

# Ad Hoc DOE-GIS Users Group Newsletter



Vol. 4, Issue 1  
April 2004

## In This Issue

- GIS User Group News, p. 1
- Geographic Information Systems at Brookhaven National Laboratory: Current Services, Future Direction, pp. 2-5
- GIS and Remote Sensing at INEEL, pp. 5-9
- Some Very Interesting GIS Portals, pp. 9-10

## GIS User Group News

We had a very informative and enjoyable user group meeting recently at the ESRI Federal User Group conference in Washington, DC. About thirty user group members from around the DOE complex were present—despite some rather frigid weather. Following welcoming remarks, Ed Bright presented an overview of the GIS program at ORNL, including a fascinating visualization of the spatial and temporal population distribution over a 24-hour period in Washington, DC. Randy Lee discussed the use of GIS in the environmental management programs at the INEL and has provided a synopsis of

his talk included in this newsletter. Lee Neher of Lawrence Livermore National Lab demonstrated several GIS-related products including a simulation of a fire spreading in a forested area. Finishing out the user presentations was Al Guber (Remote Sensing Lab) who managed an outstanding soft-shoe performance without the assistance of his faltering laptop.

Susan Hargrove (DOE-HQ Office of the Chief Information Officer) reviewed a number of GIS-related initiatives being sponsored by her office and Denise Bleakly closed the meeting with an informal discussion. It was good just seeing everyone there!

Make sure to mark your calendars for the next user group meeting in sunny San Diego.

See you there...Jim Bollinger  
Savannah River Technology Center

## Upcoming Events

- User Group meeting at the ESRI Conference - August 11, 2004.  
More details to follow.

## Feedback

Your feedback regarding the DOE-GIS user group newsletter and planned user group activities is welcomed and would be greatly appreciated. Please send comments to:

- Denise Bleakly (505) 284-2535  
[drbleak@sandia.gov](mailto:drbleak@sandia.gov)
- Paul Rich (505) 667-1850  
[pmr@lanl.gov](mailto:pmr@lanl.gov)
- Jim Bollinger (803) 725-1417  
[James02.bollinger@srs.gov](mailto:James02.bollinger@srs.gov)

## Geographic Information Systems at Brookhaven National Laboratory— Current Services, Future Direction

### Amy Ramsdell

Brookhaven National Laboratory  
[Ramsdell@bnl.gov](mailto:Ramsdell@bnl.gov)

In the early 1990s, Brookhaven National Laboratory (BNL) established the Environmental Restoration Division to handle its Superfund activities. The Geographic Information Systems (GIS) group resides in this division to provide mapping and geospatial data maintenance for these environmental restoration activities. This role has since expanded to include support for routine environmental compliance and monitoring. Our products include maps and web applications for interactive spatial analyses. This description is not inclusive of all GIS work done at BNL. There is occasional work in the Science departments not related to or integrated with the GIS in Support services.

We map and maintain geospatial information about investigation, characterization, and remedial work. This information is used for public meetings and various reports such as the Annual Site Environmental Report, sampling and analysis plans, and feasibility studies. In addition to providing maps for reports and documents, we provide services through web applications so that the geographic information we maintain is accessible to all internal personnel. In one intranet map application developed, field engineers and project managers have

access to the sampling and monitoring activities conducted at a given location or they can view available scanned documents for temporary and permanent wells (Figure 1). In another intranet map, users can access an interactive site map where each building is directly linked to the building image and floor plans (Figure 2).

Community outreach initiatives using GIS have included a LandTrek website (DOE's web access for land transfer, reuse, and environmental knowledge) that describes BNL's groundwater protection and monitoring program. Members of the community can view trends in the concentration of contaminants at wells routinely sampled as compared to ambient water quality standards. For more information on this please refer to the Ad Hoc DOE-GIS Users Group Newsletter Vol. 3, Issue 1, January 2003. A website was also built to provide central access to information about remediation areas that are subject to land use and institutional controls. It includes brief information on each of the contaminated sites and facilities, their cleanup status, contaminants of concern, and maps depicting land use and land use restrictions (Figure 3).

