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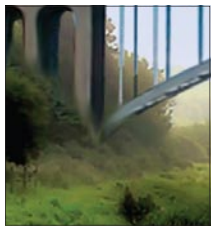
Building INSPIRE: The Spatial Data Infrastructure for Europe

By Max Craglia, Joint Research Centre of the European Commission

This article is about the European spatial data infrastructure (SDI), which is called, formally, Infrastructure for Spatial Information in Europe, or INSPIRE. Many readers of *ArcNews* will be familiar with the concept of an SDI, as efforts in the United States to develop a National SDI (NSDI) have been under way since the mid-1990s (*see also the article "Governance of the NSDI" by Will Craig in the Fall 2009 issue of* ArcNews), and many other countries in the world are very active in developing their own. For the readers who are not so familiar with the concept of an SDI, it is easier to think of it as an extension of a desktop GIS. Whilst in a "normal" GIS most of the data we geospatial professionals use for analysis is our own or collected by the agency we work for, an SDI is an Internet-based platform that will make it easier for us to search and find data that may be relevant for our work and that may be collected, stored,



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ArcGIS in the Cloud

Cloud computing is viewed as the next evolution that will impact businesses and how they manage their IT infrastructures. Cloud computing has a direct impact on GIS and GIS users. ESRI has already been leveraging cloud computing resources for a number of years and, in the coming months, will

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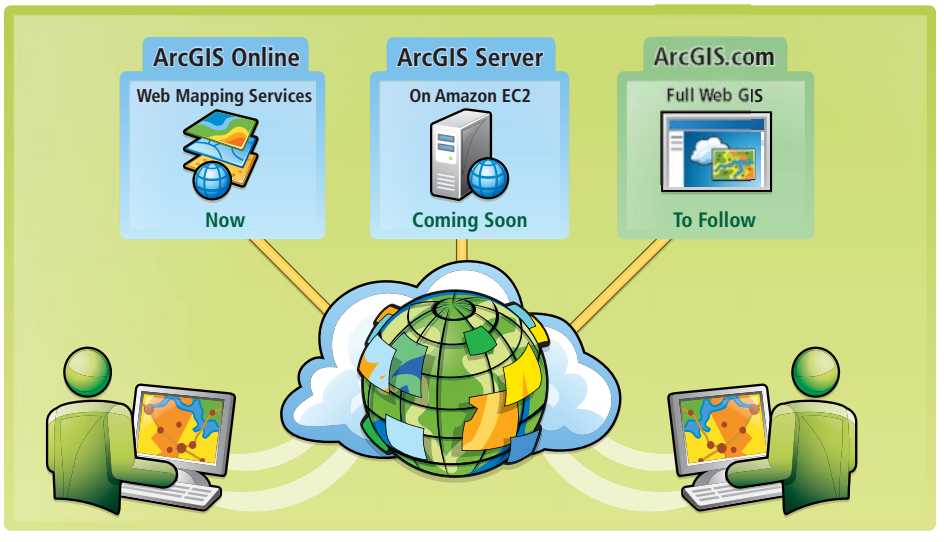

In 2010, ArcGIS will deliver a growing selection of online services and software.

Geographic Knowledge Helps Peacekeepers, Humanitarians

UN Uses GIS to Promote Peace and Provide Aid

UN GPS training (photo: UN Photos).

Founded in 1945 after the Second World War, the United Nations (UN) has a long history of working to maintain peace and security around the world. The international organization, composed of 192 member states, strives to improve relations among nations and protect human rights.

In the UN Secretariat alone, approximately 40,000 staff members work each day to implement UN programs and policies. From Darfur in western Sudan, Africa, to Lebanon, Haiti, and beyond, GIS is

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Why Geography Matters to Patients and Physicians

Linking Health to Geography

"Where do health care and medicine collide with brilliant minds and uninhibited imagination?" That was the slogan of TEDMED 2009, the Technology, Entertainment, and Design in Medicine conference (**tedmed.com**). The answer, according to the organizers of this gathering of forward thinkers in health care and medicine, was "At TEDMED."

But one of the presenters also wanted health care and medicine to collide with geography and the environment. Bill Davenhall, ESRI's global marketing manager for health and human services, used the metaphor of a train wreck to describe to a rapt TEDMED audience in San Diego, California, how each of these elements slammed together during his personal health care journey. His train wreck? A heart attack.

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Virtual USA Emergency Initiative

ESRI announces support for Virtual USA, an initiative designed to improve decision making for local, state, tribal, and federal homeland security practitioners. Headed by the Department of Homeland Security Science and Technology Directorate, Virtual USA integrates existing resources to provide real-time access to operational information from multiple sources and jurisdictions. Data about weather, traffic, infrastructure, fuel supplies, emergency shelters, and medical facilities can be fully integrated, analyzed, mapped, and disseminated for interagency situational awareness.

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VIPER image showing real-time data.

New Training Offerings

Training Without Travel

Travel restrictions don't have to mean missing out on important training. Via the online Virtual Classroom, ESRI offers instructor-led classes that GIS professionals can take from anywhere. Students gain the advantages of live instruction from an ESRI professional trainer but don't have to be away from the office or get travel approval. Classes are held in real time in an interactive environment that promotes learning.

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Mumbai Selects ArcGIS for Its Enterprise GIS

The Municipal Corporation of Greater Mumbai (MCGM), India, is one of the largest local governments on the Asian continent. The organization caters to a service area of approximately 440 square kilometers, including seven islands and four island suburbs. The MCGM jurisdictional area houses approximately 12 million people, with a population density of about 27,000 people per square kilometer, making Mumbai the world's most populous city. Like most city organizations, MCGM requires fast and easy access to digital maps and data.

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ArcGIS in the Cloud

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Highlights

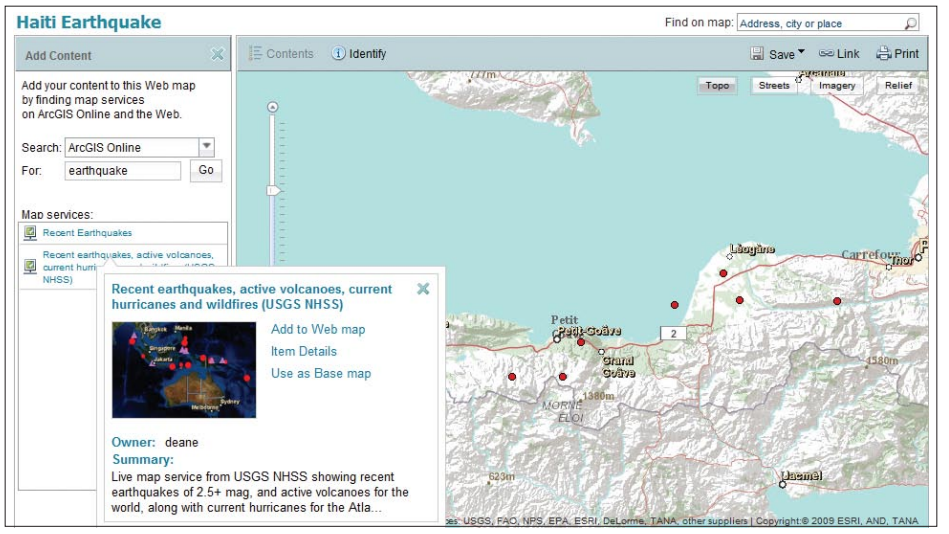
- On-demand access to cloud services is part of working with ArcGIS.
- ArcGIS users will be able to access full GIS capabilities in the cloud.
- Coming soon, ArcGIS Server will be in the Amazon cloud.

offer additional products for direct use in the cloud. ESRI's emerging cloud-ready strategy is to provide customers with a range of opportunities for choosing the most efficient, cost-effective, and secure mix of on- and off-premises GIS applications and services to meet their business needs.

ArcGIS in the cloud makes it possible to take advantage of the benefits of cloud computing, including deployment of Web 2.0 applications that require flexible scalability. ArcGIS Server and ArcGIS Online provide new, cost-effective, and flexible opportunities for organizations to deliver and consume GIS content and services in the cloud. Using ArcGIS in the cloud shifts the duty of maintaining on-premises resources to the cloud vendor, alleviating the customer's responsibility for maintenance and support.

A Complete Online GIS

The road map for ESRI's cloud-based GIS offerings includes access to full GIS capabilities in a cloud environment. This will include authoring, analysis, geodata management, hosting Web services, and applications. ESRI sees cloud-based GIS as a key aspect of any GIS system moving forward. Some aspects of this are available now, and more will be available over time. Over the next year, ESRI will systematically release capabilities and components in a fully integrated system.



Example of recent Haiti Earthquake interactive Web map shared via ArcGIS Online.

Users Take Advantage of the Cloud with ArcGIS Online

Many ArcGIS users are already interacting with on-demand cloud services as part of their normal GIS workflow. These services are built into ArcGIS software with ready-to-use high-quality imagery and topographic and street basemaps, as well as routing and geocoding services for North America and Europe. This system allows users to access and apply these maps and the most current available data and functions without the expense and labor of developing and maintaining this information in-house.

