Esri News
for Map, Chart & Data Production
Summer 2012

Indonesia NSDI

One Map for the Nation

Indonesia's vision for geospatial data is to make it more easily acquired and created throughout the island nation via a strong foundational system. This will support regional development planning for provincial governments as well as help manage natural resources, protect the environment, and mitigate natural hazards, ultimately contributing to the overall economic development of Indonesia.

↑ Providing access to authoritative data to provinces, local governments, and the private sector through an easy-to-use online portal will increase the use and benefits of the data.

Indonesia, nestled in the Indian Ocean, is the largest archipelagic country in the world. With the proliferation of complex national development tasks, such as rebuilding after the 2004 Boxing Day tsunami, the need for geospatial information has proved to be a necessity. Geographic information system (GIS) technology is an important tool for helping decision makers formulate, implement, monitor, and evaluate national and regional development plans. The technology has proved itself in the construction and management of various development and infrastructure projects; emergency measures against natural disasters; environmental protection policies; land use; the cadastral system; forestry, agricultural, land, and building tax; and statistics, marine affairs, and mineral enterprise resources management, among many other enterprises.

Indonesia NSDI

A National Spatial Data Infrastructure (NSDI) is now being introduced throughout the country to help GIS proliferate while reducing the duplication of effort among agencies, improving data quality, and reducing costs. The project is undergoing the early stages of development, ensuring all institutions have the required technology to implement the system.

The Japanese government's Japan International Cooperation Agency provided a loan to the Indonesian Geospatial Information Agency (Badan Informasi Geospasial). NTT Data, a Japanese-owned company experienced with IT integration, is overseeing implementation. ArcGIS for Server and Esri Geoportal Server are the foundation of the national system. NTT Data and its Indonesian counterpart are implementing the project

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Delivering GIS Benefits with a Limited IT Budget

Effective Project Management Is the Key

When access to GIS data, maps, and applications is broadly available throughout an organization, we call it an enterprise GIS. Organizations intrigued by the idea of deploying GIS enterprise-wide often have concerns about the work (and costs) involved. Is there a particular way to go about it? Where do you start? What if you can't afford a consultant?

For answers to these and more questions, Suzanne Boden of Esri Training Services turned to Dave Peters, manager of systems integration at Esri. Peters spent most of the 1980s with the US Air Force, working on aerospace systems integration projects. In former lives, he was a physicist, pilot, and engineer. During his 20-year tenure at Esri, Peters has worked on system design projects with numerous clients and has become the acknowledged expert on system architecture design for enterprise GIS operations. In this interview, Boden asked Peters about different aspects of implementing an enterprise GIS.

Boden: Is enterprise GIS cost prohibitive for organizations with limited IT budgets?

Peters: I would think not. We implement enterprise GIS to improve business efficiency and effectiveness. The benefits of implementing GIS throughout the enterprise far outweigh the cost. These benefits have been demonstrated over and over again by organizations both big and small.

If you have a limited budget, you can take smaller steps forward; over time, you will see the same benefits accrue. Today, hardware and software costs are significantly reduced, driven by the increase in processing capacity and performance for both servers and networks. This opens a variety of opportunities for small business automation.

Proper planning is the key to success. Understanding the technology and getting it right at the beginning reduces cost and improves the effectiveness of any IT deployment. Effective project management can deliver GIS benefits within a limited IT budget.

Boden: An organization has decided to implement an enterprise GIS. How much time should it plan to invest in the system design process?

Peters: I feel strongly that the system design process should be an integral part of GIS planning—and too, many times, it is not. Dr. Roger Tomlinson's book *Thinking About GIS* [4th edition, Esri Press, 2011] addresses the importance of GIS planning and estimates about 5 to 7 percent of the first year's overall GIS budget as [being] a typical planning investment.

Most of this planning focuses on clearly understanding your business needs—what information products and data resources make your business work, what your business workflows are, what GIS information products should be developed for your user community, and when. The organization's GIS and IT staff need to take the time to understand the environment and appreciate how GIS can make a difference in their business.

Boden: Your recipe for a successful enterprise GIS deployment includes four key ingredients: communication, planning, project management, and performance milestones. What do organizations risk if they don't follow the recipe?

> "If organizations don't follow lessons learned by those who have gone before, the risks can be high."
>
> Dave Peters, Manager of Systems Integration, Esri

Peters: If organizations don't follow lessons learned by those who have gone before, the risks can be high. Good communication between the GIS user community and the IT support staff is critical and not always easy to establish. There are clear relationships between user business needs, system processing loads, and required hardware specifications—and these relationships are important to understand.

Planning is where you put these relationships together. Getting it right before you start spending money on the solution reduces implementation risk and overall cost.

Good project management is needed to implement the plan and manage changes to the plan that impact cost, budget, performance, and the ability of the final solution to satisfy business requirements.

Performance should be an integral part of your project plan, with milestones identified to validate compliance throughout the implementation process. The Capacity Planning Tool [CPT] is designed to help project managers understand performance constraints and implement GIS operations that satisfy user productivity needs.

Boden: In the foreword to your book, *Building a GIS* [Esri Press, 2008], Esri president Jack Dangermond calls you a "teacher and an inventor of creative solutions." Can you give an example of a creative solution you engineered?

Peters: My focus is to help Esri customers build successful GIS operations—to make a difference where it counts (at the bottom line). To be successful, customers need to understand how to build systems that make their users more productive—understand their user needs, the GIS software technology that can make a positive difference, and the IT infrastructure required to make it happen.

Over the years at Esri, I've worked on a number of projects to get the information out to organizations through system architecture

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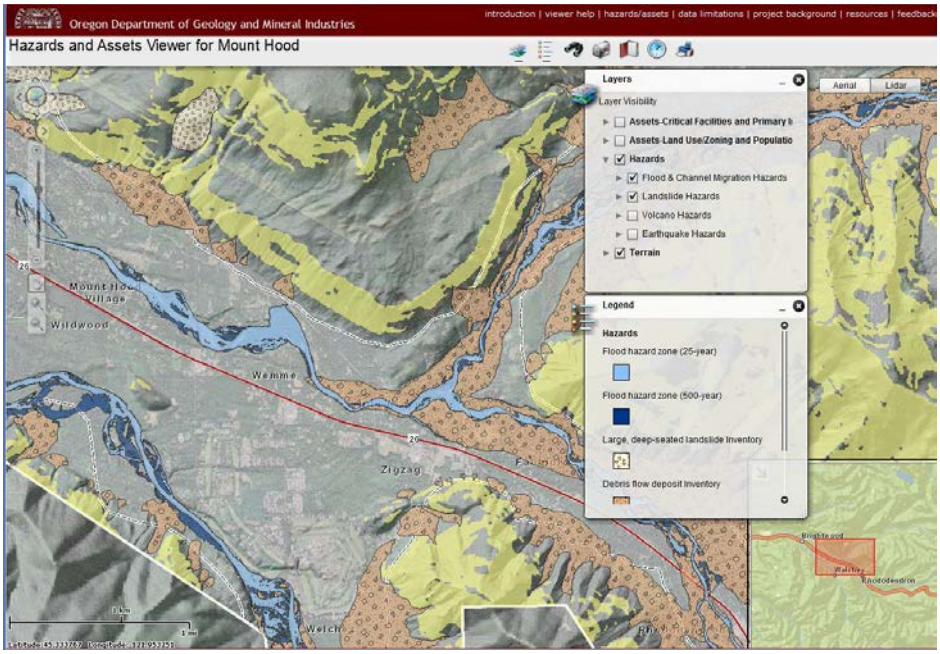
Discovering and Mapping Natural Hazards with Lidar

DOGAMI Uses ArcGIS 10 for Server and ArcGIS API for Flex to Serve Up 33 Terabytes of Lidar Data to Oregonians

On February 17, 2011, President Barack Obama declared a major disaster in the state of Oregon due to a severe winter storm that had caused flooding, mudslides, landslides, and debris flows during the previous month. Western Oregon counties—including Clackamas, Clatsop, Crook, Douglas, Lincoln, and Tillamook—were affected. The total public assistance cost estimate is more than $6 million.

To help mitigate the suffering from events like this and maintain a safe environment for those living in the state, the Oregon Department of Geology and Mineral Industries (DOGAMI) is using light detection and ranging (lidar) data to more accurately find and analyze hazards like landslides and debris flows. DOGAMI makes this data available to the public using an innovative solution based on Esri's ArcGIS, the standard GIS platform used by the State of Oregon.



↑ More accurate hazard mapping is done with lidar data in Coos County, Oregon.

Seeing the Hazards through the Trees

Oregon is known for its natural beauty. From cliff-lined beaches to snow-capped mountains, the landscape has been formed into modern-day eye candy by millennia of geologic processes. With this beauty comes danger; the earth's movements, which created such breathtaking views, can also be the cause of destruction. Natural hazards such as floods, landslides, earthquakes, coastal erosion, volcanic eruptions, and tsunamis are all possible and have occurred in Oregon over the past century.

Maintaining an accurate inventory of these hazards can be difficult in a region that contains lush tree cover and is where cloudy days outnumber sunny ones. Traditionally, aerial photography has been used to create topographic data through stereo pair analysis, but this method cannot always capture the detail needed to identify hazard locations and accurate model inputs.

When DOGAMI staff members first started using lidar, they discovered they weren't even close to mapping the entire landslide hazard inventory of western Oregon. "The technology has proved to be invaluable in improving the accuracy of Oregon's hazard inventories," says Rachel Lyles, GISP, a project operations manager in the Geologic Survey and Services program at DOGAMI.

Lidar data is used to create bare-earth digital elevation models (DEMs), representations of the earth's surface where all man-made structures and vegetation have been removed. These DEMs are much more accurate than those based on aerial imagery. The detailed topography of lidar-derived DEMs has greatly improved the precision of hazard mapping as well as many other mapping efforts throughout the state.

Hazard Mapping with Lidar

In addition to landslide mapping, DOGAMI is utilizing lidar as the driver for new projects associated with other natural hazards throughout Oregon. Coos County was the first county in the state of Oregon to receive updated approximate flood zones that used lidar topography to update inundation layers. DOGAMI also used lidar and lidar-derived products to update and correct basemap layers, which greatly improved Digital Flood Insurance Rate Maps (DFIRM) in both detail and readability.