The GIS group consists of two people and approximately four others who use the GIS on occasion. At its peak, the GIS supported environmental restoration with 35 staff positions. The system that we use has evolved from an ArcInfo Workstation environment in Unix to ArcGIS in the PC Windows environment. Our data storage and maintenance has shifted from coverages and AutoCAD DXFs to shapefiles and a geodatabase, although we routinely use AutoCAD formats when working with

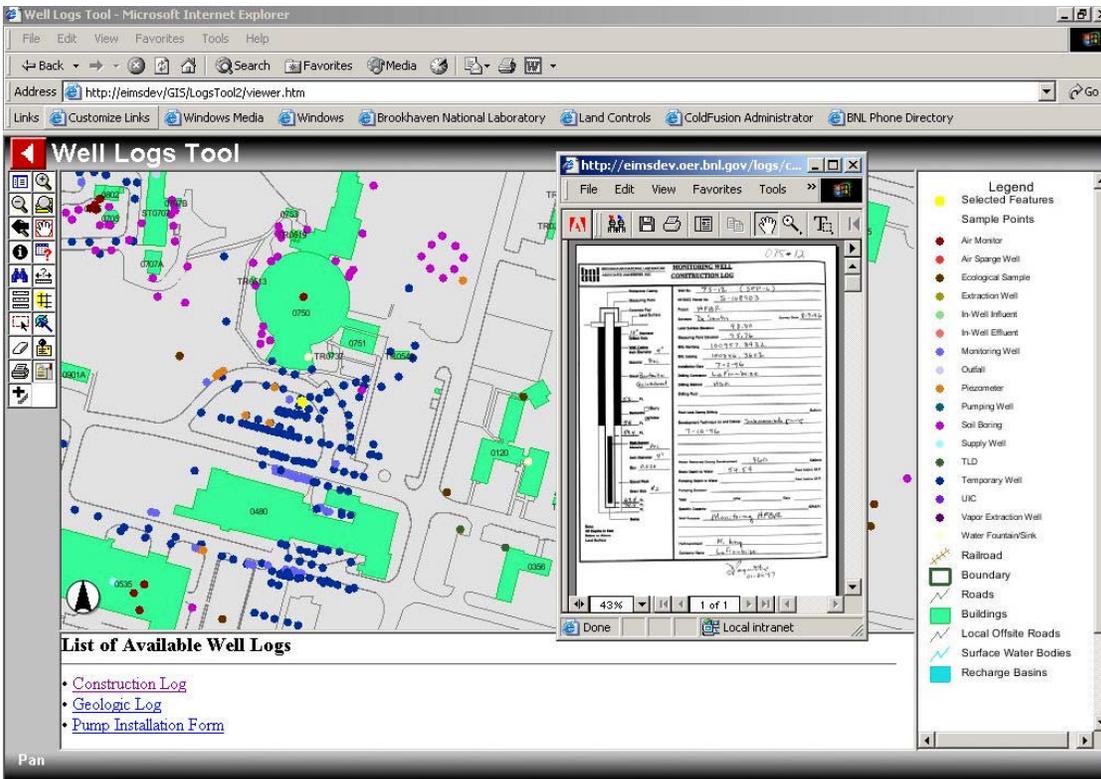


Figure 1. BNL Web-Based Well Logs Tool

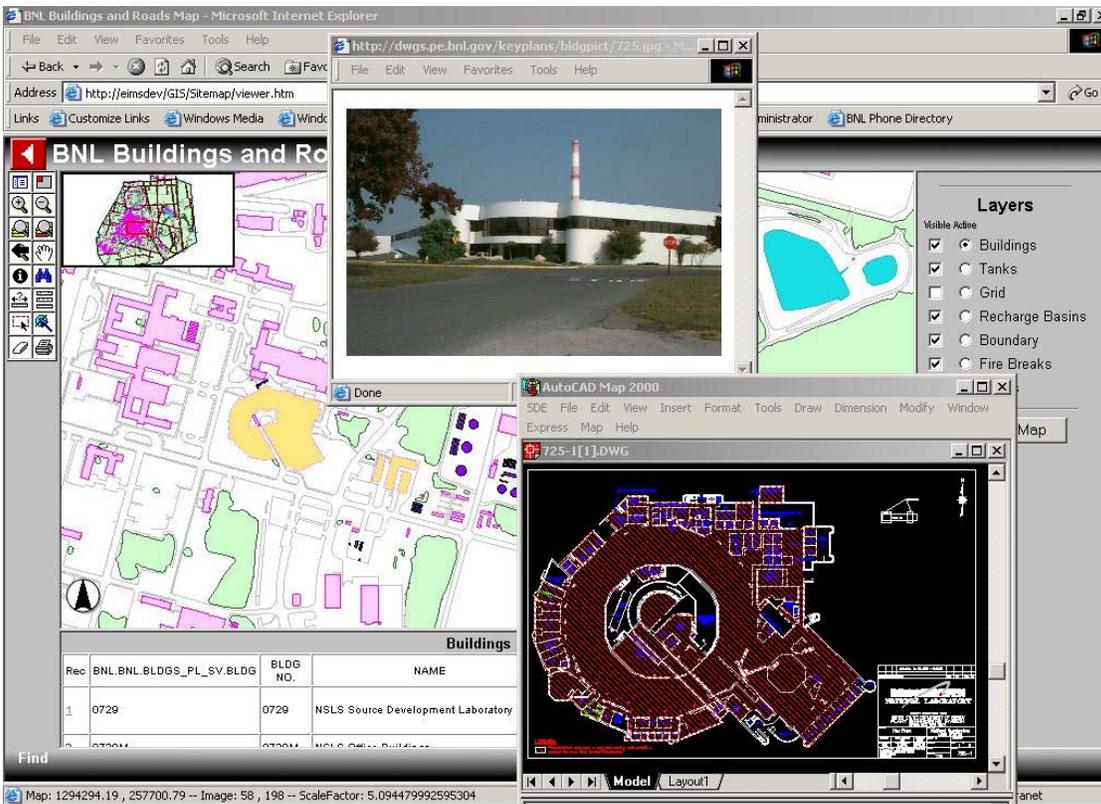
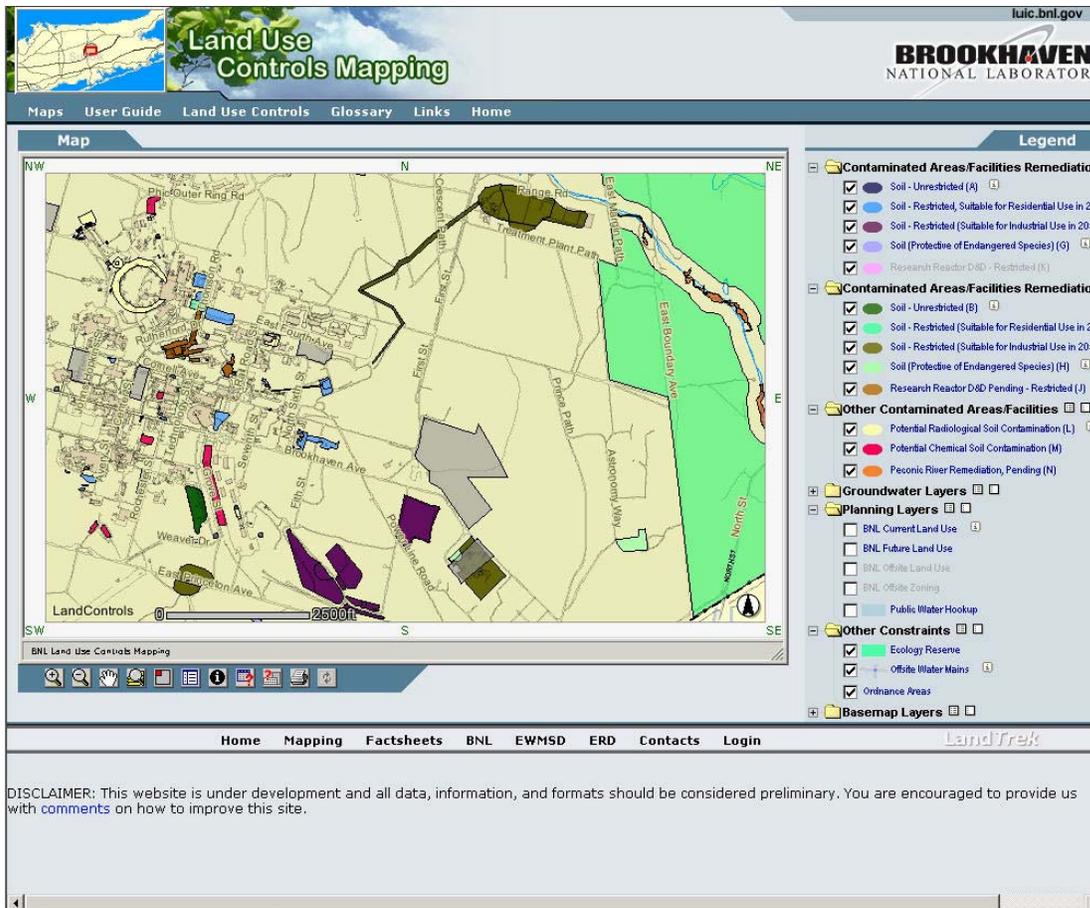