ArcGIS Online also allows users to share their maps and data and collaborate with others who have a common interest. Users can create and join groups and upload items to share. They can control access to their own data, either making it available only to certain groups or sharing it publicly. This system allows GIS users to collaborate on joint projects and quickly share their GIS work within specific communities. ArcGIS Online includes content published by ESRI, other GIS users, and commercial data vendors. It also includes a Web map application for visualizing shared services and creating mashups without any programming. Developers can also access ArcGIS Web Mapping APIs through ArcGIS Online.

ArcGIS Server on the Amazon Cloud

Increasingly, users have been asking to leverage ArcGIS in the cloud to supplement their local in-house resource and/or reduce their capital expenses for hardware. ESRI will shortly support and provide preconfigured Amazon Machine Images for ArcGIS Server for use in the Amazon cloud infrastructure. Running ArcGIS Server on Amazon allows organizations to take advantage of multiple cloud services and features. These include the ability to deploy ArcGIS Server across more than one data center and access Amazon's elastic computing infrastructure, which makes it possible for organizations to quickly adjust the capacity of ArcGIS Server services and applications to user demand.

More Information

To access cloud-based resources and share your GIS content, join ArcGIS Online today at **www.arcgisonline.com**. AN

Mumbai Selects ArcGIS for Its Enterprise GIS

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"MCGM considers GIS as a solution that brings it greater efficiency," says Shantaram Shinde, joint municipal commissioner, MCGM, "by promoting information sharing across multiple departments, speedy decision making, and transparency in the functioning of corporations. GIS is part of creating an information infrastructure needed for providing effective government services in the 21st century as a stable governance-oriented decision support system."

MCGM, the primary agency for urban governance in Mumbai, has selected ESRI ArcGIS Server technology as its citywide GIS enterprise management solution. ArcGIS Server will integrate images, detailed maps, and property-level maps and link them to a wide range of enterprise data used for various city functions. ArcGIS Server will also provide a common platform for authorized and secured access to data to harmonize the workflow of respective departments and disseminate information for the public's benefit.

NIIT GIS Limited (ESRI India), ESRI's distributor in India, is working with MCGM to develop a large-volume enterprise geodatabase and 12 custom ArcGIS applications, which will assist the city with property taxation, utility management, vehicle tracking, and land-use development.

"ESRI India will work closely with MCGM to establish and support its very critical endeavor," says Mukund Rao, president and chief operating officer, ESRI India. "It is a mission to make the city benefit from the use of GIS technology. With the ESRI platform as its core, we will work with all stakeholders in the city and bring the best value to the city of Mumbai."

In the past, MCGM has used GIS as a desktop solution but not as an enterprise solution to support governance. With the ability of ArcGIS Server to handle large-scale maps and networks and integrate with management information system solutions, MCGM believes it can use ArcGIS to better serve the people of Mumbai.

More Information

For more information, contact ESRI India (e-mail: info@esriindia.com, Web: **www.esriindia.com**). AN

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The New Age of Cloud Computing

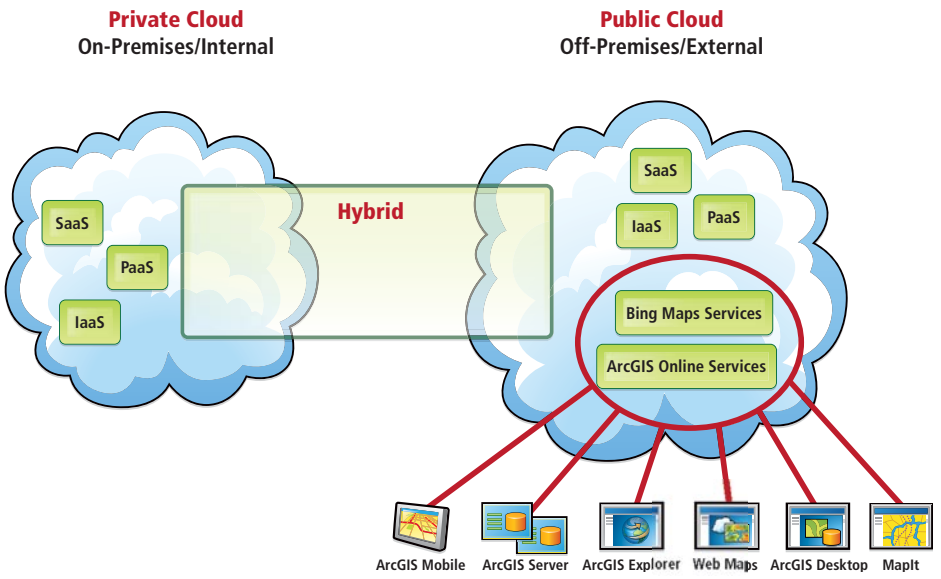
Cloud computing is rapidly emerging as a technology trend that almost every industry that provides or consumes software, hardware, and infrastructure can leverage. The technology and architecture that cloud service and deployment models offer are a key area of research and development for ESRI in current and future iterations of the ArcGIS system platform solutions *(see cover story)*.

Although there are several variations on the definition of cloud computing, some basic tenets characterize this emerging environment. Cloud computing furnishes technological capabilities—commonly maintained off premises—that are delivered on demand as a service via the Internet. Since a third party owns and manages public cloud services, consumers of these services do not own assets in the cloud model but pay for them on a per-use basis. In essence, they are renting the physical infrastructure and applications within a shared architecture. Cloud offerings can range from data storage to end-user Web applications to other focused computing services.

One critical difference between traditional and cloud computing is the scalable and elastic nature cloud computing provides. Instead of a static system architecture, cloud computing supports the ability to dynamically scale up and quickly scale down, offering cloud consumers high reliability, quick response times, and the flexibility to handle traffic fluctuations and demand. Cloud computing also supports multitenancy, providing systems configured in such a way that they can be pooled to be shared by many organizations or individuals. Virtualization technology allows cloud vendors to convert one server into many virtual machines, thereby eliminating client-server computing with single-purpose systems. This maximizes hardware capacity and allows customers to leverage economies of scale.

The service model comprises three core options within the cloud computing environment.

- Software as a Service (SaaS) comprises end-user applications delivered as a service rather than as traditional, on-premises software. The most commonly referenced example of SaaS is Salesforce.com, which provides a customer relationship management (CRM) system accessible via the Internet.
- Platform as a Service (PaaS) provides an application platform, or middleware, as a service on which developers can build and deploy custom applications. Common solutions provided in this tier range from APIs and tools to database and business process management systems to security integration, allowing developers to build applications and run them on the infrastructure that the cloud vendor owns and maintains. Microsoft's Windows Azure platform services are often referenced as PaaS solutions at this middleware tier.
- Infrastructure as a Service (IaaS) primarily encompasses the hardware and technology for computing power, storage, operating systems, or other infrastructure, delivered as off-premises, on-demand services, such as the Amazon Elastic Compute Cloud (Amazon EC2) or Amazon Simple Storage Service (Amazon S3), rather than as dedicated, on-site resources.



Cloud computing speeds delivery of applications and can reduce costs.

The Cloud's Benefits

Cloud computing provides opportunities for organizations to become more cost-effective, productive, and flexible in order to rapidly deliver new capabilities.

The pay-as-you-go pricing model is often quite flexible when renting cloud applications or infrastructure, allowing prospective cloud clients to "try before they buy," while existing cloud consumers can pay in advance to take advantage of volume discounts and satisfy budget forecasting requirements. Renting assets shifts the duty of maintaining on-premises data centers to the cloud vendor, alleviating the customer's responsibility for software and hardware maintenance, ongoing operation, and support.

Ideally, cloud clients should be confident they are consuming state-of-the-art systems that are highly reliable and flexible enough to handle large traffic fluctuations. The burden, then, is on the vendor to scale and continually reinvest in the on-demand information technology (IT) architecture and service so that consumers are consistently provided with a robust, updated solution.

Moving parts of the corporate data and computing center to the cloud also reduces the amount of fragmented infrastructure, driving down up-front capital spending. As monies are reallocated to be invested in core business, other initiatives could be launched to provide direct value to customers and employees, giving the organization a competitive advantage.

With outsourcing and offshoring growing, leading to creation of a global workforce, team productivity depends on the power of networks and the Internet as a common platform. As such, cloud services are available 24/7, accessible from any browser on any device regardless of time zone. This provides faster, easier access for workers to do their jobs, allowing competitive differentiation for the organization and, likewise, attracting and retaining valuable and talented staff.

IT professionals' top concerns when considering moving to the cloud: security and privacy.

Risks in the Cloud

Despite cloud computing's many benefits, it's important to be aware of the risks and concerns when doing business in a cloud architecture.

Security and privacy are two of most IT professionals' top concerns when considering moving to the cloud, either as a vendor, broker, or consumer. The numerous known instances of security breaches should serve as reminders to be vigilant and cautious in the on-demand marketplace. Typical security and privacy examples include data storage and data transfer protection, vulnerability management and remediation, personnel and physical security, application security, data privacy, and identity management.

Depending on your industry, customer base, or public or private organization, compliance requirements exist that must be met and secured. Some compliance concerns include business continuity and disaster recovery; security standards (ISO 27001); logs and audit trails (eDiscovery); and specific standards and governmental compliance requirements, such as Sarbanes Oxley, Payment Card Industry, and the Health Insurance Portability and Accountability Act.

