-depth understanding of cartographic principles as they relate to computer mapping and GIS. This workshop discusses mapping styles with discrete and continuous data types, map projections and coordinate systems, and digitizing considerations.

Instructor: Dr. Lawrence Carstensen, Department of Geography, Virginia Polytechnic Institute and University.

5. Global Positioning Systems and GIS

GranTree Inn Ponderosa Room, 8:00 a.m. to 12:00 noon, 3 December.

For GIS users with an interest in using the Global Positioning System (GPS) to collect positional data for input into a GIS. This workshop will begin with an overview of the GPS system and a discussion of the many approaches to using the system, and will continue, if adequate satellites are visible, with a kinematic data collection survey in the vicinity of the hotel.

Instructor: Dr. David Tyler, Department of Survey Engineering, University of Maine.

6. GIS in City and County Government

GranTree Inn Ponderosa Room, 1:00 p.m. to 5:00 p.m., 3 December.

For urban and rural planners, surveyors, developers and others involved in city or county planning and management. This workshop covers case studies and examples of GIS applications by urban agencies in thee Northwest, with additional discussion of start-up and management of GIS.

Instructors: Kirsty Burt and Kim Sapunar, City of Bellevue, Washington.

7. Introduction to GIS: "Hands-on" Applications

MSU Department of Earth Sciences, 1:00 p.m. to 5:00 p.m., 3 December.

For new GIS users wanting "hands-on" experience. This workshop will take you on a guided tour of Africa using the IDRISI software package, a simple and inexpensive raster-GIS developed by Clark University specifically for teaching GIS concepts.

Instructors: Christine Ryan and Robert Snyder, Geographic Information and Analysis Center, Montana State University.

Workshops (cont.)

8. Terrain Analysis and GIS

Holiday Inn University Room, 1:00 p.m. to 5:00 p.m., 3 December.

For environmental scientists and engineers interested in the application of terrain analysis methods for modeling the hydrologic behavior of three-dimensional terrain. This workshop will draw on examples from water quanity and soil erosion modeling applications.

Instructor: Dr. Ian Moore, Centre for Resource and Environmental Studies, Australian National University.

9. GIS Teach In - An Open Invitation to the General Public

Holiday Inn Montana State University Room, 7:30 p.m. to 9:30 p.m., 3 December.

Outside of our select group of conference attendees, even the most well-educated Montanan has probably never heard of a GIS. We will extend an open invitation to the public to join us for a GIS Teach In. We will explain, in layman's terms, the basic concepts of a GIS, and demonstrate some typical applications. As more information is converted to digital form, it becomes more powerful for a wide range of applications. However, the information may become less accessible to those without the appropriate technology. At some point, the general public must be introduced to this new technology. This workshop will make the Fourth Annual Montana GIS Conference the first place in the nation where an effort has been made to acquaint the public with this new and exciting technology.

Instructors: Allan Cox and Kris Larson, Natural Resource Information System, Montana State Library

Jack Dangermond
Founder and President
ESRI, Inc.

KEYNOTE ADDRESS

PUBLIC ACCESS: THE NEXT REVOLUTION IN GIS TECHNOLOGY

Wednesday, December 4th
9:00 am - 10:15 am
Holiday Inn Gallatin/Jefferson Room

There may be as many as five or ten million citizens accessing public GISs on CD-ROM or cable networks by the year 2000. Either way, this public access promises to revolutionize our thinking about GIS and how GIS is used. What will citizens be able to do with GIS? What should they be able to do with this technology? Who'll make this next revolution happen? Jack Dangermond's keynote address will raise many such questions and outline a few possible answers.

Jack Dangermond graduated with a B.S. from California Polytechnic College, Pomona; M.S. in Urban Planning from the Institute of Technology at the University of Minnesota; and M.S. in Landscape Architecture from the Graduate School of Design, Harvard University, where he worked in the Laboratory for Computer Graphics and Spatial Design. He is the founder and president of **Environmental Systems Research Institute, Inc.** (ESRI), of Redlands, California, a firm that has been in the geographic information system (GIS) field since 1969. ESRI is generally acknowledged as the technical and market leader in GIS software and custom turnkey systems, with a worldwide installed base of more than 3,000 ARC/INFO systems on workstations, minicomputers and mainframes, and more than 3,000 such systems on personal computers.

Mr. Dangermond has been the recipient of numerous fellowships, grants and awards, including the Urban and Regional Information Systems Association (URISA) Horwood Award "for outstanding contributions...to the information systems field." He has served on various national advisory committees and boards, including, for example, NASA's Science and Technology Advisory Committee. He has delivered keynote addresses at various national and international meetings and conferences, including Harvard's Computer Graphics Week, Indonesia's National Computer Conference, Australia's National Conference for Planners, and others. He has authored hundreds of papers dealing with GIS technology, published in journals and conference reports in such diverse fields as photogrammetry, computer science, planning, environmental science, and cartography.

Mr. Dangermond is recognized in both academia and industry as a leader of and an authority on the GIS field. With 21 years experience, he and his firm are pioneers in digital cartography, mapping, and GIS.

7:30 AM - 8:30 AM

Continental Breakfast
Holiday Inn Lower Lobby

8:30 AM - 10:15 AM

Holiday Inn Gallatin/Jefferson Room

Welcome: John Wilson, Conference Chair
Tim Swanson, Mayor Pro-Tem, City of Bozeman
Michael Malone, President, Montana State University

Keynote Address: Jack Dangermond, President, Environmental Systems Research Institute
PUBLIC ACCESS TO GIS

10:15 AM - 10:45 AM

Break
GranTree Inn Atrium
Holiday Inn Lower Lobby

10:15 AM - 8:00 PM
Exhibits

GranTree Inn Atrium

10:45 AM - 11:45 AM
Poster Session

Holiday Inn Lower Lobby
Chair: Kristin Gerhart, Soil Conservation Service

Craig Bacino, Reserved Water Rights Compact Commission
A PORTABLE, ANALOG, QUALITATIVE DECISION/NEGOTIATION SUPPORT GIS

David Delsordo, University of Montana
THE USE OF GIS TO MAP UNDERSTORY VEGETATION ON THE BLACKFOOT/CLEARWATER WILDLIFE MANAGEMENT AREA

Paul Hyndman, U.S. Bureau of Mines
MONTANA MINERALS MAPS

Stuart Kirkpatrick and Jon Sesso, Butte-Silver Bow Planning Department
BUTTE-SILVER BOW GOVERNMENT GIS ACTIVITIES

Kirk McEachern, Jeffrey Jacobsen, Gerald Nielsen and John Wilson, Montana State University
DIGITAL ELEVATION MODEL ATTRIBUTES FOR PREDICTING SOIL FERTILITY

Douglas Richardson, GeoResearch, Inc.; Bill Armold, Yellowstone County Planning Department; and Monty Sealey, Musselshell County Planning Department
MAPPING MONTANA'S COUNTIES: THE MUSSELSHELL COUNTY AND YELLOWSTONE COUNTY GIS PROJECT

Paul Rubright, Jeffrey Jacobsen, William Inskeep, John Wilson and Gerald Nielsen, Montana State University
A GEOGRAPHIC INFORMATION SYSTEM TO EVALUATE PESTICIDE GROUNDWATER CONTAMINATION POTENTIAL

Robert Scott, Woodward-Clyde Consultants
GIS BASED VISUAL STUDIES

James Stimson, Peter Langen and John Jarvie, Montana State Library
USING A GIS INTERFACE TO ASSESS MONTANA'S WATER DATA COVERAGE

John Whittingham, Montana State University
GROUND WATER AVAILABILITY IN A MOUNTAIN AQUIFER SYSTEM, MAYNARD CREEK CATCHMENT, BRIDGER RANGE, MONTANA

11:45 AM - 1:00 PM

Buffet Lunch, GranTree Inn Atrium

1:00 PM - 3:00 PM
GIS: From Plans to Practice

Holiday Inn Gallatin/Jefferson Room
Chair: Allan Cox, Montana State Library

1:00 John Wilson, Montana State University
WHEN IS GIS NEEDED?

