Proceedings of the U.S. Geological Survey Fourth Biennial Geographic Information Science Workshop: Denver, Colorado, April 23–27, 2001

Scientific Investigations Report 2005–5117

U.S. Department of the Interior
U.S. Geological Survey

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By Jennifer B. Sieverling, Stephen J. Char, and Carma A. San Juan

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U.S. Geological Survey

U.S. Department of the Interior
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
yard (yd)	0.9144	meter
	Area	
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	2.590	square kilometer (km^2)

Si to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
meter (m)	1.094	yard
	Area	
square meter (m^2)	0.0002471	acre
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861	square mile (mi^2)

Proceedings of the U.S. Geological Survey Fourth Biennial Geographic Information Science Workshop: Denver, Colorado, April 23–27, 2001

By Jennifer B. Sieverling, Stephen J. Char, and Carma A. San Juan

Introduction

The U.S. Geological Survey (USGS) Fourth Biennial Geographic Information Science (GIS) Workshop (USGS-GIS 2001) was held April 23–27, 2001, at the Denver Federal Center in Denver, Colorado. The workshop provided an environment for participants to improve their knowledge about GIS and GIS-related applications that are used within the USGS. Two major topics of USGS-GIS 2001 were the application of GIS technology to interdisciplinary science and the distribution and sharing of USGS GIS products. Additionally, several presentations included GIS technology and tools, project applications of GIS, and GIS data management.

USGS-GIS 2001 included user and vendor presentations, demonstrations, and hands-on technical workshops. Presentation abstracts that were submitted for publication are included in these proceedings. The keynote speaker was Karen Siderelis, the USGS Associate Director for Information (Geographic Information Officer). In addition to the USGS, other Federal agencies, GIS-related companies, and university researchers presented lectures or demonstrations or conducted hands-on sessions. USGS employees and contractors from every discipline and region attended the workshop. To facilitate the interaction between the Federal agencies, each of the presenting Federal agencies was invited to send a representative to the workshop.

One of the most beneficial activities of USGS-GIS 2001, as identified by an informal poll of attendees, was the Monday evening poster session in which more than 75 poster presentations gave attendees a chance to learn of work being performed throughout the USGS. A feature new to USGS-GIS 2001 was internet participation of USGS personnel through cyber seminars of the morning plenary sessions.

Purpose and Scope

These proceedings document the information presented at USGS-GIS 2001. These proceedings include a description of workshop attendees, their participating organizations, and the workshop schedule. Presentation abstracts are listed alphabetically by primary author.

Summary Description of Registered Attendees:

Total number of attendees: 207

- USGS employees and contractors: 200
- Biological Resources Discipline: 20
- Geographic Information Office: 2
- Geology Discipline: 44
- Director's Office: 1
- Geography Discipline: 43
- Operations: 2
- Water-Resources Discipline: 88
- Federal Geographic Data Committee: 1
- Minerals Management Service: 3
- U.S. Bureau of Reclamation: 3

States represented by USGS personnel:

Alaska, Arizona, California, Colorado, Florida, Georgia, Iowa, Idaho, Illinois, Indiana, Kansas, Louisiana, Maryland, Maine, Massachusetts, Minnesota, Missouri, Montana, New Mexico, North Carolina, New Hampshire, Nevada, New York, Ohio, Oklahoma, Oregon, South Carolina, South Dakota, Texas, Utah, Virginia, Washington, Wisconsin

Participating Organizations:

Federal Agencies:

Bureau of Reclamation
Bureau of Land Management
U.S. Census Bureau
U.S. Department of Agriculture
U.S. Department of Agriculture Forest Service
U.S. Department of Agriculture National Resources Conservation Service
U.S. Department of Energy
U.S. Department of the Interior
U.S. Environmental Protection Agency
Federal Emergency Management Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Park Service

Consortia:

Federal Geographic Data Committee
Open GIS Consortium

Universities:
- Colorado School of Mines
- Oregon State University
- University of Colorado

Commercial vendors:
- AutoDesk, Inc.
- Dynamic Graphics, Inc.
- Environmental Systems Research Institute, Inc.
- ERDAS, Inc.
- EMC2
- IBM Corporation
- LizardTech, Inc.
- Microsoft Corporation
- Oracle Corporation
- Research Systems, Inc.
- Silicon Graphics Inc.
- Trimble Navigations Limited
- Voice Insight

Peer Review Process

All abstracts in this report have undergone the review procedures mandated by USGS policy. Minor modifications have been made to selected abstracts to ensure consistent formatting and use of acronyms.

A glossary of selected terms is at the end of this document. Terms, abbreviations, and acronyms were selected for inclusion in the glossary if they were used in more than one abstract. Terms, abbreviations, and acronyms that are not in the glossary are explained in the abstract in which they are used.

USGS-GIS 2001 Schedule

<table>
<tr><th colspan="10">MONDAY, APRIL 23</th></tr>
<tr><th colspan="10">Building 810 Auditorium</th></tr>
<tr><td>8:00-9:45 AM</td><td colspan="9">Plenary session:
Orientation; Jennifer Sieverling, Workshop Coordinator
Welcome; Tom Casadevall, Central Region Director
Keynote; Karen Siderelis, GIO</td></tr>
<tr><td>9:45-10:00</td><td colspan="9">BREAK</td></tr>
<tr><td>10:00-11:30AM</td><td colspan="9">Plenary session:
ESRI's Vision of the Future of GIS; Clint Brown, ESRI</td></tr>
<tr><th colspan="10">Building 53, National Training Center</th></tr>
<tr><th>ROOM--></th><th>Breckenridge</th><th>Copper</th><th>Keystone</th><th>Snowmass</th><th>John B. Weeks</th><th>Loveland</th><th>Winter Park</th><th>Silver Creek and Telluride</th></tr>
<tr><td>11:30 AM-1:00 PM (LUNCH)</td><td colspan="5">LUNCH/BOFs</td><td>(Tom Owens) Mark Dunn (EMC[2]);
Data Storage Strategies</td><td colspan="2">LUNCH/BOFs</td></tr>
<tr><td>1:00-2:50 PM</td><td>Hands-on Session: Beginning Remote Sensing (ERDAS)</td><td>Hands-on Session: ArcGIS (ESRI) (first offering)</td><td>Hands-on Session: ArcSDE (ESRI)</td><td>Hands-on Session: Raster Display and Analysis in ArcMap (USGS and ESRI) (first offering)</td><td>National Datasets: (Keven Roth)
Paul Wiese and Tommy Dewald; The National Hydrography Dataset, 40 minutes
Kim Sparks; Introducing Reach Indexing Tools, 20 minutes
Adam M. Davis; The Washington DC Area Geologic Map Database: A tool for solving environmental and resource problems, 40 minutes</td><td>DOI Case Studies: (Ingrid Landgraf)
Lorri Peltz-Lewis and others, USBR
90 minutes</td><td>Education: (Mark Negri)
Joseph J. Kerski; Implementing GIS Technology and Methods in Education, 40 minutes
Mark G. Negri; Migration Paths to ArcGIS version 8.1, 40 minutes
Alan Ward and Joseph J. Kerski; GIS Education for Professionals, 40 minutes</td><td rowspan="3">Vendor Displays</td></tr>
<tr><td>2:50-3:10</td><td colspan="7">BREAK</td></tr>
<tr><td>3:10-5:00 PM</td><td>Hands-on Session: (continuation)</td><td>Hands-on Session: (continuation)</td><td>Hands-on Session: ArcPad(ESRI) (first offering)</td><td>Hands-on Session: ArcGIS 8.1 Metadata Tools (ESRI)</td><td>National Datasets: (Al Rea)
Stephen M. Howard and James E. Vogelmann; The National Land Cover Dataset, 20 minutes
Kristine Verdin; NED & its Hydrologic Derivatives (Status and Plans), 40 minutes
Alan Rea; Development of a National Watershed Boundaries Data Set, 40 minutes</td><td>System Administration: (Lance Clampitt)
Boyce Blanks; Hardware and network issues, 40 minutes
Joe Adams; Using Samba and Microsoft's Distributed File System to share GIS data, 1 hour</td><td>Cartography and Accuracy: (Barb Ray)
Jean Dupree and David Litke; Map graphics made easy--an impossible goal?, 20 minutes
Gary L Merrill; Evaluating Digital Elevation Models for Horizontal Accuracy, 20 minutes
Maria McCormick; How to avoid having your cartographic license revoked, 1 hour</td></tr>
<tr><td>6:00-9:00 PM</td><td colspan="9">Poster Session at Holiday Inn, Lakewood (Barb Ray, coordinator)</td></tr>
</table>

