Field Collection to Natural Resource Enterprise Database

Some Experiences in the Transition to Enterprise GIS and its Impacts on Monitoring Natural Resource Trends on Public Lands in the Western United States

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Abstract

The Bureau of Land Management has been implementing an Enterprise Architecture designed by ESRI since 2001. This is a tale of Idaho's attempts to implement the architecture with internal ArcIMS and Citrix serving ArcGIS applications while accessing both flat files and an SDE geodatabase in IBM Informix.

The emerging strategy requires development of multiple applications, natural resource database standards, and enterprise feature classes. Tests over the past two years have been conducted by state and field office GIS staff. Because staff maintains normal workloads, they often use command line coverage editing techniques while still learning and testing new methods. A current challenge includes channeling hundreds of daily field collections into the enterprise database. The goal is to ensure a statewide, enterprise, standard resource database to sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations.

Introduction

This paper will not discuss the specific hardware and software components, the installation techniques or the benchmark performance of the Enterprise Geographic Information System (EGIS) in the Bureau of Land Management (BLM). This paper assumes the reader understands the role of the Spatial Database Engine (SDE), Citrix and ArcGIS Internet Map Server (ArcIMS) softwares in EGIS.

This paper will focus on the statewide implementation of EGIS and will discuss the changing relationship between users and the database, as well as the changing daily work processes for users statewide to complete their daily work. It will also discuss the impact of this new relationship on our baseline of historic and current land health conditions on BLM public lands in the western United States.

The opinions expressed in this paper are the views solely of the author, who is a newcomer to federal public service and thus naïve in the policies and sciences of BLM resources and public land management. In no way should these opinions be assumed to be blessed, approved or representative of current or proposed policy being considered by BLM managers or scientists.

What is Enterprise GIS?
Enterprise GIS (EGIS) is the hardware, the software, the business processes and the master database to meet the needs of professional, casual and novice users throughout an organization for asking questions of spatial data to assist in knowledgeable and defensible decision making. The core of EGIS is the transition from GIS stored in files to a GIS relational, spatially-enabled database (geodatabase).

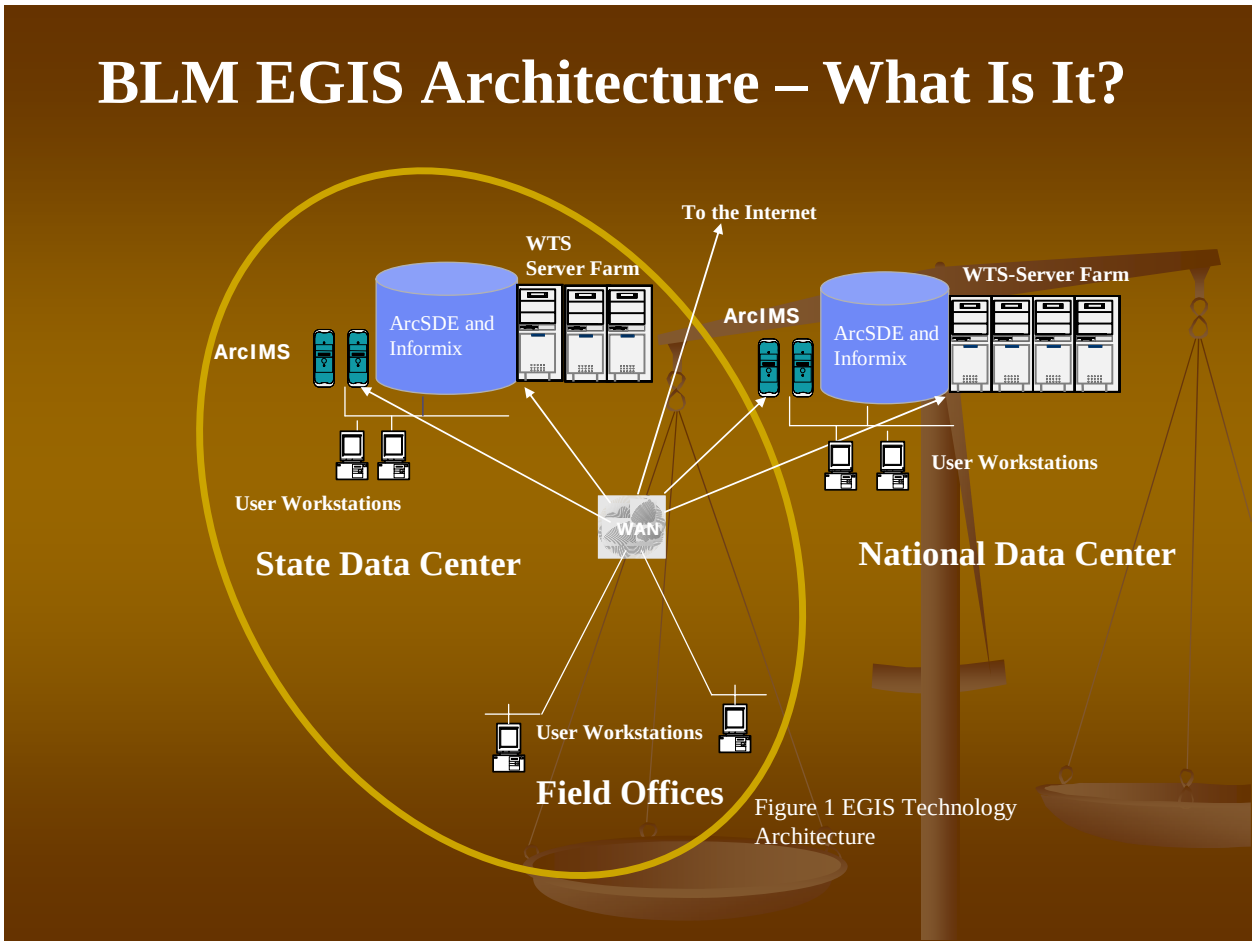
What is the Background of Enterprise GIS in BLM?
The national BLM, with assistance from ESRI, developed the architecture for Enterprise GIS over many years. The architecture was tested and documented through a successful pilot project in 2003. The architecture focused on the hardware and software. The architecture did not address the central geodatabase standards, changes in business processes or training. The architecture did identify a potentially large risk of user acceptance of the new system.

What are the Components of the Idaho Implementation of EGIS?
Software:
Most of the software was purchased by the national office of the BLM. This includes Environmental Systems Research Institute (ESRI) ArcGIS, Arc Spatial Database Engine (SDE) and Arc Internet Map Server (IMS). Idaho BLM has also been provided with upgrades to the Informix database software license by the national office and Moximedia Internet Mapping Framework (IMF).

Idaho has funded Citrix licenses for 40 concurrent users and seven ERDAS Imagine professional licenses. The cost of Citrix software for EGIS is directly offset by the savings of floating enterprise licenses for a GIS softwares, such as ERDAS Imagine.

Hardware:
BLM National and State funds have been used to purchase hardware and professional assistance for implementation including:

1. SDE Server (aix, about $100,000)
2. Four Citrix Servers and software (Windows, about $15,000 each)
3. ArcIMS Server (Windows, about $20,000)
4. Network upgrades (not EGIS-related but a national project)
5. GIS flat file data server (Windows for personal geodatabases and shapefiles, about $20,000)



In Idaho, the system was installed using a collaboration of public servants from USGS and BLM, as well as from private companies with local and regional expertise. BLM professionals from other state and national BLM offices assisted in the installation. A few days of time were needed from ESRI professionals from ESRI and a local engineering company to install ArcIMS and to enhance performance of the Citrix Servers. Idaho BLM Staff in both GIS and IRM completed training and have been responsible for the bulk of the implementation and daily monitoring of the system.

Who is Using Enterprise GIS in Idaho?

Users now include:

1) 320 staff with desktop ArcGIS in Idaho (50 concurrent users of ArcInfo and 50 concurrent users of ArcGIS ArcView)
   - Rather than force users to access ArcGIS only via Citrix, as in the national architecture, Idaho chose to save a similar amount of Information Resources Management (IRM) time, nearly 1000 hours, by remotely installing and upgrading ArcGIS 9.1 statewide overnight from the Boise State Office
   - Users are Field and State Office GIS and Resource staff who may view or edit GIS data

2) 40 concurrent users of ArcGIS or ERDAS Imagine on Citrix
   - Users are State or Field office GIS professionals use Citrix to edit the SDE database
   - Users are non-editing Boise State Office users of ArcGIS, including resource staff, managers and the GIS State Lead (about 20 staff). In these cases, ArcGIS was deleted from their desktops. Not one user has asked for a local installation, although it has been offered if needed.
   - Users are field office editing or casual GIS users who travel or work on projects across administrative boundaries. Fire and Fuels staff are using Citrix due to its portability.
   - Users are professional GIS staffs statewide who run processes in the background on Citrix simultaneously with working on a desktop ArcGIS project.
   - Users statewide also access software not available on the desktop, such as EZMapper, ERDAS Imagine and Topo USA.
3) 400 or more users of the internal ArcIMS Map Browser
   - All BLM staff, temporary, seasonal and contract employees have access to the Map Browser, which hosts BLM corporate data internally, for
     - Law enforcement and incident mapping 24/7
     - Resource and lands reporting and queries
     - Preliminary maps for proposals, such as mining claim and project development
     - Customer service research

The Idaho Guiding Teams & Staff

Management Team

The Idaho management team originally funded EGIS in 2003 and provides overall direction for EGIS. Management has continued declining funding for four years with a transition in 2006 to normal IT maintenance budgets (no longer tagged as a separate project for hardware/software support).

GIS Team

The Idaho GIS Team includes six BLM GIS Professionals, including two from the state office and four from the district offices. The Idaho GIS Team has guided the technical decisions and implementation of EGIS. The team also reports and advises management on issues and needs.

It was necessary to also have a recognized lead on the state GIS team strong enough to keep the process moving. Although the management team provided funding for the implementation, some GIS Team members loathed spending budgeted funds. The lead, by receiving incremental approvals from the Team, has made the purchases and kept the project under budget and on time. The lead also reports annual progress to the management team, which has resulted in continued funding during years of extremely tight budgets

Sub teams of the Idaho GIS Team include:

1. Idaho SDE Data Transition Team,
   This team works with IRM to test, install and maintain each piece of the enterprise system in the State office in Boise
2. Idaho Map Browser (ArcIMS) Team
   This team works with IRM to test, install, build map services and maintain the internal Map Browser of corporate BLM data
3. Idaho Cartographics Team
   This team researched and approves standards for colors, symbology and collar data
4. Idaho GIS Data Management Committee
   This team develops and reviews new database standards and business processes.