1:30 Stuart Challender, Utah Automated Geographic Reference Center
IMPLEMENTING AND OPERATING A GIS: INSTITUTIONAL CHALLENGES

2:00 John Sharrard, Oregon Department of Energy
TECHNOLOGICAL CHALLENGES TO IMPLEMENTING AND OPERATING A GIS OR 'HOW TO KEEP AIM AT A MOVING TARGET"

3:00 PM - 3:30 PM

Break
Holiday Inn Lower Lobby

3:30 PM - 5:00 PM
Concurrent Session I. Forestry Applications

Holiday Inn Montana State University Room
Chair: Ken Wall, University of Montana

3:30 Brian Long and Donna Leeper, Division of Forestry, Montana Department of State Lands
GIS APPLICATIONS FOR FOREST MANAGEMENT

4:00 Allan Vandiver, Gallatin National Forest
HEBGEN LAKE RANGER DISTRICT RESOURCE ANALYSIS

4:30 Dean Sirucek, Flathead National Forest
ANALYSIS OF THE WILDFIRE REGIMES AND THEIR EFFECTS ON THE FOREST STRUCTURE OF THE FLATHEAD NATIONAL FOREST

Concurrent Session II. Water Resources Applications

GranTree Inn Ballroom
Chair: James Stimson, Montana State Library

3:30 David E. James, Lockheed Engineering and Sciences Co.
MODELING NON-POINT SOURCE POLLUTION: A CASE STUDY FOR THE BLACKFOOT RIVER GEOGRAPHIC INFORMATION SYSTEM

4:00 Ian Moore, Australian National University
SPATIALLY-DISTRIBUTED HYDROLOGIC PROCESS REPRESENTATION USING GIS: SOIL WATER CONTENT

4:30 Ruth Thayer, Bureau of Indian Affairs
IRRIGATION SYSTEM MAPPING WITH GPS ON THE WIND RIVER INDIAN RESERVATION, WYOMING

5:30 PM - 8:00 PM

Hors d'oeuvres (Partially Sponsored by Geographic General, Inc. and IBM Corp.) and Cash Bar
GranTree Inn Atrium (Exhibit Area)

8:00 PM - 9:30 PM

Montana GIS Technical Working Group Meeting
GranTree Inn Ballroom

7:30 AM - 8:30 AM

Continental Breakfast
Holiday Inn Lower Lobby

8:30 AM - 3:30 PM
Exhibits

GranTree Inn Attrium

8:30 AM - 10:00 AM
Concurrent Session I. Energy and Mineral Applications

Holiday Inn Montana State University Room
Chair: Steve Sherer, Bonneville Power Administration

8:30 Paul Hyndman, U.S. Bureau of Mines, Spokane, WA
WESTERN MONTANA'S WITHDRAWN MINERALS: GIS SHOWS HOW MUCH TODAY!

9:00 Phil Smith, Bonneville Power Administration
GIS APPLICATIONS FOR ENVIRONMENTAL ANALYSES AT THE BONNEVILLE POWER ADMINISTRATION - THE NW MONTANA/N. IDAHO SUPPORT PROJECT EXPERIENCE

9:30 Douglas Richardson and Anne Cossitt, GeoResearch, Inc.
GIS AND ENVIRONMENTAL IMPACT STATEMENTS: THE USFS OIL AND GAS LEASING EIS

Concurrent Session II. GIS and Remote Sensing

GranTree Inn Ballroom
Chair: David Tyler, University of Maine

8:30 Sam C. Doak, Pacific Meridian Resources
DEVELOPMENT OF A DETAILED LAND COVER AND LAND USE GIS FROM SATELLITE IMAGERY

9:00 Don Krogstad, Flathead National Forest
REMOTE SENSING IN GIS

9:30 Ron Behrendt, Cody Benkelman and Dale Johnson, Positive Systems, Inc.
THE HIGH RESOLUTION AIRBORNE DATA ACQUISITION AND REGISTRATION (ADAR) SYSTEM

10:00 AM - 10:30 AM

Break
GranTree Inn Atrium

10:30 AM - 12:00 NOON
Concurrent Session I. Forestry Applications

Holiday Inn Montana State University Room
Chair: Darl Enger, U.S. Forest Service

10:30 Michael Sweet and Ken Wall, University of Montana
"ALICE IN GIS WONDERLAND", A RETROSPECTIVE OVERVIEW

11:00 Fred Hodgeboom, Flathead National Forest
TIMBER AVAILABILITY STUDY - FLATHEAD NATIONAL FOREST

11:30 Jim Reid, Flathead National Forest
DATA SUITABILITY FOR PROJECT ANALYSIS

Concurrent Session II. Ecological Applications

GranTree Inn Ballroom
Chair: Don Luse, Bureau of Indian Affairs

10:30 Roland Redmond, University of Montana
IDENTIFICATION AND PROTECTION OF BIODIVERSITY IN MONTANA USING A GIS

11:00 James Berry and William Kemp, USDA-ARS Rangeland Insect Laboratory
PREDICTING RANGELAND GRASSHOPPER DENSITIES USING A GIS WITH MACHINE LEARNING TECHNIQUES

11:30 William Kemp and Thomas Kalaris, USDA-ARS Rangeland Insect Laboratory; William Quimby, Montana State University
REGIONAL POPULATION VARIATION IN INSECTS: RANGELAND GRASSHOPPERS (ORTHOPTERA: ACRIDIDAE) IN SPACE AND TIME

12:00 NOON - 1:30 PM

Lunch and Montana GIS Technical Working Group Update
Holiday Inn Gallatin/Jefferson Room

1:30 PM - 3:00 PM
Concurrent Session I. Data Integration/Implementation Issues

Holiday Inn Montana State University Room
Chair: Andy Epple, City of Bozeman

1:30 Ken Wall, University of Montana
IMPLEMENTING A LARGE SCALE GIS ON A STATEWIDE PROJECT: THE FOREST PRODUCTIVITY BASED TAXATION SYSTEM