TUESDAY, APRIL 24								
Building 810 Auditorium								
8:00-9:30 AM	Plenary session: ERDAS's Vision of the Future of Remote Sensing; John Allan, ERDAS							
9:30-9:45	BREAK							
9:45-11:30 AM	Plenary session: New Tools - ArcGIS 8.1; Clint Brown, ESRI Future of NSDI and Related Initiatives; John Moeller, FGDC							
Building 53, National Training Center								
ROOM-->	**Breckenridge**	**Copper**	**Keystone**	**Snowmass**	**John B. Weeks**	**Loveland**	**Winter Park**	**Silver Creek and Telluride**
11:30 AM-1:00 PM (LUNCH)	LUNCH/BOFs					(Tom Owens) Peter Curtis (Trimble); GPS: New Products and Data Maintenance	BOF: Building a National Streamflow Statistics Application; Kernell Ries, Pete Steeves, and Al Rea	LUNCH/BOFs
1:00-2:50 PM	Hands-on Session: Introduction to using Autodesk Engineering Tools for managing 3D point data, including bore log data and terrain modeling (Autodesk)	Hands-on Session: Reach Indexing Tools (USGS)	Hands-on Session: Implementing ArcIMS (USGS and ESRI)	Hands-on Session: Intro to VBA for ArcGIS 8.1 (ESRI)	Case Studies: (Carma San Juan) Wayne R. Belcher and A. Keith Turner (Applied Earth Sciences, Delft); Geographic Information Systems (GIS), Visualization, and Data Dissemination for the Harappa Archaeological Site, Punjab Province, Pakistan: a Model for WRD, 40 minutes ArcView 8.1 for ArcView 3.2 Users lecture (ESRI) 1 hour	Remote Sensing: (Tom Owens) Ralph Root, Ray Kokaly, Karl Brown, and Gerry Anderson; Future Directions in Remote Sensing for the Detection of Invasive Plants, 20 minutes Ralph Root, Ray Kokaly, Karl Brown, Gerry Anderson, and Steve Hager; Detection of Leafy Spurge Infestations through Imaging Spectroscopy using the Compact Airborne Spectrographic Imager (CASI), 20 minutes Zachary H. Bowen and Robert G. Waltermire ; Evaluation of LIght Detection And Ranging (LIDAR) for Measuring Topography in a River Corridor , 30 minutes	DOI Case Studies: (Nancy Shock) Melinda Walker, BLM, 1 hour Bob Johnson (MMS); GIS, GPS and Resolution of Legal and Jurisdictional Boundaries, and Joe Cornellisson (MMS), GIS from the Ground Up, 1 hour	Vendor Displays
2:50-3:10	BREAK							
3:10-5:00 PM	Hands-on Session: Publish Your Data on the Web: The MapGuide Solution (Autodesk)	Hands-on Session: (continuation)	Hands-on Session: (continuation)	Hands-on Session: (continuation)	National Datasets and Elevation issues: (Barb Ray) Oregon State University; PRISM climatic data, 40 minutes John J. Kosovich and John E. List; Elevation Research Activities at the Rocky Mountain Mapping Center, 1 hour	DSS and Internet Applications: (Lance Clampitt) Henry C. DeHaan, Timothy James Fox, Carl E. Korschgen, Charles H. Theiling, and Jason J. Rohweder; Habitat Needs Assessment GIS Query Tool for the Upper Mississippi River System, 40 minutes Adam C. Schultz and Marc Levine; GEODE - An interactive data retrieval, display, and analysis Internet application, 40 minutes	DOI Case Studies: (Ingrid Landgraf) Steve Gregonis (USFS); The Forest Service Geospatial Enterprise, 1 hour	
TBA	Birds-of-a-Feather meetings							

WEDNESDAY, APRIL 25								
Building 810 Auditorium								
8:00-9:50 AM	Plenary session: announcements GEOMAC: Wildland Fire Support; (John D Guthrie, USGS); and Jeff Barsnyi, ESRI Gateway to the Earth; Ken Lanfear, USGS							
9:50-10:05	BREAK							
10:05-11:30 AM	Plenary session: Open GIS Consortium; Sam Bacharach, OGC Fred Broome, U.S. Census Bureau							
Building 53, National Training Center								
ROOM-->	**Breckenridge**	**Copper**	**Keystone**	**Snowmass**	**John B. Weeks**	**Loveland**	**Winter Park**	**Silver Creek and Telluride**
11:30 AM-1:00 PM (LUNCH)	LUNCH/BOFs				BOF: ArcIMS, Jacque Coles	LUNCH/BOFs		
1:00-2:50 PM	Hands-on Session: Advanced Remote Sensing (ERDAS)	Hands-on Session: Working with NHD (USGS)	Hands-on Session: ArcView 8.1 for ArcView 3.2 Users (ESRI) (first offering)	Hands-on Session: Basic Earth Vision Applications (Dynamic Graphics, Inc.)	Internet and Data Distribution: (Gary Kress) Jeanne Heuser and Bob Davis; Missouri River InfoLINK Internet Map Display, 20 minutes Laura R.H. Biewick and Gregory L. Gunther; Using Internet / Intranet GIS Technology To Make USGS Information More Accessible, 40 minutes Mike Buswell; New E-Commerce Sites At United States Geological Survey / Earth Resources Observation Systems Data Center, 40 minutes	Tools: (Nancy Shock) Raster tools lecture (ESRI), 1 hour 3-D Tools lecture (ESRI), 1 hour	DOI Case studies: (Ingrid Landgraf) Leslie Armstrong, NPS National GIS Coordinator, 1 hour Deb Southworth-Green, FWS National GIS Coordinator, 1 hour	Vendor Displays
2:50-3:10	BREAK							
3:10-5:00 PM	Hands-on Session: (continuation)	Hands-on Session: USGS ArcInfo Custom Commands and Enhancements (Curtis Price, USGS)	Hands-on Session: ESRI 3-D Tools (ESRI)Advanced Earth Vision Applications (Dynamic Graphics, Inc.)	Hands-on Session: Advanced Earth Vision Applications (Dynamic Graphics, Inc.)	Internet and Data Distribution: (Gary Kress) Marianne August and David W. Litke; ArcIMS website for browsing GIS data sources, 20 minutes Implementing ArcIMS lecture; ESRI, 50 minutes David Greenlee; Base Layers for Internet Mapping 40 minutes	Project Applications: (Ingrid Landgraf) Matthew L. Jones and Grady M. O'Brien; GWSI Utilities: An Application that Improves the Integration of Ground-Water Site Inventory (GWSI) System Information with a Desktop Geographic Information System (GIS), 20 minutes Matthew L. Jones and Grady M. O'Brien; The Hydrograph Analyst: an Arcview GIS Extension that Integrates Point, Spatial, and Temporal Data and Provides a Graphical User Interface for Hydrograph Analysis, 20 minutes	Fire Projects: (Tom Owens) Jeff L. Sloan and Stan Wilds; Rapid Update of Digital Raster Graphics for Wildland Fire Support, 20 minutes Karl Brown; GPS Myths and Rumors, 40 minutes Karl Brown; Fire Projects, 40 minutes	
TBA	Birds-of-a-Feather meetings							

THURSDAY, APRIL 26									
Building 810 Auditorium									
8:00-8:30 AM	ANNOUNCEMENTS, POSTER AWARDS								
8:30-9:30	Plenary Session: Integrated Science; Randy Olsen, USGS								
9:30-9:45 AM	BREAK								
9:45-11:30 AM	Plenary session: DSS; Ken Snyder, DOE INCLUDE; Christine Turner, USGS								
Building 53, National Training Center									
ROOM-->	**Breckenridge**	**Copper**	**Keystone**	**Snowmass**	**John B. Weeks**	**Loveland**	**Winter Park**	**Silver Creek and Telluride**	
11:30 AM-1:00 PM (LUNCH)	LUNCH/BOFs				(Barb Ray)Tom Barclay (Microsoft), TerraServer Steve Ekblad (USDA-NRCS) and Wendall Oaks (USDA-NRCS), The Lighthouse Project, USDA - NRCS Web Based Soil Data Viewer and Resource Data Gateway	BOF: GIS Weasel and Integration of GIS and Models, Roland Viger	LUNCH/BOFs		
1:00-2:50 PM	Hands-on Session: ArcGIS (ESRI) (second offering)	Hands-on Session: Who said remote sensing software should be difficult? (RSI)	Hands-on Session: Image Analysis (USGS)	Hands-on Session: Raster display and analysis in ArcMap (USGS and ESRI) (second offering)	Database issues: (Gary Kress) Dwight S. Hughes; Geographic Names Data for GIS Systems, 1 hour Kirk Fisher (Oracle); Spatially Enabling the Enterprise, 40 minutes	Metadata and clearinghouse: (Ingrid Landgraf) Michelle Anthony, 2 hours	Tools: (Carl Rich) Visual Basic for Applications for ArcGIS lecture (ESRI) 1 hour Visual Age for Java Applications for eGovernment (IBM) 50 minutes	Vendor Displays	
2:50-3:10	BREAK								
3:10-5:00 PM	Hands-on Session: (continuation)	Hands-on Session: Watershed Delineation Using the National Elevation Dataset and Semi Automated Techniques (Jay R. Kost and Glenn G. Kelly, USGS)	Hands-on Session: (continuation)	Hands-on Session: Surface Interpolation Concepts, Methods, and Tools (USGS and ESRI)	Database issues: (Boyce Blanks) John Peterson (LizardTech); Image and Document File Reduction and Management: Data Management Solutions for GIS/Enterprise Intranet and Internet Data Users, 40 minutes Paul Rockwood (IBM); Enterprise Spatial Data Management with DB2 and Spatial Extender, 50 minutes	Project Applications: (Mark Negri) James B. Johnston, Helena Schaefer, Steve Hartley, Scott Wilson, William Jones, and Antonio Martucci; Advanced GIS and Spatial Analysis Technologies for Natural Resource Management at the National Wetlands Research Center, 40 minutes Mark G. Negri; Migration Paths to ArcGIS version 8.1, 40 minutes	Tools: (Carl Rich) SDE lecture (ESRI) 1 hour		
TBA	Birds-of-a-Feather meetings								