Staff Critical to the Transition
There was no experience either in GIS or IRM in most components of the system but BLM Idaho has relied for installation and maintenance on a few staff who already had critical enterprise systems knowledge:
Informix Database Administrator
Network Administrator
Windows Specialist (in house contractor)
GIS Systems Technical Specialist
Unix Specialist

Specific softwares and components of EGIS were learned on the job by these and other staff with assistance from regional BLM technical centers and through specialized training courses.

Trainers
In 2003, Idaho BLM realized that it would be more cost effective to maintain an internal training cadres and designated a statewide Training Coordinator to implement the Idaho BLM Five Year Training Plan, including:
1) Three ESRI authorized instructors teach six or more ArcGIS I classes annually to BLM staff at locations around the state (about 70 students annually).
2) One Trimble certified instructor teaches seven classes in Resource GPS for GIS annually, including Terrasync, ArcPad with GPS Correct and GPS Analyst (about 70 students annually).

In addition to the authorized/certified instructors, BLM staff also offers the following live courses annually statewide to the staff:
3) Intermediate ArcGIS (BLM curriculum)
4) Introduction to Metadata
5) Editing in SDE
6) Introduction to the Map Browser (Arc IMS with IMF tools)

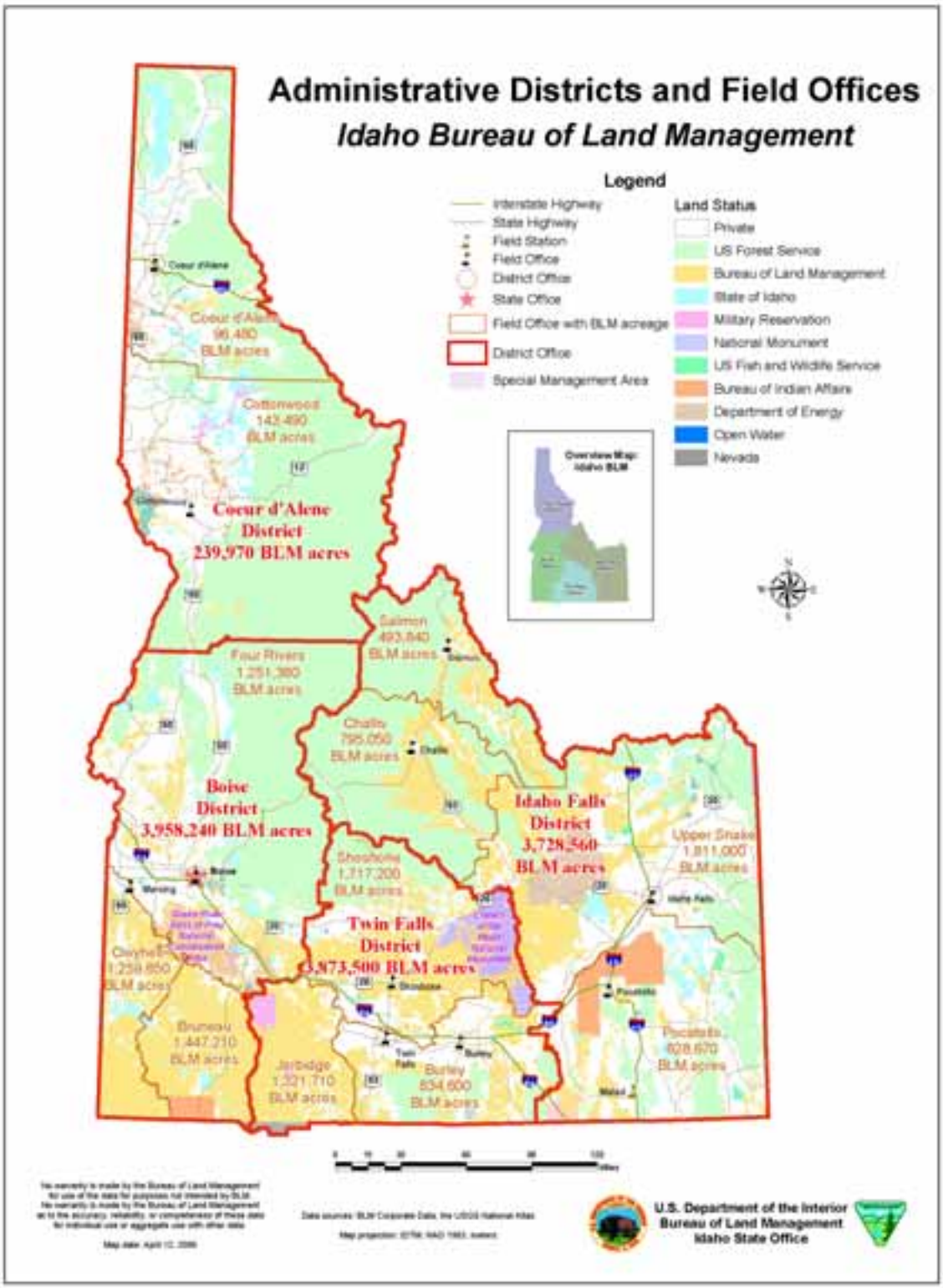
Since State Office and Regional Instructors travel and no tuition is charged, BLM Idaho has been able to assist BLM staff in many departments and remote locations to use the system at little cost to local budgets. The cost to implement and maintain this training program, not including staff labor, is less than $5000 annually for some 200 seats of live training.

The national office also covers the costs of unlimited ESRI virtual campus courses for Idaho BLM staff. About 50 courses are completed online from ESRI annually.

Finally, GIS and IRM staff receive about one week of live training annually from ESRI and other companies in Citrix, ArcIMS, ArcSDE, geodatabase development, modeling and QAQC for GIS systems. These courses are funded directly from the Idaho EGIS project and cost about $15,000 for five days tuition for 12 professional GIS and IRM staff.

Summary of Idaho Guiding Teams and Staff

In summary, the vision and funding of the national and state BLM Management, with the unrelenting support of a few key managers, have been the driving force to move Idaho BLM to EGIS. The Idaho GIS Team was critical for technical decisions and direction to create the Idaho system. The assistance and cooperation of national and state IRM department, some key staff, the sub teams and the trainers have all been the workhorses to build and maintain the many components of EGIS. EGIS has been a focused effort of multiple departments and staff of Idaho BLM for the past four years. By no means should it be assumed that any staff was dedicated full time to EGIS or that any new positions were created because of EGIS. EGIS has been a background effort since current staff continued to meet daily workloads, projects and crises unrelated to EGIS over the four years.


Administrative Districts and Field Offices
Idaho Bureau of Land Management
Legend
Interstate Highway
State Highway
Field Station
Field Office
District Office
State Office
Field Office with BLM acreage
District Office
Special Management Area
Land Status
Private
US Forest Service
Bureau of Land Management
State of Idaho
Military Reservation
National Monument
US Fish and Wildlife Service
Bureau of Indian Affairs
Department of Energy
Open Water
Nevada
Coeur d'Alene
96,480
BLM acres
Cottonwood
143,490
BLM acres
Coeur d'Alene
District
239,970 BLM acres
Salmon
493,840
BLM acres
Four Rivers
1,251,380
BLM acres
Challis
795,050
BLM acres
Boise
District
3,958,240 BLM acres
Idaho Falls
District
3,728,560
BLM acres
Upper Snake
1,811,000
BLM acres
Shoshone
1,717,200
BLM acres
Twin Falls
District
3,873,500 BLM acres
Owyhee
1,239,850
BLM acres
Bruneau
1,447,210
BLM acres
Jarbidge
1,321,710
BLM acres
Burley
854,600
BLM acres
Pocatello
628,670
BLM acres
U.S. Department of the Interior
Bureau of Land Management
Idaho State Office

The Emergence of the Idaho EGIS Database
The transition to EGIS in Idaho, while following the national architecture for all hardware and software purchases, has never followed a clear transition plan. The roots of EGIS in Idaho actually predate the creation of the national EGIS architecture because Idaho management saw a need for a better, standard, corporate GIS database with metadata.

Once the national architecture emerged, there was intense disagreement among the five-six members of the Idaho GIS Team about the vision and about every facet of EGIS implementation. Therefore, although an EGIS implementation plan was drafted by the State Lead in 2002, it was never edited or completed.

For example, as late as June 2004, the consensus on the EGIS vision was to serve only novice and casual users with EGIS. By the autumn, the Idaho GIS Team consensus suddenly included the needs of professional GIS staff for the power, tools and integrity of SDE Geodatabase. Therefore, as the system was being installed, the vision and the system changed dramatically. With the change in vision, the Idaho EGIS became more similar to the national vision by focusing on the spatial data needs of both casual and professional GIS users.

The lack of overall consensus meant that the Idaho GIS Team had to be flexible and search for options that would work in each corner of the state. As consensus was built for each small step, statewide buy-in of the system was eventually built. Ultimately, because the national BLM had created the EGIS architecture and because the state management team funded EGIS in 2003, the Idaho GIS Team felt united in a responsibility to attempt a workable Idaho EGIS.

Data Standards 2001
Of major importance to Idaho BLM was the work, since 2001, of one staff member tasked by management to develop resource data standards for Idaho BLM. This database specialist researched all national and local BLM databases and developed standards and data models for, initially, ten core datasets, including:
Range
Riparian
National Land Conservation System (NLCS) databases such as
- Areas of Critical Environmental Concern
- Wilderness
- Wilderness Study Areas
- Wild and Scenic Rivers
- Special Recreation Management Areas
- Outstanding Natural Areas
- Research Natural Areas
- National Monuments
- National Conservation Areas

Water Rights

Timber
Special Status Species (Plants and Animals)
See a sample of one resource data standard in Appendix A.

As might be expected, each of these ten standards developed into nearly 100 standards due to the multiple databases necessary for each. Also, the original standards were developed for coverage format and had to be re-engineered for the enterprise geodatabase.

Once the majority of the first wave of resource standards was complete, it was discovered that Idaho BLM needed standards for framework data as well. Therefore, standards are being developed for Transportation and other framework layers.

The Field staff did not have time, due to decreases in staffing, to implement the standards at the local level. The Idaho GIS Team agreed in 2005 that the Idaho BLM State Office staff would implement the standards as the data was moved into the EGIS SDE geodatabase. Thus, enterprise GIS is making possible the implementation of the data standards statewide.

A Datum Change and Inventory 2003
The corporate BLM database transitioned from UTM NAD 1927 meters to UTM NAD 1983 meters in 2003. The datum change meant that GPS data no longer embedded a 14-foot error in its reprojection to NAD 1927 and so was heralded as an improvement in BLM data accuracy.