2:00 Michael Blongewicz, Environmental Systems Research Institute, Inc.
INTEGRATING CAMAS DATA FROM THE STATE WITH YELLOWSTONE COUNTY'S PARCEL MAPS

2:30 Dean Anderson, Environmental Systems Research Institute, Inc.
IMPLEMENTING A GIS: NECESSARY FUNCTIONS, SUCCESSFUL STRATEGIES

Concurrent Session II. Soils Applications

GranTree Inn Ballroom
Chair: Kristin Gerhart, Soil Conservation Service

1:30 Rob DeVelice, Gerry Daumiller, John Jarvie, Montana State Library; Pat Bourgeron, Nature Conservancy
NATURE PRESERVE REPRESENTATIVENESS: ASSESSMENT USING A COMBINATION OF A GIS AND RULE-BASED MODEL

2:00 Thomas Keck, Montana State University
GIS AND STATISTICAL MODELING FOR ORDER 1 SOIL SURVEYS

2:30 Doug Harrison, Soil Conservation Service
INTEGRATING THE SCS SOIL LEACHING POTENTIAL INDEX (SLPI) INTO THE IDAHO GROUND WATER VULNERABILITY RATING SYSTEM

3:00 PM - 3:30 PM

Break
Holiday Inn Lower Lobby

3:30 PM - 5:00 PM
Concurrent Session I. GIS Policy Issues

Holiday Inn Montana State University Room
Chair: Jon Sesso, City of Butte

3:30 Kris Larson, Montana State Library
GIS IN LIBRARIES - PUBLIC ACCESS TO PUBLIC DATA

4:00 Montana GIS Technical Working Group
MONTANA GIS STANDARDS PLAN PANEL DISCUSSION

Concurrent Session II. New GIS Initiatives

GranTree Inn Ballroom
Chair: Don Cromer, Montana Department of Transportation

3:30 Pamela Lovely, United States Geological Survey
OFFICE OF MANAGEMENT AND BUDGET CIRCULAR A-16 "COORDINATION OF SURVEYING, MAPPING, AND RELATED SPATIAL DATA ACTIVITIES"

4:00 Gerry Daumiller, Montana State Library
CHOOSING A MAP PROJECTION FOR A STATEWIDE DATABASE

4:30 James Stimson, Peter Langen and John Jarvie, Montana State Library
GIS - A NEW TOOL FOR THE MONTANA WATER INFORMATION SYSTEM

5:10 PM - 5:20 PM
Closing Comments

Holiday Inn Montana State University Room
Chair: John Wilson, Conference Chair

Abstracts

Wednesday (8:30 AM - 10:15 AM)

PUBLIC ACCESS: THE NEXT REVOLUTION IN GIS TECHNOLOGY

Jack Dangermond, President, Environmental Systems Research Institute, Inc., Redlands, CA 92373

There may be five or ten million GIS users by the year 2000; if so, most of them will be citizens, accessing public GISs, probably on CD-ROM or a cable network. Either way, public access will revolutionize our thinking about GIS and how GIS is used. What can citizens do with GIS? What should they do? Who'll make this next revolution happen? This presentation raises many such questions and outlines a few possible answers.

Wednesday (10:45 AM - 12:00 AM)

A PORTABLE, ANALOG, QUALITATIVE DECISION/NEGOTIATION SUPPORT GIS

Craig Bacino, Reserved Water Rights Compact Commission, State of Montana, Helena, MT 59620

The Reserved Water Rights Compact Commission is authorized to negotiate and conclude compacts for the division and apportionment of waters between the state (and its people) and Indian tribes and federal agencies claiming reserved water rights in Montana. A number of data themes, including hydrography, soils, irrigated lands, administrative boundaries, land ownership and the public land survey, are used in the course of reserved water rights settlements. During planning and negotiating sessions it is useful to put issues into a spatial context. A portable display of data themes, on transparent overlays, helps to stimulate discussion, clarify issues, and formulate pertinent questions. It is complementary to the digital, quantitative geographic information system from which it is derived.

THE USE OF GIS TO MAP UNDERSTORY VEGETATION ON THE BLACKFOOT/ CLEARWATER WILDLIFE MANAGEMENT AREA

David Delsordo, School of Forestry, University of Montana, Missoula, MT 59807

This project involves the construction of a digital vegetation map with linked non-spatial databases to support the operations plan for the Blackfoot/Clearwater Wildlife Management Area (BCWMA) managed by the Montana Department of Fish, Wildlife & Parks (DFWP). The project will serve as a demonstration of the utility and capability of GIS technology in wildlife management and make improvements in information management and data analysis for the study area. The BCWMA is currently the state's largest wildlife management area with 65,488 acres under management. The BCWMA is also one of the state's oldest wildlife management areas, it was purchased in 1948. The primary mission of the BCWMA is to provide and maintain winter range for elk, mule deer, and white-

tailed deer. The secondary mission is to provide controlled public access for hunting and recreation. The area also provides habitat for waterfowl and other game and non-game species.

The vegetation cover types are more complex than other DFWP-owned wildlife management areas because the BCWMA encompasses combinations of forestland, rangeland, riparian, and agricultural communities. Timber stand structure is continually changing on land leased from Champion International, Montana Department of State Lands, and Plum Creek Timber Company. At present, DFWP is unable to accurately and efficiently determine the carrying capacity of the timbered winter range on the BCWMA. The timber overstory consists of second growth stands in a wide range of age classes. Timber management activities have created a mosaic of stand structures, and this management continues to alter the structure of the winter range in the study area. A mathematical model is being developed to predict the relationships between timber overstory and topography. GIS will be used to display the distribution and extent of the various classes of understory vegetation. This work is being done at a scale of 1:24,000. In addition, other data layers will be developed such as buffers and overlays which are appropriate to the area and DFWP's mission.

MONTANA MINERALS MAPS

Paul Hyndman, Western Field Operations Center, U.S. Bureau of Mines, Spokane, WA 99202

The poster will show four statewide maps of Montana at a scale of 1:1,000,000. The themes of the maps are: (i) leasable mineral areas, (ii) locatable mineral areas, (iii) the availability of leasable areas, and (iv) the availability of locatable areas in western Montana.

BUTTE-SILVER BOW GOVERNMENT GIS ACTIVITIES

Stuart Kirkpatrick and Jon Sesso, Butte-Silver Bow Planning Department, Butte, MT 59701

In 1991, the Planning Department in Butte, MT acquired a geographic information system (GIS) with funding provided by the Atlantic Richfield Co. (ARCO). Initially, the primary use of the system, fully operational as of August, 1991, is to analyze and monitor Superfund activities occurring in the Butte Area. In the long term, the Butte GIS will provide several County departments with a spatial analysis tool serving a variety of planning functions.

This poster for the 1991 Montana GIS Conference presents several GIS products being used in the Superfund process. Used at neighborhood meetings, the zoning maps have helped people understand what types of development are permitted today in Butte and how these activities could change in the future due to Superfund decisions. The Historic Park maps reveal a conceptual vision of Butte's future -- a concept designed to merge the necessity of environmental cleanup with cultural and economic development of the community.