There are specific legal concerns when providing cloud services and, subsequently, consuming them. These revolve around liability and recourse, intellectual property issues and terms, and vendor transparency regarding location of recovery data centers. When relying on an Internet service, there is always a question of availability and the peak-load capacity that the vendor can carry. For example, current and prospective customers can scrutinize the uptime (and downtime) of Amazon Web Services and Google App Engine through CloudStatus.com to determine how healthy the services have been, monitoring their track record of service failures, latency, and throughput.

And finally, as of yet, there are no standards to ensure interoperability or free movement between cloud providers. As such, cloud consumers should also be aware of vendor lock in when moving forward in the cloud ecosystem.

When consuming cloud services, clearly, it's important to recognize the potential hazards and risks ahead, as with any new or existing IT investment. Concerns about security, inquiries around the provider's maturation in an incubating industry, reliability, and regulatory issues are all topics for discussion and clarification in a vendor service-level agreement (SLA). Although not a guarantee, to better ensure delivery of best practices in the cloud, SLAs with the cloud vendor are recommended when consuming cloud services. Realistically, these concerns are not too different from those that one would have choosing any third-party provider or service. As barriers to entry into cloud computing continue to fall away, confidence in cloud vendors will be established through repeated successful experiences, testimonials, and proven reliability with respect to operating procedures and performance.

Cloud Computing Deployment Models

There are several types of cloud computing deployment scenarios. The National Institute of Standards and Technology (NIST) is emerging as the preferred provider of the de facto definition of cloud computing and the distribution models.

The public cloud is the most commonly referenced regarding the topic of cloud computing, where the infrastructure and applications are owned by the organization selling cloud services. However, since many traditional vendors and users are not quite ready to jump into public cloud computing or are restricted from doing so, the cloud service tiers are replicated within a private cloud environment, behind the firewall, and maintained within the parameters of the host organization. Many believe that the sweet spot for cost optimization in an organization will rely on a delicate balance of public, or community, and private clouds. However, since this hybrid cloud solution is commonly bound together by proprietary technology, it will only be embraced by enterprise computing in the future as standards are developed.

More Information

To read an expanded version of this article, visit **www.esri.com/cloudcomputing**.

Linking Health to Geography

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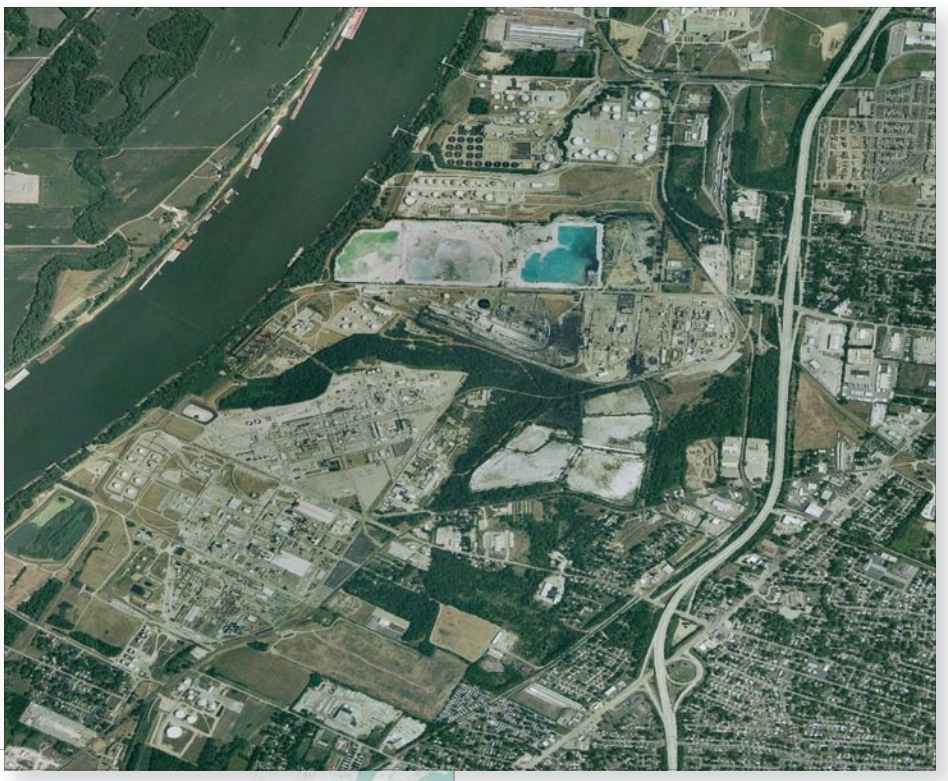
During his presentation, "Can Geographic Information Keep You Healthy?" Davenhall suggested that a patient's geographic (or place) history is as relevant to personal health as genetics and lifestyle. One reason for including geography is that where you live can expose you to environmental toxins.

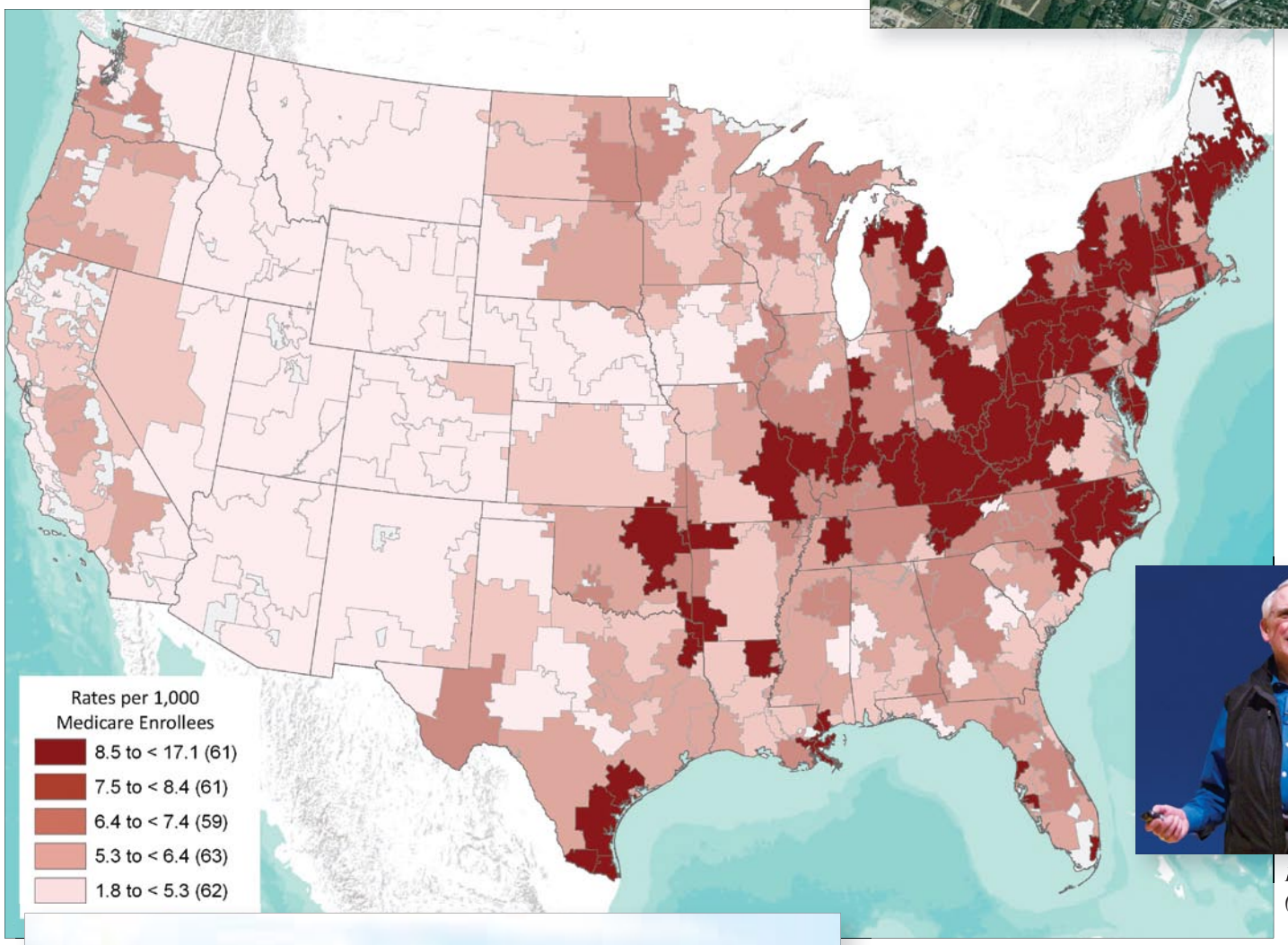
"I've lived in some of the most polluted areas in the nation," Davenhall said. He went on to demonstrate his place history using a GIS map. For the first 19 years of his life, Davenhall was exposed to sulphur dioxide fumes from burning coal waste in Scranton, Pennsylvania. Then he moved to Louisville, Kentucky, where various industries spewed out multiple contaminants. In the 1990s, he relocated to California and breathed smog toxins produced in and around Los Angeles.

Did these exposures contribute to his heart attack? Maybe not, but he made the point that a lifetime of environmental exposures should be considered when deciphering a patient's health problems.