DOGAMI recently released OFR O-11-16, *Multi-Hazard and Risk Study for the Mount Hood Region, Multnomah, Clackamas, and Hood River Counties, Oregon*, to help communities on or near Mount Hood become more resilient to geologic hazards including volcano, landslide, flood, channel migration, and earthquake. The study demonstrated the necessity of high-resolution lidar data for multihazard mapping, including locating landslides and faults and redelineating flood and volcanic mudflow hazard zones. Lidar data is also critical for mapping assets such as buildings and infrastructure. The accuracy and fine-scale resolutions of the hazard, asset, and risk data make the results more reliable and thus more likely to be useful in risk reduction.

In Oregon, DOGAMI also manages the National Tsunami Hazard Mitigation Program,

which has been administered by the National Oceanic and Atmospheric Administration (NOAA) since 1995. DOGAMI's work is designed to help coastal cities, counties, and sites reduce the potential for disastrous tsunami-related consequences by understanding and mitigating this geologic hazard. DOGAMI has developed a new generation of tsunami inundation maps and evacuation brochures using Esri's ArcGIS to help residents and visitors prepare for the next Cascadia Subduction Zone (CSZ) earthquake and tsunami. Lidar for the Oregon coast was acquired between 2008 and 2009. The onshore lidar has been integrated with offshore and nearshore bathymetry, providing greatly improved topographic inputs for tsunami modeling. With NOAA funding, DOGAMI and Oregon Health and Science University (OHSU) have worked to successfully model tsunami inundation scenarios for the entire Oregon coast. The detailed topography improved model outputs by providing greater definition and inundation accuracy. These improvements have allowed DOGAMI to better educate and inform coastal communities of the risk of tsunami hazards.

Throughout Oregon, local municipalities, state and federal agencies, and tribal communities have been applying lidar topographic data to all aspects of mapping. "One of the great things that has come from this mass of data is a coming together of users and sharing of ideas," says John English, lidar database coordinator at DOGAMI. "People have found new ways to address geospatial needs. Lidar has changed the way Oregon thinks about mapping."

Lidar for Everyone

DOGAMI staff embarked on an ambitious project to make lidar data available and searchable on the web so people could compare and contrast lidar data against aerial photographs, topographic maps, and 10-meter DEMs for their own education. In 2011, DOGAMI began using ArcGIS Viewer for Flex to create an interactive map tool that allows anyone with a web browser to view the lidar data at the 1:9,028 scale. Viewers can navigate using pan and zoom tools, and they can hide and display different data layers, depending on their interests.

The primary data layers available in the viewer are the US Topo 24K, which displays USGS 1:24,000-scale quadrangle boundaries, names, and Ohio codes; county and state administrative boundaries; and a contour layer. DOGAMI uses the Ohio code grid system to identify lidar data quadrangles. (The Ohio code grid system splits a 1 × 1 grid block into 64 7.5-foot quadrangles. Ohio code values are derived from the geographic coordinates of the southeast corner of each block and an assigned grid number, ensuring consistency across the contiguous United States.) The contour layer displays 20-foot contours and labels at the 1:18,056 and 1:9,028 scales.

The lidar data shown in the data viewer is 3-meter resolution, bare-earth hillshade imagery. Users have the option to view the lidar data either alone or as a semitransparent layer draped on top of other basemap layers—Esri's aerial, street, and topo basemaps.

One of the most helpful tools for people who are unfamiliar with navigating interactive maps is the overview map. This index map uses the Esri street basemap and overlays a red box to indicate the extent of the primary lidar data viewer. Controls at the top right-hand side of the main map display allow viewers to search for and identify DOGAMI

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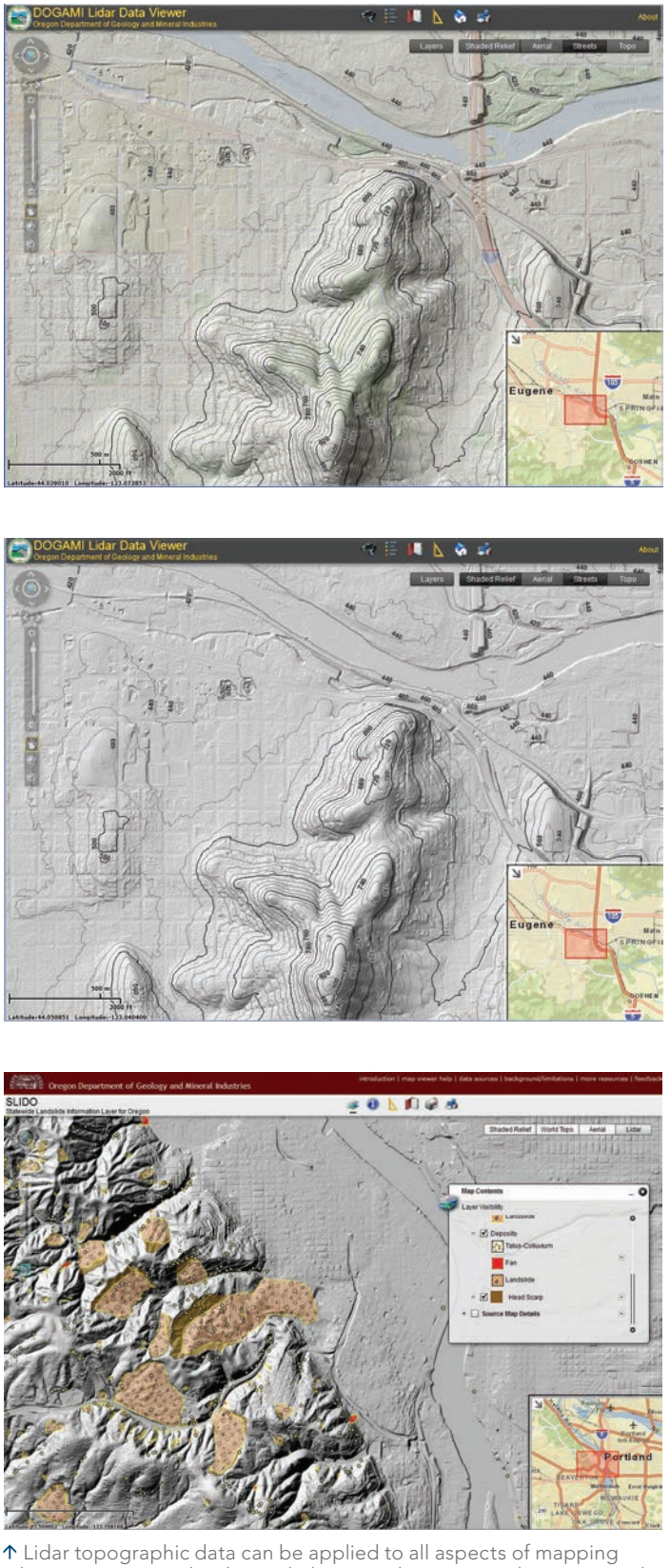


↑ Lidar topographic data can be applied to all aspects of mapping when it is integrated with aerial photographs, topographic maps, and DEMs.

The Importance of Cartographic Design in the SDI Environment

By Karen Richardson, Esri Writer

Dr. Anja Hopfstock

A comprehensive access service to the underlying geospatial data should not be limited to simple discovery, view, and download functionalities but should include graphical presentations that consider the user's capabilities and abilities to handle geospatial data.

Dr. Anja Hopfstock, Technical Manager, EuroRegionalMap

Esri writer Karen Richardson sat down with Dr. Anja Hopfstock to ask a few questions about cartographic design in the spatial data infrastructure (SDI) environment. Hopfstock is an executive officer with the Federal Agency for Cartography and Geodesy (BKG) for the Federal Republic of Germany and technical manager for EuroRegionalMap, a Pan-European reference dataset from EuroGeographics located in Brussels, Belgium. Hopfstock's doctoral thesis, "A User-Oriented Map Design in the SDI Environment Using the Example of a European Reference Map at Medium Scale," deals with this topic.

Richardson: You have focused quite a bit of your doctoral work on the advantages and disadvantages of a common cartographic representation of European topographic data that can be shared among countries. Tell me why you feel this is such an important topic to address.

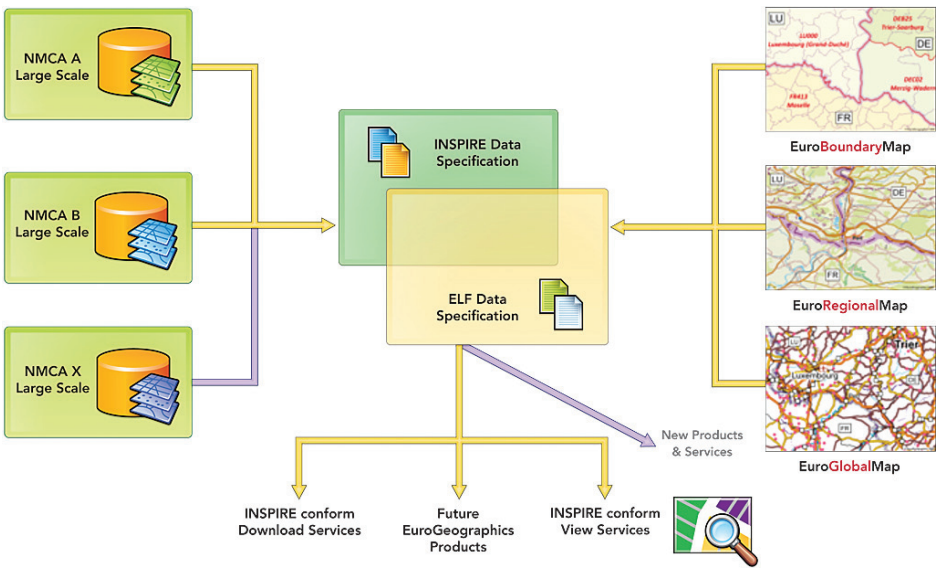
Hopfstock: Similar to the national level, good governance across Europe requires relevant, harmonized, and quality geographic information for the formulation, implementation, monitoring, and evaluation of European Community policies. Today, Pan-European datasets, such as the EuroGeographics products EuroBoundaryMap, EuroRegionalMap, and EuroGlobalMap, provide a continuous, seamless, and object-based description of the European landscape. Built from national contributions, they fulfill the INSPIRE [Infrastructure for Spatial Information in Europe] principles and can be regarded as elements of the European SDI [spatial data infrastructure] data collection. However, the international cooperation currently focuses solely on the harmonization of feature and attribute concepts.

Based on the understanding that geographic information is the result of human geospatial information processing, it is argued that cartography is essential in the SDI context to achieve the overall objectives of SDI. My thesis aimed at exploring the concept of user-oriented map design in relation to SDI and elaborating a methodology for creating effective cartographic representations for SDI-relevant user types.