FRIDAY, APRIL 27								
Building 810 Auditorium								
8:00-9:45	Plenary Session: Voice Recognition and Wireless Technologies for GIS; Charles Kemper, Voice-Insight S.A.							
9:45-10:00	BREAK							
10:00-11:30 AM	Plenary session: Emerging Trends in GIS (presentations and panel discussion); Barbara P. Buttenfield, University of Colorado; and A. Keith Turner, Colorado School of Mines and Applied Earth Sciences, Delft							
Building 53, National Training Center								
ROOM-->	**Breckenridge**	**Copper**	**Keystone**	**Snowmass**	**John B. Weeks**	**Loveland**	**Winter Park**	**Silver Creek and Telluride**
11:30 AM-1:00 PM	LUNCH/BOFs					Graham Beasley and Tony DeVarco (SGI); The Power of Collaboration and Data Visualization - SGI Solutions for GIS	LUNCH/BOFs	
1:00-3:00 PM	OPEN	Hands-on Session: Earth Explorer: Accessing US Geological Survey Products on the Web (Barbara A. Ray and Steven N. Reiter, USGS)	Hands-on Session: Introduction to ArcPad (ESRI) (second offering)	Hands-on Session: ArcView 8.1 for ArcView 3.2 Users (ESRI) (second offering)	Project Management (Gary Kress) Christopher A. Sanocki; Minnesota model for GIS data and application management, 20 minutes David A. Ferderer, Greg Gunther, and Chris Skinner; A Data Management Life-Cycle, 1 hour	Modeling and Concepts: (Roland Viger) Roland Viger and Lauren E. Hay; The Climate Station Selector Extension to the GIS Weasel, 20 minutes Roland Viger, Steven L. Markstrom, and George H. Leavesley; The GIS Weasel - An Interface for the Development of Spatial Parameters for Physical Process Modeling, 40 minutes Jennifer B. Sieverling; Spheroids, Datums, and Projections, Oh My! , 40 minutes	Tools and Case Studies: (Ingrid Landgraf) ArcGIS Lecture (ESRI), 1 hour FEMA, 30 minutes	Vendor Displays
3:00 PM	ADJOURN							

USGS GIS-2001 Workshop Abstracts

Using Samba and Microsoft's Distributed File System to Share Geographic Information Systems Data
by Joe Adams

Joe Adams
USGS
Box 25046, MS 516, Denver Federal Center
Denver, CO 80225
E-mail: jdadams@usgs.gov

In a mixed environment of UNIX and MS Windows systems, GIS data are distributed across many machines. UNIX systems can share data via Network File Systems (NFS), and Windows systems can share data via Windows file sharing. These two environments remain virtual islands that are loosely connected with data transfer utilities such as File Transfer Protocol (FTP). This paper documents a real-world example showing how to install and configure the file-sharing protocol, Samba, to enable Windows-client access to GIS data residing on UNIX systems.

The Windows world provides access to data through "drive letters." For every machine accessed across the network, a new drive letter is "mapped." As more machines are connected, the drive-letter list may run out of letters for new drives. Also, with inconsistencies among the selection of drive letters, problems quickly arise with files containing pathnames, such as map compositions and ArcView projects. Microsoft's Distributed File System (DFS) provides a mechanism for accessing all GIS data through a single drive letter. This document will explain how to obtain, install, and configure DFS on Windows NT 4.0.

ArcIMS Website for Browsing Geographic Information System Data Sources
by Marianne August and David W. Litke

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David W. Litke
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Box 25046, MS 415, Denver Federal Center
Denver, CO 80225
E-mail: dwlitke@usgs.gov

In 1997, the FGDC and National States Geographic Information Council sent out a Framework Data Survey to more than 5,000 agencies within the United States. The survey was sent to Federal, State, regional, county, municipal, tribal, university, and private agencies. Responding agencies provided information about the content and geographic extent of their GIS data holdings. The authors created a website using ArcIMS software to allow browsing of the survey results by using an interactive map. The design goal of the website was to keep the map interface simple and focused on the single objective of browsing survey results. The default ArcIMS map interface, therefore, was modified by removing unneeded functionality, by replacing tool icons with text buttons, and by automating the selection and activation of map layers. As a result, users need only to select an agency type and then click on a map location to view summaries of Framework Survey data available for that location.

Geographic Information Systems, Visualization, and Data Dissemination for the Harappa Archaeological Site, Punjab Province, Pakistan: A Model for WRD
by Wayne R. Belcher and A. Keith Turner

Wayne R. Belcher
USGS
6770 S. Paradise Road
Las Vegas, NV 89119
E-mail: wbelcher@usgs.gov

A. Keith Turner
Applied Earth Sciences,
Delft University of Technology
Delft, The Netherlands
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GIS, visualization, and data-dissemination techniques were used to examine and present results of a study involving the Harappa archaeological site, a Bronze Age city in Pakistan. Integrated data management and visualization serve to archive and preserve geologic and hydrologic data and interpretations. Techniques developed in this study are a model for integrating data, visualization, and dissemination for WRD information.

GIS technologies (2-dimensional [2D] and 3-dimensional [3D]) were used to produce spatial models linked to a database containing text and graphics. A multiscaling user interface was developed to allow users to display data at different levels of details by zooming in or out of the current view. Gridded surfaces were developed to visualize the modern topography, paleotopography, and the stratigraphy for the site. These surfaces were used to construct a 3D digital stratigraphic model. A gateway complex, consisting of a series of walls, drains, and other structures, was digitally reconstructed. Scientific and trade journals, popular magazines, and the Internet were used to disseminate this work. A website (http://www.harappa.com/3D) presents the 3D stratigraphic model of the site and animation of the reconstructed gateway. The multiscaling interface was published in a trade journal, and articles appeared in a scientific journal and a popular magazine.

Using Internet/Intranet Geographic Information System Technology to Make USGS Information More Accessible

by Laura R.H. Biewick and Gregory L. Gunther

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The USGS Central Energy Resources Team (CERT) is a research organization devoted to assessing the origin, occurrence, quality, and quantity of fossil fuels in selected areas of the United States and the world. The science-based assessments, utilizing numerous public and proprietary databases, provide information to the public, decisionmakers, and researchers.

GIS tools help scientists access, analyze, summarize, and deliver energy-assessment data, results, and products. Currently, the assessment toolkit makes prominent use of ArcInfo and ArcView. The Energy Team is investigating implementing internet/intranet map serving for the dissemination of data and GIS functionality in the assessment process and for delivery of USGS products. The release of ArcGIS 8.1 is a major breakthrough in the evolution of ESRI software; it marks the unification of ESRI's desktop environments in the new software architecture. A significant new capability is that all ESRI desktop applications (ArcInfo, ArcEditor, ArcView, ArcExplorer, and ArcIMS Viewer) will be able to stream vector data across the Web from an ArcIMS server. This presentation discusses issues related to current utilization of ArcView and the implementation and impact of internet/intranet map serving on the assessment process.

Evaluation of LIght Detection And Ranging (LIDAR) for Measuring Topography in a River Corridor

by Zachary H. Bowen and Robert G. Waltermire

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LIDAR is relatively new in the commercial market for remote sensing of topography, and it is difficult to find objective reporting on the quality of contractor-supplied datasets. Accuracy specifications for LIDAR data in published evaluations and estimates provided by contractors ranged from 1 to 2 m RMSE (x,y) and 15 to 30 cm RMSE (z). Most of these estimates were based on measurements over relatively flat, homogeneous terrain. This study evaluated the accuracy of one contractor-supplied LIDAR dataset over a range of terrain types in a western river corridor. Elevation errors based on measurements over all terrain types were larger (RMSE (z) = 43 cm) than values typically reported. Cross-sectional profiles indicated algorithms that were effective for removing vegetation in relatively flat terrain were less effective near the active channel where dense vegetation was found in a narrow band along a low terrace. LIDAR provides relatively accurate data at densities (50,000 to 100,000 points per km^2) not feasible with other survey technologies. For many projects, horizontal accuracy of 1 to 2 m RMSE (x,y) and vertical accuracy of 15 to 30 cm RMSE (z) in relatively flat terrain are more than adequate. Options for projects requiring higher accuracy will be expensive and include low-altitude aerial photography and intensive ground surveying.