The GIS products have provided a dynamic graphic medium to explain various concepts and solicit public input. In the end, the GIS will be instrumental in the community effort to make effective decisions.

DIGITAL ELEVATION MODEL ATTRIBUTES FOR PREDICTING SOIL FERTILITY

Kirk McEachern, Jeff Jacobsen and Gerald Nielsen, Department of Plant and Soil Science; John Wilson, Department of Earth Sciences, Montana State University, Bozeman, MT 59717

The development of a field-scale geographic information system (GIS) for fertility management depends on sufficiently precise soil fertility maps. The use of digital elevation models (DEM) in combination with an SCS soil survey may improve the development of soil fertility maps. The objective of this work is to determine which DEM terrain attributes are most relevant to NO_3-N, P, K, pH and organic matter. The treatment area is a 100m by 1605m strip near Power, MT. Maps of slope gradient, plan curvature, profile curvature and relative wetness were determined from a DEM with terrain analysis techniques. Soil samples were taken on a 30.5m by 50.3m grid prior to planting in August, 1990 and at harvest in July, 1991. Analysis of variance is being used to compare the variability within and between landscape units determined from overlays of the DEM maps with SCS soil map and soil attribute maps in Arc/Info.

MAPPING MONTANA'S COUNTIES: THE MUSSELSHELL COUNTY AND YELLOWSTONE COUNTY GIS PROJECT

Douglas Richardson, GeoResearch, Inc.; Bill Armold, Yellowstone County Planning Department; Monty Sealey, Musselshell County Planning Department; GRI GeoResearch, Inc., Billings, MT 59101

GeoResearch, Inc., is preparing an extensive GIS-based Natural Resources and Infrastructure Inventory and Analysis for Musselshell County, Montana. The GIS project documents land use, natural resources, public facilities, and transportation information necessary for ongoing county management. The Arc/Info data base produced during the planning study can be appended to other regional GIS data bases at a later date to enlarge the region of coverage. GIS, together with the GeoLink mapping system, is being used to integrate existing geographic data. Features mapped into the GIS database include: roads, streets, railroad lands, township and range legal land line information, surface ownership and city boundaries, as well as numerous natural resources and county infrastructure categories.

In addition, GeoResearch recently developed GIS maps and analyses for the Yellowstone County Comprehensive Plan. Soils, highways, zoning, and land use were among the features mapped to aid in the Comprehensive Planning process. GIS has proven to be practical, powerful and convenient tool for planning, economic, development, and facilities management for Montana counties.

A GEOGRAPHIC INFORMATION SYSTEM TO EVALUATE PESTICIDE GROUNDWATER CONTAMINATION POTENTIAL

Paul Rubright, Jeff Jacobsen, William Inskeep and Gerald Nielsen, Department of Plant and Soil Science; John Wilson, Department of Earth Sciences, Montana State University, Bozeman, MT 59717

The Chemical Movement in Layered Soils (CMLS) model was used to predict the time taken for a fraction of selected pesticides to leach below the root zone of agricultural soils. Predictions were made for State Soil Geographic (STATSGO) (1:250,000 scale) and Soil Survey Geographic (SSURGO) (1:24,000 scale) soil mapping units within Teton and Gallatin counties, Montana. The CMLS model was integrated with Arc/Info geographic information system (GIS) software to produce a series of

interpretive maps that classify site susceptibility to groundwater contamination from pesticide leaching. A prototype farm-scale (1:24,000) GIS could eventually provide varied application recommendations for different pesticide and soil combinations with low, moderate, or high potential for groundwater pollution.

GIS BASED VISUAL STUDIES

Robert Scott, Woodward-Clyde Consultants, Denver, CO 80237

This poster describes several visual resource studies that have been used in environmental impact analysis and assessment studies for several mining and energy development projects located in Montana. Two- and three-dimensional displays (computer maps) are included. The two-dimensional displays will provide spatial topographic mapped information showing which landscapes are of higher visibility. This is an important resource analysis tool when attempting to locate industrial facilities or activities near visually-sensitive areas such as national parks, wilderness or recreation areas.

The three-dimensional displays portray the location and scale of an activity on the landscape. This product provides significant information to agencies and the public assessing the visual change on the land and aids in determining if this level of visual contrast is acceptable to land management guidelines.

USING A GIS USER INTERFACE TO ASSESS MONTANA'S WATER DATA COVERAGE

James Stimson, Peter Langen and John Jarvie, Montana State Library, Helena, MT 59620

The Montana Water Information System (MWIS) is using a modified version of the Generic Demo Interface (GDI) to streamline some routine operations and to help assess statewide water data coverage. MWIS staff created statewide coverages for surface water, ground-water, water quality, and climate sites from the US Geological Survey, USDA-Soil Conservation Service, US Environmental Protection Agency, and National Weather Service. These coverages are useful for quality checking site location information and the production of reference maps for each data type.

GROUND WATER AVAILABILITY IN A MOUNTAIN AQUIFER SYSTEM, MAYNARD CREEK CATCHMENT, BRIDGER RANGE, MONTANA

John Whittingham, Department of Earth Sciences, Montana State University, Bozeman Montana, 59717

Ground water availability may be a limiting factor for recreation and resource development in arid, high mountain environments. An investigation is underway to define the function of unconsolidated, geomorphologic deposits on the storage, transmission, and discharge of ground water in the Maynard Creek catchment of the Bridger Range, Montana. PC and workstation versions of Arc/Info are being used to define the spatial relationships between bedrock and near-surface aquifers and the surface hydrology and geomorphology of the Maynard Creek catchment. Map products used for spatial overlays include a digital elevation model, a geologic map, a geomorphologic map, hydrologic maps, geophysical maps, and a vegetation map. Complementary database files are being constructed to describe the key attributes on each map coverage.

Wednesday (1:00 PM - 3:00 PM)

WHEN IS GIS NEEDED?

John Wilson, Department of Earth Sciences, Montana State University, Bozeman, MT 59717

The adoption and utilization of GIS technology within an organization is usually predicated on a decision that GIS will improve the organization's overall performance. This decision is as difficult as it is important, because: (i) GIS is but one of a number of different types of information systems that an organization could adopt and not every organization will need GIS to improve their information management capabilities, (ii) GIS adoption will require large investments in digital database creation and staff training as well as computer hardware and GIS software for most organizations, and (iii) it will often be impossible for potential system users to fully describe and anticpate their needs. This presentation describes some of the issues that should be addressed when making a decision to proceed or not and explains why a broad understanding of the processes the information system is designed to support will increase the likelihood of making the appropriate decision within a particular organization.

IMPLEMENTING AND OPERATING A GIS: INSTITUTIONAL CHALLENGES

Stuart Challender, Utah State Geographic Reference Center, Salt Lake City, UT 84114

The success of a GIS installation is dependent on many factors. During GIS planning the focus is often on hardware and software with little thought given to organizational and personnel considerations. This presentation focuses on the organizational, staffing and database issues that affect the success of implementing a GIS to meet an organization's needs. The topics that will be discussed include: the organizational structure or 'corporate environment', the importance of clearly defined goals and objectives, how this information can help to determine an appropriate level of GIS implementation and staffing within an organization, how these goals and objectives also help in establishing database standards and in prioritizing database development efforts, and the use of cooperative agreements between organizations as a way to minimize redundancy and duplication of effort in database and/or application development projects. The presentation will draw on experiences at the Utah Automated Geographic Reference Center in consulting with organizations for GIS implementation plans, database and application development.