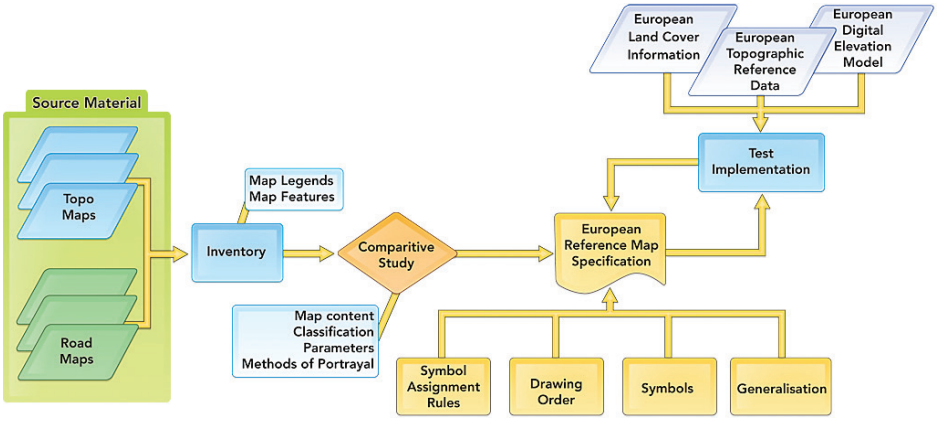
Richardson: How can SDI be used successfully by the many different types of users you are serving?

Hopfstock: In general, two main groups of SDI end users can be distinguished, considering their abilities and capabilities to handle geospatial data: expert users [e.g., spatial planners] and nonexpert users [e.g., decision makers and the general public].

The visualization of geospatial data has a key function for data discovery and evaluation, because the data becomes easier to understand and interpret if presented in the appropriate context. Currently, SDI geoportals provide a marketplace for users to access SDI data collections. Discovery and view, download, and transformation services assist users to find, locate, and transform the data for their task-specific aims. So far, the presentation of geospatial data has only been considered at a



↑ ESDIN Data Specification



→ The cartographic reverse-engineering approach aims at the optimal cartographic design for a European reference map.

basic level. However, the user's acceptance in terms of usability depends on a useful graphical presentation of the geospatial data.

A comprehensive access service to the underlying geospatial data should not be limited to simple discovery, view, and download functionalities but should include graphical presentations that consider the user's capabilities and abilities to handle geospatial data. This means that the visual component of the data is used in the data supply chain so that the graphic presentation enables a communicative, map-based acquisition of geographic information that stimulates the visual reasoning of users and, ultimately, supports decision making.

Richardson: Tell me about your experiences working with the INSPIRE group and helping national mapping organizations comply with INSPIRE.

Hopfstock: As a EuroGeographics expert, I was a member of the Thematic Working Group, setting up the data specification for the INSPIRE Annex I theme Hydrography.

For the last two and a half years, I have led the working group, elaborating how to migrate the existing EuroGeographics products into the INSPIRE framework. The European Spatial Data Infrastructure with a Best Practice Network [ESDIN] project, cofunded by the European Commission, had an ambitious mission to provide best practices in creating harmonized data across Europe to help countries meet their INSPIRE obligations. ESDIN has gone beyond this to lay the foundations for the European Location Framework of data and services. It has created an integrated data model and successfully transformed the existing EuroGeographics products into a dataset for Pan-European harmonization. ESDIN has proposed extensions to the INSPIRE specifications [that] enable the interoperability of topographic, administrative, and cadastral reference data to comply with the INSPIRE Directive and other user requirements at the European level. Conformance to these specifications will enable national mapping organizations to fulfill INSPIRE requirements.

Richardson: How do you see the INSPIRE Directive helping ensure that proper symbology and understanding of geographic data permeates throughout Europe?

Hopfstock: Member states of the European Union are obliged to make geospatial datasets available in conformance with the INSPIRE data specification through services that allow visualization, overlay, or spatial and temporal analysis of spatial information from different sources.

The INSPIRE Implementing Rules for View Services recommend that "datasets belonging to the same theme shall be rendered following the same portrayal rules, in a default rendering style. This style shall be defined for each layer across Europe." The current version of INSPIRE Data Specifications for Annex I themes (v3.0) defines only a basic default style per spatial object type despite the recommendations on how to establish the portrayal rules. These are given in section A.11, Portrayal of the INSPIRE Methodology for the Development of Data Specifications:

- The symbology should be chosen in order to have cartographically correct data representation.
- Portrayal rules in INSPIRE should be built upon existing cartographic experience and upon common traditions, if they exist.
- If, for a given theme, harmonized rules about portrayal already exist, they should be adopted by INSPIRE data specifications.

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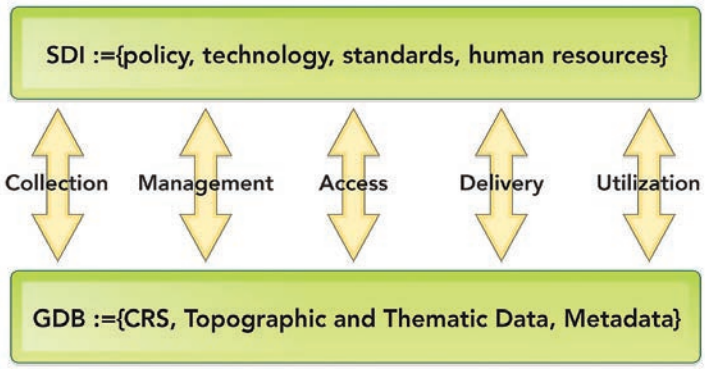


↑ SDI Components and Activities

Looking Up for Answers on the Ground

Providing First Responder Maps for the 2011 Japanese Earthquake and Tsunami

By Karen Richardson, Esri Writer

We found the layout capabilities of ArcGIS 10 to be the perfect tool because it was user-friendly, making it easy to pull in imagery. I don't think we could have done this with any other solution.

Dr. Terance Winemiller, GISP, Associate Professor of Anthropology and Geography, Auburn University

A professor of anthropology used his remote-sensing expertise, developed exploring ancient cultures, to aid emergency response to the Tohoku earthquake and tsunami.

Dr. Terance L. Winemiller, GISP, associate professor of anthropology and geography at Auburn University, Montgomery (AUM), in Alabama, took his first GIS course while in graduate school. His interest in geospatial technology led him to become a specialist in remote sensing. He found GIS was the perfect tool for interpreting ancient cultures by constructing maps of archaeological sites that had never been mapped before. Employing total stations and GPS collectors, he gathers data he uses to construct maps in ArcGIS in both two and three dimensions.

His interest in mapping led him to develop a GIS program at AUM in 2004—the first at the university. Today, the program includes as many as eight courses for bachelor and master programs. A site license provides students with access to Esri software.

A Call to Action

On March 11, 2011, a 9.0-magnitude earthquake hit Japan, unleashing a massive tsunami that crashed into Japan's northeastern coast, resulting in widespread damage and destruction. Japanese officials soon realized that they needed to understand the extent of the damage in order to help their citizens. Satellite sensors provide global coverage so the damage caused by natural disasters can be assessed using current and historical imagery. The worldwide remote-sensing community was asked to help.

When a catastrophe strikes, the International Charter on Space and Major Disasters takes effect. This charter, first initiated by the European Space Agency, provides space satellite data to relief organizations responding to these events. The US Geological Survey (USGS) was part of the US team of signatories to this charter. USGS, working through GISCorps, an organization composed of GIS professional volunteers, requested help processing and analyzing imagery from Japan. Winemiller—along with Christopher Blair and Sissy Speirs, two student assistants who gave up other plans for their spring break—volunteered, and AUM became one of four universities in the United States that helped process and analyze imagery related to the disaster.

↑ US Naval helicopters deliver food, donated by the city of Ebina, Japan, to survivors of the earthquake and tsunami. (Photo courtesy of the US Navy/Released Official Navy Photos, used under Attribution Common License)

Efficient Workflow When Every Second Counts

Winemiller was given access to more than 1,200 different imagery datasets. Less than two days after the disaster, the team began working on the project. They searched for imagery on USGS Earth Resources Observation and Science (EROS) Hazards Data Distribution System (HDDS) public and restricted databases and public sites for coverage of the three areas in Japan they were assigned: Miyagi-Kamaishi, Iwate-Miyako, and Iwate-Miyakoshi.

"We were looking for images, both pre- and postdisaster, to understand the changes that occurred and the amount of damage that was done," said Winemiller. "We studied the geology of the areas we were assigned to assess earthquake damage and, of course, damage from the tsunami, which was the easiest to identify."

Time mattered. Winemiller's team members had to sift through and process vast amounts of data from a variety of sensors and platforms. They needed to easily process and analyze this imagery and produce detailed maps. They chose ENVI image analysis software for image processing and analysis, and ArcGIS for GIS analysis and mapping production.

The automated image preprocessing tools in ENVI were used to prepare the imagery for viewing and additional analysis within ArcGIS. Imagery was resampled to create a uniform pixel count and size so different images could be registered and fused. Subsetting cropped images to focus them on areas of interest. Georeferencing established the correct position of an image relative to other images or on a map. Building a mosaic combined multiple images into one larger scene.

After enhancement in ENVI, the images were pulled into ArcGIS to create before and after insets from the layouts of the same locations. From these insets, they created maps. The maps were uploaded to USGS, which provided them to first responders on a secure server.