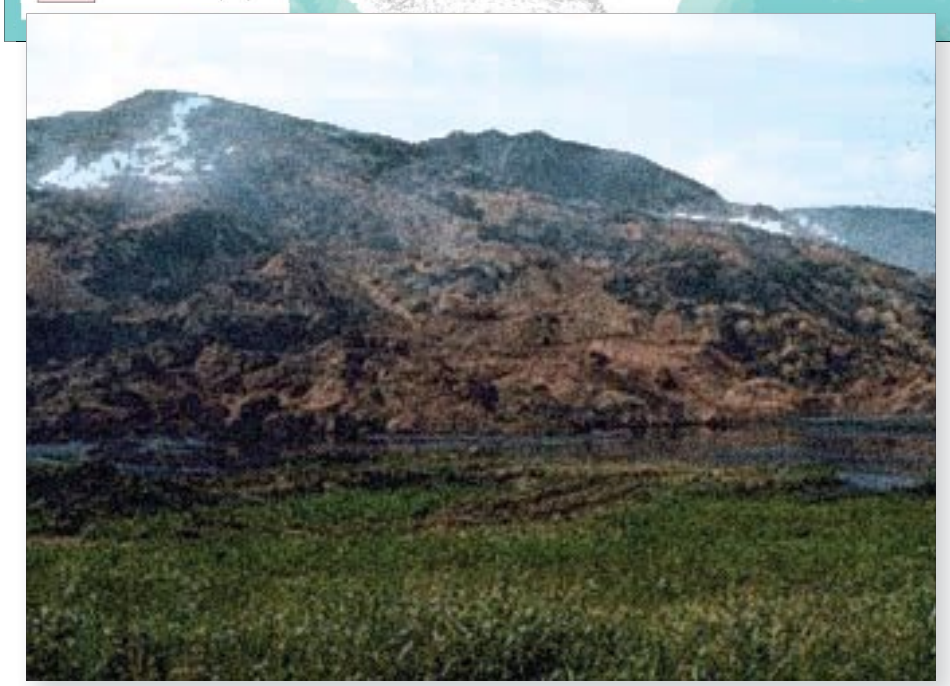
Noting that the average physician office visit takes about eight minutes, Davenhall drove home the message that it's too short a time for a physician to make a connection between where a patient has lived and a history of environmental exposures. The physician needs to consider many things, including a patient's place history and its intrinsic context. Those contribute to a more complete picture of the person's health.



In and around Louisville, Kentucky, industries produce multiple contaminants.



Heart attack risks for U.S. Medicare enrollees shown here in the contiguous United States, mapped by county. (Data source: Dartmouth Atlas of Health Care.)



Sulphur dioxide fumes from burning coal waste in Scranton, Pennsylvania.

Davenhall noted, "All the rich data collected by such organizations as the National Library of Medicine and the Environmental Protection Agency simply have not entered the picture when it comes to our face-to-face encounters with our physicians. I think this needs to change."

According to Davenhall, the first step to connecting a patient's medical and geographic histories could be achieved using an electronic health record (EHR). The advantage of an EHR is that an accurate, full place history can be filled out just once and made available to physicians as needed. EHRs might actually lighten the burden of massive record-keeping requirements on the modern physician's office.

However, the second step—the interpretation of geography and environmental exposures—depends on a physician's understanding of the concepts of geomedicine (the application of spatial analysis methods to medicine). To increase this understanding, Davenhall wants the education of health professionals to include training in geomedicine. The place history of a patient could become a clinical marker and eventually unlock everything known about a patient's health risks related to toxic air, water, ground, and food exposures, as well as culture and demographics.

"Ultimately," Davenhall emphasized, "the goal is to help people stay healthy."

Obviously, Davenhall recovered from his heart attack. But his point about geography was made well enough that everyone in the audience craned their necks to see his display of a map showing heart attack rates across the United States. The question in everyone's mind was, What's the risk where I live? For Davenhall, risks were high in all three of his hometowns.

Bill Davenhall (photo: ESRI).

After Davenhall's presentation, Alexandra Carmichael, cofounder of CureTogether.com, listed Davenhall's geographic approach as one of her Top 10 Innovations at TEDMED. *Scientific American* wrote: "Bill Davenhall . . . made a compelling plea to add a history of places to medical information that doctors review."

More Information

For more information, contact Bill Davenhall, ESRI (e-mail: bdavenhall@esri.com). Visit **www.esri.com/geomedicine**.

About TEDMED

The original TED conference, held in 1984, initiated conversations on technology, entertainment, and design. TEDMED 2009, held October 28–30 in San Diego, was the fifth in a series that focused on health. TEDMED was created by Marc Hodosh, consultant and entrepreneur, and Richard Saul Wurman, author of more than 80 books including *Information Anxiety.* Wurman was the organizer of the original TED conference and creator of the phrase "information architect." Wurman's newest project seeks to identify successful urban design models that can be used to improve the lives of citizens living in megacities. Visit **tedmed.com**. AN

Building INSPIRE: The Spatial Data Infrastructure for Europe

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Disclaimer: The views expressed in this article are the author's alone and do not necessarily represent those of the Joint Research Centre or the European Commission.

or published by other organizations and often other countries. The key components of an SDI are, therefore, catalogues of available resources, documented in a structured way through metadata; agreed-upon access policies and standards; and a set of services to access and download the data to our GIS. In many countries, some key datasets have been identified that are perceived to be of general usefulness to many (the so-called "framework" data in the United States). Priority has therefore been given to documenting them and making them available. Once we have found and downloaded the data we need, we analyze it in our GIS, and finally, we contribute (often but not often enough) to the international pool of knowledge by publishing the results of our analysis so that others can use them.

This, of course, is a rather simplistic perspective. SDIs are children of the Internet, without which they would not exist. They are also the response to an increased recognition that the environmental and social phenomena we are called to understand and govern are very complex, and that no single organization has the know-how and the data to do the job alone. Hence, we need to share knowledge and data across multiple organizations in both public and private sectors, and SDIs support this effort.

INSPIRE

The INSPIRE Directive is a legal act (Directive 2007/2/EC) of the Council of the European Union and the European Parliament setting up an Infrastructure for Spatial Information in Europe based on infrastructures for spatial information established and operated by the 27 Member States of the European Union (EU). For the readers not familiar with the institutional setup of the European Union, it is worth pointing out that the EU is not a federal state but a union of 27 sovereign Member States that agree through a series of international treaties (the latest being the Lisbon Treaty of 2009) to the policy areas in which they wish to share responsibilities and resources (e.g., agricultural, environmental, and regional policies) and those that remain instead the exclusive domain of the national governments (e.g., defense and immigration).

The key decision-making bodies are, therefore, the national governments—represented in the Council with a number of votes proportional to the size of the country—and the European Parliament that is elected by universal suffrage every five years. The European Commission is the civil service body of the EU and has the power of proposing legislation (to the Council and European Parliament) and monitoring its implementation once approved. Not being a federal state also means that there is no equivalent to the U.S. federal agencies in respect to the collection of topographic or demographic data like the United States Geological Survey and the Bureau of the Census. All data comes via the responsible organizations in the Member States. As a result, setting up an EU-wide SDI can only be done in a decentralized way, building on the SDIs and related activities established and maintained by the Member States.

The purpose of INSPIRE is to support environmental policy and overcome major barriers still affecting the availability and accessibility of relevant data. These barriers include

- Inconsistencies in spatial data collection, where spatial data is often missing or incomplete or, alternatively, the same data is collected twice by different organizations
- Lack or incomplete documentation of available spatial data
- Lack of compatibility among spatial datasets that cannot, therefore, be combined with others
- Incompatible SDI initiatives within a Member State that often function only in isolation
- Cultural, institutional, financial, and legal barriers preventing or delaying the sharing of existing spatial data

The key elements of the INSPIRE Directive to overcome these barriers include

- Metadata to describe existing information resources so data can be more easily found and accessed
- Harmonization of key spatial data themes needed to support environmental policies in the European Union
- Agreements on network services and technologies to allow discovery, viewing, and downloading of information resources and access to related services
- Policy agreements on sharing and access, including licensing and charging
- Coordination and monitoring mechanisms

INSPIRE addresses 34 key spatial data themes organized in three groups (or Annexes to the Directive) reflecting different levels of harmonization expected and a staged phasing *(see table 1)*.

The legal framework of INSPIRE has two main levels. At the first, there is the INSPIRE Directive itself, which sets the objectives to be achieved and asks the Member States to pass their own national legislation establishing their SDIs. This mechanism of European plus national legislation allows each country to define its own way to achieve the objectives agreed upon, taking into account its own institutional characteristics and history of development. As an example, Germany does not have a single SDI but a coordinated framework with 17 SDIs, one for each of its states (Länder) and one at the federal level (which also means that 17 different legal acts had to be passed to implement INSPIRE). Similarly, Belgium will have probably three SDIs, one for each of its regions (Wallonia and Flanders) and one for Brussels. The INSPIRE Directive also requires the establishment of an EU geoportal operated by the European Commission to which the infrastructures of the Member States have to connect.