To prepare for the transition, a complete inventory of all corporate GIS data statewide was submitted to the State office.

As with most industries and agencies, the popularity of ArcView 2 and 3 resulted in a fragmented database statewide in the Idaho BLM. Furthermore, many of the edits were created by non-GIS professionals, resulting in non-professional edits (for example, graphics were edited, rather than the databases). One District Coordinator, on taking the helm for three field offices, discovered over 200 master datasets for range allotments and pastures in the District. Not one master could be considered “correct” as each had updated areas that the other masters did not contain.

The Datum change was seen in Idaho as an opportunity to clean up the BLM data by consolidating it into master datasets with complete metadata at the Field Office or District level. This work was done locally under the direction of the three District Coordinators (please note, a fourth BLM District was added in 2004, or after the NAD 1983 transition).

Key Corporate Datasets and Directory File Structure Identified 2004
The State BLM then completed a survey of staff for key vector datasets with a resulting list of 33 datasets slated for statewide consolidation to prepare for SDE enterprise database loading. These key datasets are mostly framework, such as state and cadastral boundaries, but the BLM also identified some unique datasets as key to our business, such as Riparian, Range allotments and Areas of Critical Environmental Concern (see the Key Datasets in Appendix B).

In addition, a national DOI change to a standard directory file structure was seized as an opportunity to improve the logical storage of file based GIS on the corporate drive. Formerly the data was organized by accuracies; today, the file structure is organized by general data themes (see the Directory File Structure in Appendix C) and divided into areas for:

- corporate data,
- draft data,
- projects (for ArcGIS .mxd files),
- maps (for .pdf images of hard copy maps) and
- misc. support (for technical support documents)

The Idaho GIS Team continues to improve and change the file structure but the general data themes have been replicated in the EGIS SDE geodatabase for logical consistency.

Design, Load and Edit the SDE Vector Database & Map Browser 2005-2006
Since 2005, State GIS staff have been designing and implementing the EGIS system. Different components of the system have been built for three types of users, the map browser, the casual user and the professional GIS staff.

Current Processes
Map Browsers
Map Browsers had to request hard copy or .pdf maps from GIS staff. Some browser staff ask GIS staff to build projects (in ArcMap or ArcReader) to view and print their own maps.

Public Data Users
Some Idaho BLM data has been disseminated through the NILS Geocommunicator site (geocommunicator.gov). BLM Idaho GIS metadata has also been disseminated through the BLM corporate metadata repository at http://web.blm.gov/CMR/index.htm

Casual GIS Users
Casual Users are usually resource staff who upload GPS data and do some editing, usually in ArcView license of ArcGIS. They take training in ArcGIS and are assisted by professional GIS staff to build tools and projects as necessary to complete their daily work. Their data edits are used by professional GIS staff to update the corporate database.

Professional GIS Staff
Before EGIS and during this transition period, data updates to the local data may be created from

- field data, often collected by GPS,
- from other sources, such as agencies or industries, by contract or partnership
- digitized from paper maps,
- COGO'd from metes and bounds,
- digitized from digital products,
- remotely sensed and extracted

BLM Idaho has many professional GIS staff edit coverages using command line workstation. In many cases, command line works more easily and predictably than some of the new tools in ArcGIS. Most GIS professionals now edit personal geodatabases using ArcTools.

The non-GIS method to build statewide or national datasets means that:

1) State Office issues a data call with a 14-30 day deadline,
2) Districts have to find, collect and check the field office data,
3) State Office has to merge the data into a statewide dataset and clean attributes and any glaring edge matching errors
4) Roll the state database to the national database where it had to be merged again with other states.

Note that the data is out of date by the time the national dataset is built and the prodigious workload to update cannot be expected on a daily or weekly basis.

Emerging EGIS Processes

Map Browsers - ArcIMS Map Browser with Added Tools
Statewide data can be accessed 24/7 on the internal Map Browser. This means that non-GIS Map Browsers can:

- enter in coordinates (called in by the county sheriff or the public)
- view the location against a backdrop of corporate resource data
- Mark up the site with notes
- Print, save and email a map
- Export the data tables into an Excel Spreadsheet for incident and reporting calculations

The change in this capability has meant that more staff is able to use the resource data at their convenience without professional GIS intervention. Since the data is at their fingertips, BLM staff is more knowledgeable and effective in the performance of their duties to preserve and conserve resources on public land, and to communicate and collaborate and to preserve public safety.

Public Data Users
The BLM has a policy to share and disseminate data to the public as much as possible. However, the funding for EGIS in Idaho was never adequate to build

the demilitarized zone and duplicate the database for public distribution as outlined in the national architecture.

Therefore, the EGIS project has managed to provide some funding to support and distribute Idaho BLM public data through the Idaho Clearinghouse for Geospatial Data (insideidaho.org). Inside Idaho is housed at the University of Idaho Library. It is a Federal Geographic Data Committee (FGDC) Node, and as such disseminates data through the federal GIS data site, the Geospatial One Stop. The result is that GIS staffs statewide save countless hours annually in answering custom data requests from the public. The Clearinghouse reported over 2500 downloads of BLM datasets in 2005.

Casual GIS Users and Professional GIS Staff - Citrix use with File based Data
Citrix was planned in the national ESRI architecture only for use with SDE. Citrix has had the largest impact in saving labor dollars in IRM support for use with file based GIS in the following ways:

- When BLM Idaho upgraded to ArcGIS 9.1, over 30 seats of the software was not reloaded on computers in the State Office. Those staff persons, which include the GIS State lead, now access ArcGIS only through Citrix. Not one person has asked for installation on the desktop because Citrix did not work adequately for them.

- Two Districts experimented with Citrix for Fire and Fuels staff during the field season because they travel so often, it was slow to connect to local servers. One District removed all but one of the Citrix installations citing slow performance in editing against rasters and the difficulties in keeping the data at the state office updated. The other continues to use Citrix.

- Idaho BLM has saved thousands of dollars in software licenses since one or two floating seats are purchased and posted on Citrix for use by any BLM staff in the state.

- Citrix has saved IRM labor to load additional applications and to maintain network security. Security is so tight in the BLM Idaho that staff must wait for permission and staff to load new software, tools and upgrades. With Citrix, once the software is approved for use, it often is only loaded on the Citrix boxes, not statewide.

- In the remote upgrade of 320 desktops to ArcGIS 9.1 in 2005, the personal computers (PC) that failed to properly upgrade usually were hung up due to custom applications. With every BLM PC now having the same configuration, (custom applications are on Citrix) future remote upgrades should occur more simultaneously and trouble free. This will save an estimated 800 hours of IRM labor annually (320 computers x 2.5 hours to unload and load upgrades).

- Professional GIS staff may simultaneously run Citrix ArcGIS and PC ArcGIS for double production. When a slow process needs to be run, it is done in the background on Citrix while the staff person can continue to run ArcGIS on their PC.

- Citrix has allowed BLM staff additional time to develop the ArcSDE database. Since staff can still access the master data in file format to compare and contrast the data across office boundaries, some data clean up and statewide analysis has been possible without waiting for the SDE version of the database.

- Citrix has allowed BLM staff to share workloads and projects statewide. During times of budget cuts and low staffing, it has been invaluable to allow state office staff to work collaboratively on local projects throughout the state.

- Field staff is able to view and use statewide datasets on the State server for the first time without downloading the data, a huge cost savings in network traffic and duplicate data storage.

The change in capabilities due to using Citrix to access file based data has had the single largest impact to date on work processes and knowledge of rangeland health. The new access to statewide enterprise data has resulted in compare differences of data availability, data quality (edge matching and error checking is easier), and data interpretation between offices.

Professional GIS Staff - SDE Enterprise Geodatabase Edits
Most of the 33 datasets have now been loaded in SDE but the full value of Enterprise GIS will occur when the data only has to be edited once, in the master SDE version.

First Test Phase for Field Editing of an SDE Geodatabase
Idaho is currently in a required test phase for all field staff to edit and maintain the master state range allotment and pasture database using SDE and Citrix. The decision to require Idaho field staff to edit range allotment and pasture data in the state SDE geodatabase was approved by consensus of the Idaho GIS Team March 2006 and the new database debuted June 20, 2006. This test will be concluded September 30, 2006 with a final decision from the Idaho GIS Team to move forward with required edits to additional datasets, to revise the system or to abandon the editing of statewide datasets by field staff.

National SDE Geodatabase Editing Required
This particular range allotment and pasture data, as well as land status, is now required for updating in the National Integrated Lands System (NILS). The NILS system for updating is being extensively developed and the Idaho State Office

has shouldered the responsibility for meeting these requirements as processes and techniques emerge and training is completed.

Editing Roles Defined
If the first SDE geodatabase editing test in Idaho is a success, the remaining key datasets in SDE will have editing duties divided between state and field office responsibility.

If the state office edited all of the resource data, a new level of error would be introduced into the data due to unfamiliarity with the geography or the resource. In the BLM, GIS professionals are data editors and Resource Scientists, such as Biologists, Hydrologists, Cultural Resources and Planning staff is the Data Stewards. When the data editor and resource scientist for each geographic location have face-to-face contact to check and approve the data, there is greater assurance that the data represents the situation seen on the ground.

Likewise, if the field office edited the administrative boundaries, a new level of error might be introduced since local field staff and their District Supervisor are not familiar with national staff and regional partners who collaborate in the maintenance of these datasets.

In short, a division of labor for maintenance and updates to enterprise SDE geodatabases is critical for quality assurance and quality control of the data.

In summary, it remains to be seen whether and how the full suite of EGIS tools will meet the needs of browsers, casual users and professional users of geospatial data in the state and national BLM. If the system works for Idaho BLM, it should have a profound impact on robust data integrity and the resulting scientific, defensible spatial data analysis for future generations. To reach the goal of using EGIS to monitor trends in rangeland health depends on the staffing, the training, the funding and the continued enthusiasm of all BLM GIS users.

Lessons Learned:
Idaho has learned some lessons, especially for the need for statewide interdepartmental coordination during this EGIS transition:

1) The State Office must ensure the system is available 24/7 in two time zones or staff somewhere cannot work. Unprecedented cooperation between IRM and GIS has been necessary in planning, purchasing, installing, testing, technically supporting and enforcing the rules of the new system.

2) Two databases, one in SDE and a second of file based data (necessary for disconnected use, shipment to the public and use by Trimble, Autodesk and ERDAS softwares) must now be stored on the BLM system.