Figure 2. BNL Facility Web-based Mapping Application



**Figure 3. Land Use Controls Mapping**

CAD-based organizations. The geodatabase is connected to an Oracle database that contains sample analytical results and associated information from the onsite sampling programs. We have two production web servers, one inside and one outside the firewall.

One of the biggest technical challenges that the GIS faces here is the disconnect between the data generators. GIS in our case has been synonymous with the ESRI software products. All environmental data layers produced in our group are maintained in the geodatabase using SQL Server and ArcSDE with a copy saved as shapefiles. The infrastructure and cadastral data that we use as base layers for our products originate and are maintained in the Plant

Engineering (PE) Division who use Autodesk products. The ability to share current data between these two groups has been a challenge over the years not only because of the differences in the software but also because of the use of two different coordinate systems. The GIS data are in the State Plane reference system while PE works in a local coordinate system. In the past, data sharing has generally been one-sided from PE to the GIS based on need, but that is changing over time as planning for infrastructure expansion requires consideration of contamination and environmentally sensitive areas. Data sharing has become easier with the new tools of interoperability between the ESRI and Autodesk software. With help from ESRI technical staff, we have also

been able to develop a specialized projection file for the local coordinate system, eliminating the need to do transforms in the ArcInfo Workstation environment. We are also in the process of helping PE to update key base map layers to meet GIS's more demanding topological requirements (closing polygons and connecting lines). This sets the stage for a more integrated approach to working with the PE Division and other CAD-based groups.

Hundreds of maps and data layers later, we have a maturing GIS system that must branch out from an environmental restoration program that is nearing completion. We will continue to support these activities until Fiscal Year 2005 and additionally provide mapping support and analysis for BNL's environmental surveillance and compliance programs. The biggest challenge to date lies in putting the GIS to work for the rest of the Laboratory. Other possible opportunities for GIS are in radiological control operations, the sciences, and emergency management. Future uses of the GIS can be easily identified; however a lack of funding for this type of service is a major roadblock. The ability to become more integrated with Laboratory operations will naturally build a stronger user base and a sustainable GIS. We would be interested in learning about how other GIS groups that started out with environmental restoration funding are expanding their scopes or otherwise modifying their services.

## GIS and Remote Sensing at INEEL

### **Randy D. Lee**

Idaho National Engineering and Environmental Laboratory

[Ldy@inel.gov](mailto:Ldy@inel.gov)

The Idaho National Engineering and Environmental Laboratory (INEEL) has recognized the importance of geospatial technologies such as geographic information systems (GIS) and remote sensing (RS) since the late 1980's. The capabilities were initially developed to support clean-up efforts, but over the years has become essential to many of the Lab's programs and work-for-others projects. The GIS team started out with two people and has grown to eleven today. Organizationally, the GIS/RS teams - Spatial Analysis Lab (SAL) and Geospatial Science and Engineering (GeoSE) - reside in two different departments, but perform as one virtual team. We share resources and data and work to the same spatial data standards. The expertise of the SAL and GeoSE teams spans the full range of geospatial technologies including GIS and remote sensing, application development, database design, and modeling.