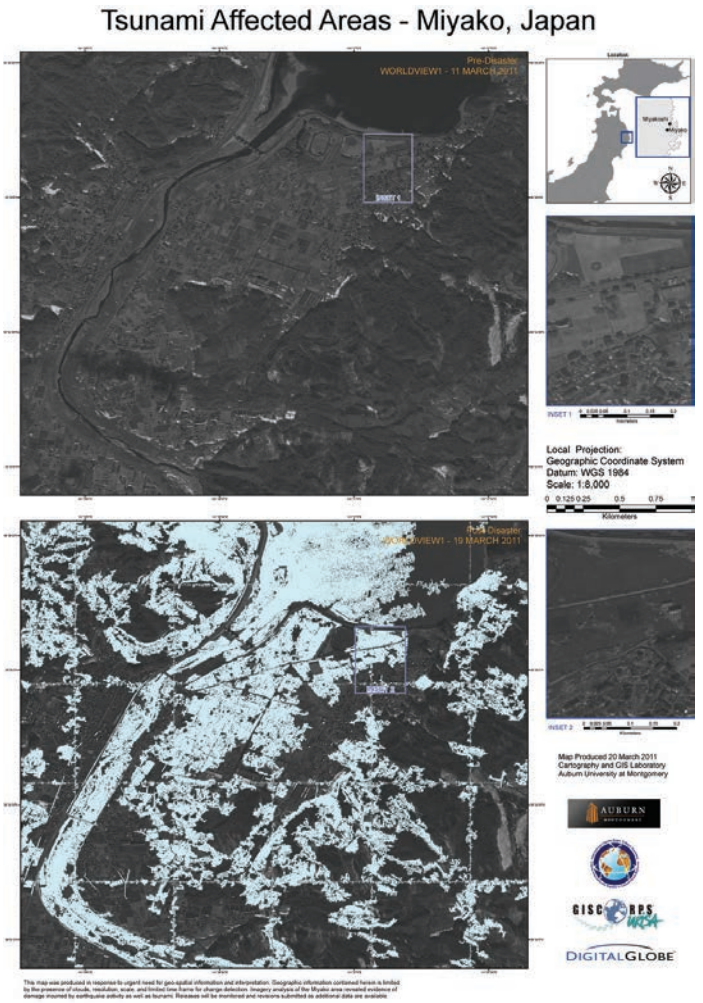
"Some of the locations in Japan had little or no communication after the disaster, so the responders had no idea what was going on there," said Winemiller. "We found the layout capabilities of ArcGIS 10 to be the perfect tool because it was user-friendly, making it easy to pull in imagery. I don't think we could have done this with any other solution."

Many Imagery Sources

Imagery for this project came from sensors aboard IKONOS, SPOT, WorldView-1 and -2, QuickBird, Landsat, and many other satellites. First, the team members looked through the imagery to determine coverage and see if the imagery could be used for this mission. They opened files in ENVI, which supports panchromatic, multispectral, hyperspectral, radar, thermal, and lidar imagery types. Winemiller and his students soon realized that a large percentage of the imagery required enhancement to improve clarity. They matched up images from different sources pixel for pixel and linked them to create rasters that accurately mapped areas for damage assessment.

The need to get imagery to responders on the ground as quickly as possible limited opportunities for performing detailed image analyses. Initially, visual comparisons of the processed before and after scenes were performed to identify the areas with the most damage. Later, Winemiller used the feature extraction tool in ENVI on pre- and postearthquake imagery to identify grids, building footprints, and other items to more accurately compare images.

After the images were processed in ENVI, the team output the images as GeoTIFFs and imported them as datasets into ArcGIS, where the detailed maps were created using the enhanced and processed imagery. ENVI's advanced image analysis tools are also available directly from ArcGIS for users who wish to access them through either a desktop or server environment. "The workflow between ENVI and ArcGIS was a piece of cake," said Winemiller.



↑ Winemiller's team processed vast amounts of data from a variety of sensors and platforms. Imagery analysis of the Miyako area revealed evidence of damage incurred from earthquake activity as well as tsunami.

Getting Maps to Responders Quickly

Satellite imagery has become a major component of postdisaster relief efforts like the one in Japan. The global coverage of satellite sensors makes them ideal for providing the imagery required when time is at a premium after a disaster.

Within 36 hours after the first request, Winemiller and his team of students had useful maps showing accurate pre- and postevent information so damage could be assessed. "Using satellite imagery with this solution enabled us to create up-to-date maps, providing emergency responders in Japan with the critical situational awareness they needed to understand which areas were affected, what the damage extent was, and what resources were needed," said Winemiller. "We were happy to help our global neighbors and provide our students with a terrific learning opportunity involving a real-world situation."

For more information, contact Terance L. Winemiller, PhD, GISP, at 334-244-3945 or twinemi1@aum.edu.

Maintaining Shifting Boundaries and Managing Shared Resources between Mexico and the United States

By Emily Meyertholen, Esri Writer

From the Gulf of Mexico to El Paso, Texas, and Ciudad Juárez, Chihuahua, Mexico, nearly two-thirds of the border between the United States and Mexico lies along the Rio Grande. In accordance with the 1970 Boundary Treaty, when the river shifts, the two countries can either correct the change by restoring the channel or accept the change and perform a land exchange or credit to the country that gained or lost land.

Along this border, the International Boundary and Water Commission of the United States and Mexico (IBWC, or Comisión Internacional de Límites y Aguas) administers the many boundary and water-rights treaties and agreements that have been established between the two nations. It serves as the liaison in any disputes that might arise and advises both countries on issues involving natural resources along the border, where flood control and water quality are major concerns.

"We try to address each issue individually, and GIS has helped us a lot," said Gilbert Anaya, supervisory environmental engineer for the United States Section of the IBWC (USIBWC). With the help of imagery accessed via ArcGIS for Server, his team built a dataset that defined the river boundary, making it easier to track changes and make informed decisions when boundary refinements are necessary.

"As a federal agency, we look at environmental concerns for all of our project areas, so our environmental management section is heavily invested in GIS to support analysis. We have compiled datasets over the years on factors such as cultural resources, locations of impacted areas, and areas where there's an environmental concern, and we incorporate data from other agencies such as EPA [Environmental Protection Agency]. to look at the whole gamut of environmental issues. When we collect imagery, we get permission from Mexico to also collect it there to ensure that we have good coverage for both of the project areas."

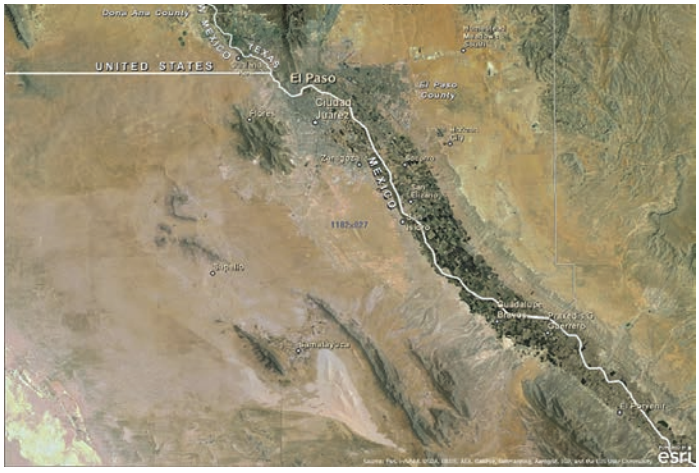
Starting in 2003, USIBWC began consolidating its GIS from several individual users into one central system in ArcGIS for Server so it could better collaborate among its own offices and with other agencies. Some datasets are currently available to the public via the USIBWC website, and plans are in the works to offer a web mapping interface so stakeholders have immediate access to GIS information, which is crucial during emergencies such as floods. The US and Mexican Sections are also working together to create a reference network for sharing datasets in an effort to complete a seamless dataset for the full border. Though the IBWC has created a digital line for the entire US-Mexico boundary, it is currently working with agencies in both countries to reach an agreement on the use of this line as the official boundary in all future datasets.

"There's still quite a bit of work to do," said Anaya. "We've started to assist the larger agencies, like the USGS [US Geological Survey] and Mexico's mapping agency Instituto Nacional de Estadística y Geografía [INEGI], with national datasets such as watersheds, rivers, and elevation data, which are important to many stakeholders and are used quite a lot. We helped jump-start that effort when we started developing the river networks using something similar to the Arc Hydro model, where all of the tributaries and main rivers are now connected via the network for better analysis."

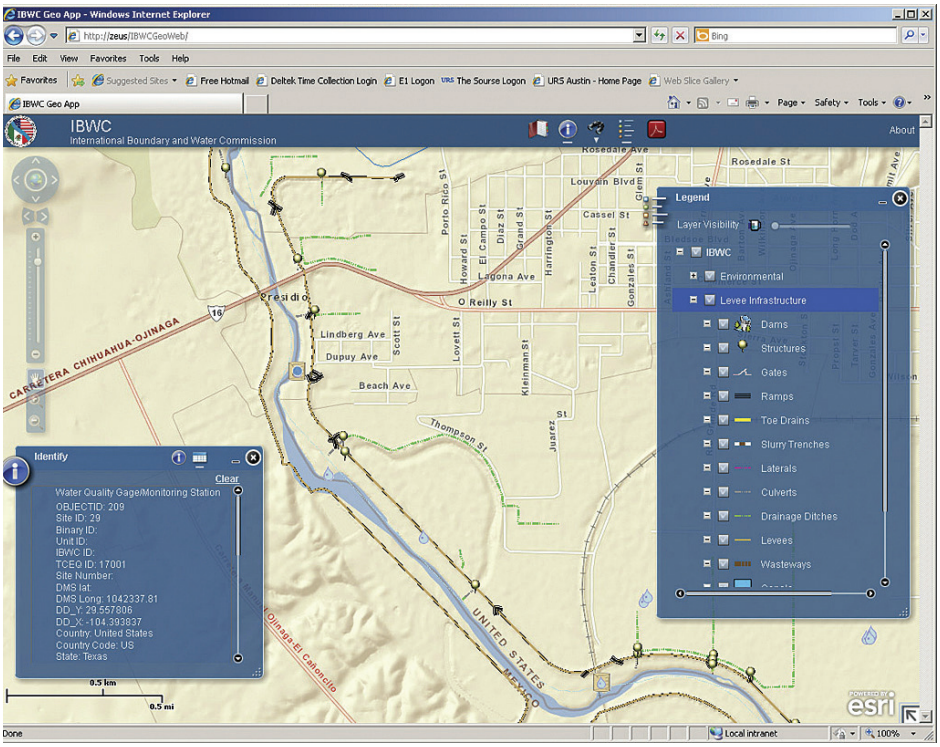
> "Through open dialog, the work groups, and the use of GIS, there's more transparency, and we are able to freely exchange information between countries."
>
> Gilbert Anaya, Supervisory Environmental Engineer, United States Section of the IBWC (USIBWC)

Many missions within the IBWC are concerned with controlling floods, and GIS proved valuable in creating inundation maps during record flooding of the Rio Grande in the summer of 2010. The USIBWC collected imagery and created templates in ArcGIS to automate map sheets that depicted river boundaries across the entire 1,254-mile stretch of the river that lies along the border.

"When we review our flood control procedures, look at hydraulic modeling scenarios, or study how our project areas have developed as the population grows, we go back up to a hundred years. It's good to be able to have historic information to compare with current conditions. We are an over 120-year-old agency, and we have a lot of



↑ The US-Mexico border follows the vagaries of the Rio Grande from the Gulf of Mexico to El Paso, Texas, and Ciudad Juárez, Chihuahua.