The drawback of having 27 different "flavours" of INSPIRE is that making the system work is undoubtedly more difficult. For this reason, the Directive envisages a second level of legislation, more stringent because it has to be implemented as is and does not require follow-up national legislation. In European terminology, this is called a *regulation.* Therefore, INSPIRE envisages technical implementing rules in the form of regulations for metadata, harmonization of spatial data and services, network services, data and service sharing policies, and monitoring and reporting indicators to evaluate the extent of the Directive's implementation and to assess its impact. Each of these regulations needs the approval of the Member States and the European Parliament. As of January 2010, the regulations for metadata, network services (discovery and view), and monitoring and reporting have already been approved. Those for data- and service-sharing policy, network services (transformation and download), and the first set of specifications for the harmonization of data have been approved by the representatives of the Member States and are now under the scrutiny of the European Parliament.

INSPIRE has some characteristics that make it particularly challenging. The most obvious is that it is an infrastructure built by 27 different countries using more than 23 languages. The requirements for multilingual services and interoperability among very different information systems and professional and cultural practices are, therefore, very demanding. This means, for example, that existing standards have to be tested in real distributed and multilingual settings. In the best scenario, all works well, but for a European-wide implementation, there is a need to translate the standards and related guidelines into the relevant languages (International Organization for Standardization [ISO]; Open Geospatial Consortium, Inc. [OGC]; and other relevant standards are typically in English only). In other instances, testing has demonstrated that the standards are not mature enough, or leave too much room for different interpretations, and thus require further definition or individual bridges to make different systems interoperate. This can be seen with tests on distributed queries

continued on page 6

Annex I
Coordinate reference systems
Geographical grid systems
Geographical names
Administrative units
Addresses
Cadastral parcels
Transport networks
Hydrography
Protected sites
Annex II
Elevation
Land cover
Orthoimagery
Geology
Annex III
Statistical units
Buildings
Soil
Land use
Human health and safety
Utility and governmental services
Environmental monitoring facilities
Production and industrial facilities
Agricultural and aquaculture facilities
Population distribution and demography
Area management/restriction/regulation zones and reporting units
Natural risk zones
Atmospheric conditions
Meteorological geographical features
Oceanographic geographical features
Sea regions
Bio-geographical regions
Habitats and biotopes
Species distribution
Energy resources
Mineral resources

Table 1: Key data themes addressed by INSPIRE.

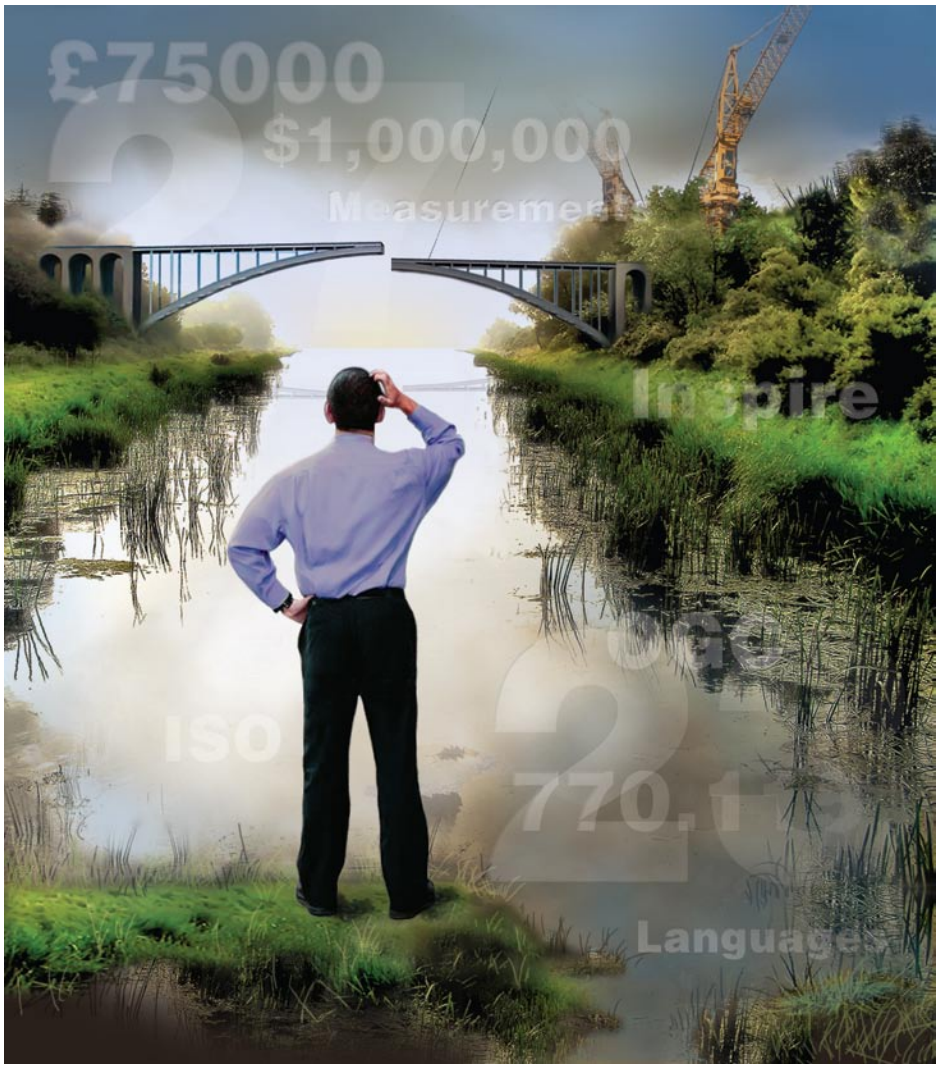
Building INSPIRE: The Spatial Data Infrastructure for Europe

continued from page 5

in catalogues all using the same specifications (OGC Catalog Service for the Web 2.0). The tests identified a number of shortcomings that required the development of an adaptor for each catalogue, which in a European-wide system with thousands of catalogues would obviously not scale.

These shortcomings have been put forward to the OGC for consideration (for further details, see **inspire.jrc.ec.europa.eu/reports/DistributedCatalogueServices_Report.pdf**). In harder cases still, there are no standards available, and, therefore, they have to be created. This applies, for example, to "invoke" services that are needed for service chaining and to the specifications required for the interoperability of spatial datasets and services, which is a central feature of INSPIRE. To understand the context, it is worth reminding readers that each country in Europe has its own heritage and traditions, which include different ways and methods for collecting environmental and geographic data and different traditions on how to analyze and visualize the data, including different coordinate reference systems (sometimes more than one in each country), projections, and vertical reference systems. These different traditions mean that it is not enough for an SDI in Europe to help users find and access data. It is also necessary to understand the meaning of what we are accessing to make appropriate use of it.

This means, in turn, that we need to develop not only translation tools to help overcome the language barriers but also agree on reference frameworks, classification systems and ontologies, data models, and schemas for each of the data themes shown in table 1 against which the national data can be transformed or mapped. This is necessary because we cannot ask the Member States and their national and local organizations to reengineer all their databases. Thus, the approach adopted is to develop agreed-upon European models and systems of transformation (on the fly or batch) so that the level of interoperability necessary for key European applications can be achieved. The approach sounds simple, but putting it into practice is very complex, as it has already required three years of work to develop an agreed-upon methodology (the Generic Conceptual Model) and tools; mobilize hundreds of experts in different domains; and deliver and test the first round of specifications for the Annex I data themes, with Annexes II and III to follow in the coming years. A visit to the INSPIRE Web site (**inspire.jrc.ec.europa.eu/index.cfm**) in the data specifications sections demonstrates the huge amount of work involved.



The Organizational Model

The organizational model put in place to develop INSPIRE is one of its more interesting features, drawing significant attention from outside Europe. In essence, it is a huge exercise in public participation, the like of which is most unusual in policy making, at least in Europe. From the outset, it was recognized that for INSPIRE to be successful and overcome the barriers to data access and use identified earlier, it was necessary for the legislators, implementers, and practitioners in the Member States to come together and agree on a shared understanding of the problem and possible solutions. Therefore, an expert group with official representatives from all the Member States was established at the beginning of the process in 2001, together with working groups of experts in the fields of environmental policy and geographic information to formulate options and forge consensus.

The INSPIRE proposal was subject to an extended impact assessment (**inspire.jrc.ec.europa.eu/reports/fds_report.pdf** and **inspire.jrc.ec.europa.eu/reports/inspire_extended_impact_assessment.pdf**) to identify potential costs and benefits before opening for public consultation. The revised proposal was then debated by the Council and European Parliament over a three-year period before final adoption in 2007. This process in itself is a good example in democracy, but the more interesting aspect is the way in which interested stakeholders are continuing to participate in all the ongoing activities required to develop the INSPIRE implementing rules (i.e., the follow-up legal acts and detailed technical guidance documents).

To organize this process, two mechanisms have been put in place: the first is to engage the organizations at European national and subnational levels that already have a formal legal mandate for the coordination, production, or use of geographic and environmental information (called Legally Mandated Organizations, or LMOs). The second mechanism aims to facilitate the self-organization of stakeholders, including spatial data providers and users from both the public and private sectors, in Spatial Data Interest Communities (SDICs) by region, societal sector, and thematic issue. The central roles that SDICs play in the development of implementing rules include the following:

- Identify and describe user requirements (to be understood as acting in line with environmental policy needs, as opposed to "maximum" requirements beyond the scope of INSPIRE and beyond realistically available resources).
- Provide expertise to INSPIRE drafting teams.
- Participate in the review process of the draft implementing rules.
- Develop, operate, and evaluate the implementation pilots.
- Develop initiatives for guidance, awareness raising, and training in relation to the INSPIRE implementation.