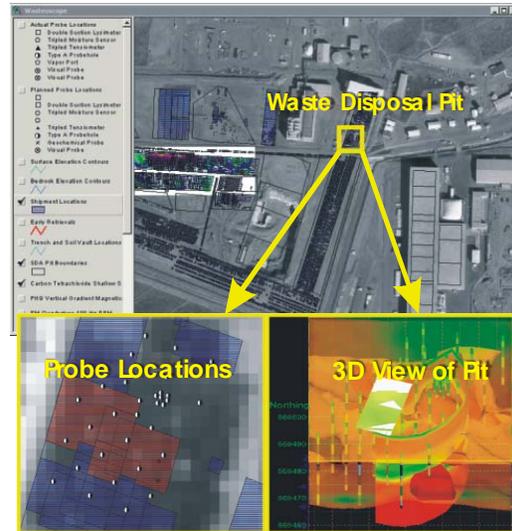
While the clean up of the INEEL remains the largest single customer for the GIS/RS teams, a wide range of other customers and programs are supported including Renewable Energies, Critical Infrastructure Assurance, Unmanned Aerial Vehicles, Precision Agriculture, and Carbon Sequestration. Research and development work is also ongoing outside the DOE in the areas of mining and natural resource management.

The geospatial analysis software packages utilized by the two GIS/RS teams at INEEL primarily include Environmental Systems Research Institute (ESRI) suite of GIS software, but also include ERDAS Imagine, Environment for Visualizing Images (ENVI), Trimble Global Positioning Systems, and Environmental Visualization Systems (EVS). We have moved to ESRI's ArcGIS desktop for nearly all map production and some analysis, but still use UNIX ArcInfo for more complex analyses. We are also in the process of converting our base spatial data layers to Geodatabase format using Oracle and Spatial Data Engine (SDE). This move will make it possible to put GIS on more desktops freeing up valuable analyst's time spent on map production.

The GeoSE and SAL teams are currently working on a number of very interesting GIS/RS projects; however, since there are too many to present in a short article, the three most interesting are summarized below.

### Waste-O-Scope

The INEEL's Waste-O-Scope is an advanced geospatial analysis application that unions historical disposal records, detailed location information about disposed waste, geographic mapping layers, and the results of geophysical studies. This application facilitates detailed investigation of the subsurface, useful in scoping, risk assessment, and remedial design. The krigged volumes, oriented in georeferenced three-dimensional space, provide a clear and understandable picture of the nature and extent of contamination. The INEEL has applied these same visualization techniques to a wide variety of