3) Staff implemented automated rollovers Oregon BLM when the enterprise license server goes down. Recently it was found that two backup systems were needed when the first backup server also failed.

4) Staff continues to experience slower performance when using the EGIS system, as compared to a local install. Professional engineering on Citrix eliminated some problems such as slow initiation but the slower zoom, pan and tool activation continue to be experienced. It has been suggested by some staff that this slowness is offset by the significant advantages of editing a master database once and having that database readily available as the authoritative version.

5) The Idaho GIS Team has been careful to not eliminate current tools and moved slowly with changes that impact daily work during the transition. Therefore, some staff still uses ArcView 3.1 to conduct their daily work. Many staff still edit local data using command line ArcInfo. All staff statewide is using the same version of ArcGIS software for the first time.
6) When change has been tested and the Idaho GIS Team votes by consensus that it is ready for implementation, it has been mandated by issuing official policy through the State Director.

7) Transition to SDE for each dataset requires a few courtesies to minimize labor and ensure that the enterprise database is the best available:
   a) A final data call to the field is issued weeks or months (depending on the complexity of the dataset) in advance for their best data and metadata
   b) Data is frozen from all edits for one-two weeks while the State Office merges the data, applies standards and loads it into SDE
   c) Data is reopened on SDE with an announcement that it is ready for maintenance by the field at the State location.
   d) Data is extracted regularly and reprojected for use by file-based software by the State Office. Field staff also can export the data immediately from SDE for local use if needed.

8) Roles must be clearly defined about who is responsible for updates of each data layer in the system and who is responsible for maintenance and technical support of each component of the system.

Lingering EGIS Concerns for Idaho BLM

Due to the creation of statewide and national enterprise datasets, Idaho BLM has experienced some expected problems that are not easily resolved:

1) Edge Matching: Nationally, the BLM has not agreed upon a state boundary dataset. Therefore, three datasets are used nationally for state boundaries by BLM professional GIS staffs:
   USGS National Map (from US Census)
   USGS 24k DLG-derived

USGS 100k DLG-derived
BLM GCDB

The three USGS boundaries are edge-matched to one another, the GCDB, while surveyed in areas, may not yet match its neighboring state boundary. The USGS 24k DLG-derived data appears to be the most accurate edge-matched source of state boundaries but this data has not been completed for all states.

2) Coincident Geometry: The internal Idaho datasets do not have proper coincident geometry. For example, the land use planning boundaries are not yet snapped to the state or to administrative boundaries. As state and administrative boundaries are refined, coincident geometry will be created by snapping to the approved data.

3) Projection: Differences in projections are resulting in differences in GIS acreage calculations:
   a) The official BLM projection for national datasets is Geographic, NAD 1983 decimal degrees
   b) The National Integrated Land System (NILS) is calculating GIS acreage in some national datasets using in Albers Contiguous, NAD 1983 meters
   c) Idaho SDE is testing IDTM, NAD 1983 meters, since it contains one zone for the state with little distortion for any one area of the state. The use of one zone reduces the data storage size by 50%.
   d) Idaho BLM approved projection for file based GIS datasets is UTM NAD 1983, native Zone 11 or 12, meters. The Statewide datasets are only stored in Zone 11 (western half of state) to reduce storage space.

   Tests indicate that acreage calculations using the various projections are usually +/- 4%. However, this 4% can mean differences of 10,000 acres or more for any area, due solely to the projection used. Therefore, BLM is careful to specify the projection, datum and units used for any GIS acreage calculation.

4) Format
   a) Although datasets are being loaded into SDE that may be accessed by BLM staff statewide, it appears necessary to continue to maintain separate “flat files”, probably personal geodatabases or shapefiles, for the foreseeable future of the datasets. BLM staff are often disconnected from the network or need a different format to use other softwares such as GPS Terrasync, AutoCad or ERDAS Imagine.

   b) Also, for customer service, the BLM serves public data through the Idaho Geospatial Clearinghouse at insideidaho.org. This site is an FGDC node and thus connected to the Geospatial One Stop as required for federal agency data. Up until Spring of 2006, BLM has served this data to Inside Idaho as .e00 coverage interchange format. However, customers no longer have the ESRI tools to extract .e00 files and so have requested that

BLM serve the data as shapefiles or personal geodatabases. Idaho BLM is complying with that request from the public.

5) Backups & Archive
   a) The need to maintain an SDE enterprise database as well as personal geodatabases at the State level, has meant IRM staff can no longer follow their preferred backup regimen nightly, weekly, monthly, quarterly and permanently. There is a lack of time to run backups during off hours and a lack of backup storage space in the system ($100k upgrade is needed). The BLM Idaho currently has a capacity of nearly 4 Tb for each database system (the SDE database in Unix and the flat files stored in Windows). One dataset, the National Agricultural Imagery Program (NAIP) quarter quads of 2004 aerial photos statewide is nearly 2 Tb alone.

   b) GIS databases are one of the few databases in BLM required for permanent archive. This means that staff must create a permanent annual archive, access the permanent archives every few years to translate it to current technology, and ship data that is 30 years old in Spatial Data Transfer Standard (SDTS) to the National Archives. Full details of the EGIS impact on this process have not yet been fully designed.

6) Database design for scale and chronology
   a) BLM needs to track data for chronology to conduct our resource work scientifically and professionally. As resources are monitored from month to month, year to year and decade to decade, records must allow for time stamps so that a picture of the resource for any given period of time can be replicated. This chronology is not easy to design in the database.

   b) BLM needs to track data for accuracy to conduct our resource work scientifically and professionally. Usually national, regional or statewide datasets are at too small a scale to show enough detail “on the ground” for BLM staff to do their work, such as the 1:100k scale data used by other agencies. Generally 1:24k or +\- 40’ is critical on those lands administered by the BLM. Even at the 1:24k scale, some records may derive from differentially corrected GPS data, with documented 5’ accuracy at the 95% confidence level. Other data is extracted from the 1:24k USGS Digital Line Graphs.

   c) Therefore, BLM must design master SDE geodatabases to track varying chronologies and accuracies and sources.

7) Incorporation of field data

Some of the best data available for the enterprise geodatabase is collected daily in the field by staff using the 200 or more GPS units in the BLM Idaho. Idaho BLM does not require a standard GPS unit although it is preferred that a

resource grade unit be used with a data dictionary, differentially corrected with automatically generated feature and file level metadata.

In reality, field offices GIS Specialists spend a ratio of about six hours computer time to every field hour to input the hundreds of GPS field data files each week. Not all data is submitted and may hide in drawers and hard drives for years. If properly collected and documented, field data is the most valuable data for improvement of the corporate SDE geodatabase.

Field GPS data arrives in the following formats:

- Handwritten notes with x and y coordinates
- Excel spreadsheets with thousands of x and y coordinates with mixing of format between decimal degrees, Degree, minute, second, project, etc.
- Computer files in text format with no attributes or metadata.
- Computer files in shapefile format with no data dictionary and few attributes.
- Computer files differentially corrected with full attributes and metadata audit records.

The worst result may not be that there are no field updates in an area. Rather, it may be discovered at the end of a field season that one watering trough was GPS'd multiple times with slightly varying locations. If staff does not export adequate metadata, then the GIS Specialist cannot make a distinction between the multiple GPS locations for the master database.

The change to an enterprise, statewide database requires a change in field data updates and processes:

- State staff must design the SDE database for polygon geometry to be dependent on arcs to allow for integration of GPS and other field updates
- Field staff must collect all appropriate GPS data with adequate feature level metadata including key information of:
    - GPS receiver type
    - Accuracy to the 95% confidence level (National Standards for Spatial Data Accuracy, or NSSDA standards)
    - Correction method
    - Date of collection.
- Field staff must upload field data to the state server before it can even be viewed with the most current version of the EGIS SDE geodatabase
- Field Staff must submit the GPS data to professional GIS staff for incorporation into the master EGIS SDE geodatabase

8) Raster Data:

Equally as valuable and challenging are the updates to the enterprise database by raster data with attribute tables. Some key datasets in Idaho BLM for monitoring of rangeland health are:

- soils data (for potential vegetation)

- current vegetation data (which changes annually due to treatments and fires)
- elevation data (for slope, aspect and analysis).

These datasets are unique in that, while they tend to be developed statewide, small projects of limited geography provide greater accuracy and should be incorporated overall into the enterprise dataset. Pockets of LIDAR data and remotely sensed vegetation data using over a dozen scientific techniques for the delineation of perennial vs annual grasses, juniper encroachment and sagebrush species are of the greatest importance to rangeland managers.

Idaho BLM has not loaded rasters into SDE due to :

- the loss of current linkages with critical value-added attribute tables and
- Current adequate performance of image catalogs.
- The need for Autodesk, GPS and ERDAS softwares to access non-SDE datasets
- A lack of storage and backup space to allow two sets of raster data (one in SDE and one in file-based storage)

If master enterprise databases are to be developed for raster data, it may well be done in a file based system outside of SDE.

Using EGIS to Monitor Ecosystem Health Trends on a Regional Basis

In the BLM Idaho, GIS is classified as a Support Service thus GIS professionals support resource scientists, planners and land managers with data and analysis to monitor rangeland ecosystem health. Although still in its infancy, the three components of the Enterprise GIS system (ArcIMS, Citrix and ArcSDE) may have exciting impacts on the costs and effectiveness of determining monitoring rangeland ecosystem health on public lands. As yet, many experimental projects exist to document monitoring techniques on a local scale. However, the BLM is in need of a consistent database, software applications and analysis tools to definitively document changing trends on a regional basis.