TECHNOLOGICAL CHALLENGES TO IMPLEMENTING AND OPERATING A GIS OR 'HOW TO KEEP AIM AT A MOVING TARGET'

John Sharrad, Geographic Information System, Oregon Department of Energy, Salem, OR 97310

This presentation describes the rapidly changing hardware and software environments and in doing so covers the following topics: current hardware and software trends; future GIS technologies; relationships with hardware and software vendors, including purchasing practices, maintenance contracts and technical support; implementation of spatial data standards and spatial data libraries; and the development of GIS as a useful tool for those people who do not wish to read a shelf of software manuals prior to accessing the GIS. Numerous examples from the State of Oregon, where GIS has been implemented on a multi-platform network within a State Service Center for GIS, will be described as well.

Wednesday (3:30 PM - 5:00 PM)

GIS APPLICATIONS FOR FOREST MANAGEMENT

Brian Long and Donna Leeper, Division of Forestry, Montana Department of State Lands, Helena, MT 58620

Current law and policy require forest managers to analyze and evaluate much more spatial data than has ever been required in the past. Montana's Department of State Lands has just begun to use GIS to produce maps and facilitate spatial data analysis. A list of map layers in the GIS and how they were generated is briefly reviewed. How GIS generated information and maps have been used for field operations and for forest management planning is discussed. Examples of GIS-derived mapped data such as old growth forest, deer and elk thermal cover, grizzly bear security cover, and streamside management zones are shown. How GIS has been used to facilitate compliance with forest management standards and guidelines is also examined.

HEBGEN LAKE RANGER DISTRICT RESOURCE ANALYSIS

Alan Vandiver, Gallatin National Forest, Hebgen Lake Ranger District, West Yellowstone, MT 59758

The Hebgen Lake Ranger District on the Gallatin National Forest is using a computer program SPATIAL as a means to display spatial relationships in graphic form. SPATIAL, when used with DWRIS and Oracle, provides a basic set of GIS functionality.

These software tools were used to produce an Integrated Resource Analysis and Timber Sale Environmental Assessment for the Mosquito/Denny Analysis Area. This area is particularly sensitive as it is located in occupied grizzly bear habitat. SPATIAL was used on a 20,000 acre area to display resource components, such as old growth stands, riparian areas, existing roads, harvest units, vegetative types, and commercial timber stands. The SPATIAL plots were used to guide a field inventory for ground truthing the database information. Field informtion was input into the database and used for resource analysis. The result was spatial displays (plots) of: grizzly bear security areas, (these plots included parts of the Gallatin and Targhee National Forests); biological corridors between key wildlife habitats; road closure schemes to accomplish wildlife objectives; and timber harvest alternatives.

ANALYSIS OF THE WILDFIRE REGIMES AND THEIR EFFECTS ON THE FOREST STRUCTURE OF THE FLATHEAD NATIONAL FOREST

Dean Sirucek, Flathead National Forest, Kalispell, MT 59901

As a portion of an environmental impact statement for wildlife habitat the Flathead National Forest did an inventory of old growth forest describing the amount and distribution of old growth forest. In addition an analysis was undertaken to document the role of wildfire in this ecosystem. The analysis included a review of the pre-settlement to present day, natural (wildfire) and human-caused (timber harvest) forest disturbance processes, and their effect on the forest structure over time.

A pre-settlement (pre-1900) account of forest conditions is reported in the early field investigations by H.B. Ayres for the U.S. Geological Survey in 1898 and 1899. Ayres conducted two timber volume

surveys on portions of what are today the Flathead National Forest. These reports provide a glimpse of the forest structure at the time of settlement and the role fire played in developing it. The major forest disturbance processes operating in the Northern Rockies are wildfire and timber harvest. Comparisons of the amount of disturbance caused by fire and timber harvest through time were made using a computerized Geographical Information System (GIS). Five GIS maps were used for this comparison as follows: (i) 1898 and 1899 timber volume maps by H.B. Ayres; (ii) a fire history map (from 1885 to present); (iii) a Habitat Type Group map; (iv) the 1991 forest structure map (satellite data); and (v) a timber harvest map. The estimates of the amounts of old-growth forest were compared between geographical areas for the two time periods. The pattern of forest disturbance and therefore the resulting forest structural composition is different now than in the pre-settlement time period. For valley bottom forest types, the amount of old-growth has been reduced from an estimated 37 percent to an estimated 9 percent. For mid-elevation forest types, the amount of old-growth is quite similar today to conditions in the pre-settlement period. In the high-elevation forest types, fire suppression has dramatically increased the amount of old growth and mature forest: old growth was non-existent in 1898-99, but now represents 28 percent.

MODELING NON-POINT SOURCE POLLUTION: A CASE STUDY FOR THE BLACKFOOT RIVER GEOGRAPHIC INFORMATION SYSTEM

David James, Lockheed Engineering and Sciences Co., Las Vegas, NV 89119

Geographic information system (GIS) techniques have used basic data layers to develop the necessary inputs for watershed level modeling of non-point source pollution. A digital database has been constructed for the following data layers -- climate, topography, hydrography, soils, and land cover. These data were integrated with digital data derived from aerial photography and satellite imagery to identify point and non-point sources of water quality degradation. The predominance of silvicultural land-use activities in the watershed led to the use of the U.S. Forest Service water resource evaluation non-point source silvicultural (WRENSS) model. The model was selected to characterize non-point inputs to the Blackfoot River. The paper will describe the steps leading to the modeling activity and lessons learned.

SPATIALLY-DISTRIBUTED HYDROLOGIC PROCESS REPRESENTATION USING GIS: SOIL WATER CONTENT

Ian Moore, Centre for Resource and Environmental Studies, Australian National University, Canberra, ACT 2601, Australia

An index approach is proposed for mapping the spatial distribution of hydrologic processes in complex landscapes using GIS. The approach is based on simplifications of the underlying physics of the processes but includes the key factors that modulate system behavior (such as topography). With this approach we sacrifice some physical sophistication to allow improved estimates of spatial patterns in landscapes. The method must be able to operate at different levels of sophistication depending on the availability of possible input data and the spatial resolution of the data. The concept of "minimum data sets" is discussed. The prediction of the spatial distribution of soil water content is used to illustrate the approach. The predicted patterns of soil water content for the Cottonwood Creek catchment on the Red Bluff Experiment Station in southwestern Montana are presented.

IRRIGATION SYSTEM MAPPING WITH GPS ON THE WIND RIVER INDIAN RESERVATION, WY

Ruth Thayer, Bureau of Indian Affairs, Wind River Agency, Fort Washakie, WY 82514

This presentation describes a GPS mapping and inventory project for a 40,000 acre irrigation area managed by the Bureau of Indian Affairs in Wyoming. The mapping project incorporates data collection using Trimble satellite receivers and the transformation of these data into Arc/Info coverages.