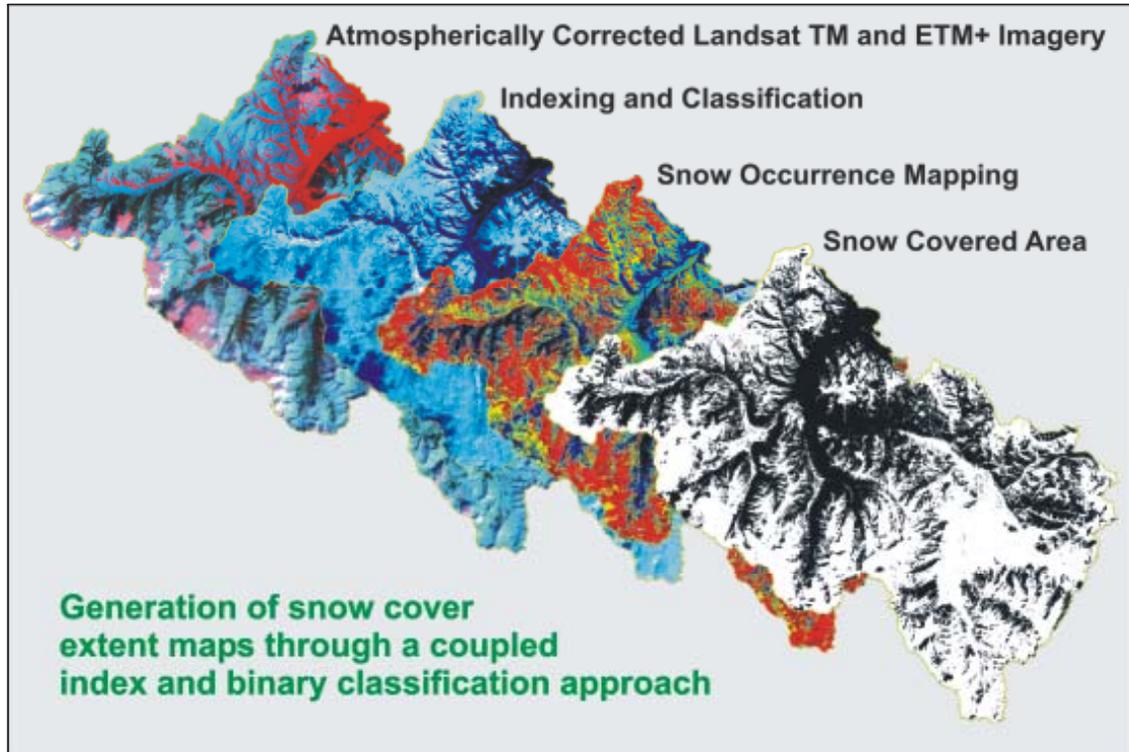


**Waste-O-Scope Application**

subsurface problems, ranging from measuring the behavior of vadose organic vapor phase plumes to visualizing the effectiveness of bioremediation techniques on a groundwater contamination plume.

### Pacific Northwest Regional Collaboratory

The GeoSE team is working on two remote sensing projects through the Pacific Northwest Regional Collaboratory (PNWRC) <http://www.pnwrc.org/> – a partnership of two national laboratories and four Northwest universities whose mission is to integrate geospatial technologies and data to meet the needs of resource managers and decision-makers in the Pacific Northwest. We are involved with two of the three projects under the PNWRC: Snow Cover Mapping and Prediction of Associated Run-off, and the development of a Phenological Model for Cheat Grass. The phenological model involves using MODIS daily coverage satellite imagery and meteorological data values to predict when discriminating cheat grass (a