New E-Commerce Sites at U.S. Geological Survey/Earth Resources Observation Systems Data Center
by Mike Buswell

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The mission of the USGS EDC is to (1) "promote new uses, new users, and new understanding of land information, so others can better understand our planet" and (2) "ensure that scientists, researchers, businesses, decision-makers, and the public have ready access to the land information they need[1]."

The USGS EDC has released two new e-commerce sites to disseminate data. EarthExplorer will replace the GLIS as EDC's access site to satellite images, aerial photographs, digital cartographic data, USGS paper maps, and Geographic Discipline data.

The most recently released Web site is the Seamless Data Distribution System (SDDS). Technologies used at this site include ArcSDE, a way to store and retrieve information, and ArcIMS, a GIS-type interface to geographic data using a standard web browser. Data will be provided to users in several optional formats for downloading and use with GIS tools. Future datasets for inclusion in the system are NLCD and NHD. Other datasets to be considered will depend on feedback from user communities and scientific staff at EDC and other USGS Centers.

[1]Strategic Direction for the USGS EROS Data Center, 1998–2008, December 1998.

The Washington, D.C.–Area Geologic Map Database: A Tool for Solving Environmental and Resource Problems
by Adam M. Davis

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The Washington, D.C.-area geologic map database (DCDB) contains geographically referenced information about the bedrock and surficial geology of three 30 × 60 minute quadrangles (Frederick, Washington West, and Fredericksburg) in and around Washington, D.C. The database is a combination of ArcView shape files and an MS Access database. It is part of an effort by the USGS to create a National Geologic Map Database that complies with the North American Geologic Map Data Model Standard. Information about the Data Model Standard can be found on the internet at (http://geology.usgs.gov/dm/).

Databases like the DCDB enhance our ability to use the information collected by geologists. Queries or geographical analyses of these digital data can provide the information necessary to support environmental and resource decisionmaking. Two examples of geographical analyses facilitated by the DCDB include display of the areal extent of bedrock types that may contribute to slower ecological succession and determination of sinkhole density within watersheds to target areas for karst studies.

The DCDB's ability to facilitate geographical analyses to solve environmental and resource problems will be enhanced when biological and hydrological data elements such as species abundance and hydraulic conductivity become part of the database.

Map Graphics Made Easy—An Impossible Goal?

by Jean Dupree and David Litke

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Presentation map graphics (slides and posters) are commonly needed, often on short notice, by scientists and managers. Improved software interfaces offer the possibility of simplifying the map-making task, but powerful software still requires a complex interplay of icons, menus, and mouse clicks to efficiently create a final product. A customized ArcMap template was created that uses VBA script and a modified user interface to test whether easy creation of map graphics is a possibility or an impossible goal. The first step was to create a standardized data frame containing library map layers commonly needed to make graphics, including streams, roads, cities, basin and county boundaries, and a color, shaded-relief background graphic. Next, custom tools were added to the interface to automate the standard map-making steps—creating a map boundary, selecting background colors, and extracting features from map layers based on feature attributes or geographic location. Finally, standardized layout templates were created for common output formats such as PowerPoint presentations and large-format poster graphics. This exercise indicated that a combination of task automation and user training can result in an improved capacity to produce map graphics.

A Data Management Life Cycle

by David A. Ferderer, Greg Gunther, and Chris Skinner

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Documented, reliable, and accessible data and information are the foundation that supports scientific research and products that enhance society's knowledge base. The USGS, a leading provider of science data and information, is uniquely positioned to integrate science and natural resource information to address societal needs. The USGS CERT provides critical data and information on the quantity, quality, and distribution of the Nation's and the world's oil, gas, and coal resources.

By using a life-cycle model, the USGS-CERT Data Management Project is developing an integrated data management system to (1) promote easy access to energy data and information, (2) increase data documentation, and (3) streamline product production and improve product delivery to the public, scientists, and decisionmakers. The project incorporates web-based technology, data-cataloging systems, data-processing routines, and metadata-documentation tools to improve data access, enhance data consistency, and increase USGS-CERT office efficiency. This presentation will discuss components of the life-cycle model, strategy implementation, and utilities developed to manage data resources.

Habitat Needs Assessment Geographic Information System Query Tool for the Upper Mississippi River System

by Henry C. DeHaan, Timothy James Fox, Carl E. Korschgen, Charles H. Theiling, and Jason J. Rohweder

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The Habitat Needs Assessment (HNA) GIS Query Tool is an ArcView GIS extension that was developed to assist with a habitat needs assessment for the Upper Mississippi River System Environmental Management Program (UMRS). It helps evaluate existing habitat conditions throughout the UMRS by allowing the user to perform bidirectional queries of species/guilds and river habitat. The user may query on a species and obtain habitat information, or they may query on a habitat to obtain species information. These queries are accomplished by using matrices that previously were developed to associate the potential of a species to occur with various types of habitat.

GIS themes, tables, charts, maps, and textual reports describe potential species habitat, occurrence, and diversity. Products generated with the tool will help establish a technically sound, consensus-based management framework for the restoration, protection, and enhancement of the UMRS ecosystem.

The query tool is distributed on a five-CD set. The query tool was developed by using the ESRI Avenue macro-language. The data loader was developed in MS VB 6.

Color-Shaded-Relief and Satellite-Image Maps for Grand Canyon National Park

by Michael F. Gishey

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Maps were produced to serve as guides for tourists to the national parks and monuments located within the boundaries of the Colorado Plateau. They were developed as part of a series of displays for Grand Canyon National Park's new Canyon View Information Plaza. The maps are intended to appeal to a general audience while providing as much information as possible. The colors for the elevation maps were selected to depict those found in the landscapes of the Colorado Plateau. The vector overlays were made to appear like those from a standard highway atlas. Numbers placed over the parks correspond to like-numbered photographs of the parks on the maps' margins. Data sources included 1-degree USGS Digital Elevation Models (DEMs), 10-meter USGS DEMs, Landsat imagery, the ESRI U.S. Street Database, and data from the National Atlas of the United States. The shaded-relief images were created using ArcInfo GRID and Adobe PhotoShop. The Landsat imagery was georeferenced and overlaid with vector data. All vector data were generated in ArcInfo and exported as postscript files. The images then were placed into Adobe Illustrator along with the vector data where the final map layout and labeling were done.

Geo-Spatial Multi-Agency Coordination Group Wildland Fire Support

by John D. Guthrie and Jeff Baranyi

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The need for information on the status, location, and proximity of wildfires to values at risk has prompted the formation of the Geo-spatial Multi-Agency Coordination Group (GeoMAC). The GeoMAC team, with representatives from the DOI—USGS, BLM, FWS, BIA, NPS, and USDA-FS—consists of technical experts in the application and utilization of the information and mapping sciences. The GeoMAC team produced an internet-based mapping application, which allows firefighting coordination centers and incident command teams to access online maps of current fire locations and perimeters by using standard web browsers such as Netscape or Explorer. Fire-perimeter data are updated daily on the basis of input from incident intelligence source, GPS data, and imagery from fixed-wing and satellite platforms. This discussion will focus on the technological challenges faced by the team, the innovative solutions devised, and the challenges ahead.

Factors Influencing the Evolution of Albuquerque's Landscape

by David J. Hester, Maria L. McCormick, and Jonathan J. Fernandez

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The landscape upon which cities evolve and the resulting urban form are influenced by various social, economic, and physiographic factors. Understanding the factors that are driving, enabling, constraining, sustaining, and shaping the urban form is essential to gain insight into the variables that contributed to Albuquerque's urban growth and land-use change.

Analyzing the factors influencing the evolution of Albuquerque's landscape requires developing an understanding of the regional land-use history and the historical events that caused the city's land-use patterns. Quantifying Albuquerque's landscape change involves analyzing the urban landform to understand the rates of growth, trends, and land-use patterns.

What factors will affect the Middle Rio Grande region's future urban form and Albuquerque's footprint on the landscape over the next 50 years? As part of the USGS Middle Rio Grande Basin Study and the Middle Rio Grande Council of Governments FOCUS 2050 Regional Plan, land-use models are being executed to predict the region's land-use patterns. Albuquerque's economy, currently (2001), ranked the 22nd highest out of 316 metropolitan areas nationwide, supports a continued economic boom and subsequent urban growth.

Missouri River InfoLINK Internet Map Display
by Jeanne Heuser and Larry R. Davis

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The USGS Columbia Environmental Research Center created the Missouri River InfoLINK to enhance understanding of the Missouri River by facilitating communication and fostering informed participation in management decisions. InfoLINK activities include managing a web page with interactive maps, conducting an annual natural-resources conference, and making scientific information available in terms and forms understandable to stakeholders, resource managers, policy makers, and citizens.