I offer below specifics on the four key datasets for monitoring BLM Idaho rangeland health. These datasets are complex and integral to monitoring rangeland health. Integrated design of these datasets and their updates are critical for future BLM monitoring of rangeland health. These critical natural datasets are:

1. Vegetation
    a. Examples of Uses: Used to compare past vegetation with current vegetation to track ecosystem health, economic development, historic and prehistoric activities, recreation opportunities, special status plant and animal habitat, potential wildfire activity, land use planning.
    b. Some Sources of Data:
        i. Raster, remotely sensed satellite data,
        ii. Vector GPS files of weeds and control stations tracked for 30 years

iii. Aerial Photography (NAIP)
iv. 1980s inventory (paper)
v. Weekly GPS perimeters of wildfires
vi. Weekly GPS perimeters of prescribed burns and other land treatments
vii. Historic aerial photography

c. Trends to monitor
    i. Species of sage brush and their fragmentation by developments or intrusive vegetation
    ii. Encroachments of juniper on sagebrush
    iii. Special Status Species (rare plants)
    iv. Impacts of land treatments and wildfires on vegetation
    v. Spatial trends of cheat grass and other invasive species
    vi. Changes in vegetation determined by comparison of historic and current field data
    vii. Changes in vegetation determined by quantitative comparison of historic and current aerial photographs, low level flights and/or satellite images

2. Soils
    a. Examples of Uses: Used to determine potential vegetation, erosion and landslide potential, mineral development, recreation activity, agricultural potential and land use planning
    b. Some Sources of Data:
        i. SSURGO NRCS coverages with
        ii. Value added tables from BLM Scientists and partners for potential vegetation
        iii. Statsgo Soils data
        iv. Regular GPS updates from field verification by soils scientists
    c. Trends to monitor
        i. Impact of development on surface soils
        ii. Erosion and landslides
        iii. Treatments and their success in vegetation changes for various soil types

3. Elevation
    a. Examples of Uses: Used to determine slope, climate & aspect of lands to indicate vegetation potential, cultural resource site location, recreation potential, agricultural and economic development, hydrography and hydrology, administrative boundaries, potential wildfire behavior, sensitive plant and animal habitat, land use planning
    b. Some Sources of Data:
        i. USGS National Elevation Data
        ii. USGS 10 m Digital Elevation Model
        iii. USGS 30 m Digital Elevation Model
        iv. LiDAR data in project spots
        v. Statewide vector contours

        vi. Thousands of elevation points from Resource grade GPS, surveyor notes and cadastral records (for development of an undulating three dimensional geodatabase – not in my lifetime….but one may dream)
    c. Trends to monitor
        i. Treatments and their success in vegetation changes for various elevations and aspects.
        ii. Appropriateness of development on varying slopes
        iii. Erosion and landslides
        iv. Modeling of potential of unknown resources at varying slopes
        v. At very fine scales, the heights of various vegetation to definitively calculate vegetation type and age by remote sensing.

4. Hydrology
    a. Examples of Uses: Used to determine vegetation potential, cultural resource site location, recreation activities, ecosystem zones, sensitive species habitat, agricultural and economic development, administrative boundaries, potential wildfire behavior, land use planning
    b. Some Sources of Data
        i. USGS National Hydrography Dataset, including Watersheds
        ii. U. S. Census Hydrography Dataset
        iii. Value added products, such as those with name attributes
        iv. USGS Digital Line Graphs
        v. Weekly GPS data of flow rates, rights, and quality
    c. Trends to Monitor
        i. Ecosystem health by watershed to the sixth hydrologic unit code
        ii. Effect of development on hydrography
        iii. Erosion and landslides potentials and changes
        iv. Modeling of potential of unknown resources at varying proximity to water

Idaho BLM is currently developing some of these datasets as SDE geodatabases. Some data is currently accessed through the EGIS Map Browser. Even so, until a comprehensive design is created that builds relationships between the varying chronologies and sources of data with an update plan, BLM will not have definitive capabilities and control of public land data to monitor trends in landscape health.

Regional Comparison of Data and Analysis through EGIS

Enterprise GIS is providing the tools to compare the regional data against the interpretation of BLM field staff, currently as well as historically. In the Owyhee Uplands Pilot Project, an area of intact sagebrush was delineated across portions of three states, including Idaho. GIS leads from each state submitted field data to a central EGIS location. The pilot project is also testing various remote sensing and aerial photography varied techniques with ground truthing by field testing of

those techniques, to derive a way to create accurate vegetation data on a regional basis. BLM is also attempting, through the pilot, to add value to the current Soils, elevation and climate data to determine the potential or historic vegetation for areas on a regional basis.

- Enterprise GIS has allowed BLM staff to look at regional differences in the datasets. The results are identical to those found by Idaho BLM in our EGIS project (see the Lingering Concerns portion of this paper). Once database differences are identified, steps can be taken to eliminate differences for more consistent analysis.
- Enterprise GIS has allowed BLM staff to work on the project together, across state lines, to correct differences in the databases, thus improving our ability to conduct meaningful analysis.
- One state regularly extracts GIS data from the other national BLM databases. Although the spatial accuracy is not good, these databases provide a link with various documented activities that are currently missing from the GIS databases in the other states.
- EGIS will allow the BLM field data to be compared against remotely sensed data so the BLM can determine appropriate uses for each in monitoring trends in ecosystem health. It is unknown at this time, which method is the most appropriate for monitoring of landscape health on a regional basis. The answer may well include a combination of methods.

Summary

In summary, the BLM focuses on vegetation, soils, water, and air resource datasets to determine trends in landscape health on a regional basis.

To meet emerging needs for regional data, Idaho staff is building an enterprise GIS system using internal ArcIMS Map Browser of BLM corporate data, a Citrix application server farm and an SDE Geodatabase using Informix.

Enterprise GIS is critical to meet the spatial data needs of the National BLM because:

1. The large raster and vector databases for soils, vegetation, hydrology and air critical to the monitoring effort require an enterprise SDE Geodatabase system for sharing projects and data nationally.

2. The enterprise SDE Geodatabase system has controls on data integrity, stability, redundancy and connectivity not possible with other GIS data storage formats.

3. The enterprise GIS component of an ArcIMS Map Browser and Internet data dissemination is the most effective way to serve data to the public and to non GIS professionals 24/7

In addition, this author believes that any effort to monitor trends in regional ecosystem health must include historic, current and future field data collection to ground truth and update remotely-sensed data and to document situations undetected by remote sensing. Wherever available, qualified local field observation data should enhance remotely sensed data as an indicator of ecosystem health. If the value of field data is accepted generally, then the value of the Enterprise GIS system grows exponentially because:

4. Data updates can be done once, not multiple times as data is rolled directly from GPS collectors to the enterprise database.

5. Updated data is available immediately, not quarterly or annually, for a state, regional, national or international view

6. QA/QC of data is more comprehensive since data is viewed across administrative boundaries, thus highlighting differences in edges, collection techniques, interpretation and missing data

7. Data is defensible since spatial geometry rules can be applied as the data is accepted into the enterprise database. Violations will not be accepted.

8. Analysis is more scientific and defensible since data and metadata standards are more easily implemented and enforced.

The Idaho implementation of EGIS has held strongly the specifications and ultimately, the vision of the national BLM architecture. This national architecture did not address database design, database standards or changes in business processes. Therefore, Idaho BLM staff discovered that there were too many unknowns to agree upon a vision or business plan prior to initial implementation. It now appears that many components of EGIS will work well, with resulting cost savings and great database benefits, for many purposes in Idaho BLM. Therefore, it is only now, with national assistance, that Idaho BLM is beginning to develop a consistent vision and business plan for the future of EGIS to support our scientists and managers with defensible, scientific data to monitor trends in ecosystem health in Idaho.

Acknowledgments

Idaho Bureau of Land Management GIS, IRM and Resources Staff and Management, especially Gary Hunter, Bureau Chief for Engineering and Geographic Sciences

Special thanks to my beloved husband, Stan A. McDonald, and to our patient family who will search the back roads late tonight for a place to lay our sleeping bags because I worked too long on this paper.

Appendix A: Sample of Idaho BLM GIS Data Standard

IDAHO BLM GIS CORE DATA STANDARD

AREA OF CRITICAL ENVIRONMENTAL CONCERN POLYGON (ACECP) THEME regions

Theme Definition: This is a digital display of ACEC (Area of Critical Environmental Concern) boundaries. ACECs are designated by decisions made during BLM Resource Management Planning.
Theme Identifier: ACECP
Feature Class: Polygon, line, **regions (ACECs have the potential to overlap)**
Input Scale: 1:24,000 or larger
Metadata: Required, full Federal Geographic Data Committee (FGDC) Compliant.
Format: Arc Info Data Set
Primary Key(s): ACECP_ID; ACECP_CASEFILE (ACECP_CASEFILE is the LR2000 primary key and LR2000 national application link)

Feature Class: Polygon (.PAT) (Polygon Attribute Table) **regions**

Item Name	Input Width	Output Width	Type
ACECP_IDENT	12	12	C
ACECP_CASEFILE	15	15	C
ACECP_GIS_ACRES	16	16	N.6

Item Definitions:

ACECP_IDENT - ***FOIA Category (Public), (Required core GIS attribute)*** This attribute is the primary unique ID for each individual ACEC. It must remain unique within Idaho and never be recycled (if the ACEC is voided, so is the number. The number cannot be reused). Close coordination among field offices should be considered when an individual ACEC boundary is located in and managed by more than one field office. The attribute will consist of a unique combination of characters beginning with the first two characters each of the District and Field Office codes. The remaining numbers are from a block of numbers not to exceed 12 total characters; (for example: 848212343500 is a Challis/Coeur d'Alene assigned unique number.) The beginning office codes are not intended to reference polygons to a field office. The only intent is to keep the codes unique and to require minimum coordination between offices when assigning codes.

ACECP_CASEFILE - ***FOIA Category (Public), (Required core GIS attribute)*** *(NOTE: This is the link to the LR2000 databases. This format is required.) Contact the ISO LR2000 Data Steward for access or information about LR2000.* This is a

BLM, ISO assigned number used for identification of all LR2000 lands and minerals case files including ACECs. This value refers to the serialized case file number for each ACEC. This field should always be in uppercase. In the example"-"represents a space. For example: CACA--0355821--, IDIDBL0123456--. The format always consists of 15 characters with all containing a minimum of one character, "0" fill, or a space. Position 1 and 2 = State prefix (always ID in Idaho), 3-6=Serial number prefix consisting of the Idaho Land Office Code. These include Lewiston IDL, Blackfoot IDBL, Boise IDB, Coeur d'Alene IDC, Hailey IDH, Idaho IDI, or I and 3 blank spaces if no land office is contained in the serial number)], 7=number prefix ("0" if prefixed or one space if not. Usually serial numbers with a land office are "0" prefixed), 8-13=Serial number-A six digit number, leading fields will be "0" filled. 14 and 15=Serial number suffix. The suffix is a two digit number. If the serial number is not suffixed, leave two blank spaces.

(NOTE: This is the link to the LR2000 databases. This format is required.)

ACECP_GIS_ACRES - ***FOIA Category (Public), (Required core GIS attribute)*** The total acres for the related polygon.
Conversion constants: sq meters*0.0002471044 = acres,
Conversion constants: acres*4046.873 = sq. meters. (Source, ESRI 'Conversion Constants' from Arc Info command line Help.) The conversion constants are based on the U.S. Survey Foot and not the International Units.