↑ The IBWC GIS web application was developed to review license/lease information on federal properties managed by the commission.

valuable and interesting information that we'd like to put into GIS, but it's going to take time," Anaya added.

The western half of the US-Mexico boundary crosses vast tracts of the Sonoran and Chihuahuan Deserts; the Colorado River; and urban areas near San Diego, California, and Tijuana. While the landscape doesn't require clearing a demarcation line through forests and thick vegetation, as it does along the US-Canada border, the United States and Mexico maintain 276 boundary monuments from El Paso, Texas, to the Pacific coast. The countries share responsibility for maintaining each monument every five years to ensure that it is unobstructed and undamaged.

IBWC data is used by a wide variety of organizations and individuals, from fishermen who use bathymetric information to develop guide maps to federal agencies that leverage the data to better meet their missions, including Federal Emergency Management Agency (FEMA), the US EPA, the Department of Homeland Security, the Army Corps of Engineers, and the Bureau of Reclamation. Collaboration with other federal organizations often involves hydraulic modeling or environmental analysis and always results in a GIS product.

"The easiest way for people to visualize what we're doing is to show it to them on a map," said Anaya. "It's always more effective than data or a table."

Like the International Joint Commission (IJC) on the US-Canada border, the IBWC lead work groups are focused on specific regions or environmental concerns. They have also formed technical work groups consisting of GIS professionals from both countries.

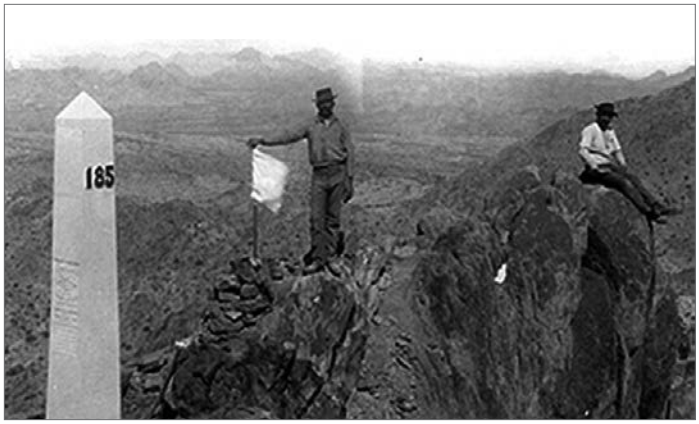
"Through open dialog, the work groups, and the use of GIS, there's more transparency, and we are able to freely exchange information between countries," said Anaya. "That is a big benefit we've seen within the last five years. We have a very good network of GIS users within federal and state agencies, and we're working toward harmonizing that data and making sure it's used as it was intended—to provide people with information."

Boundary organizations from other countries have expressed interest in the way the United States and Mexico manage their border, and they often have similar concerns. Groups from China and the Middle East have inquired about the IBWC as a model for handling international boundary issues, especially transboundary rivers. Both the Rio Grande and the Jordan River, for example, serve residents of different countries, making it difficult to manage water use while ensuring a healthy ecosystem.

"That's a common theme that we come across and that we struggle with as well," said Anaya. "As resources become less available, there has to be a commitment to conserve and find a balance, especially in times of drought. When you couple that with another country that's experiencing a similar need, it's twice as difficult. One of our jobs is to get people to notice the benefits of jointly managing resources and get the right people to the table. One of those components is providing the data to support proposed actions. Ultimately, that leads to visualizing what we're trying to do, and that always leads back to GIS. You have to provide the science behind what you're trying to do in order to get the support."

To learn more about these organizations and their GIS work, visit the International Boundary and Water Commission of the United States and Mexico website or the International Joint Commission website, or contact the following:

JT Moore, Lead Engineering Tech, moorej@ibcusca.org
Michael Laitta, GIS Coordinator, laittam@washington.ijc.org
Gilbert Anaya, Supervisory Environmental Engineer, gilbert.anaya@ibwc.gov



↑ This monument was erected as part of a resurvey of monuments by commissioners J. W. Barlow (US) and Jacobo Blanco (Mexico) that was completed in 1896. (Photo courtesy of the IBWC—US and Mexico)

HELCOM Powers Up Baltic Sea Map Service

Multiple Map Services Rolled Up into One Server Platform

Northern Europe's Baltic Sea has a combination of geographic, climatic, and ecological characteristics that make it highly sensitive to environmental impacts. Because it is shallow and almost enclosed, its brackish water remains within the sea for up to 30 years.

The environmental quality of the sea and its coastlines has deteriorated due to a long history of discharges from industries and municipalities, runoff from agriculture, and various airborne pollutants. These pollutants, combined with the basin's natural tendency to stagnate, endanger the Baltic Sea's living resources. Much work has been done to reduce pollution in the last few decades, so the deterioration has slowed.

The Baltic Marine Environment Protection Commission (commonly known as the Helsinki Commission, or HELCOM) is an intergovernmental organization of all nine Baltic Sea countries and the European Union; it works to protect the marine environment of the Baltic Sea from all sources of pollution. For more than 30 years, the commission has been assessing and reporting on the status of the sea. These reports, based on unique compilations of data and analysis, help experts evaluate the impact of human activity on the marine environment and formulate policies and priorities to protect the environment and ensure sustainable use of its natural resources.

HELCOM has used Esri software for processing and analyzing data since 2004. The commission's GIS-enabled website provides users with access to the organization's various map and data services, including maritime accident response, nutrients, maritime spatial planning, coastal fish monitoring, metadata, the Baltic Sea Monitoring Programme, and project data. HELCOM recently migrated these to the ArcGIS for Server platform, which integrates all these services into a single map service.

"In the last few years, the commission's operations have increasingly utilized GIS," says Minna Pyhälä of the HELCOM Secretariat. "Now, with the new service, users can search for material themselves and do what they want with it. This reduces our workload dramatically. The map service is also an implementation of HELCOM's data and information strategy, which aims to make all HELCOM data openly available to the public."

As a result, Baltic Sea data is available from one centralized place. This makes it much easier for people to use maps and data to understand the Baltic's ecology, protected areas, pollution, maritime traffic, and fishing industry. Hosted on the commission's server, the GIS platform makes the map and data service more flexible. Users can access data via a user-friendly table of contents; select and combine data layers of interest; and use various GIS tools, such as adjusting layer transparency.

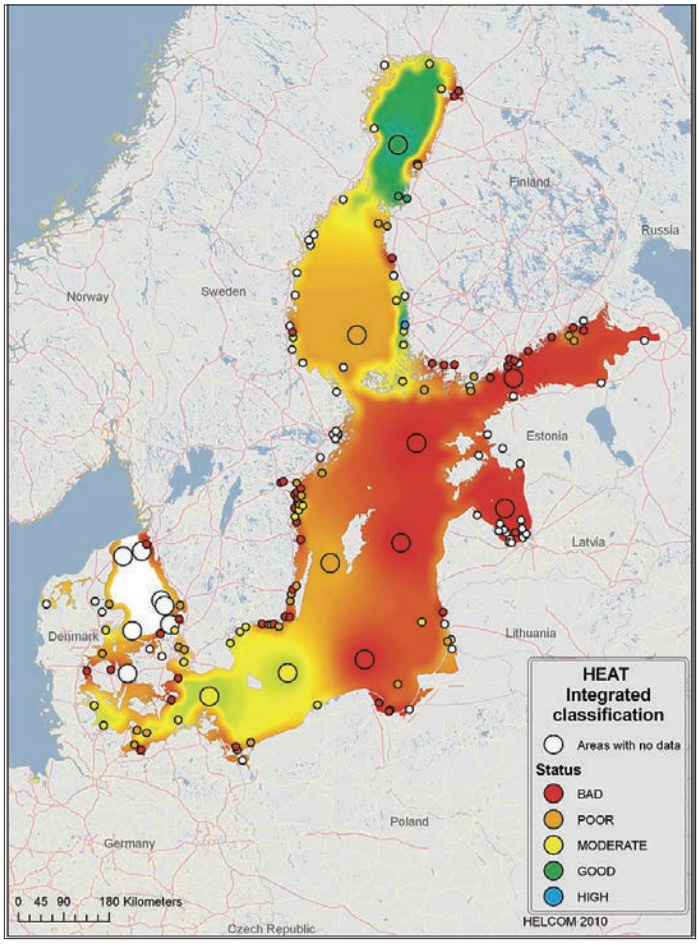
The new map service was built on ArcGIS for Server and ArcGIS API for Flex. Flex, an Adobe development platform based on an Adobe Flash Player client, is well integrated with ArcGIS for Server. Using it to build the map service made the development process relatively straightforward and the applications easy to deploy.

Project researcher Manuel Frias, who developed the HELCOM GIS,

> "ArcGIS for Server has made our map services visually and functionally better because the service is much faster."
>
> Manuel Frias, Project Researcher, the Baltic Marine Environment Protection Commission (commonly known as the Helsinki Commission, or HELCOM)

explains, "ArcGIS for Server has made our map services visually and functionally better because the service is much faster. It is more user-friendly, providing easy map navigation [zoom and pan], and has a look and feel similar to other popular web map services. Moreover, we can easily tailor applications to include special tools and services, such as exporting WMS [Web Map Service] or KML."

Users who want to use datasets in their own ArcGIS software can either connect to the HELCOM database via WMS or download



↑ Heat-integrated classification shows the status of eutrophication in locations around the Baltic Sea.

material in Esri shapefile format to their own projects. HELCOM's new map and data service provides Open Geospatial Consortium, Inc.-compliant WMS so that users can access available layers from within their own GIS mapping environments. The service is designed as a service-oriented architecture. All transactions between the Flash Player client and ArcGIS for Server occur via a REST-based service endpoint.

Although copyrighted data and maps cannot be downloaded, more than 200 map layers are contained in the service, of which 99 percent can be downloaded for personal use. In addition, attribute information for map objects can be downloaded in comma-separated variable format via the Search function, which means that data can be used and edited in a spreadsheet.

Datasets hosted by other organizations can similarly be linked via WMS and displayed in HELCOM's map and data service.

Pyhälä concludes, "If a service has a live link to our database, you can be sure that you always have the latest version of our data available."

Esri Resources for GIS Learning

Value for Your Training Budget

Esri Virtual Campus web courses provide self-paced, on-demand training that organizations can take advantage of to prepare staff for upcoming projects and support professional development plans. A Virtual Campus annual user license provides the best price option for organization-wide access to the full catalog of Esri web courses for one year. An annual user license includes more than 40 courses on ArcGIS 10 software topics, as well as dozens of courses on previous ArcGIS releases.