In 1998, InfoLINK began serving base maps of the Missouri River on the Internet using ArcView IMS. Through a partnership with ESRI and the USGS Mid-Continent Mapping Center, InfoLINK maps are being updated by using the new ArcIMS. Map design at various scales is coordinated with USEPA-funded community projects in Columbia, Missouri, and Bismarck, North Dakota, and with resource managers at the FWS Big Muddy National Fish and Wildlife Refuge. Currently (2001), an ArcIMS design is being developed to display results from the Missouri River Benthic Fishes Study. It will provide a template for incorporating biological data in a spatial context for management decisions.

The InfoLINK goal is to build the foundation map structure needed for a Missouri River decision-support system. The presentation will discuss unique challenges encountered in building maps to be served on the Internet that cover one-sixth of the United States.

The National Land-Cover Dataset
by Stephen M. Howard and James E. Vogelmann

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The USGS EDC, in cooperation with USEPA and other Federal agencies, recently completed the NLCD. Based on early 1990s Landsat Thematic Mapper (Landsat TM) imagery purchased by the Multi-Resolution Land Characteristics Consortium (MRLC), the NLCD represents the most up-to-date, nationally consistent land-cover dataset available for National and regional level analyses. The digital raster dataset is distributed as State files (lower 48 only) with 30-meter resolution and 21 categories of land-cover information in an Albers Equal-Area map projection. Accuracy assessments have been completed for the eastern one-quarter of the United States and show an 80-percent accuracy at Anderson Level 1. The remainder of the United States should be finished by the close of 2001.

Since its release, thousands of individual state files have been distributed to users. Feedback from the users is being gathered into a database to help the USGS assess needs for land-cover data. Reported applications range from water-quality assessments and wildlife-habitat assessments to disease vector studies, radio signal propagation models, and visualization. Users are primarily Federal and State agencies and universities, but commercial firms and local governments also are showing interest.

Geographic Names Data for Geographic Information Systems

by Dwight S. Hughes

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The Geographic Names Information System (GNIS) contains the federally recognized names and locations of two million physical and cultural geographic features in the United States. Each feature is located by coordinates, State, and county, and is identified by class, feature relations, and other data. GNIS is the only official repository of domestic geographic names information. The system also contains 350,000 cells and related data. It was developed and is maintained by the National Mapping Program Geographic Names Office and supports the Executive Secretary of the U.S. Board on Geographic Names. The system has provided datasets to TerraServer, LandView, National Atlas, and NHD.

The system is undergoing a complete redesign and rebuild in Oracle8i, including Oracle Spatial. For the first time, feature name, location data, and cell data will be available in spatial format. The lead analyst and development team leader will describe the database design and the status and schedule of redesign with a short demonstration. Alternatives for access by other systems and for making datasets and(or) data layers available to other systems will be discussed. The staff wishes to hear from participants about requirements for spatial or nonspatial data and suggestions for meeting those requirements.

Advanced Geographic Information Systems and Spatial Analysis Technologies for Natural-Resource Management at the National Wetlands Research Center

by James B. Johnston, Helena Schaefer, Steve Hartley, Scott Wilson, William Jones, and Antonio Martucci

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For the past 15 years, staff at the National Wetlands Research Center in Lafayette, Louisiana, has been gathering, analyzing, and disseminating digital data, and developing GIS technologies to support natural-resource management. The range of activities include monitoring and planning of wetland restoration projects for the $300 million coastal Louisiana effort, conducting status and trends studies on submerged aquatic vegetation for the Gulf of Mexico region, assessing impacts of natural disasters such as hurricanes and floods, and developing GIS datasets and technologies for DOI and other agency natural-resource managers. This presentation will provide an overview on new and advanced spatial analysis technologies at the Research Center. Technologies to be covered include:

1. Designing multifunctional spatial decision support systems, including a spatial statistics component, for uses such as wetland restoration planning, landscape modeling, biodiversity, and sensitivity analyses;
2. Developing and testing advanced data acquisition technologies, that is, GPS for geographic locational data, digital video cameras to monitor wetlands, and data management and display systems; and
3. Developing advanced capabilities for interactive computer technologies such as map servers, Internet and CD/DVD products, and 3D computer graphics.

Ground-Water Site Inventory Utilities: An Application that Improves the Integration of Ground-Water Site Inventory System Information with a Desktop Geographic Information System

by Matthew L. Jones and Grady M. O'Brien

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Ground-Water Site Inventory (GWSI) Utilities is composed of four modules—"GWSI Codes," "GWSI Snapshot," "GWSI Enhancer," and "GWSI Transformer"—that facilitate GWSI database integration with a desktop GIS. The application was built for the Windows NT platform and requires MS Access 2000 and Computer Associates' Ingres client. The GWSI Codes module creates an Access database containing all GWSI codes and their definitions. GWSI Snapshot creates a snapshot replication of GWSI in an Access database. The snapshot replication will integrate with a desktop GIS but its use is limited by several data definitions inherent to GWSI. GWSI Enhancer creates an enhanced version of the snapshot replication database that resolves these limitations. The GWSI Enhancer improves the snapshot replication by (1) converting codes to meaningful definitions, (2) storing numeric data in numeric fields rather than text fields, (3) storing dates in date-time fields rather than text fields, (4) adding fields that store dates in decimal-year format, and (5) adding coordinates that are in a Universal Transverse Mercator projection system for each site. The GWSI Transformer module transforms the data in the GWSI Enhancer database into a relational-database schema used by the Death Valley Regional Flow System Project. This schema is capable of integrating additional hydrologic information from data sources other than GWSI.

The Hydrograph Analyst: An ArcView Geographic Information System Extension that Integrates Point, Spatial, and Temporal Data and Provides a Graphical User Interface for Hydrograph Analysis

by Matthew L. Jones and Grady M. O'Brien

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The Hydrograph Analyst (HA) is an ArcView GIS 3.2 extension developed to assist hydrologists analyzing water-level data from wells. The extension enhances ArcView with increased relational database (RDB) capabilities and includes a Hydrograph Document Graphical User-Interface (DocGUI) based upon the Chart DocGUI. The RDB enhancements enable the user to utilize an identify tool in the View DocGUI to dynamically retrieve hydrologic information about a well from various tables in an RDB. This information is displayed in an "Identify" window showing fields and values for each record. Another HA menu allows the user to generate hydrographs for wells selected from the point theme. Hydrographs generated by the HA are added as hydrograph documents and accessed by the user with the Hydrograph DocGUI, which contains tools and buttons for hydrograph analysis. The Hydrograph DocGUI has a "Select By Polygon" tool used for isolating particular data points on the hydrograph inside a user-drawn polygon. The Hydrograph DocGUI enables the user to attribute (or flag) individual water levels on a hydrograph with the attributes dynamically communicated to the RDB. The "Flag" tool activates a dialog box that prompts the user to select an attribute and "methods" or "conditions" that qualify that attribute.

Implementing Geographic Information System Technology and Methods in Education

by Joseph J. Kerski

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Why are educators interested in using GIS to teach science, math, history, and geography? What is the difference between teaching with GIS versus teaching about GIS? A 5-year study from a survey of 1,520 educators owning GIS software assesses the extent to which GIS technology and methods are being implemented in secondary education in the United States. Case studies of GIS in three high schools showed that GIS provides the opportunity for education that is issues-based, student-centered, standards-based, and inquiry-oriented, but its effectiveness is limited by social and structural barriers. Barriers such as the structure of the school day and testing requirements proved more important than hardware and software constraints. Results of 86 experiments of the effectiveness of GIS were mixed, although students using GIS performed significantly better on their assignments than those using traditional methods. Case studies showed that using GIS in education changes teacher and student roles, communication, and methods of teaching and learning.

Elevation Research Activities at the Rocky Mountain Mapping Center

by John J. Kosovich and John E. List

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Recent technological advances have enabled increased accuracy, higher resolution, and potentially reduced cost for elevation data acquired by using airborne IFSAR (Interferometric Synthetic Aperture RADAR) and LIDAR systems. Associated IFSAR magnitude (RADAR DOQ) data also offer improved resolution, dynamic range, and reduced noise over earlier systems. These improved data sources promise higher-accuracy elevation products, from higher-resolution DEM files to derived datasets such as contours and hydrography. Processes have been developed to merge IFSAR or LIDAR elevation with IFSAR or optical orthoimagery and to display these datasets in such a way to depict relative topography (by graytone shaded relief) and relative height (by color hypsometric tinting), along with the georectified surface features from the orthoimagery. The IFSAR, LIDAR, and USGS-DEM elevation surfaces for the Morrison quadrangle pilot study site are being compared using difference-surface anomaly detection and visualization processes developed at the USGS Rocky Mountain Mapping Center (RMMC). Potential feature-extraction capabilities from IFSAR and LIDAR data will be explored as well.

Other elevation research activities also will be presented, including examples of color shaded-relief processes for and output graphics of the NED DEM data for Colorado and New Mexico.