Feature Class: Line (.aat) (Arc Attribute Table)

Item Name	Input Width	Output Width	Type
ACECP_DEF_FEATURE	30	30	C
ACECP_COORD_SOURCE	3	3	C
ACECP_ACCURACY	5	5	C

Feature Class: ***Region*** Subclass ACEC (.pat ACEC)

Item Name	Input Width	Output Width	Type
ACECP_IDENT	12	12	C
ACECP_CASEFILE	15	15	C
ACECP_GIS_ACRES	16	16	N.6

Item Definitions:

ACECP_IDENT - ***FOIA Category (Public), (Required core GIS attribute)*** This attribute is the primary unique ID for each individual ACEC. It must remain unique within Idaho and never be recycled (if the ACEC is voided, so is the number. The number cannot be reused). Close coordination among field offices should be

considered when an individual ACEC boundary is located in and managed by more than one field office. The attribute will consist of a unique combination of characters beginning with the first two characters each of the District and Field Office codes. The remaining numbers are from a block of numbers not to exceed 12 total characters; (for example: 848212343500 is a Challis/Coeur d' Alene assigned unique number.) The beginning office codes are not intended to reference polygons to a field office. The only intent is to keep the codes unique and to require minimum coordination between offices.

ACECP_CASEFILE - ***FOIA Category (Public), (Conditional Required core GIS attribute)*** *(NOTE: This is the link to the LR2000 databases. This format is required.) Contact the ISO LR2000 Data Steward for access or information about LR2000.* This is a BLM, ISO assigned number used for identification of all lands and minerals case files including ACECs. This value refers to the serialized case file number for each ACEC. This field should always be in uppercase. In the example"-"represents a space. For example: CACA--0355821--, IDIDBL0123456--. The format always consists of 15 characters with all containing a minimum of one character, "0" fill, or a space. Position 1 and 2 = State prefix (always ID in Idaho), 3-6=Serial number prefix consisting of the Idaho Land Office Code. These include Lewiston IDL, Blackfoot IDBL, Boise IDB, Coeur d'Alene IDC, Hailey IDH, Idaho IDI, or I and 3 blank spaces if no land office is contained in the serial number)], 7=number prefix ("0" if prefixed or one space if not. Usually serial numbers with a land office are "0" prefixed), 8-13=Serial number-A six digit number, leading fields will be "0" filled. 14 and 15=Serial number suffix. The suffix is a two digit number. If the serial number is not suffixed, leave two blank spaces.

(NOTE: This is the link to the LR2000 databases. This format is required.)

ACECP_GIS_ACRES - ***FOIA Category (Public), (Required core GIS attribute)*** The total acres for the related polygon.
Conversion constants: sq meters*0.0002471044 = acres,
Conversion constants: acres*4046.873 = sq. meters. (Source, ESRI 'Conversion Constants' fro ArcInfo command line Help.) The conversion constants are based on the U.S. Survey Foot and not the International Units.

Feature Class: Line (.aat) (Arc Attribute Table)

Item Name	Input Width	Output Width	Type
ACECP_DEF_FEATURE	30	30	C
ACECP_COORD_SOURCE	3	3	C
ACECP_ACCURACY	5	5	C

Item Definitions:

ACECP_DEF_FEATURE - ***FOIA category (Public), (Required core GIS attribute)***

This attribute represents the physical feature types that form the ACEC boundary.

Allowable Values

RIM = Line generally follows a rim, contour line, or natural barrier.

FENCE = Line follows a constructed fence line.

ROAD = Line was digitized, copied, or derived from road theme data.

STREAM RBANK = Downstream right bank of stream boundary indicates that the stream is within the downstream left of the ACEC boundary.

STREAM LBANK = Downstream left bank of the stream boundary indicates that the stream is within the downstream right of the ACEC boundary.

STREAM CENTER = Stream center serves as boundary between two ACEC boundaries.

PARCEL = Boundary follows a legal line such as ownership or section lines.

POINT TO POINT = Boundary is not defined by any legal or geographic feature.

ROAD OFFSET = Boundary follows a road, but is offset from it on one side or the other.

UNKNOWN = It is not known what feature forms the ACEC boundary.

NONE = The ACEC is not defined by any known feature.

ACECP_COORD_SOURCE - ***FOIA Category (Public), (Required GIS Attribute)*** This value refers to the actual source of the defining feature. It is the digital map source of the original arc that makes up the ACEC boundary.

Allowable values

1 = USGS 7.5 minute DLG (direct)
2 = USFS 7.5 minute Cartographic Feature File (CFF) (direct)
3 = DLG 7.5 minute format, but converted from CFF
4 = ADS data but originally from DLG
5 = ADS data but originally form CFF
6 = ADS data, digitized in ADS, Mylar source
7 = ADS data, digitized in ADS, paper source
8 = GCDB data (except for ownership, see 16)
9 = 1:24K, NHD (National Hydrography Dataset)
11 = Digitized from 1: 24K source Mylar, ARC/INFO
12 = Scanned from 1: 24K source Mylar, ARC/INFO
13 = (Ownership only): Created by section subdivision algorithm

14 = (Ownership only): Manual cartographic transfer
15 = (Ownership only): Ownership duplicate line from other RBD source
16 = (Ownership only): Ownership line based on GCDB data
17 = Arc data, digitized from 1:100K base data Mylar
18 = Arc data, heads-up digitized from 1:100K base Mylar source
19 = Arc data, heads-up digitized from 1:24K base map
20 = GPS (with no differential correction)
21 = GPS (with differential correction)
22 = Arc data, scanned from 1:100K source Mylar
90 = Other
99 = Unknown

ACECP_ACCURACY - Locational accuracy code which indicates how close to the true geographic location on the ground a GIS entity has been recorded.

Accuracy Codes:

The Geographic Coordinates Spatial Data Standard has a Point Reliability Code attribute with a list of values allowable including the following:
0 = Default/unknown
1 = 1 foot or less
2 = 3 feet or less
3 = 10 feet or less
4 = 40 feet or less
5 = 100 feet or less
6 = 200 feet or less

It is recommended that Data Standard accuracy fields for reporting GPS accuracy at the 95% confidence level to be in compliance with FGDC (Federal Geographic Data Committee) Geospatial Positioning Accuracy Standards.

NMAS (National Map Accuracy Standard) uses a 90% confidence level value and the GPS Data Standard uses the NSSDA (National Standard for Spatial Data Accuracy) 95% confidence level; therefore, the conversions are listed below.

For data required to meet the NMAS accuracy requirement of 1:24,000 scale maps:

(Puerto Rico, Hawaii, and Continental US)
NMAS at 90% confidence level = 12.2 Meters (40Feet)
Expressed as NSSDA:
NMAS at 95% confidence level = 13.9 Meters (45.6 Feet)

Manuscripting

MAN1 = within 40 feet
MAN2 = within 100 feet
MAN3 = within 150 feet
MAN4 = within 300 feet
MAN5 = within 660 feet
MAN6 = within 1,320 feet
MAN7 = within one-half mile

MAN8 = best estimate with no distance limit indicated

Township and Range

The TR accuracy code is different from GPS and MAN. It is ONLY used where the site location is recorded only by a Township/Range/Section AND no attempt to try to locate it on a map is made. For example, An ACEC recorded only by T/R/S may still be locatable along a road going through that section and given the appropriate MAN accuracy (probably MAN4 or MAN5). If, however, no reasonable assumptions are possible, the TR codes are useful. In these cases, a point is placed in the center of the section, ¼ section, etc., and labeled with TR10 for a ¼ ¼ ¼ section (located to with 10 acres); TR40 for a ¼ ¼ section (within 40 acres); TR160 for a ¼ section (within 160 acres), TR320 for a ½ section (within 320 acres) and TR 640 for a section record (within 640 acres). These points are buffered to 1 meter to make polygons.

TR10 = located to within 10 acres (¼ ¼ ¼ section).
TR40 = located to within 40 acres (¼ ¼ section).
TR160 = located to within 160 acres (¼ section).
TR320 = located to within 320 acres (½ section).
TR640 = located to within 640 acres (1 section).

For more detailed information; See Oregon GPS standards
http//web.or.blm.gov/or957/cadastral/gps/blmstd_04-22-03.pdf

DATA COLLECTION AND MAINTENANCE PROTOCOLS

Accuracy Requirements: Positional accuracy is important for the ACEC (Area of Critical Environmental Concern) theme. The ACCURACY field within the line attribute table contains feature level accuracy information stratified by input method and the absolute accuracy (how close, in +/- feet, the GIS mapped feature is to the actual ground feature). This flags the less accurate lines for replacement when possible. It is expected that GPS will be used to more accurately locate ACEC boundaries.

Collection and Input Protocols: The District Data Steward will develop standard field data collection methods and work with the GIS Coordinator to develop corresponding standard GIS input methods. The most common methods of boundary capture are: (1) Manuscript lines onto USGS quad maps and digitize; (2) GPS the ACEC boundaries in the field and input the GPS coordinates into GIS; (3) Use ortho-photos as a backdrop for on-screen digitizing; or (4) Import DLG boundary data and other existing data. It is important to know what type of boundary each GIS line segment represents so that appropriate existing data can be brought in rather than digitizing new data. A pervasive problem with boundary lines is the large degree of coincidence with subdivision lines. To avoid creating a huge number of sliver areas when the ACECP theme is combined with the PLSS (Public Land Survey System) or GCDB (Geographic Coordinate Data Base) theme, it is recommended that the District Data Steward and GIS Coordinator decide on a minimum distance under which coincidence will be forced. For example, if

the mapped boundary is within 100 feet of the PLSS (Public Land Survey System) line or GCDB (Geographic Coordinate Data Base) line it is intended to follow, use the PLSS/GCDB line, not the mapped line. Buffering the DLG boundary and using the appropriate buffer lines can make this input easier if it is not critical to capture the exact location of the boundary. It is highly recommended that source maps be 1:24000 or better.

Update Transactions: The unit of processing for updating the theme is the district. This means to update the theme district-wide transactions will be initiated by editors within the districts. Editors will "check-out" their districts' theme features. They will then add, delete or modify the features prior to "check-in". The district GIS Coordinator will approve update processes and provide assistance and oversight.

Update Frequency: Once the theme has been created for a district it is the responsibility of the District Data Steward to ensure that the theme remains current. Bringing the theme up to a current level should take place at least once per year if not more frequently. It is also the responsibility of the District Data Steward to ensure that any database (local-national) external to the GIS be kept current and consistent with the GIS.