Web courses for ArcGIS 10 feature an updated, streamlined interface that enhances the learning experience. These courses include software demonstrations, graphic slide shows, and interactive activities designed to reinforce key concepts. All courses include hands-on exercises that allow students to practice applying the software to complete common GIS tasks and workflows.

Find out more about Virtual Campus annual user licenses at esri.com/aul.

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Web courses are available through the Esri Virtual Campus at esri.com/training. Instructor-led classes are made available at Esri Learning Centers nationwide and directly to desktops in multiple time zones via the instructor-led online classroom. Learn more about instructor-led training options at esri.com/instructorled.

Designing and Producing Maps with ArcGIS 10

These courses teach how to create well-designed maps that feature your authoritative GIS data:

- Creating and Publishing Maps with ArcGIS—Instructor-led course
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- Working with Annotation Using ArcGIS 10—Web course

Sample Questions Now Available for ArcGIS for Desktop Associate and Professional Certifications

Individuals who want to evaluate their readiness to take the ArcGIS for Desktop Associate or Professional Technical Certification exam have a new tool at their disposal. More than 30 sample questions for each certification are now available online through Esri Virtual Campus. After completing the sample questions, users will be able to immediately see how many they answered correctly and get an explanation of each correct answer. The sample questions are available for free at esri.com/skillsreview for the following:

- Esri Technical Certification: Sample Questions for ArcGIS for Desktop Associate
- Esri Technical Certification: Sample Questions for ArcGIS for Desktop Professional

Sample questions are intended to provide a general idea of how certification exam questions are structured, help users evaluate their proficiency with some of the skills measured by the exam, and identify skill areas that may require additional study. These sample question sets have not been designed to predict performance on an actual certification exam.

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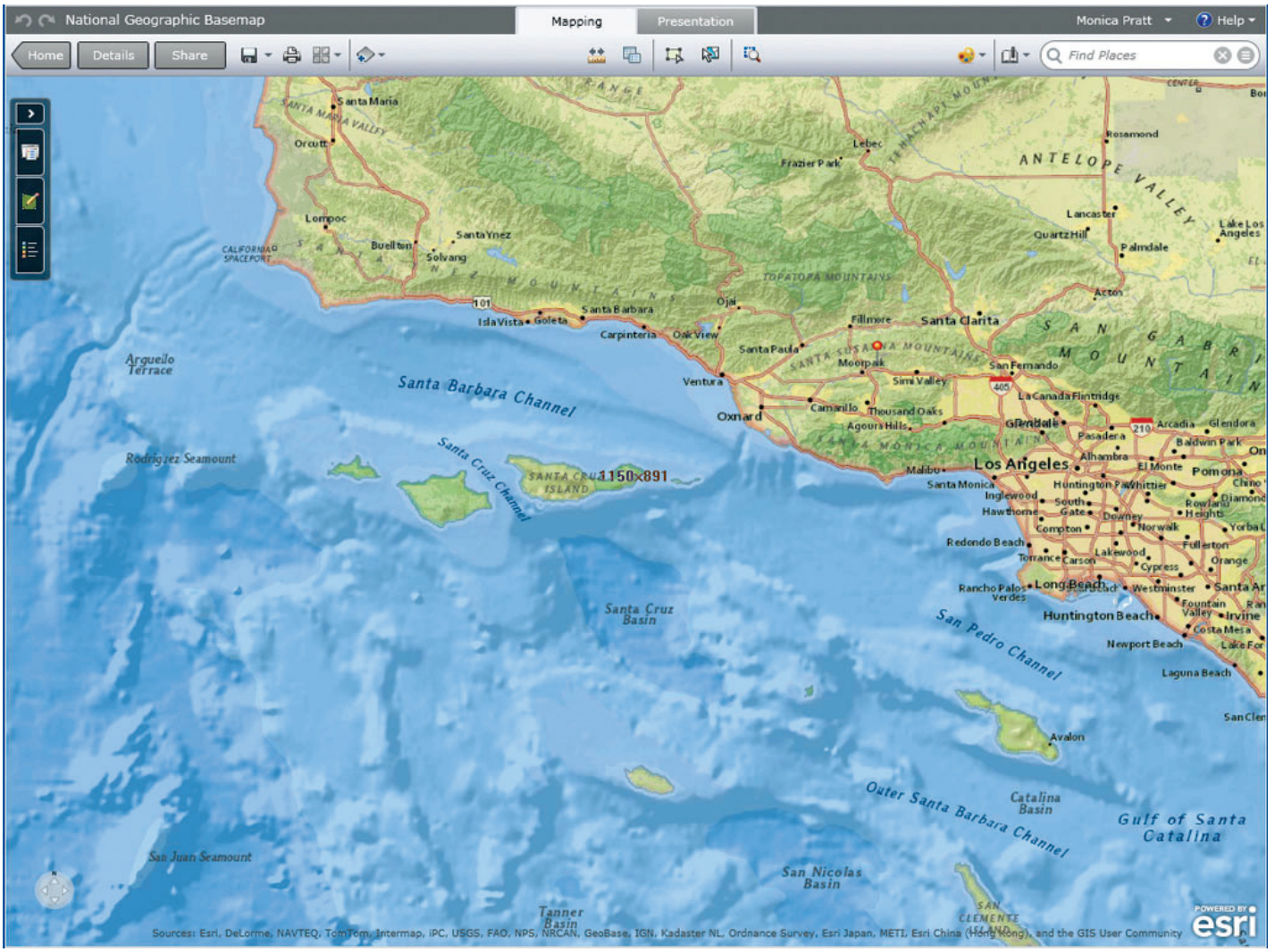
National Geographic Basemap

Multiscale Reference Map of the World on ArcGIS Online

National Geographic World Basemap, a general reference map for informational and educational purposes, is available from ArcGIS Online. This new Internet-based map service combines a century-old cartographic tradition with GIS technology. Created by the National Geographic Society in cooperation with Esri, it provides a basemap for users who want to display minimal data against a vibrant, detailed background when creating web maps and web mapping applications. This reference map includes physical and natural features, administrative boundaries, cities, transportation infrastructure, landmarks, protected areas, ocean floors, and other layers. Shaded relief and land-cover imagery supply added context. Global coverage is available to 1:144,000 scale, and more detailed coverage, down to 1:9,000, is available in urban areas in North America. The map uses data from a variety of leading data providers including DeLorme, NAVTEQ, UNEP-WCMC, NASA, ESA, and USGS.

↓ National Geographic World Basemap can be used to create web maps and applications.



Esri Aeronautical Solution—Airports GIS Package Now Available

Software Suite Helps Airports Comply with FAA Regulations

An Esri Aeronautical Solution—Airports GIS Package license is now being offered under special introductory bundled pricing to qualified customers. The solution is a software configuration suite specifically developed to help US airports comply with the Federal Aviation Administration's (FAA) Airports GIS data management and submission requirements.

This updated offering expands the number and types of preconfigured automated validation checks to include those used by the FAA during data submission as well as critical and noncritical attributes.

Esri Aeronautical Solution—Airports GIS Package is a software suite specifically developed to help US airports and the consultant community meet the requirements of the FAA Airports Surveying—GIS program. Version 2 includes more than 300 preconfigured validation checks developed from the FAA's 18B specification, enabling airports to improve their data quality and better comply with FAA review.

In 2009, the FAA published *Advisory Circular 150/5300-18B*, detailing a regulation that establishes a comprehensive digital data standard for US airports. As part of the standard, US airports are required to submit accurate, high-quality GIS data that will be subject to quality checks. Esri Aeronautical Solution—Airports GIS Package provides airports and the consultant community with an integrated toolkit of automated GIS functionality. The solution includes preconfigured workflows, data validation rules, cartographic layouts, and editing templates. It makes the collection, management, quality control, and submission of airport data more efficient, resulting in time and cost savings.

Current Esri Aeronautical Solution customers can simply download the Airports GIS Package from the Aeronautical Solution resource center.

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Esri News for Map, Chart & Data Production E-newsletter

Esri News for Map, Chart & Data Production is also a quarterly e-newsletter that provides information for GIS users working in national mapping and charting, SDI, and cartography. To subscribe, e-mail nationalmapping_info@esri.com.

 continued from page 1

with guidance from Esri Professional Services. This spatial geoportal will provide access to geospatial data throughout the country.

Success of the NSDI relies on institutes and national data producers, including provinces and local governments, as well as the private sector, all working together. The goal is to increase data availability to make it easy to find, access, and use online. This in turn will make geospatial data more accessible to the public, increasing its benefits.

Creation through Legislation

The road to Indonesia's NSDI began with a historic move: the establishment of the Geospatial Information Act on April 21, 2011. Passage of this act has created three main advantages: increased access to reliable geospatial information, more effective delivery of geospatial information, and the ability to use that data throughout the country. More effectively sharing necessary geospatial information between ministries was the goal.

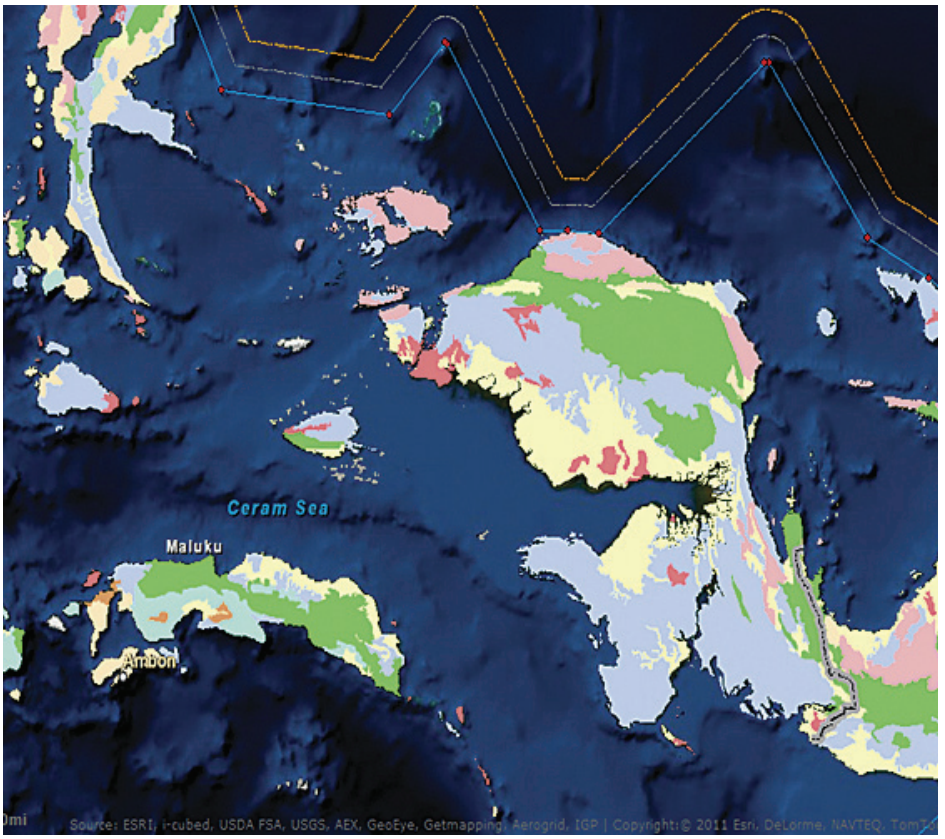
With every cabinet meeting requiring that geospatial data be displayed, however, the reality of using geospatial data set in. Every ministry and nonministerial institution had to prepare its own data to report on the progress of national development.