Watershed Delineation Using The National Elevation Dataset And Semiautomated Techniques

by Jay R. Kost and Glenn G. Kelly

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Federal, State, and local agencies have realized that currently available hydrologic units are not of sufficient scale for many applications. An interagency effort currently is under way to subdivide the existing hydrologic units into smaller units called watersheds and subwatersheds. The NED contains the best available elevation data merged into a seamless database for the entire United States. These digital elevation data can be readily used to delineate watershed and subwatershed basins. Recently developed ArcView tools were designed to facilitate the semiautomatic delineation of watersheds and subwatersheds.

Analysis of Coral Reef Morphology Using Scanning Hydrographic Operational Airborne LIDAR Survey Data: Moloka'i, Hawai'i

by Joshua B. Logan, Curt D. Storlazzi, and Michael E. Field

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The fringing reef on the south coast of Moloka'i, Hawai'i, is the focus of a USGS multidisciplinary project studying the health and geologic variability of coral reef systems. As part of this study, we obtained high-resolution Scanning Hydrographic Operational Airborne LIDAR Survey (SHOALS) bathymetric data to better understand the reef morphology. These bathymetric data allow us to map the reef off southern Moloka'i with a level of precision (±0.5 m) and spatial coverage (>50 km^2, 4-m resolution) previously unattainable using conventional aerial photography or boat surveys. By using the capabilities provided under ESRI ArcInfo, these data were used to interpolate a GRID surface. From this surface, we are able to extract high-resolution bathymetric profiles of the reef using an AML script. The script provides tools for displaying surface profiles visually and in text format, and allows us to quantitatively evaluate reef structures. The text output can be imported into MATLAB by MathWorks to conduct Fourier analyses on the undulating spur-and-groove morphology to determine the predominant wavelengths of these features and how they change alongshore and at different depths. Our long-term goal is to determine if there is any correlation between the reef morphology and variations in the island's topography.

Colorado Color-Shaded Relief

by Maria L. McCormick and John J. Kosovich

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Using NED DEM data, USGS researchers can easily depict elevation zones and various surface features for large extents of terrain. This poster shows the surface expression of Colorado, color shaded by the given elevation ranges, overlaid by various USGS National Atlas and NHD layers, with selected features labeled. Upon inspection, it is easy to confirm the fact that, with an average elevation of 6,750 feet, Colorado has the highest overall elevation of the 50 States.

The NED data were delivered in four separate blocks, so the entire statewide set was seamed together using ArcInfo Grid. The paneled dataset was projected into Albers Conic Equal-Area space. An AML program created the color-shaded relief from the raw elevation surface by using a custom color scheme. Data layers obtained from the National Atlas site (http://www.nationalatlas.gov/), and from the NHD site (http: //nhd.usgs.gov) were projected into Albers space and plotted over the shaded relief.

Evaluating Digital Elevation Models for Horizontal Accuracy
by Gary L. Merrill

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Traditionally, contours have been a means used to depict topographic relief on USGS topographic maps. In turn, topographic contours have contributed, as source materials, to an ongoing national elevation program for production of USGS DEM data. DEMs currently are used for hydrologic studies, shaded-relief mapping, and as source material for production of USGS Digital Orthophoto Quarter Quadrangle (DOQQ) data. Other uses for DEMs currently are being investigated, including the potential for using DEMs as a source for generating vector contours. The ability to generate vector contours from a DEM has been available to users for quite some time and, as such, will continue to be a useful function for many users due to the costs associated with contour collection using standard stereocompilation methods. The question becomes how accurate are vector contours generated from a DEM that was created by using contours compiled from stereo photography. This paper will share results from evaluations conducted to determine horizontal accuracies of contour vectors generated from USGS DEM data by using various hardware/software platforms. The test procedures involved a direct comparison of USGS DEM-derived vector contours to contours displayed on existing USGS topographic maps.

Migration Paths to ArcGIS Version 8.1
by Mark G. Negri

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For the last 5 years, the USGS primary GIS software base has been a combination of ArcInfo and ArcView by ESRI. The ArcInfo and ArcView suites of software provide different features, and the GIS user's need for different functionality was the major factor in choosing one or both of the suites. In Spring 2001, ESRI released a new GIS product called ArcGIS version 8.1 that merges the functionality of the ArcInfo and ArcView software suites. For the USGS to migrate effectively to ArcGIS 8.1, a thorough examination of licensing schemes and costs as they relate to functionality will be essential. This examination currently (2001) is being performed by the Geographic Information Program Office (GIPO) with input from various USGS field sites that are participating in the ArcGIS 8.1 Beta program. This examination will result in advice and guidance from GIPO for USGS field offices to ensure all GIS functionality needs are met at the most reasonable costs.

USGS ArcInfo Custom Commands and Enhancements

by Curtis Varney Price

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A set of customizations to the ArcInfo software has been maintained by the USGS for about 10 years. These customizations include additional ArcInfo commands and standard symbols. Most of these customizations have been contributed by USGS GIS users. These additional ArcInfo commands perform data import and export from ArcInfo, advanced cartography, GIS data and documentation management, and GIS analysis. The current (2001) set of customizations support Workstation ArcInfo 7.x and 8.x on NT, Sun, SGI, and DG UNIX computers. The custom commands are written in platform-independent Arc Macro Language, with some supporting C and Fortran programs. Presently, customizations apply only to Workstation ArcInfo, except for updated metadata stylesheets that are used in the ArcCatalog application.

The purpose of this session is to describe the USGS ArcInfo Enhancement Patch and to share ideas about the future of USGS enhancements to ArcInfo. Possible future efforts include the incorporation of specialized software such as BASINSOFT (watershed analysis) and SAMPLE (stratified random sampling tool), and custom symbols for ArcMap. This session will provide a forum for users of this software to comment and ask questions.

Earth Explorer: Accessing U.S. Geological Survey Products on the Web

by Barbara A. Ray and Steven N. Reiter

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Earth Explorer is a Web site that provides USGS customers with product documentation and the capability to search, preview, and order these products using a credit card or USGS account number. The products available for query and ordering include certain satellite images, aerial photographs, digital cartographic data, and USGS paper maps.

Users will notice many enhancements in this new online query tool that replaces the GLIS. By utilizing user-specific spatial, temporal, and dataset criteria, users now can access metadata records for not only one, but also multiple datasets. The capabilities to save the query results and to place an order using a credit card are two new features that have been anticipated and welcomed by our customers.

Like the GLIS, the new system allows users to preview images before ordering. This preview function is another big plus for our users, and because these preview images are in the public domain, they can be saved locally. Selected images can be previewed from these datasets: Landsat MSS, Landsat TM, Landsat enhanced TM+, Advanced Very High Resolution Radiometer (AVHRR), Corona, and DOQs.

Some may view Earth Explorer as a precursor to a fully integrated Gateway to Earth.

Development of a National Watershed Boundaries Dataset

by Alan Rea

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Federal agencies coordinating spatial water data have identified the development of a National Watershed Boundaries Dataset as a top priority for inclusion in the National Spatial Data Infrastructure (NSDI).

The proposed NSDI Watershed Boundaries Dataset will have the following key characteristics:

- Nationally consistent digital dataset
- Nested subdivisions of established cataloging units
- 5–15 watersheds per cataloging unit
- Boundaries based on 1:24,000-scale topographic maps
- Hydrologically based watersheds—not political divisions
- 10-digit hydrologic unit codes
- Formally established watershed names
- Attribute information to identify all upstream and downstream units

Where watershed boundaries have not already been mapped using appropriate criteria, new watershed boundaries will be developed using a semiautomated procedure based on elevation data from the NHD. The boundaries will be checked and edited using 1:24,000-scale DRGs.

The National Watershed Boundaries Dataset, the NED, and NHD are inherently related. Early maintenance efforts will seek to identify inconsistencies between these three datasets and use those inconsistencies to help improve the quality of each national dataset.

Future Directions in Remote Sensing for the Detection of Invasive Plants

by Ralph Root, Ray Kokaly, Karl Brown, and Gerry Anderson

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The application of remote sensing to plant pest problems is a relatively young science. For the past 20 years, approaches have ranged from the conventional manual interpretation of aerial photographs at various scales to the automated image classification of different types of multispectral images. More recently, airborne imaging spectroscopy has shown significant potential for detecting and mapping invasive plants, and further advances in orbital remote sensing technologies hold the promise to make these tools more cost effective. Issues to be explored include resolution, data-analysis technologies, and cost considerations with regard to the many new "high-resolution" satellites now appearing in ever increasing numbers. Resolution issues include spatial, spectral, radiometric, temporal, and geopositional elements.