LMOs have similar functions but also play a central role in reviewing and testing the draft implementing rules and in assessing their potential impacts in respect to both costs and benefits.

An open call was launched on March 11, 2005, for the registration of interest by SDICs and LMOs that were also asked to put forward experts and reference material to support the preparation of the implementing rules. The response was immediately very good, with more than 200 SDICs and LMOs registering within a month, putting forward some 180 experts (funded by them) from which we have set up drafting teams to help in developing the first batch of technical documents. At the present time, a second call for experts is open on the INSPIRE Web site to support the development of Annex II and III specifications, and an Internet forum (**inspire-forum.jrc.ec.europa.eu**) has also been set up for Member States to share experiences and tools to help implement INSPIRE. Table 2 shows the extent of the community directly involved in shaping the policy and the technical documents.

Three aspects are particularity important in understanding the work and the challenges of the drafting teams: first, each expert represents a community of interest and, therefore, has the responsibility to bring to the table the expertise, expectations, and concerns of this community; secondly, each drafting team has to reach out to all thematic communities that are addressed by INSPIRE. As a matter of comparison, it is worth recalling that the U.S. NSDI defined only seven framework themes: geodetic control, orthoimagery, elevation, transportation, hydrography, governmental units, and cadastral information, most of which have a federal agency that is taking the lead in data collection and management. The implication for the drafting teams is that they have a much more difficult task in collecting and summarizing reference material, seeking common denominators and reference models, and developing recommendations that satisfy user requirements without imposing an undue burden on those organizations that have day-to-day responsibility for data collection and management across Europe. Seeking compromise between different requirements and perspectives is crucial to the work of each drafting team.

Last, but not least, it is important to note that the drafting teams have ownership of their work. They make the recommendations and submit them for review to all the registered SDICs and LMOs and the representatives of the Member States. It is only after they have taken on board all the comments received that the Commission takes ownership of the draft implementing rules and submits them for internal consultation. After revision and checking, the draft implementing rules go through the final round of the democratic process before becoming a new legal act. This involves qualified majority voting by the representatives of the Member States and the scrutiny of the European Parliament.

The complexity of this participatory approach is certainly innovative not only in relation to the developments of SDIs but also more generally to the formulation of public policy at the European level. The outcome produces both consensus-based policy and the development and maintenance of a network of stakeholders that make it possible to implement more effectively this distributed European SDI.

The Challenges

Although a great deal of work has clearly taken place with the support of many stakeholders, there are still several organizational and technical challenges (and opportunities) that need to be addressed.

Organizational: The most immediate challenge is to maintain the momentum and the high level of commitment of all stakeholders and the experts contributing to the development of the implementing rules. This is not trivial and requires a notable amount of resources (time, money, expertise, commitment) to ensure that stakeholders feel ownership of the process, which then becomes a prerequisite for more effective implementation. Just to give an example of the scale of the task, the development of the data specifications for Annex I themes involved addressing more than 7,500 comments received from hundreds of stakeholders and organizing some 350 meetings (both physical and virtual) over a two-year period. If you consider that there were 8 themes in Annex I and another 26 to do, in addition to the revisions and maintenance of all guidance documents already created, then you have a sense of this facet of the organizational

The Inspire Community in 2009
361 Spatial Data Interest Communities (SDICs)
198 Legally Mandated Organizations (LMOs)
300 experts (drafting teams and working groups)
238 experts for Annex II/III latest call
3,087 user organizations registered on the INSPIRE Web site

Table 2: The INSPIRE Community in 2009.

challenge. The INSPIRE forum is one way to address this challenge, but managing expectations, ensuring real participation, and delivering the benefits are key aspects we constantly need to focus on.

Another facet, which is even more important, is the organizational challenge in the Member States to implement INSPIRE. The INSPIRE Directive asks Member States to establish and maintain their SDIs, nominate an organization as a contact point with the Commission, and set up appropriate coordinating mechanisms, all of which have given rise to a flurry of activity across Europe. In many countries, SDIs already exist and work well at national and subnational levels. So the effort is more focused on agreeing on a division of responsibility than in setting up new structures. In other countries, INSPIRE offers an opportunity for the organizations that have been leading SDI developments for years to get their just recognition and acquire new status and legitimacy.

Of course, the difficult financial climate of this period makes it potentially more challenging to invest in new infrastructures and ways of working. Hence, the challenges in most countries are to leverage resources available from different sources (European, national, international) and/or ensure strong synergy between the investment required by INSPIRE and those committed in related projects, for example, in the framework of e-government. In this sense, the work needed is critical not only to align sources of funding but also to ensure that initiatives, standards, systems, and deployments are well coordinated and that they do not duplicate, or contradict, each other. Readers of this article who are familiar with large public-sector organizations will know how challenging this may prove to be.

Underpinning this organizational challenge are the key issues of awareness, education, and training. Although we have involved thousands of people in the development of INSPIRE, and most national-level organizations in the Member States are aware of this initiative, there is still much to do. Even in the organizations involved in INSPIRE, sometimes only a few people are actively participating, and the level of awareness of INSPIRE and its future impacts may be lost to other parts of the same organization.

Moreover, many public-sector administrations at the subnational level still have limited or no knowledge of INSPIRE. This is partly due to (1) insufficient dissemination efforts in the Member States; (2) local and regional authorities only becoming more directly involved when the data themes they are responsible for, which are mainly in Annexes II and III, are addressed by INSPIRE; and (3) the complexity of the technical documentation being produced at the present time, which very few people can understand or use. This brings us to the education and training issues. Even if we take a very simplified view of an SDI and assume that all it involves is creating metadata and setting up OGC-compliant services for discovery, view, and access, then where are the technicians versed in the relevant standards and technologies who will be able to implement these services across hundreds of datasets in the thousands of organizations across Europe? Who is training them? Where are the technical colleges and universities forming such competent technical staff? Where is the training material consistently being designed and translated across Europe so that everybody implements exactly the same specifications? And, where are the courses to train professional users (city planners, environmental engineers, social scientists, etc.) on the added value of the SDI to their work? The answer, of course, is that we still have to build up this capacity.

There have been notable efforts in respect to the professional users such as the Center for Spatially Integrated Social Science in the United States (**www.csiss.org**) and several EU-funded projects in Europe (e.g., **www.vesta-gis.eu**), but the demand far outstrips the supply, and often, the funding to support these projects is limited to a few years, typically three or four. An interesting effort to overcome this short-term funding problem is represented by the Vespucci Initiative for the Advancement of Geographic Information (GI) Science (**www.vespucci.org**), a not-for-profit, self-funded initiative bringing together leading GI scientists and practitioners in intensive week-long courses to foster interaction and exchange of experience along the "training the trainers" formula. After eight years of operation, some 500 participants have lived the Vespucci experience, and thousands more will have benefited from the indirect effects of being trained by the Vespucci alumni.

*The INSPIRE geoportal (**www.inspire-geoportal.eu**).*

Technical: The main challenge here is to develop and maintain an infrastructure that works and that delivers added value. As indicated earlier, the suite of international standards and specifications available is sometimes not mature enough to deliver or is subject to different interpretations, change, and inconsistencies. To give one small example, at the core of SDIs is metadata. The international standards for metadata for datasets and services are ISO 19115 and ISO 19119, respectively. The application schema for both is ISO 19139, but these schemas can be found at two different locations: the ISO repository for official standards and the Open Geospatial Consortium Schema Repository. Unfortunately, the schemas available at these two sites differ because of the different versions of Geography Markup Language (GML) they use.

This is now being addressed, but it is just one example of the many problems one has to face in practice. The devil is always in the details, and in the case of INSPIRE, we took the view that it was not feasible to include all the very detailed specifications down to rules for encoding into a legal act, as any change in standards, technologies, or good practice would then require lengthy procedures to amend the legislation. As a result, the INSPIRE implementing rules are short and only say what functionalities are required, leaving the detailed implementation to nonbinding guidelines documents. This has its drawbacks, as we cannot guarantee that everyone will use the guidelines and that interoperability will be achieved immediately. On the other hand, experience has shown that we are still making small adjustments to the guidelines for metadata two years after their approval. Had they been set in tablets of stone (i.e., legally binding), there is no way that we could be able to make any change fast enough.

So, in practice, we adopted a more pragmatic approach, setting up an Initial Operating Capability Task Force with representatives from the agencies in charge in every country to implement INSPIRE. With them we can discuss in detail how they are implementing their services, what seems to work, and what does not; make the necessary changes and adjustments; and disseminate good practice, as well as share tools (and reduce costs). INSPIRE is a process, not just an artifact!

A second challenge is to facilitate the transition from a spatial data infrastructure perspective, that is, the "extended GIS metaphor" used in the introduction, which only addresses relatively few technical experts, toward a spatial information infrastructure, a service providing information products and analyses that are of wider use to nonexperts. This requires turning many of the functionalities and analytic processes encoded in GIS software and usable by few trained geospatial professionals into geoprocessing services that can operate in established workflows over the datasets available on the Web and provide answers to questions posed by the many who are not experts.