The data were collected: (i) with the GeoLink software on a lap-top computer, and (ii) as remote files on Trimble receivers. The capture of the attribute data was handled differently in each case. GeoLink allowed the use of picklist files for point and line data capture, whereas the remote files had to be edited after Pathfinder software correction and Arc/Info generation had taken place. The benefits of the mapping project are the automation of the irrigation data, increased accuracy over older maps and the ability to model the irrigation project for improved management.

The presentation will cover the techniques used in data capture and transformation to Arc/Info. The problems encountered both in the field and in post-processing the raw data will also be presented.

Thursday (8:30 AM - 10:00 AM)

WESTERN MONTANA'S WITHDRAWN MINERALS: GIS SHOWS HOW MUCH TODAY!

Paul Hyndman, Western Field Operations Center, U.S. Bureau of Mines, Spokane, WA 99202

The U.S. Bureau of Mines is using GIS to answer several questions about mineral resources and the Federal mineral estate in western Montana. The questions are: (i) where is the Federal mineral estate, (ii) what are the legal and management restraints on the estate, and (iii) how much of the Federal estate is available, restricted, or unavailable for exploration and development. Answering these questions will provide a picture of where and how much of western Montana's mineral areas are withdrawn today. These answers may also provide insights as to what might happen tomorrow!

GIS APPLICATIONS FOR ENVIRONMENTAL ANALYSES AT THE BONNEVILLE POWER ADMINISTRATION - THE NW MONTANA/N. IDAHO SUPPORT PROJECT EXPERIENCE

Phil Smith, Bonneville Power Administration, Portland, OR 97208

The Northwest Montana/North Idaho Support Project is designed to maintain electrical service to communities in the Northwest Montana and North Idaho area consistent with Bonneville Power Administration's (BPA) reliability criteria. The existing system faces significant near-term and long-term reliability problems. Therefore, action must be taken to avoid overloads which could force BPA to cut off or reduce electrical service. BPA employs its GIS capabilities routinely to assist in siting facilities and evaluating their environmental impacts. This paper discusses the application of BPA's GIS in determining the environmental impacts posed by construction of a new 230-kV transmission line from Libby dam to Bonners Ferry, Idaho.

GIS AND ENVIRONMENTAL IMPACT STATEMENTS: THE USFS OIL AND GAS LEASING EIS

Douglas Richardson and Anne Cossitt, GeoResearch, Inc., Billings, MT 59101

GIS and GPS technologies were used extensively by GeoResearch, Inc. to prepare a major Oil and Gas Leasing Environmental Impact Statement for the U.S. Forest Service/Custer National Forest and the U.S.Bureau of Land Management on a 1.2 million acre Little Missouri National Grasslands study area. The environmental impact statement analyses of the USFS proposed action and four alternatives which were developed for management of the federal oil and gas estate throughout the National Grasslands.

The integration of GIS and GPS, through the GeoLink mapping system, was used to analyze data and create new information as an integral part of this EIS in order of provide critical information never before gathered. For example, as a part of this study the GIS was used to combine layers displaying numerous classes of mineral and surface ownership. The resulting single layer, or map, displays surface and mineral ownership information for individual parcels of land proposed for lease by the USFS, and compares these with existing and proposed new roads and oil well sites for each alternative analyzed in the EIS. Key environmental features mapped by GIS and GeoLink included wildlife areas, woody draws, slopes, etc. These were intersected with lease tract types, federal land management areas., to provide analyses of environmental effects of various alternative actions.

DEVELOPMENT OF A DETAILED LAND COVER AND LAND USE GIS FROM SATELLITE IMAGERY

Sam Doak, Pacific Meridian Resources, Portland, OR 97201

A pilot study was conducted to assess the utility of using satellite imagery to map rural land cover and land use on the outskirts of the Portland metropolitan area, and to create a GIS land use/land cover polygon data layer to supplement existing parcel-based GIS data for the interior metropolitan area. Image classification was performed using ERDAS image processing software on geocoded, terrain-corrected Landsat TM data using a combined supervised and unsupervised classification approach. The image classification and GIS development was assisted by data linkages between ERDAS, SAS and ARC/INFO and by ancillary data including existing transportation and hydrology GIS coverages, 1:24,000 aerial photography, and field reconnaissance. A three level classification scheme was developed patterned after Anderson's classification scheme (Anderson, 1976). In order to increase classification accuracy, spectral and land cover variation were minimized by classifying the image in two stages. In the first stage a preliminary classification was developed to stratify the image into four broad types: forest, agriculture, urban and water. This preliminary classification was used to mask the image so that greater detail could be identified through the second classification. The masked portions of the image were classified separately providing much greater detail within each broad type and helping to pinpoint and correct errors in the initial classification. After classifying the image in this manner the resulting raster GIS was edited manually using aerial photography and field notes. Polygon creation included the application of scanning algorithms to create homogeneous cover type areas followed by conversion to an ARC/INFO polygon coverage containing three cover type attributes corresponding to the three levels of classification detail. Field accuracy assessment will be performed on a stratified random sample of polygons within each cover type selected from the ARC/INFO database. Three separate error matrices will be presented, one for each classification level.

REMOTE SENSING IN GIS

Don Krogstad, Flathead National Forest, Kalispell, MT 59901

The Flathead National Forest has been using remote sensing and image processing technology in support of GIS for the past 10 years. This presentation will cover past and present applications using Landsat and Spot satellite imagery. Image processing techniques will be discussed to generate and update GIS themes. Examples of image processing projects include: Timber Stand Atlas and road updates, vegetation mapping, patch-edge analysis, and timber availability.

THE HIGH RESOLUTION AIRBORNE DATA ACQUISITION AND REGISTRATION (ADAR) SYSTEM

Ron Behrendt, Cody Benkelman and Dale Johnson, Positive Systems, Inc., Kalispell, MT 59903

The Airborne Data Acquisition and Registration (ADAR) System 5000 described in this paper is a new computer system designed specifically to collect, multispectral raster images for GIS systems. From small aircraft, this system provides high resolution (i.e .5 to 5 meters per pixel) digital imagery in spectral bands custom tuned for specific applications. The System 5000 also incorporates the use of GPS technology, allowing scenes to be registered with approximate location information. This feature greatly enhances the effectiveness of images listed in applications where location information is critical and difficult to obtain.

The data collected by the System 5000 is available in standard formats for input into GIS/IP systems shortly after the completion of each flight. This allows GIS users to process data quickly and efficiently, permitting time critical applications that might not be feasible with other data sources.

Thursday (10:30 AM - 12:00 NOON)

"ALICE IN GIS WONDERLAND", A RETROSPECTIVE OVERVIEW

Michael Sweet and Ken Wall, School of Forestry, University of Montana, Missoula, MT 59812

GIS technology is truly wonderful, but a strong dose of reality is needed when it comes to assessing the role GIS will play within an organization. Before embarking on a trek through "Wonderland", an organization needs to evaluate it's own abilities, and decipher the real motivation for implementing a GIS. As Lewis Carroll's Alice would suggest, things aren't always as they seem to be.