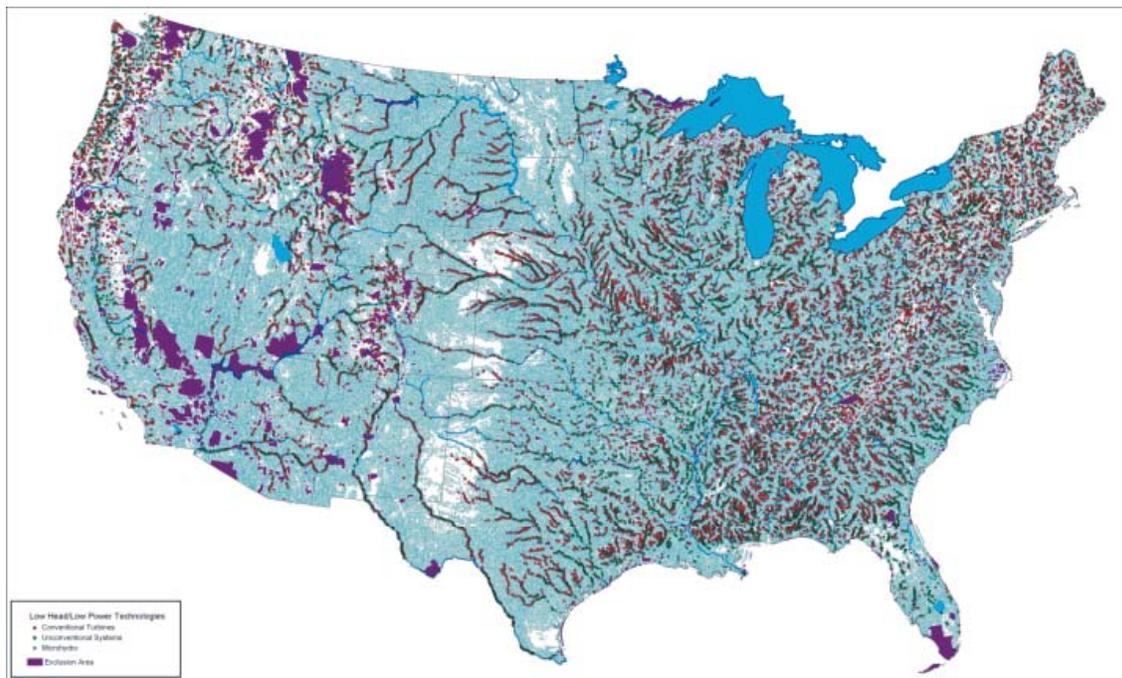
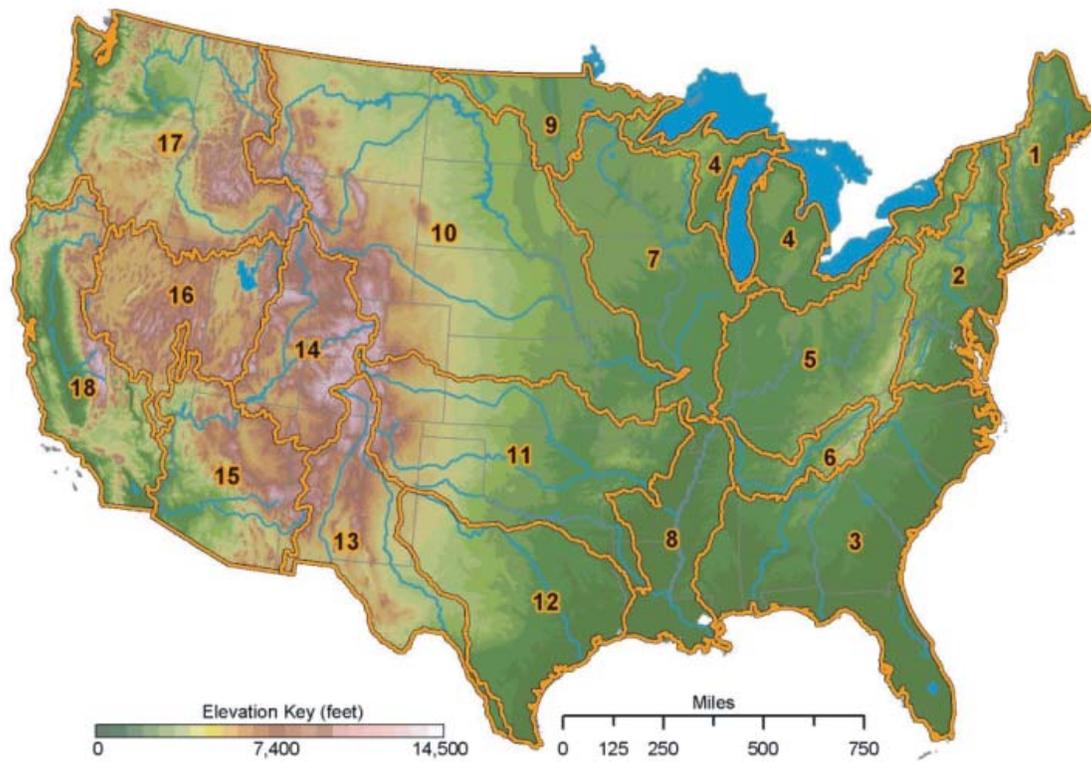
common invasive weeds species in Idaho) phenological stages will occur. This information will be used to optimize both high-resolution imagery acquisition, and data analysis time to accurately detect and map this invasive species. The resulting methodology can then be applied to other species of interest.

Seasonal volumetric stream flow forecasts are generated using Landsat TM and MODIS derived snow cover maps, and the Natural Resource Conservation Service SNOTEL stations to improve forecast accuracy. The Landsat TM snow cover mapping methods overcome the known limitations of optical remote sensing by using snow occurrence and prediction toolsets to generate more timely snow cover extent maps. In addition, automated retrieval and processing of MODIS snow cover products have been

developed to support near real time operation of the University of Washington Land Surface Hydrology Research Group's Variable Infiltration Capacity (VIC) Land Surface model and the Snow-melt Runoff Model (SRM) being implemented by the University of Idaho.

**Low Head/Low Power Hydropower Assessment of the U.S.**

Analytical assessments of the hydropower potential in the 20 hydrologic regions of the U.S. were performed using state-of-the-art digital elevation models and geographic information system tools. The principal focus of the study was the amount of low head (less than 30 ft)/low power (less than 1 MW) potential in each region. To obtain these estimates, the hydropower potential of all the stream segments in a region, which averaged 2 miles in



**Low Head/Low Power Hydropower Technologies Distribution Map**

length, were calculated. These calculations were performed using hydrography and hydraulic heads that were obtained from the U.S. Geological Survey's Elevation Derivatives for National Applications dataset and stream flow predictions from a regression equation developed specifically for the region. Stream segments excluded from development and developed hydropower were accounted for to produce an estimate of total available hydropower potential. The total available hydropower potential was subdivided into high power (1 MW or more), high head (30 ft or more)/low power, and low head/low power total potentials. The low head/low power potential was further divided to obtain the fractions of this potential corresponding to the operating envelopes of three classes of hydropower technologies: conventional turbines, unconventional systems, and microhydro (less than 100 kW). Summing information for all the regions provided total hydropower potential in various classes for the entire U.S. Distribution maps show the location and concentrations of the various classes of hydropower potential.