The research issues here are many and include eliciting and formalizing processes and models from experts; turning them into geoprocesses, which can be understood and used across disciplines (including explanation of the theoretical underpinning of models so that they can be used appropriately); and selecting the appropriate service to go with the appropriate data to contribute to addressing a question in ways that are methodologically robust. Some of these challenges were addressed, for example, by the ORCHESTRA project (**www.eu-orchestra.org/overview.shtml**), but in that instance, all the geoservices had to be chained manually, which would not scale up in a global setting with thousands of datasets and services available. So we need automatic or semiautomatic means of making the right choices and links.

To add spice to these challenges, there are also always new ideas and technologies to understand and harness. So as we were settling in to implement service-oriented architectures (SOA) for SDIs with the corollary of ISO metadata, OGC discovery services, etc. (i.e., following the paradigm of the library that separates the resources from their metadata), along came Linked Data (**linkeddata.org**) with Resource Description Framework (RDF) to provide semantically rich descriptions of resources and their linkages. Of course, Linked Data and SOA are not necessarily at odds. However, this is a good example of the way one needs to build the infrastructure for today with a view to where we should be going tomorrow.

Toward the Next-Generation Digital Earth

To help sharpen our vision of the future, the Vespucci Initiative brought together in 2008 a number of environmental and geographic information scientists from academia, government, and the private sector to consider the changes that have taken place since the 1998 Digital Earth speech by U.S. Vice President Al Gore (**www.isde5.org/al_gore_speech.htm**). The meeting was an opportunity to consider the major technological developments that have made it possible to bring the experience of Digital Earth to hundreds of millions of people in their homes and desktops. It also reviewed the many public-sector-led initiatives aimed at organizing geographic information (SDIs and INSPIRE, the Global Earth Observation System of Systems initiative [**earthobservations.org**], the International Society for Digital Earth [**www.digitalearth-isde.org**], etc.) and the major private-sector developments aimed at organizing world information geographically. These have made it possible for citizens to contribute and share geographic information easily and interact with each other in what is labeled as Web 2.0.

Overall, the emerging view was that there is a need to bring together these seemingly parallel worlds: top-down official information and bottom-up citizen-provided information. On this basis, we articulated a revised vision of Digital Earth to help guide our effort. This vision recognizes the need to integrate scientific and public- and private-sector data to help us understand the complex interactions between natural, man-made, and social environments over time and across space—a framework to help us realize what has changed or is likely to happen, when, and why. To support this vision, we also identified key research topics on which to focus our energies, including improved methods for the spatiotemporal modeling of heterogeneous and dynamic data (citizen provided, sensors, official), the visualization of abstract concepts in space (e.g., risk, vulnerability, perceived quality of life), and ways to assess and model reliability and trust in information coming from many different sources (for more details, see **ijsdir.jrc.ec.europa.eu/index.php/ijsdir/article/view/119/99**).

You could argue that with all the work we still have to do to develop and implement INSPIRE in Europe, we can ill afford to look for new organizational and technical challenges and research topics. Yet we should never lose sight of why we are building these infrastructures and investing significant public resources to do so. They are not ends in themselves but a means to improve our understanding and stewardship of the environment and develop our knowledge-based society. Without a clear view of where we want to go and what is needed to get there, we will not be able to guide the process effectively and address the grand challenges of today and tomorrow. The *Next-Generation Digital Earth* paper provides an initial contribution in shaping the longer-term view, and we welcome your feedback and contributions on **inspire-forum.jrc.ec.europa.eu/pg/groups/98/next-generation-digital-earth**.

About the Author

Max Craglia works in the Spatial Data Infrastructures Unit of the Joint Research Centre of the European Commission. This unit is responsible for the technical coordination of INSPIRE, working closely with other Commission colleagues in the Directorate General for the Environment and EUROSTAT. Craglia edits the *International Journal of Spatial Data Infrastructures Research* (**ijsdir.jrc.ec.europa.eu**) and is one of the founders of the Vespucci Initiative for the Advancement of Geographic Information Science (**www.vespucci.org**).

More Information

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Virtual USA Emergency Initiative

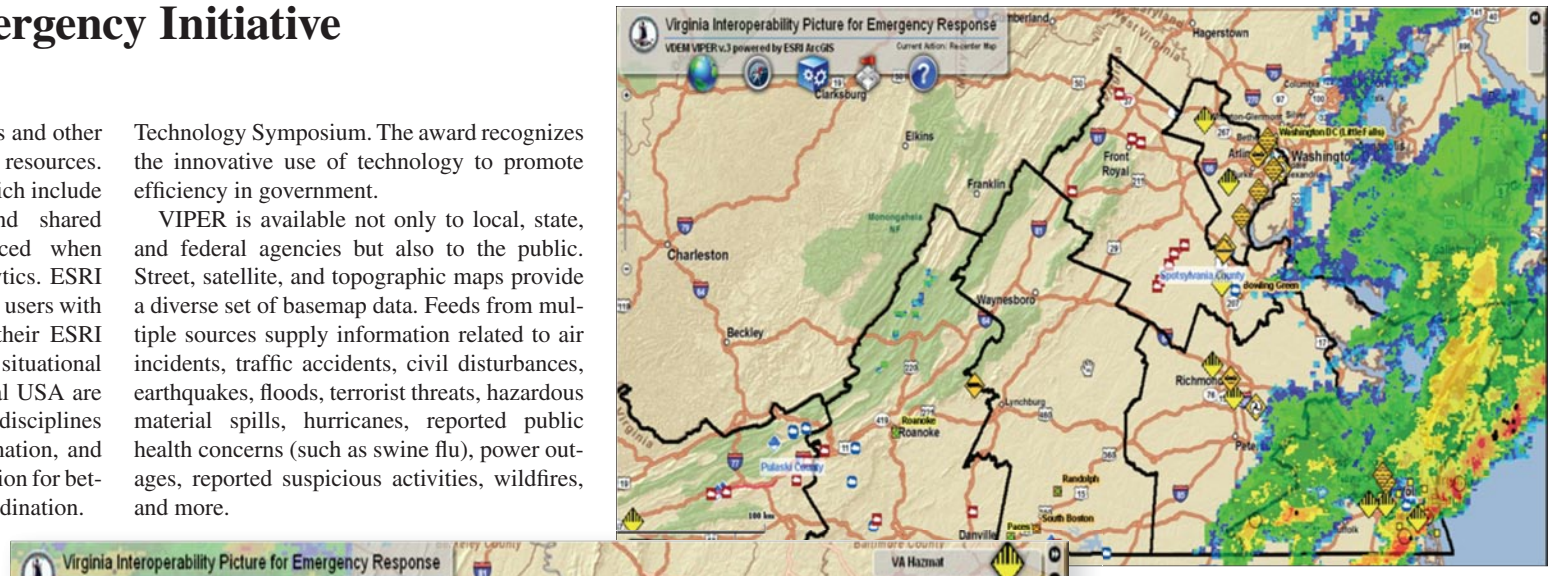
continued from cover

ESRI will work closely with users and other stakeholders to provide support and resources. The objectives of Virtual USA—which include data sharing, interoperability, and shared situational awareness—are enhanced when combined with GIS tools and analytics. ESRI will continue to develop and provide users with tools that are freely available for their ESRI platform, enabling comprehensive situational awareness. As the benefits of Virtual USA are realized, multiple jurisdictions and disciplines will interact, share real-time information, and create greater interagency collaboration for better preparedness, response, and coordination.

Virtual USA currently operates a pilot program in eight states: Alabama, Florida, Georgia, Louisiana, Mississippi, Tennessee, Texas, and Virginia. Additional states will join the pilot program.

The State of Virginia, through its Department of Emergency Management (VDEM), has embraced the Virtual USA initiative and achieved real results. VDEM launched the Virginia Interoperability Picture for Emergency Response (VIPER) using enterprise GIS software from ESRI. In addition to providing a Web-based common operating picture and analysis tools, VIPER integrates with numerous information systems and links with approximately 250 data feeds. Emergency managers; first responders; and police, fire, and government officials can tap into a single information resource for better decision making. VIPER recently earned the Virginia governor's IT as Efficiency Driver award during the Commonwealth of Virginia Innovative Technology Symposium. The award recognizes the innovative use of technology to promote efficiency in government.

VIPER is available not only to local, state, and federal agencies but also to the public. Street, satellite, and topographic maps provide a diverse set of basemap data. Feeds from multiple sources supply information related to air incidents, traffic accidents, civil disturbances, earthquakes, floods, terrorist threats, hazardous material spills, hurricanes, reported public health concerns (such as swine flu), power outages, reported suspicious activities, wildfires, and more.



Above: As situation reports come in, they are displayed by jurisdiction name to alert the watch center of the submittal. Left: Summer weather and the afternoon commute out of Washington, D.C. The red diamonds are indications of radar-detected severe hail.

"I have seen firsthand how VIPER has and continues to revolutionize information sharing throughout public safety and across all levels of government," says Charles L. Werner, Charlottesville, Virginia, fire chief and Virtual USA GIS Working Group chair. "Virtual USA has created a momentum that will enhance this capability exponentially and change the way we see, understand, and share data."