This presentation will take a retrospective look at the trials and tribulations of 5-years of experience in implementing a GIS to assist in managing information for a 30,000-acre forest. By focusing on a few key issues important to successfully implementing a GIS, we hope potential user's will avoid some of the pitfalls, and gain a higher degree of confidence in their ability as an organization to make the right decisions.

TIMBER AVAILABILITY STUDY - FLATHEAD NATIONAL FOREST

Fred Hodgeboom, Flathead National Forest, Kalispell, MT 59901

GIS, remote sensing and relational data base methods and products are in use to quantify timber stands needed for non-timber purposes as specified by standards in the Land and Resource Management Plan (LRMP). Questions have been raised as to whether the resource management standards written in the LRMP were adequately considered in the forest planning process which used FORPLAN (an optimizing linear program) to model Allowable Sale Quantity (ASQ) and land use alternatives (ASQ is the maximum amount of timber harvest scheduled in decade 1). This project uses a basic classified LANDSAT vegetation layer in a GIS system along with standard stand exam data and topographic and planimetric map data to provide a forest-wide "in place" 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 type, crown canopy closure, and merchantable volume. Vegetation attributes are modeled together as specified by LRMP wildlife habitat standards to derive maps and reports for forage/cover classes for ungulates and grizzly bears, habitat, 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 "not available" layer and stands are co-located to meet multiple standards to the extent possible. Results of this study are intended to provide a factual basis for determining whether or not compliance with the LRMP standards makes achievement of the ASQ infeasible.

DATA SUITABILITY FOR PROJECT ANALYSIS

James Reid, Flathead National Forest, Kalispell, MT 59901

The Flathead National Forest (FNF) uses GIS to evaluate existing conditions and to help plan management alternatives to implement our forest plan. When planning an analysis project, an information needs assessment (INA) is performed first to plan proper methodology, to insure the suitability of the data that is available and to plan the final output product needs. This planning can save many hours of wasted efforts, it can insure that the data available is at a suitable accuracy, that the attributes are of needed detail, and whether or not new data is needed for the analysis. Not all data collected is suitable for every analysis that may be needed. The scale, detail and accuracy of the source map and the collection methods will greatly influence the quality of the data. Not all the data in storage has an associated database containing information needed for analyses. New data, or additional detail may need to be obtained. The INA process also helps in the development of planning procedures and with work load planning and scheduling. This INA planning and data suitability analysis is essential to meet management needs and maintain a high confidence level in the GIS output.

IDENTIFICATION AND PROTECTION OF BIODIVERSITY IN MONTANA USING A GIS

Roland Redmond, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, MT 59812

Increasing losses of the earth's ecosystems, communities, and species during recent decades have focused the attention of scientists and conservationists on the need to preserve these irreplaceable

biological resources. In the United States, preservation of biological diversity is a stated objective of federal land management agencies and numerous private conservation organizations. Planning for the conservation of biodiversity, however, first requires identification of the components and how well they are protected under existing land management regimes. Scientists at the University of Montana recently began a statewide GIS application to: 1) analyze the spatial distributions of terrestrial vegetation and native vertebrates, in conjunction with land ownership and management data throughout the state, 2) assess how well ecological types and native vertebrates are represented in protected areas, and 3) identify patterns of species richness and gaps in their level of protection. Such an approach is intended to help agencies effectively manage wildlife species before populations decline to the point that costly and heroic measures are required to insure their survival. This project will compile and share a standardized set of GIS databases for use and further development by state and federal agencies, as well as private organizations. Land managers should find these a valuable tool for anticipating and preparing for future conflicts over land use.

PREDICTING RANGELAND GRASSHOPPER DENSITIES USING A GIS WITH MACHINE LEARNING TECHNIQUES

James Berry and William Kemp, USDA-ARS Rangeland Insect Laboratory, Bozeman, MT 59717

For some problems, machine learning algorithms can effectively capture information from large, complex data sets. Machine learning software can potentially be used to find relationships in spatially-referenced, historical (since 1948) rangeland grasshopper data. These discovered relationships may be used to predict grasshopper densities for a coming year. A GIS (120 data layers) was used to prepare input data for machine learning software and to display the predictions.

REGIONAL POPULATION VARIATION IN INSECTS: RANGELAND GRASSHOPPERS (ORTHOPTERA: ACRIDIDAE) IN SPACE AND TIME

William Kemp and Thomas Kalaris, USDA-ARS Rangeland Insect Laboratory; William Quimby, Department of Mathematical Sciences, Montana State University, Bozeman, MT 59717

Variability of adult rangeland grasshopper densities was studied for yearly statewide collections in Montana. Manager-oriented hazard maps were produced through the application of the geostatistical technique known as indicator kriging. The development of experimental semivariograms and indicator kriging from yearly rangeland grasshopper density data are discussed, as well as the potential for indicator kriging in predicting future hazard. Vegetative characteristics were also examined as an additional level of resolution in hazard assessment. Results and methods will be useful to entomologists and pest managers interested in predicting insect hazard.

Thursday (1:30 PM - 3:00 PM)

IMPLEMENTING A LARGE SCALE GIS ON A STATEWIDE PROJECT: THE FOREST PRODUCTIVITY BASED TAXATION SYSTEM

Ken Wall, School of Forestry, University of Montana, Missoula, MT 59812

This presentation will provide an overview of the methods and products for a multi-year GIS project to produce 1:15,840 scale township level forest productivity maps. The GIS will include all private

commercial forest land in Montana for use as a basis for new legislation establishing the forest productivity based taxation system.

The presentation will highlight linkage of biogeoclimatic models with digital elevation models and the statewide STATSGO soils database to predict forest productivity, use of Landsat Imagery to delineate forested and non-forested areas and integration of GIS data from multiple sources. Discussion will include the use of two GIS programs used for this project, Arc/Info and PAMAP, and problems inherent in integrating varied data sources.

INTEGRATING CAMAS DATA FROM THE STATE WITH YELLOWSTONE COUNTY'S PARCEL MAPS

Michael Blongewicz, Environmental Systems Research Institute, Inc., Olympia, WA 98501

The intent of this paper is to outline the process used to interface Yellowstone County's parcel maps with the CAMAS database from the State of Montana, utilizing ARC/INFO software.

In a benchmark, ESRI was given the task of taking a portion of the CAMAS database, successfully linking it to the parcel maps developed for the County, and establishing a match between the parcel and the assessor's database within the County. This meant dealing with tabular data that existed in many fields of different character types and widths and parcels that only had a lot and block number. The data fields had to be reclassified into one that would equal the tax-parcel number developed from the lot and block number plus the quarter section number on the parcel maps.

IMPLEMENTING A GIS: NECESSARY FUNCTIONS, SUCCESSFUL STRATEGIES

Dean Anderson, Environmental Systems Research Institute, Inc., Olympia, WA 98501

To successfully implement a GIS, each organization must perform ten general functions. Each requires certain capabilities, skills and knowledge, although one individual often performs more than one function. In many cases, numerous people perform the same function. The people range from a manager to a digitizer and a programmer.