Detection of Leafy Spurge Infestations through Imaging Spectroscopy using the Compact Airborne Spectrographic Imager

by Ralph Root, Ray Kokaly, Karl Brown, Gerry Anderson, and Steve Hager

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Leafy spurge Euphorbia esula is one of the most aggressive and hard-to-control invasive plant pests in the upper Midwest part of the United States, from the Mississippi River to the Northern Rocky Mountains. TEAM (The Ecological Area-wide Management—Leafy Spurge http://www.team.ars.usda.gov/), in cooperation with the U.S. Department of Agriculture Agricultural Research Service, is evaluating the capabilities of numerous remote-sensing platforms for the regional mapping of leafy spurge. As part of a larger study, Compact Airborne Spectrographic Imager (CASI-II) data were collected over a part of the south unit of the Theodore Roosevelt National Park and neighboring U.S. Forest Service Little Missouri National Grasslands. The purpose was to test the effectiveness of low-altitude hyperspectral data with approximately 5-m spatial resolution for detecting and mapping leafy spurge. Preliminary results were compared to ground surveys and previous leafy spurge maps generated through the manual interpretation of 1:24,000-scale aerial photographs. This study can help in describing future strategies for further applications of CASI-II in mapping leafy spurge on a region-wide basis.

To Krig or Not to Krig: Defining the question

by Sarah J. Ryker and Dennis R. Helsel

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Is kriging always, or even generally, an appropriate technique for defining surfaces for environmental data? In ground-water-quality studies, modeling a surface often involves skewed and highly variable concentrations of a nonpoint contaminant. Such datasets are challenging to model with kriging techniques and require statistical preprocessing before the surface can be adequately defined. We demonstrate the process of producing a good kriging model on such a dataset, including refinements found in current statistical software packages. We also examine alternative methods to kriging, and conclude that for this and similar datasets, a robust smoothing approach is the simplest and most effective method for defining the surface.

This work illustrates that: (1) it is critical to decide whether the desired surface should represent “typical” or “anomalous” values; (2) the degree of local variability in the dataset should be considered in selecting techniques and models; (3) if kriging is used, the data first must be transformed to closely approximate a normal distribution, even though no hypothesis tests are performed on the surface; (4) better surfaces are obtained when trends in all independent variables are removed before kriging; and (5) robust modeling procedures are much safer for scientists not familiar with properties and requirements of kriging.

Minnesota Model for Geographic Information System Data and Application Management

by Christopher A. Sanocki

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USGS GIS staff develops geographic datasets that provide maps, data, and interpretive services to support District projects. A suite of GIS tools and standardized datasets collected and developed by the Minnesota Department of Natural Resources are being incorporated into the USGS, Minnesota District GIS program. These tools and standardized datasets allow users to easily display and clip DOQs and DRGs. The tools and standardized datasets are able to display common symbols for roads, rivers, lakes, land use, GNIS, National Wetland Inventory (NWI) data, and a variety of other datasets.

Using a Geographic Information System to Determine the Chicot Aquifer System Surficial Confining Unit's Thickness and Location of Sand Lenses, Southwestern Louisiana

by Blaine Pierre Sargent and Paul C. Frederick

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The Chicot aquifer system in southwestern Louisiana has a surficial confining unit composed of fine sand, silt, and clay that is undifferentiated from overburden material. Confining unit thickness was mapped using water-well and petroleum-well data from Federal and State agency databases.

Point-specific thicknesses were estimated from 128 petroleum-well geophysical logs, 260 water-well geophysical logs, and 1,705 water-well driller's logs. Water-well driller's logs vary in quality. Thickness values from driller's logs were not used if the values were not consistent with thickness values from other nearby geophysical and driller's logs.

Regional confining unit thickness was estimated using kriging, an interpolation method. Kriging can handle spatial variability, smooth out random "noise," and mitigate the impact of "hot spots" where there is a great quantity of data. Universal kriging was used instead of ordinary kriging because the data were highly correlated in a particular direction.

The distribution of shallow domestic wells completed in sand lenses within the surficial confining unit was compared to the distribution of sand lenses obtained from the log data. This comparison provided independent corroboration of areas where sufficient water is available for rural domestic use.

GEODE - An Interactive Data Retrieval, Display, and Analysis Internet Application

by Adam C. Schultz and Marc Levine

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GEODE (Geo-Data Explorer: http://geode.usgs.gov) is an internet-based system that delivers digital information from a variety of sources to the desktops of clients and users. Policy makers, land- and resource-management decisionmakers, educators, private industry, and others are able to define queries of maps and active databases, control map appearance, display multiple layers of data, and create custom map and data downloads. Users manipulate data through a GIS interface provided by GEODE.

GEODE provides the information necessary for making decisions that involve multiple, geologic program-related issues. Information on energy, volcanoes, earthquakes, geologic maps, climate change, ecosystems, coastal and marine issues, and minerals is combined with additional data layers such as satellite imagery, major transportation systems (including pipelines), digital elevation models, and census and population data.

This application has the capability to access dynamic databases because the functionality of the application is independent of the type or location of the database. This application provides an avenue for fast and accessible spatial research and analysis such as resource estimates and risk or hazard assessment without the need for special hardware, software, or training.

Spheroids, Datums, and Projections, Oh My!

by Jennifer B. Sieverling

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In the rush to “get the work done,” working with spatial coordinate systems can become a task performed without contemplation. The concepts behind spatial coordinate systems tend to move to the background, and day-to-day work can seem especially disconnected from the most fundamental concepts. Eventually, relearning these concepts can be daunting for even an experienced GIS professional. The most basic concepts of spatial coordinate systems are the spheroid, datum, and projection. A spheroid is a three-dimensional shape based on an ellipse in the same way that a sphere is a three-dimensional shape based on a circle. Essentially, a horizontal datum is a spheroid with a defined position relative to the Earth. A projection is a mathematical method of taking features that exist on a three-dimensional shape, a datum, and representing them on a flat piece of paper. Each one of these concepts is used to mathematically describe an irregular land surface and will always be an approximation of the actual land surface. By being aware of this approximation, the GIS user can begin to understand fundamental sources of error in GIS applications and analysis.

Rapid Update of Digital Raster Graphics for Wildland Fire Support

by Jeff L. Sloan and Stan Wilds

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The increasing use by the wildland fire community of the USGS mapping products for fire suppression and Burned Area Emergency Response (BAER) activities have highlighted the need to develop the capability to capture more current specific data content. The USGS 1:24,000-scale topographic map commonly is used for these activities; however, the information depicted on these maps is not current or does not reflect critical information. This is a problem particularly in the Wildland/Urban interface for transportation and structures. A technique was developed to update critical information depicted on a DRG within a 24-hour period. The process uses the best available image source to capture this information and superimpose it on the DRG. The more current data can be disseminated using the Web or through overnight mail.

Terrain and Landscape Modeling of Potentially Unstable Slopes, Green Mountain, Jefferson County, Colorado

by Richard W. Spengler

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Seven terrain and landscape thematic layers, extracted from a high resolution DEM and multispectral satellite imagery, were analyzed and combined using a weighted overlay approach to model locations of potentially unstable slopes on Green Mountain, Jefferson County, Colorado. Selected thematic layers include elevation, slope, Strahler stream order, proximity to geologic contact, relative soil moisture, relative surface temperature, and land cover.

Of the 78 mapped slope failures, 39 are interpreted as active to intermediate in relative age. They commonly occur (1) at elevations of less than 2,030 m, (2) on slopes that range from 7 to 22 degrees, (3) within 75 m of stream channels with high Strahler stream orders, (4) within 100 m of the basal contact of the Green Mountain Conglomerate, (5) within areas of high relative soil moisture, (6) within areas of low relative surface temperatures, and (7) within areas of healthy vegetation growth. Models that heavily weight thematic layers derived from imagery provide more realistic representations of the distribution and extent of potentially unstable slopes within the Green Mountain area. Reflection and emission characteristics of the terrain may provide important thematic components for modeling potentially unstable slopes elsewhere along the Front Range.

The Climate Station Selector Extension to the GIS Weasel

by Roland Viger and Lauren E. Hay

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Have you ever wanted to retrieve precipitation and temperature data for an area of interest (AOI) but were put off by what you had to go through to get it? Now there is an easier way: the Climate Station Selector (CSS) extension to the USGS's GIS Weasel.

The CSS builds a list of National Weather Service and NRCS SNOTEL stations in and around the AOI. The CSS displays the AOI surrounded by six concentric buffers, up to a distance of 95 km, and climate stations within the largest buffered area. The CSS menu allows the user to change station labeling to show attributes such as the station's name, the elevation, or the period of record. The user then chooses the distance to buffer the AOI. The climate stations within that buffer are extracted and described in an output file. This file is used as input to a separate program, named DatPull, which assembles data files for three time series (precipitation, maximum temperature, and minimum temperature) for each of the selected stations. The data are pulled from a database containing daily data for 11,938 stations in the United States. The DatPull program is available to USGS personnel on a per request basis.

The GIS Weasel–An Interface for the Development of Spatial Parameters for Physical Process Modeling

by Roland Viger, Steven L. Markstrom, and George H. Leavesley

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The GIS Weasel is a GUI-driven tool that has been developed as an aid to modelers in the delineation, characterization, and parameterization of Modeling Response Units (MRUs) for use in distributed or lumped parameter physical process models. The interface does not require user expertise in GIS. The user does need knowledge of how the model will use the output from the GIS Weasel. The GIS Weasel uses Workstation ArcInfo 8.0.2 AML, as well as scripts and C subroutines. The GIS Weasel will run on any platform that Workstation ArcInfo runs.