QUALITY CONTROL

Transaction Level: This level of quality control occurs during feature update. Attributes are carefully checked. Lines are compared to other themes for potential slivering problems.

Monitoring Level: The State Data Steward and the District Data Stewards are responsible for reviewing the theme across the state minimally once per year. A key item to be reviewed is consistency between districts in attributing. Additional guidance for labeling may need to be developed. Progress toward similar levels of accuracy is another review item. The correct linkage to any related external databases should be tested by District Data Stewards at least annually.

DATA ORGANIZATION/STRUCTURE

In Arc/Info the attribute data is organized into two feature attribute files. A polygon attribute table (.pat) for information about the polygons and an arc attribute table (.aat) for information about the lines.

AREA OF CRITICAL ENVIRONMENTAL CONCERN

Definition: This standard describes the minimum required corporate data base attribute, format, and content to be collected for BLM ACECs (Areas of Critical Environmental Concern) in Idaho.

Metadata: Required, full Federal Geographic Data Committee (FGDC) compliant.

Application: These data standards define how minimum core attribute resource data are to be captured in any paper or digital collection process in the Idaho BLM. The standards should be implemented immediately for all existing and new Geographic Information System (GIS) databases, Microsoft (MS) Access database, MS Excel Spreadsheets, MS Word documents, GPS data dictionaries, etc. Standardization or conversion of historical or previously collected data to the current standards will take place on an "as needed" basis, as determined jointly by the Data Stewards and Field Offices to meet local and/or statewide needs.

Area

Item Name	**Input Width**	**Output Width**	**Type**
ACECP_IDENT	12	12	C
ACECP_CASEFILE	15	15	C
ACECP_NAME	40	40	C
ACECP_REASON1	3	3	C
ACECP_REASON2	3	3	C
ACECP_REASON3	3	3	C
ACECP_REASON4	3	3	C
ACECP_REASON5	3	3	C
ACECP_REASON6	3	3	C
ACECP_REASON7	3	3	C
ACECP_REASON8	3	3	C
ACECP_REASON9	3	3	C
ACECP_REASON10	3	3	C
ACECP_OTH_REASON	40	40	C
ACECP_DES_STATUS	1	1	C
ACECP_DES_DATE	8	8	D
ACECP_NOM_DATE	8	8	D
ACECP_CON_DATE	8	8	D

ACECP_LUP	40	40	C
ACECP_MGMT_CONST1	3	3	C
ACECP_MGMT_CONST2	3	3	C
ACECP_MGMT_CONST3	3	3	C
ACECP_MGMT_CONST4	3	3	C
ACECP_MGMT_CONST5	3	3	C
ACECP_MGMT_CONST6	3	3	C
ACECP_MGMT_CONST7	3	3	C
ACECP_MGMT_CONST8	3	3	C
ACECP_MGMT_CONST9	3	3	C
ACECP_MGMT_CONST10	3	3	C
ACECP_MC_OTHER	40	40	C

Item Definitions:

ACECP_IDENT - ***FOIA Category (Public), (Required core attribute)*** This attribute is the primary unique ID for individual ACECs. It must remain unique within Idaho (the same numbers cannot be used in other field offices in Idaho) and never be recycled (if the ACEC is voided, so is the number. The number cannot be reused). Close coordination among field offices should be considered when an individual ACEC boundary is located in and managed by more than one field office. The attribute will consist of a unique combination of characters beginning with the first two characters each of the District and Field Office codes. The remaining numbers are from a block of numbers not to exceed 12 total characters; (for example: 848212343500 is a Challis/Coeur d' Alene assigned unique number.) The beginning office codes are not intended to reference polygons to a field office. The only intent is to keep the codes unique and to require minimum coordination between offices when assigning codes.

ACECP_CASEFILE - ***FOIA Category (Public), (Conditional required core attribute)*** *(NOTE: This is the link to the LR2000 databases. This format is required.) Contact the ISO LR2000 Data Steward for access or information about LR2000.* This is a BLM, ISO Assigned number used for identification of lands and minerals case files including Areas of Critical Environmental Concern. The requirement for entering case-file attribute information is: When an Idaho serialized case file has been established, a case-file number assigned and set up to maintain data and information about the ACEC, CASEFILE is then considered a mandatory attribute. This value refers to the serialized case file number for each ACEC. This field should always be in uppercase. In the example"-"represents a space. For example: CACA--0355821--, IDIDBL0123456--. The format always consists of 15 characters with all containing a minimum of one character, "0" fill, or a space. Position 1 and 2 = State prefix (always ID in Idaho), 3-6=Serial number prefix consisting of the Idaho Land Office Code. These include Lewiston IDL, Blackfoot IDBL, Boise IDB, Coeur d'Alene IDC, Hailey IDH, Idaho IDI, or I and 3 blank spaces if no land office is contained in the serial number)], 7=number prefix ("0" if prefixed or one space if not. Usually serial numbers with a land office are "0" prefixed), 8-13=Serial number-A six digit number, leading

fields will be “0” filled. 14 and 15=Serial number suffix. The suffix is a two digit number. If the serial number is not suffixed, leave two blank spaces.

** (NOTE: This is the link to the LR2000 databases. This format is required.)

ACECP_NAME - ***FOIA Category (Public), (Required core attribute)*** NLCS (National Landscape Conservation System) national standard. This value refers to the official name of the ACEC. The name is established for the official record by the same planning decision that designates the area as an ACEC. The first character of each word in the name will be upper case and the characters coming after in lower case (proper name format). This will include one space separating each word in the name. It may contain spaces and a combination of upper and lowercase alpha characters. For example: Little Jack Creek.

ACECP_REASON1 - ***FOIA Category (Public unless otherwise stated), (Required core attribute)*** This attribute refers to the first resource value being identified for special management attention, justification or reason for special management designation. Reasons will be selected from the approved pick list. The “ACECP_OTH_REASON” option may be used when the reason code is not contained in the acceptable list.

ACECP_REASON2 through 10 - ***FOIA Category (Public unless otherwise stated), (Required core attribute only if there are more than one reasons)*** This attribute refers to the second resource value being identified for special management attention, justification or reason for special management designation. Reasons will be selected from the approved pick list. Up to 10 reasons may be picked for the approved list. The “ACECP_OTH_REASON” option may be used when the reason code is not contained in the acceptable list.

Acceptable values for ACECP_REASON 1,2,3,4,5,6,7,8,9,10

CUL = cultural ***(FOIA Cat 1-3 dependent on the sensitivity and the impact of releasing the information)***
ECO = ecological
FIS = fish
GEO = geological ***(FOIA Cat 1-3 dependent on the sensitivity and the impact of releasing the information)***
FEA = features
HAB = habitat
HAZ = hazard-avalanche area, dangerous flooding area, landslides, unstable soils, seismic activity, dangerous cliffs.
HIS = historic
NAT = natural features
PAL = paleontology
RAN = rare, endemic, relict animal or special animal communities
RAP = rare, endemic, relict vegetation or special plant communities
REC = recreational

REF = reference site
RNA = research natural area
RIP = riparian
SAF = safety
SCE = scenic
SSA = special status animal
SSP = special status plant
VEG = vegetation
WQY = water quality
WSD = watershed
WTD = wetland
WLD = wildlife

ACECP_OTH_REASON - ***FOIA Category (Public), (Required core attribute only if none of the reason acceptable values apply.)*** This is a free format field and may be used to enter legally recognizable reasons that are not contained in the acceptable list.

ACECP_DES_STATUS - ***FOIA Category (Public), (Required core attribute)*** This value refers to the status of the ACEC.

Acceptable values

D = Designated - Meeting the Nationally established designation requirements for authorized ACECs and having been designated by a decision record or Record of Decision as part of the planning process.
N = Nominated – Identified by individuals or groups inside or outside the agency to be considered through the land use planning process for ACEC designation.
C = Considered but not designated.

ACECP_DES_DATE - ***FOIA Category (Public), (Required core attribute if designated)*** This value refers to the date of action (DOA) (YYYYMMDD) the ACEC was designated by BLM.

ACECP_NOM_DATE - ***FOIA Category (Public), (Required core attribute if nominated)*** This value refers to the date of action (DOA) (YYYYMMDD) the ACEC was nominated by BLM.

ACECP_CON_DATE - ***FOIA Category (Public), (Required core attribute if considered)*** This value refers to the date of action (DOA) (YYYYMMDD) the ACEC was considered by BLM.

ACECP_LUP - ***FOIA Category (Public), (Required core attribute)*** This refers to the name of the Land Use Plan that designated or nominated the ACEC. Not necessarily the current Land Use Plan. It must be in proper name format. The first character of each word in the name will be upper case and the characters coming after in lower case (proper name format). This will include one space

separating each word in the name. It may contain spaces and a combination of upper and lowercase alpha characters. For example: Little Jack Creek. In-holdings should be labeled as in-holdings.

ACECP_ MGMT_CONST1 - ***FOIA Category (Public), (Required core attribute)*** This attribute indicates the first legally recognizable/designated management constraint placed on an area designated as an ACEC. Constraints will be picked from the approved pick list. The "OTH = other" option may be used when the constraint code is not contained in the list.

ACECP_ MGMT_CONST2 through 10 - ***FOIA Category (Public), (Required core attribute only if there are multiple management constraints.)*** These attributes indicate legally recognizable/designated management constraints placed on an area designated as an ACEC. Constraints will be picked from the approved pick list. The "ACECP_MC_OTH " option may be used when the constraint code is not contained in the list.

Acceptable values for ACECP_MGMT_CONST 1,2,3,4,5,6,7,8,9,10

RDS = No new roads
ROW = No new rights-of- way
SOC = No surface occupancy
SRS = Seasonal restriction on activity/occupancy
GUN = No firearms discharge
OHV = No off-highway travel
MOT = No motorized travel
MEC = No mechanized travel
GRA = No livestock grazing
FAC = No new livestock facilities (e.g. fences, salt blocks, water troughs, corrals).

ACECP_MC_OTHER - ***FOIA Category (Public), (Required core attribute only if none of the management constraints acceptable values apply.)*** This is a free format field and may be used to enter legally recognizable management constraints that are not contained in the acceptable list.

OPTIONAL - Other optional items may be added for individual field office needs, but they must follow (come after) the state standard field.

DATA COLLECTION AND MAINTENANCE PROTOCOLS

Accuracy Requirements: It is expected that GPS will eventually be used to more accurately locate ACEC boundaries and that GPS data dictionaries will be used to simultaneously collect associated standardized (format and content) attribute information required by these data standards.