The intent of this paper is to identify those people and the functions that each performs in implementing a GIS.

NATURE PRESERVE REPRESENTATIVENESS: ASSESSMENT USING A COMBINATION OF A GIS AND RULE-BASED MODEL

Rob DeVelice, Gerry Daumiller and Jon Jarvie, Montana State Library; Pat Bourgeron, The Nature Conservancy, Helena, MT 59620

Identification of significant sites and assessment of the representativeness of sets of preserves are important objectives in nature conservation. A combination of a GIS and a rule-based model were utilized to evaluate preserves in a approximately 500,000 acre area in western Montana. The key climatic and soil attributes hypothesized to have the most direct influence on plant species growth and survival (i.e., moisture regime, temperature regime, soil fertility) were aggregated in a bioenvironmental classification. A map of bioenvironmental types was generated. Existing and

proposed preserve boundaries were overlaid on these maps. Gaps in the representation of the range and diversity of bioenvironmental types were identified. Preliminary boundaries for a representative set of preserves are suggested.

GIS AND STATISTICAL MODELING FOR ORDER 1 SOIL SURVEYS

Thomas Keck, Department of Plant and Soil Science, Montana State University, Bozeman, MT 59717

The joint application of GIS and statistical modeling provides an alternative means for upgrading soil surveys. Data were collected on a 50 meter grid for the following soil attributes: depth to water table, depth to sand and gravel, thickness of mollic epipedon, and depth to secondary lime. Statistical interpolation methods were used to estimate values at unsampled locations and the data were composited in a raster based GIS. This method provides site specific estimates of soil properties at each location. Interpretive maps are drawn based on the underlying data and the results compared to the standard soil survey.

INTEGRATING THE SCS SOIL LEACHING POTENTIAL INDEX (SLPI) INTO THE IDAHO GROUND WATER VULNERABILITY RATING SYSTEM

Doug Harrison, USDA Soil Conservation Service, Bozeman, MT 59715

A method to integrate the SCS Soil Leaching Potential Index (SLPI) was developed for the Idaho Groundwater Vulnerability Rating System. SLPI, a function of soil surface horizon thickness, organic matter content of the surface horizon, and hydrologic group, was used as a measure of the attenuation potential of soils for dispersing pesticides. SLPI numeric ratings were derived for selected soil map units in the Idaho State Soil Geographic Data Base (STATSGO). Numeric ratings for SLPI classes were calculated based on the percentage composition of soils within each STATSGO unit. A geographic information system was used to merge SLPI ratings with existing numeric ratings for land use/recharge and depth to ground water layers developed by the Idaho Department of Water Resources and U.S. Geological Survey, respectively. A groundwater contamination hazard map for pesticides was derived for the 1:100,000 scale Lake Walcott Quadrangle, Idaho.

Thursday (3:30 PM - 5:00 PM)

GIS IN LIBRARIES - PUBLIC ACCESS TO PUBLIC DATA

Kris Larson, Natural Resource Information System, Montana State Library, Helena, MT 59620

Many GIS organizations and agencies are already working hard to promote data sharing and database compatibility among their peers. Ideally, data sharing must expand beyond governmental agency use and extend to all Montana residents. The Natural Resource Information System recently wrote a proposal for a grant of hardware and software to place a user-friendly GIS in several Montana libraries for a one year period. The locations will represent a cross-section of libraries and information needs for this pilot project. This presentation will address the issue of public access to public data, the implementation of the pilot project, and demonstrate how the GIS system will be used in a typical library.

MONTANA GIS STANDARDS PLAN PANEL DISCUSSION

Montana Interagency GIS Technical Working Group

The Montana Interagency GIS Technical Working Group (TWG) was charged in its charter to develop and compile "data standards for the common base map themes depicting public land lines, hydrography, transportation, and ownership" and investigate "methods and priorities towards the creation of a statewide transferable digital database". These charges have resulted in the development by the TWG of a GIS standards plan for Montana. The TWG began work on the plan in May 1991 and is presenting the final draft to the Montana GIS User Group at the 1991 GIS Conference for comment. Members of the Montana GIS User Group are encouraged to review and comment on the plan. These comments will be reviewed by the TWG and a final version of the plan will be adopted at the winter, 1992 TWG meeting. The plan includes topics on: GIS spatial data standards, data transfer methods, data documentation, state-wide base layers, project and data coordination, and ethical considerations. This presentation will briefly provide an overview of the plan and the assumptions, considerations, issues, and compromises behind the plan's development.

OFFICE OF MANAGEMENT AND BUDGET CIRCULAR A-16 "COORDINATION OF SURVEYING, MAPPING, AND RELATED SPATIAL DATA ACTIVITIES"

Pamela Lovely, Coordination & Requirements, National Mapping Division, United States Geological Survey, Denver, CO 80225

On October 19, 1990, the Office of Management and Budget (OMB) issued the revised OMB Circular A-16, titled "Coordination of Survey, Mapping, and Related Spatial Data Activities." The revised Circular establishes a new interagency coordinating committee, the Federal Geographic Data Committee (FGDC). The objective of the FGDC is to promote the coordinated development, use, sharing, and dissemination of surveying, mapping and related spatial data.

An important focus of the FGDC will be to provide guidance and promote cooperation among Federal, State, and local government agencies and between the public and private sectors in collecting, producing, and sharing of spatial data. Initially, a liaison working group will assess opportunities for coordination with non-Federal spatial data users.

CHOOSING A MAP PROJECTION FOR A STATEWIDE DATABASE

Gerry Daumiller, Natural Resource Information System, Montana State Library, Helena, MT 59620

NRIS has several GIS projects active in different parts of Montana. Each project used a different map projection for its geographic data. When statewide data started to become available, NRIS had to decide on a map projection to use for this data and for all of the projects.

This presentation describes the process we used to determine which projection would portray the state with the least error in scale and area. It also describes an Arc/Info AML program that we use to plot maps of any area of the state with North running straight up and down on the map sheet.

GIS - A NEW TOOL FOR THE MONTANA WATER INFORMATION SYSTEM

James Stimson, Peter Langren and John Jarvie, Natural Resource Information System, Montana State Library, Helena, MT 59620

The Montana Water Information System (MWIS) was established as a clearinghouse and referral service to link users with the best sources of water information. The MWIS now uses GIS to streamline some of these operations with a version of the Generic Demo Interface (GDI), developed by ESRI and customized by MWIS. For example, statewide coverages were created for climate, surface water, ground-water, and water quality sites. With the GDI, these coverages are used to help assess statewide data inventories, quality check site location information, and to produce reference maps for each data type. The GDI is also used to generate study area maps in response to individual requests. The maps show site locations from which data were obtained and help the patron quickly assess the value of the available data to their project. MWIS will continue to modify the GDI to support it's routine operations and new projects (i.e., drought monitoring and stream reach mapping).

Abstract Author Index