In the beginning, the issues were related to questions of how to present the information on a map. Once government staff members learned to represent their own datasets on a map, integrating the data with other ministers' datasets turned out to be just as challenging. Different scales and formats made sharing information, as the legislation requested, a difficult task.

Better Data Access through NSDI

Access to authoritative data that could be easily shared between parties was very important. The logical step forward was to implement an environment in which stakeholders, using technology, standards, and shared geospatial information, could interact to better achieve their objectives at different political or administrative levels. On August 3, 2007, the Regulation of the President of the Republic of Indonesia No. 85/2007 took effect for the implementation of the NSDI.

The NSDI project will help achieve good governance of Indonesian geospatial data between national, provincial, and local governments as well as nongovernmental organizations. The NSDI will support more efficient administration, especially in eliminating duplicate sets of data. The vision is for geospatial data to be more easily acquired and created throughout the island nation via a strong foundational system. This will support regional development planning for provincial governments as well as help manage natural resources, protect the environment, and mitigate natural hazards, ultimately contributing to the overall economic development of Indonesia.



↑ Esri Geoportal Server provides the foundation for geospatial data that can be used across Indonesia.

GIS Is BIG in Indonesia

The agency charged with this vision is the National Coordinating Agency for Surveys and Mapping (Bakosurtanal), which is evolving into the Geospatial Information Agency (BIG). Before the Geospatial Information Act, Bakosurtanal was responsible for only providing basemaps up to a scale of 1:25,000. The new mandate for the agency will be to provide an implementation strategy and funding for basemaps at various scales, from 1:1,000,000 all the way to 1:1,000.

Managing the NSDI project will involve many complex activities related not only to administrative matters but also to creating the right technical environment within government institutions to be able to evaluate, select, and manage geographic information. The first phase of the project will be completed by mid-2013 and will involve nine state institutions and two provincial governments. It will be considered successful if the developed NSDI complies with the original operational concept, uses approved standards, and increases the usefulness of Indonesia's geospatial assets.

Once the NSDI is established, every institution involved will be thinking of how to keep the momentum of this historic project going. More participants will be included, more applications will be designed to use the system, and a working committee will be created to continue to define the direction and policies of this national treasure.

Discovering and Mapping Natural Hazards with Lidar continued from page 5

lidar data quadrangles (LDQ) as well as take action, such as showing and hiding the map legend, drawing and measuring on the map interface, and finding and zooming to an address. The current extent of the data viewer can be printed, as well.

By using the Lidar Quad Search/Purchase tool that is available on the map, LDQ publications can be located and ordered. These publications are a series of 7.5 foot quadrangles, each containing a bare-earth DEM, highest-hit DEM, and high-intensity TIFF image, all in Esri Grid format. Viewers can search for LDQ publications based on Ohio grid or USGS topographic quadrangle name or county. If an LDQ publication already exists for the area being searched, the viewer can click the Order Data button or the web link in the pop-up window to order data quadrangles. Clicking this link will bring the viewer to the Nature of the Northwest website (naturenw.org), which is operated by DOGAMI and the USDA Forest Service's Pacific Northwest region staff. The site is a one-stop shop for purchasing maps, publications, books, and software on the region's geologic information.

Coordinating Lidar Collection

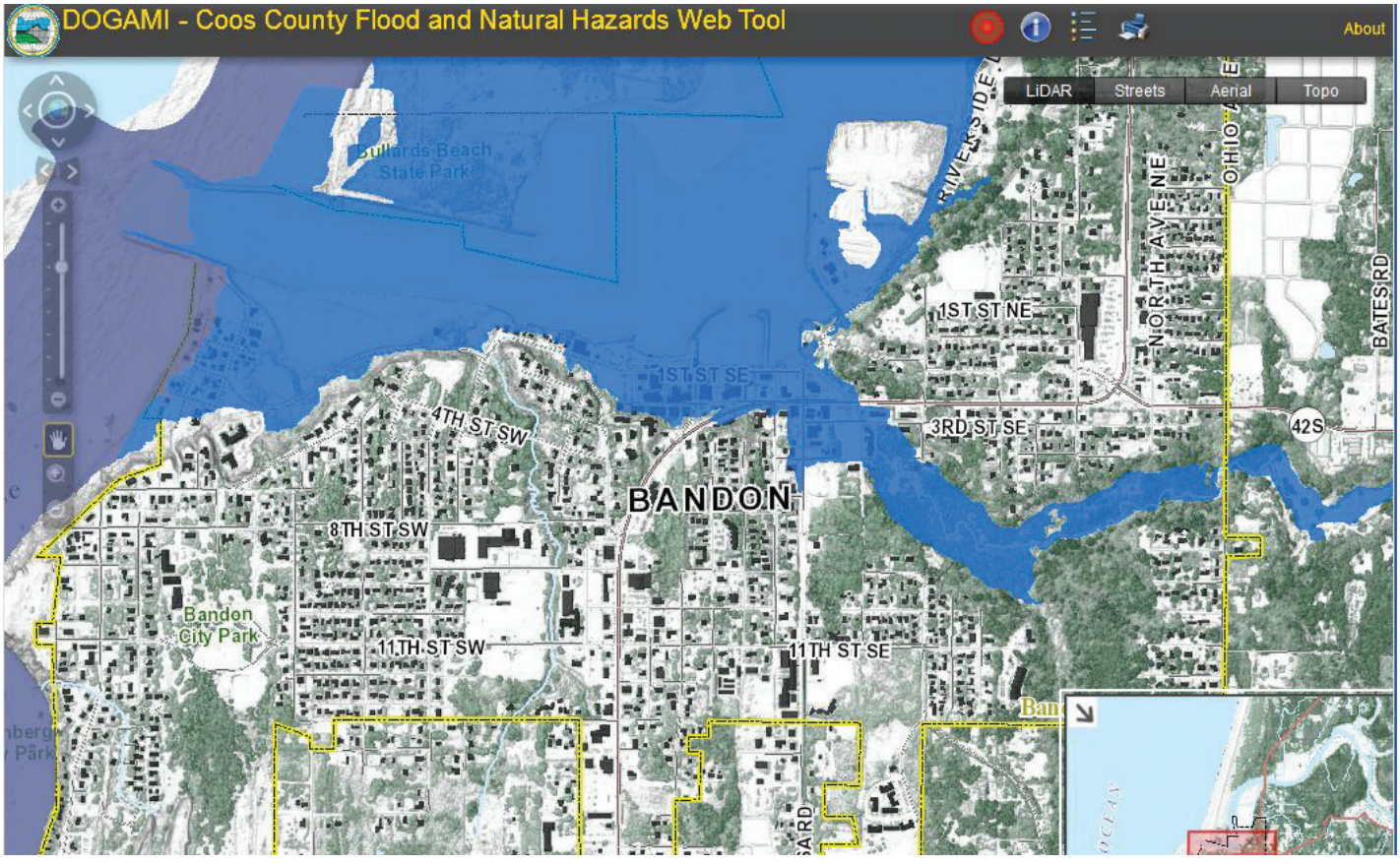
DOGAMI has been overseeing the collection of lidar throughout the state since 2008, when Oregon LiDAR Consortium (OLC) was formed. OLC has been the most successful consortium model in the United States, collecting 13.9 million acres of high-density data throughout the northwest. DOGAMI continues to supervise and coordinate the collection of large swaths of lidar data in Oregon, as designated by the state legislature. Using a nationwide selection process, DOGAMI has a state price agreement in place with Watershed Sciences Inc. of Corvallis, Oregon, for a predetermined unit cost based on the size of project areas. DOGAMI and consortium partners (which include local, state, federal, and tribal agencies) have combined interests and funding to facilitate Oregon's many lidar data needs.

Additionally, DOGAMI uses Esri products to serve more than 33 terabytes of lidar data to the public for viewing and purchase using the online Lidar Data Viewer.

Visit www.oregongeology.org/sub/lidardataviewer/index.htm for more information.

Contributors: Rachel Lyles Smith, project operations manager, Oregon Department of Geology and Mineral Industries, and John English, lidar database coordinator, Oregon Department of Geology and Mineral Industries

Lidar Data Viewer Development: Paul Ferro, GIS analyst and web designer, Oregon Department of Geology and Mineral Industries



↑ Anyone can access lidar data using the interactive map tool developed with ArcGIS Viewer for Flex.

The Importance of Cartographic Design in the SDI Environment

continued from page 7

- With respect to the current and future availability and usability of geospatial data, there are certain doubts that spatial datasets provided for INSPIRE from different member states can be used directly for the production of a reference map at a certain scale. A thorough analysis of metadata and data quality will be required to evaluate the data fitness for use.

Richardson: Tell me how you developed a map design specification to meet this challenge.

Hopfstock: The development of the map design specification for a European reference map at a scale of 1:250,000 was approached by evaluating and comparing existing map products to achieve an optimal cartographic design. Using a cartographic reverse-engineering approach, an inventory and comparative study of 24 European topographic and commercial road maps were carried out.