Collection and Input Protocols: The District Data Steward will develop standard field

data collection methods and work with the GIS Coordinator to develop corresponding standard GIS input methods. Update Transactions: The unit of processing for updating the ACEC databases is the district resources subject matter experts. This means to update the database(s) district-wide, transactions will be initiated by editors within the districts. The district GIS Coordinator will provide assistance to the District ACEC Data Steward to develop update processes and provide assistance and oversight.

Update Frequency: It is the responsibility of the District Data Steward for the ACEC Program to ensure that the database(s) remain current and in compliance with established database standards. Bringing the database up to a current level should take place continuously and at regular intervals to be determined by the District Data Steward for the ACEC Program. It is also the shared responsibility of the District Data Steward for the ACEC Program in cooperation with the District GIS Coordinator to ensure that any database (local-national) external to the GIS be kept current and consistent with the GIS.

QUALITY CONTROL

Monitoring Level: The State Data Steward and the District Data Stewards are responsible for reviewing the ACEC data dictionaries and corresponding data bases across the state at a minimum of once per year. A key item to be reviewed is consistency between districts in data base attributing and structure. The correct linkage to any related external databases or National applications should be tested by District Data Stewards at least annually.

DATA ORGANIZATION/STRUCTURE

Data will initially be stored in a District or Field Office MS Access external relational database. The standard database will be provided by the ISO to all field offices for storage and maintenance of the core attributes. Its structure will be compatible with and importable/exportable to and from Arc GIS data tables.

FY06 Status Idaho GIS BLM Priority Statewide Datasets

The Following Datasets have been completed and are loaded as SDE Geodatabases

data group Boundaries

Name	Scale	Type Feature
Areas of Critical Environmental Concern	24k	poly
Areas of Critical Environmental Concern	24k	region
BLM Administration	24k	poly
Cities	100k	poly
Cities	100k	point
County Boundary	100k	poly
National Conservation Areas	24k	poly
National Monuments	24k	poly
Outstanding Natural Areas	24k	poly
Research Natural Areas	24k	poly
Special Recreation Management Areas	24k	poly
State Boundary	100k	poly
Wilderness	24k	poly
Wilderness study areas	24k	poly
Wilderness study areas	24k	region

data group Cadastral

Name	Scale	Type Feature
Sections	100k	line
Sections	24k	point
Sections	24k	poly
Sections	100k	poly
Sections	24k	line
Sections	100k	point
Townships	100k	poly
Townships	24k	poly

data group Fire

Name	Scale	Type Feature
Communities at Risk	24k	poly
Historic Fuels/Fire Occurrence	24k	point
Historic Fuels/Fire Perimeters	100k	poly

data group Hydrography

Name	Scale	Type Feature
Creeks & Canals	100k	line
Creeks & Canals	24k	poly
Lakes & Reservoirs	24k	line
Lakes & Reservoirs	24k	poly

data group Land Status

Name	Scale	Type Feature
General	100k	poly
General	24k	poly
General	100k	poly

data group Planning

Name	Scale	Type Feature
Land use planning areas	100k	poly

data group Range

Name	Scale	Type Feature
Allotments polys	100k	poly
Pastures polys	100k	poly

data group Recreation

Name	Scale	Type Feature
National Scenic and Historic trails	100k	line
National Scenic and Historic trails	1m	line
Recreation Sites points	24k	point

data group Transportation

Name	Scale	Type Feature
Major Highways	100k	line
Railroad	100k	line

The Following Datasets have NOT been completed and will be done within this fiscal year

data group Aerial Photos

Name	Scale	Type Feature
NAIP	24k	DNA

data group Boundaries

Name	Scale	Type Feature
Zip Code Block Groups	100k	poly

data group Cadastral

Name	Scale	Type Feature
Geodetic Control (HARN) points	24k	point

data group Fire

Name	Scale	Type Feature
Fire Protection Response Boundaries	100k	poly
Management Units	500k	poly

data group Geomorphology

Name	Scale	Type Feature
Soils (Statsgo)	100k	poly

data group Hydrography

Name	Scale	Type Feature
Dams	100k	line
Dams	100k	point
Riparian wetlands	100k	poly

data group Land Status

Name	Scale	Type Feature
Land Rehab/Treatments	100k	poly
Land Rehab/Treatments	100k	region

data group Recreation

Name	Scale	Type Feature
Off Highway Vehicle	24k	line

data group Transportation

Name	Scale	Type Feature
Bridges	24k	point

data group Utilities

Name	Scale	Type Feature
Communication & other towers, wind energy	100k	point
Pipelines	100k	line
Power Plants & substations	500k	point
Powerlines	100k	line

data group Vegetation

Name	Scale	Type Feature
Existing	100k	poly
Noxious Weeds	24k	poly

Appendix C: Directory File Structure

GIS Directory File Structure for Idaho BLM

The format has been created, coordinated and approved by the Idaho BLM GIS Coordination Committee and its subcommittee, the Idaho BLM GIS Data Management Team. As such, significant changes to this directory structure should be approved by these authors.

The theme-based directories under /gis are reserved for the master Idaho statewide corporate data in a file based format (i.e. not SDE Geodatabases). Master Idaho statewide corporate data may come from non-BLM sources with complete metadata. Some data posted here may show only a portion of the state. This might indicate that the dataset is under construction and has not been completed in some portions of the state. Alternatively, it might indicate that the features only exist in a limited portion of the state, such as those for National Monuments.

The logic behind the directory structure is that data will be posted in theme-based directories to limit the depth and number of mouse clicks to find statewide corporate data.

In addition to the theme directories are the following special directories:

draftdata - This directory is reserved for the Idaho statewide draft data in a file based format (i.e. not SDE Geodatabases). This data is under construction and is not ready for release as corporate BLM data. Subdirectories are theme based similar to the final corporate data theme categories. A subdirectory for final QC and approval prior to corporate data updates will also be created here (i.e. “qcdata”). Subdirectories are theme based similar to the final corporate data theme categories.

fieldoffice – This directory is reserved for Field Office data and projects that have been copied or moved to the State Office for the fastest speed and performance of enterprise ArcGIS. Subdirectories are divided by office name (i.e. bd, if, etc) and access permissions will be determined by the respective office.

maps – This directory is reserved for any cartographic products that can be viewed and printed outside of ArcGIS. Subdirectories are resource based according to the categories under corp.id.blm.gov\loc.

miscsupport – This directory is reserved for GIS notes, programs, meeting minutes, technical support and other GIS related documents of statewide interest.

projects – This directory is reserved for projects (i.e. .apr, .dwg or .mxd). It is open for editing by multiple staff in Idaho BLM. Projects and special case data may be included. Subdirectories should be resource based according to the categories under corp.id.blm.gov\loc. Subdirectories should be listed by project name below the resource category.

GIS Directory File Structure \gis

The subdirectories shown are listed as samples only and are not intended to be a complete list of possible subdirectories.

gis

+ **boundary:** acec, wsa, rna, srma, wildlife management areas, district and field office boundary, cities, counties, state, wilderness, blm admin, zipcode

+ **cadastral:** GCDB, survey information, usfs cff

+ **climate**: precipitation data, raws station data, airsheds, climate classification system (Koppen)

+ **cultural:** demographics, structures, historic trails, historic range of variability, restricted cultural directory

+ **draftdata:** Idaho statewide draft data in a file based format (i.e. not SDE Geodatabases). This data is under construction and is not ready for release as corporate BLM data. Subdirectories are theme based similar to the final corporate data theme categories (i.e. boundaries, cadastral, etc).

+ **elevation:** DEM, DTM, hillshade, aspect, slope, vector contours

+ **fieldoffice:** Field Office data and projects that have been copied or moved to the State Office for the fastest speed and performance of enterprise ArcGIS. Subdirectories are divided by office name (i.e. bd, if, etc) and access permissions as well as format will be determined by the respective office.

- **bd**
- **bf**
- **bu**
- **cd**
- **if**
- **ch**
- **co**
- **po**
- **sa**
- **sh**
- **tf**

<u>fire</u>: wildfire, structure protection, fmp, fire protection boundaries, rural fire departments, fire history

+ **<u>fisheries</u>:** bull trout, cutthroat trout, sculpin species, aquatic management habitat zones

+ **<u>forestry</u>:** timber inventory, historic timber sales, tpcc, strata, insect and disease, plantations, thinning

+ **<u>fuels</u>:** fuels projects, fuel models, fire conditions class, treatment areas, communities-at-risk, fire history points, fire perimeters

+ **<u>geology</u>**: geomorphology, geothermal, geochemical, fluid minerals, solid minerals (locatable, leasable, saleable)

+ **<u>hazmat</u>:** mine site locations, nrda water quality, hazmat sites, aml, mine tunnels

+ **<u>hydro</u>:** streams, lakes, rivers, diversions, canals, NHD, watersheds, floodplains, monitoring springs, 303d, dams, water rights, wild and scenic rivers

+ **<u>images</u>**: satellite imagery, doqq's, naip, aerial photography

+ **<u>maps</u>:** state, district or field office maps in image format (i.e..pdf, .jpeg, .tiff.) cartographic products that can be viewed and printed outside of ArcGIS. Subdirectories are resource based according to the categories under corp.id.blm.gov\loc.

miscsupport: Support documentation, templates, tools, applications, GIS notes, programs, meeting minutes, technical support and other GIS related documents of statewide interest.

+ **planning:** rmp, eis, landuse plans, ba

projects: This directory is reserved for statewide projects (i.e. .apr, .dwg or .mxd). It is open for editing by multiple staff in Idaho BLM. Projects and special case data may be included. Subdirectories should be resource based according to the categories under corp.id.blm.gov\loc. Below the resource category, subdirectories should be listed by project name.

+ **range:** allotments, pastures, grazing utilizations, improvements, plot trends

+ **realty:** Land Ownership, row's, withdrawls, easements, land use permits, master title plats

+ **recreation:** Recreation sites, ros, vrm, campgrounds, boat ramps

+ **riparian:** wetlands, pfc (lotic and lentic), riparian conservation management area

+ **soils:** soils data, ssurgo, statsgo, landslide prone areas, erosion potential, land types

+ **specialstatusspecies:** t&e species, sensitive species, proposed species

+ **topomaps:** drg (24k, 100k, 250k)

+ **<u>transportation</u>:** Roads, airports, railroads, district/field office transportation plan, travel routes

+ **<u>utilities</u>:** utility corridors, powerlines, pipelines, compressor stations, communications sites

+ **<u>vegetation</u>:** vegetation data, gap, collaborative weed management areas, application sites

+ **<u>wildlife</u>:** birds, mammals, amphibian/reptiles habitat

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