The GIS Weasel requires, as input, an ArcInfo grid of elevation. Tools are provided for defining an area of interest. MRUs can be delineated according to one or a combination of several methodologies including logical queries of topographic or nontopographic data, overlay analyses, and flow-based associations. Menu interfaces and tools for examining and modifying the MRU map and its attributes are provided. Tools for version control and documentation are provided. User-selected model parameters can be generated using MRU attributes and their statistical measures. Output can be created in several formats, including a columnar, space-delimited ASCII file. More information is available at http://wwwbrr.cr.usgs.gov/weasel.

GIS Education for Mapping Professionals
by Alan Ward and Joseph J. Kerski

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Improving GIS literacy for employees in the geospatial professions is increasingly critical to support the missions of all science organizations. To better respond to customer requirements, enhance current geographic research projects, and provide for the future geospatial data needs of the Nation, the USGS instituted a GIS training program in October 1998 at its Rocky Mountain Mapping Center (RMMC) in Denver, Colorado. This program includes a diverse series of inhouse and onsite classes, university coursework, and on-the-job training in tools, analysis, and applications. Through this program, any one of 350 employees can be internally certified in three levels of GIS proficiency. Although this certification carries no official status in industry or any other Federal agency, it is considered by RMMC management as essential to keep the work force current with the demands of the data-user public and to support the overall strategic plan of the National Mapping Discipline. Employees view this program as an opportunity for development and career enhancement. This presentation will examine strategies for designing a GIS training program in the organizational setting.

The National Hydrography Dataset
by Paul Wiese and Tommy Dewald

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The National Hydrography Dataset (NHD) is a geographic database that interconnects and uniquely identifies the stream segments or “reaches” that comprise the nation’s surface-water drainage system. It is based initially upon the content of the USGS 1:100,000-scale DLG hydrography data integrated with reach-related information from the U.S. Environmental Protection Agency Reach File Version 3.0 (RF3). More specifically, it contains reach codes for networked features and isolated lakes, flow direction, names, stream level, and centerline representations for areal water bodies.

The NHD provides a national framework for assigning reach addresses to water-related entities, such as industrial dischargers, drinking water supplies, fish habitat areas, and wild and scenic rivers. Reach addresses establish the locations of these entities relative to one another within the NHD surface-water-drainage network in a manner similar to street addresses. Once linked to the NHD by their reach addresses, the upstream/downstream relations of these water-related entities and any associated information about them can be analyzed using software tools ranging from spreadsheets to GIS.

For more information on the National Hydrography Dataset, see http://nhd.usgs.gov.

Kvector data—A coordinate-based data structure commonly used to represent point, line, or polygon geographic features. Each feature is represented as an ordered list of x and y vertex locations.
Windows NT, Windows 2000—Computer operating systems developed by Microsoft Corporation. Currently (2001) the primary development platform for ESRI’s software products.

Glossary of Selected Terms, Abbreviations, and Acronyms Used in Abstracts

AML—Arc Macro Language. The native programming language of Workstation ArcInfo software by ESRI.

ArcIMS—Arc Internet Map Server software by ESRI.

ArcInfo—Professional GIS software by ESRI.

ArcSDE—Arc Spatial Database Engine software by ESRI.

ArcView—Desktop GIS software by ESRI.

BRD—Biological Resources Discipline of the USGS

BIA—Bureau of Indian Affairs

BLM—Bureau of Land Management

CERT—USGS Central Energy Resources Team

coverage—The basic unit of vector data storage in ArcInfo. A coverage stores geographic features and associated attributes.

DBMS—Data Base Management System: computer software for storing tabular data

DEM—Digital Elevation Model. A USGS digital data product composed of elevation data for a given area in a digital file.

DFS—Microsoft Distributed File System. A file system that allows access to data stored on multiple networked systems through a single drive letter. An option to Windows NT 4.0 and built into Windows 2000.

DG—Data General. A brand of computers commonly used at one time by the USGS and USEPA.

DLG—Digital Line Graph. A digital USGS base-map vector dataset derived from USGS topographic quadrangle sheets. Also, the digital format standard for Digital Line Graph datasets.

DOI—Department of the Interior

DOQ—Digital Orthophoto Quadrangle. A USGS digital dataset derived from orthorectified photographic imagery that encompasses one quadrangle.

DOQQ—Digital Orthophoto Quarter Quadrangle. A USGS digital dataset derived from orthorectified photographic imagery that encompasses one quarter of one quadrangle.

DRG—Digital Raster Graphic. A USGS digital dataset derived from USGS topographic quadrangle maps.

DSS—Decision Support System.

EDC—EROS Data Center

EROS—Earth Resources Observation Systems

ESRI—Environmental Systems Research Institute, Inc. A vendor of a variety of GIS software products.

FGDC—Federal Geographic Data Committee

FWS—U.S. Fish and Wildlife Service

GD—Geologic Discipline of the USGS

GIS—Geographic Information Science or Geographic Information System.

GIS Weasel—GIS Weasel is a graphical-user-interface-driven modeling support tool developed by the USGS.

GLIS—Global Land Information System. A USGS geographic-information and product distribution system developed by the USGS.

GNIS—Geographic Names Information System. A USGS database system populated with place names from USGS maps, developed by the USGS.

GPS—Global Positioning System. A collection of satellites, ground control stations, and receivers that allow for relatively precise and instantaneous location at any point on the earth.

grid or GRID—A cell-based geoprocessing system for use with ArcInfo. Also, a geographic data model representing information as an array of equally-sized square cells arranged in rows and columns.

GUI—Graphical User Interface

IMS—Internet / Intranet Map Serving

INFO—A tabular DBMS used by ArcInfo to store and manipulate feature attribute tables and other related tables.

Kriging—One of a family of least-squares statistical methods commonly used for fitting a spatial surface to data. Conceptually, kriging adds to least-squares a component that accounts for spatial autocorrelation in the data: Data closest to the location being considered are given higher weights than data further away, allowing departures from a flat planar surface.

Landsat—A program developed by the National Aeronautics and Space Administration (NASA), and later by the National Oceanic and Atmospheric Administration (NOAA) and then USGS, to support the study of land resources through satellite-based imagery collection. Also, the names of the satellites in the Landsat system.

LIDAR—Light (or LASER) Detection and Ranging. A remote-sensing method for collection of elevation data.

metadata—Data about data. As used in this document, metadata describe the creation, use, and accessibility of digital geospatial datasets.

MS—Microsoft Corporation

MSS—Multispectral Scanner. A specific remote-sensing instrument that was deployed on the Landsat satellite system between 1972 and 1992.

NED—National Elevation Dataset. A dataset developed by the USGS to provide the best-available-quality, high-spatial-resolution elevation data for the United States.

NFS—Network File System

NHD—National Hydrography Dataset. A dataset developed by the USGS and USEPA to provide digital, hydrologically consistent surface hydrography for the United States.

NLCD—National Land Cover Dataset

NMD—National Mapping Discipline of the USGS

NPS—National Park Service

NRCS—Natural Resources Conservation Service, formerly the Soils Conservation Service

OGC —Open GIS Consortium

RADAR—Radio Detection And Ranging

raster data—Data that are arranged in a regularly spaced array of cells.

remote sensing—Acquiring information about an object without contacting it physically. Methods include aerial photography, RADAR, and satellite imaging.

RDBMS—Relational Database Management System

RMMC —Rocky Mountain Mapping Center of the USGS National Mapping Discipline

RMSE—Root mean square error. The square root of the mean of squared observed errors. RMSE is common estimation of positional error in geographic analysis.

shapefile—The ESRI ArcView shapefile is a simple, nontopological vector format for storing geometric location and attribute information of geographic features. Also, a geospatial dataset in this format.

SHOALS—Scanning Hydrographic Operational Airborne LIDAR Survey.

SDTS—Spatial Data Transfer Standard. A digital format standard used by the USGS to transfer vector data. Initially developed in 1994, SDTS is a newer format than DLG.

SNOTEL—NRCS Snow Telemetry

TM—Thematic Mapper. A specific remote-sensing instrument that has been deployed on the Landsat satellite system since 1982.

Topology—Spatial relations between adjoining geometric features.

UNIX—A computer operating system popular in a server environment.

USDA-FS—U.S. Department of Agriculture - Forest Service (also USFS)

USEPA—U.S. Environmental Protection Agency (also EPA)

USGS—U.S. Geological Survey

VB—Visual Basic. A programming language developed by Microsoft Corporation (also, more formally, MS VB).

VBA—Visual Basic for Applications. An application-embedded programming language developed by Microsoft Corporation.

vector data—A coordinate-based data structure commonly used to represent point, line, or polygon geographic features. Each feature is represented as an ordered list of x and y vertex locations.

Windows NT, Windows 2000—Computer operating systems developed by Microsoft Corporation. Currently (2001) the primary development platform for ESRI's software products.

WRD—Water Resources Discipline of the USGS

WWW—World Wide Web

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