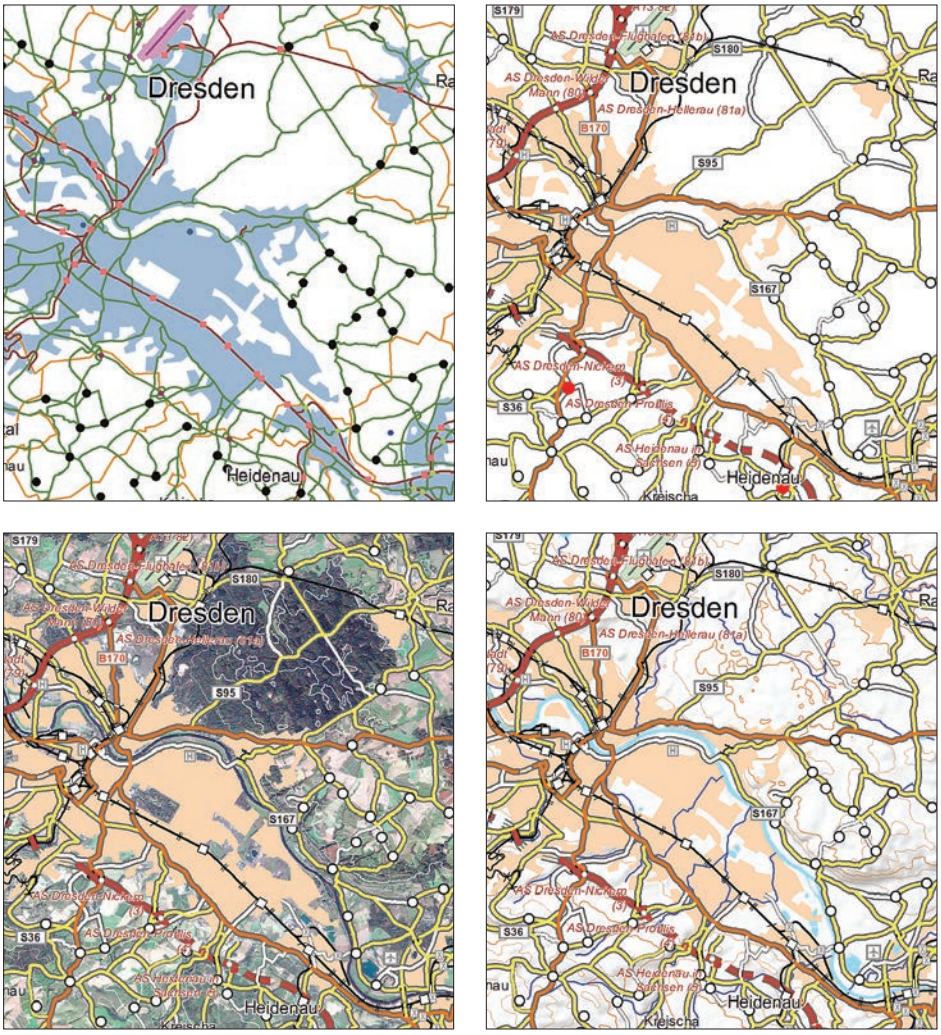
The inventory gave a general overview about the map content and the bandwidth of cartographic representations used in Europe today. The comparative study then offered an insight into the basic principles and elements of their map composition. For the test implementation, three different source datasets were acquired from European SDI stakeholders: EuroRegionalMap, EuroDEM, and Image2000. The gap analysis of the EuroRegionalMap dataset against the proposed map content concept revealed a high overlap. The preparation of the other two source datasets required extensive preparation and preprocessing to transform the data into cartographic representations according to their intended usage.

ArcGIS provided the underlying technical environment for the transformation of the source data into cartographic representations and map compilation. It did this because the EuroRegionalMap and EuroDEM datasets were available in Esri data formats. Also, ArcGIS provided all the necessary functions to handle and transform the data.

Richardson: Based on your study, do you feel it is achievable for so many different countries to work together on a harmonized European symbol catalog?

Hopfstock: In general, yes, it is achievable, but there are still some issues to solve regarding the data harmonization and technological aspects. Map design in the SDI context is a challenging task. The wide range of map use contexts requires a great flexibility of design variants depending on the dimension of human-map interaction. The map design needs to be user driven for efficiency. Besides their function as a graphic interface, maps facilitate a common understanding of the depicted geographic features and phenomena when sharing geographic information between SDI users.

The case study proved that it is feasible to produce a reference map from multiple sources. However, comparable and consistent map content requires semantically and geometrically harmonized reference data. Providing geospatial data just based on national classifications might not be sufficient for work at the European level. If a European SDI aims at facilitating a common understanding of the European landscape, it is essential to introduce European classification schemes for feature and attribute concepts. Another field for research concerns the development and introduction of a map design knowledge base and a registry for design solutions within an SDI.



↑ Different design variants for the European reference map at medium scale

For more information on Esri solutions for INSPIRE, visit esri.com/inspire.

Delivering GIS Benefits with a Limited IT Budget continued from page 3

design consulting services: the *System Design Strategies* technical reference document, the System Design Strategies training course (an Esri instructor-led course), the System Architecture Design for GIS seminar presented each year at the Esri International User Conference, the Esri Press book *Building a GIS*, and the CPT.

The CPT is a set of tools shared as an Excel workbook that automates the system architecture design analysis that would normally require a skilled system design consultant. The CPT helps answer many system performance questions such as the following:

- What are the steps to selecting the right platform solution?
- What system do I need to support my peak user loads with this workflow?
- What network capacity do I need?
- How does my existing infrastructure impact remote site user productivity?
- How can I understand my existing GIS operational system performance capacity?
- How can I model and manage system performance for my enterprise GIS operations?

The CPT identifies user input requirements and shows the information we need to answer your design questions. It also provides the final IT hardware and network solution—this makes the CPT something you can use to better understand your environment. It is updated regularly and available on the Building a GIS online resource center. We use the CPT to model our understanding of the technology. You can use the tool to manage enterprise GIS operations.

With all the solutions listed above, our purpose has always been the same: to share with customers real solutions that help them build successful GIS operations.

Boden: You are, in fact, a teacher. You developed the System Design Strategies training course and regularly present it to Esri customers. Where does training fit into the system design process?

Peters: Understanding the technology is the first step to building a successful enterprise GIS. The training class teaches a communication framework for GIS business users and their IT support staff counterparts. They learn how to represent their specific user productivity needs and clearly identify the IT hardware systems required to meet them.

When building a GIS, the GIS/IT systems integration management team members need to understand how they can all contribute to system performance and scalability—how to get the most of their GIS investment. This is what the training course is all about.

GIS managers need to understand how to reduce system deployment risk, improve user productivity, and spend their development dollars wisely, and many times they are asked to show their management how this can be done.

IT managers need to understand how GIS is making a difference—what the software technology does, how it performs, system configuration best practices, data administration strategies, network and hardware performance constraints, and platform configuration and sizing requirements that make GIS work within their organization.

GIS programmers need to understand how to build applications and services that satisfy user productivity needs.

Data administrators need to understand how to manage the variety of GIS data resources and deployment formats for optimum performance and scalability.

The CPT is fully integrated with the course; it is used throughout the course to teach how to build and manage successful enterprise GIS operations.

Resources for Building an Enterprise GIS

Search for these topics at **esri.com**

System Design Strategies Wiki

The latest place to learn about Peters' system design methodology

Enterprise GIS Resource Center

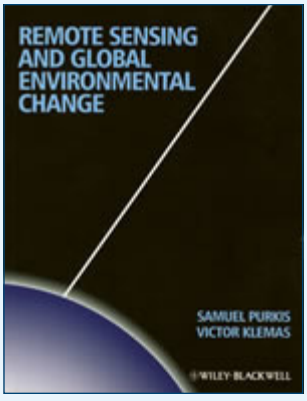
A rich source of technical information for IT professionals on system architecture, security, and performance

Technology Topics: Enterprise GIS

A good resource for managers and others looking for an overview of how enterprise GIS can help achieve business objectives

Remote Sensing and Global Environmental Change

By Sam J. Purkis and Victor V. Klemas



Rather than providing extensive information on sensor specifications and operation, this book presents the fundamentals of remote-sensing technology and concentrates on the application of this technology in assessing the health of atmosphere, cryosphere, oceans, coastal areas, freshwater systems, and land cover and devotes a chapter to each. The target audience for this book is advanced undergraduate and graduate students in earth science, environmental science, or physical geography. However, it is a valuable reference for GIS professionals who use remote-sensing data for monitoring and mapping environmental change at regional and global scales. Wiley-Blackwell, 2011, 384 pp., ISBN: 978-1405182256

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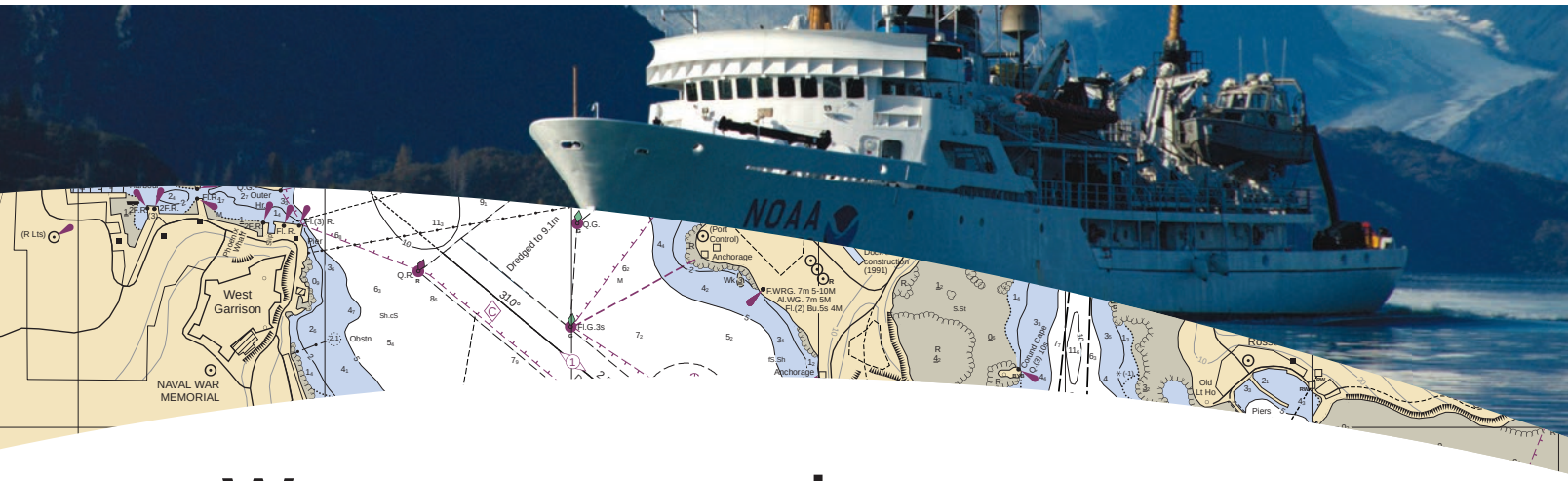

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