### **Future Directions**

Continued growth of the two GIS/RS teams is expected with support of several INEEL major initiatives and programs including, Nuclear Energy (EIS, reactor siting), National Security (Critical Infrastructure Assurance, energy assurance), Unmanned Aerial Vehicles, Idaho Completion Project, Pacific Northwest Regional Collaboratory, and Renewable Energies. The GIS professionals at INEEL will also

continue to support and participate in both the ad hoc GIS Users Group as well as the DOE GIS Core Team.

### **PRODUCT DISCLAIMER**

References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government, any agency thereof, or any company affiliated with the Idaho National Engineering and Environmental Laboratory.

## **GIS Portals**

### **Denise Bleakly**

Sandia National Laboratory

Compiled November 2003

[Drbleak@sandia.gov](mailto:Drbleak@sandia.gov)

**Geospatial One-Stop** – Your one stop for federal, state & local geographic data.

<http://www.geodata.gov/gos>

**Starting the Hunt** - Guide to Mostly On-line and Mostly Free US Geospatial and Attribute Data - a whole host of links to data sets from across the US - some have mapping engines, some do not.

<http://mama.indstate.edu/users/morgan/hunt.html>

**GIS Monitor** - "Ultimate Map/GIS Directory" GIS Portals website - has links to GIS web portals in other languages.

<http://www.gismonitor.com/reference/portals.php>

**Bill Thoen's GIS Website links** - Bill was one of the first guys to compile lists

of GIS sites - he has his picks for "The Best GIS Resource Lists" and Delivering GIS Via the web. The site has not been updated in a while.

<http://www.gisnet.com/notebook/>

### **GIS.com resource website**

<http://www.gis.com/resources/library/directories.html>

### **Thailand Environmental Institute GIS Websites -**

[http://www.tei.or.th/eic/gis\\_list.htm](http://www.tei.or.th/eic/gis_list.htm)

### **University of Utrecht GIS Master List - international geography related websites**

<http://www.frw.ruu.nl/nicegeo.html>

### **The University of Edinburgh GIS WWW Resource List - detailed list of international GIS resources alphabetically listed**

<http://www.geo.ed.ac.uk/home/giswww.html>

### **Center for Advanced Spatial Technologies (CAST) GIS List and Pointers - they have a specific listing of Interactive Mapping Sites -- primarily in the Eastern US**

<http://www.cast.uark.edu/local/links/gis/>

### **US EPA Region 2 GIS Resources and Links**

<http://www.epa.gov/region02/gis/links.htm>

### **GIS Internet Addresses**

<http://www.joffes.com/GIS/websites.html>

### **Department of the Army, Integrated Training Area Management, GIS Links**

<http://www.army-itam.com/gis/page5.html>

### **YAHOO GIS links**

[http://dir.yahoo.com/Science/geography/geographic\\_information\\_systems\\_gis/](http://dir.yahoo.com/Science/geography/geographic_information_systems_gis/)

**Ligon Middle School GIS Links page -** what makes this site so interesting, is that they have a whole lot of "GIS Projects listed" of actual GIS applications on the internet.

<http://www.ncsu.edu/midlink/gis/links.htm>

**Top 100 Map Sites** (believe it or not there is a company that compiles this!) Links to the most popular and used mapping websites on the internet -- Map Quest, National Geographic Map Machine, Expedia, MapBlast, etc.

<http://www.100topmapsites.com/>

**The GIS Workshop** - a private consulting firm that has compiled a great deal of GIS related information

[http://www.gisws.com/gis\\_data.htm](http://www.gisws.com/gis_data.htm)

**Harvard Design & Mapping The GIS Portal** - a private company that aims to have the "best" portal to GIS information.

<http://www.gisportal.com/>