As more states participate in Virtual USA, the amount of data sharing, communication, and collaboration will improve all aspects of emergency management, including mitigation, planning, response, and recovery.

More Information

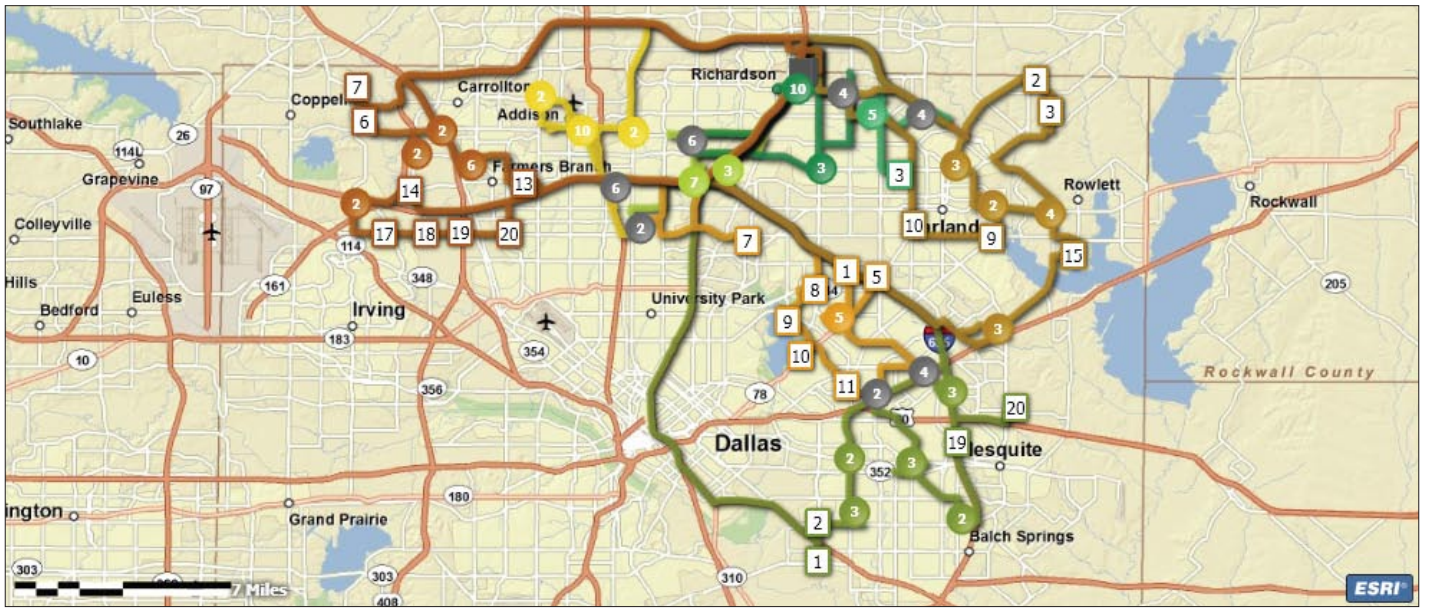
For more information, contact Russ Johnson, ESRI (e-mail: russ_johnson@esri.com). AN

Cloud Solution Brings Efficient Routing to Small Fleets

New ArcLogistics Helps Reduce Fuel Costs and Carbon Emissions

Highlights

- Create efficient routes and schedules that reduce fleet costs.
- Improve customer service and satisfaction.
- Access a no-cost 30-day trial.



ArcLogistics is workflow driven, taking a dispatcher or route planner through each step of the scheduling process.

ESRI's ArcLogistics, the GIS-based routing and scheduling solution known for helping organizations save 15 to 30 percent in fleet-related costs, is now available as a Software plus Service (S+S) solution that leverages ArcGIS Online.

Vehicle fleet operators and managers can download the software and subscribe to the service based on the number of vehicles they wish to route.

ArcLogistics helps organizations optimize routes and schedules based on their unique business operations, including vehicle capacities, specialties, truck restrictions, and customer time windows.

The software's vehicle number-based subscription model makes ArcLogistics both affordable and accessible for small- to midsized fleets.

The new S+S solution continues to build on the ArcLogistics desktop solution, developed in the late 1990s, whose users consistently reported significant operational cost savings. The original ArcLogistics is an effective operational tool for midsized to large fleets, as it was designed for non-GIS professionals to quickly create the best routes and schedules while taking into account their business rules and the accuracy of real and up-to-date street networks.

When routes and schedules are created with ArcLogistics, small jurisdictions, as well as small businesses, will see measurable cost savings, resulting from reduced vehicle use and employee overtime, in addition to improved customer service.

Like previous versions of ArcLogistics, the new S+S solution requires no GIS knowledge or skill. Its workflow-driven interface starts by importing or prompting the user to enter locations, vehicles, drivers/crews, and order information. Of course, behind the scenes, ArcLogistics is GIS based and can integrate easily with other ESRI products, making it a valuable operational tool, as well as a data collection point for larger, enterprise GIS efforts and analysis.

The solution goes well beyond finding the shortest path between a set of stops because it incorporates driver and vehicle costs, capacity, schedules, and street network attributes into a suggested route.

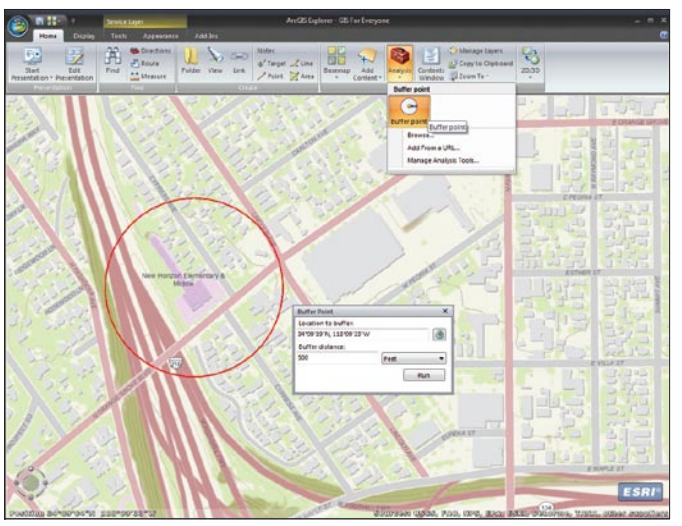
Organizations that implement ArcLogistics typically see reductions in fleet-related expenses including fuel, maintenance, capital investment, driver overtime, and time spent planning routes. Service to the customer is improved with enhanced on-time performance from accurate and optimal routes.

The current ArcLogistics release is for U.S. customers only, with international services coming soon.

More Information

Anyone who operates a small- or medium-sized fleet of vehicles and is interested in ArcLogistics can download the software and try it for 30 days at no cost. To get the trial, visit **www.esri.com/arclogistics**.

Easy Access to GIS with New Version of ArcGIS Explorer



The new ArcGIS Explorer includes an Analysis Gallery for direct access to geoprocessing services.

The new version of the freely available ArcGIS Explorer builds on its highly visual and intuitive capabilities to explore, share, and present geographic information better than ever.

The release features a new Analysis Gallery that allows direct connections to geoprocessing services. Like map services, just choose and use. Additionally, the Basemap Gallery has been updated to offer new ArcGIS Online imagery, as well as topographic and street maps. Finally, Bing Maps services (Aerial, Hybrid, and Road) are built right in ArcGIS Explorer. They are ready to use with no registration required.

Authors of custom maps and presentations will find it easier to create products that are more effective and interactive. Basemap and Symbol Gallery management has been improved to make it easier to manage and use custom basemaps and symbols.

The new release also offers support for enhanced layer package properties, improved feature labels, and the ability to fly along user-defined paths.

More Information

To find more information or download ArcGIS Explorer, visit **www.esri.com/arcgisexplorer**.

ArcGIS 10 Improves Productivity and Makes GIS Available Everywhere

ArcGIS 9.4 Has Been Renamed ArcGIS 10

Highlights

- ArcGIS 10 makes map creation and production much easier.
- This release lets users create, manage, and visualize time-aware data.
- Python scripting for automating common tasks and analyses is included in ArcGIS 10.

ArcGIS 10 will transform the way people use and apply GIS. This release will help users be more productive with their work and provide them with more powerful spatial analysis capabilities while significantly improving performance. Users will also be able to leverage GIS everywhere: via Web-extended desktops, Web-hosted applications, and cloud GIS.

Perform GIS Work Faster

ArcGIS 10 dramatically improves the user experience and integrates productivity tools to support the workflows of GIS professionals. This release makes map creation and production much easier and provides best practices templates to help users get started quickly. At ArcGIS 10, users can search by keywords or data types to find data and maps. They can also use the search function to quickly and easily find symbols to use in their maps and tools for analysis.

Editing in ArcGIS 10 is streamlined; this release introduces sketch-based desktop and Web editing, which means that users can choose from a customizable on-screen palette of features in desktop and Web clients. In addition to making users more efficient, this new editing experience allows the expansion of volunteered geographic information or user-generated content on the Web.

Faster performance at ArcGIS 10 is the result of averaging local graphics cards on desktops and improved cache generation and management, as well as optimized Web graphics. These caching and Web graphic improvements translate into more responsive drawing performance, including smooth, continuous panning of data.

Powerful Spatial Analysis

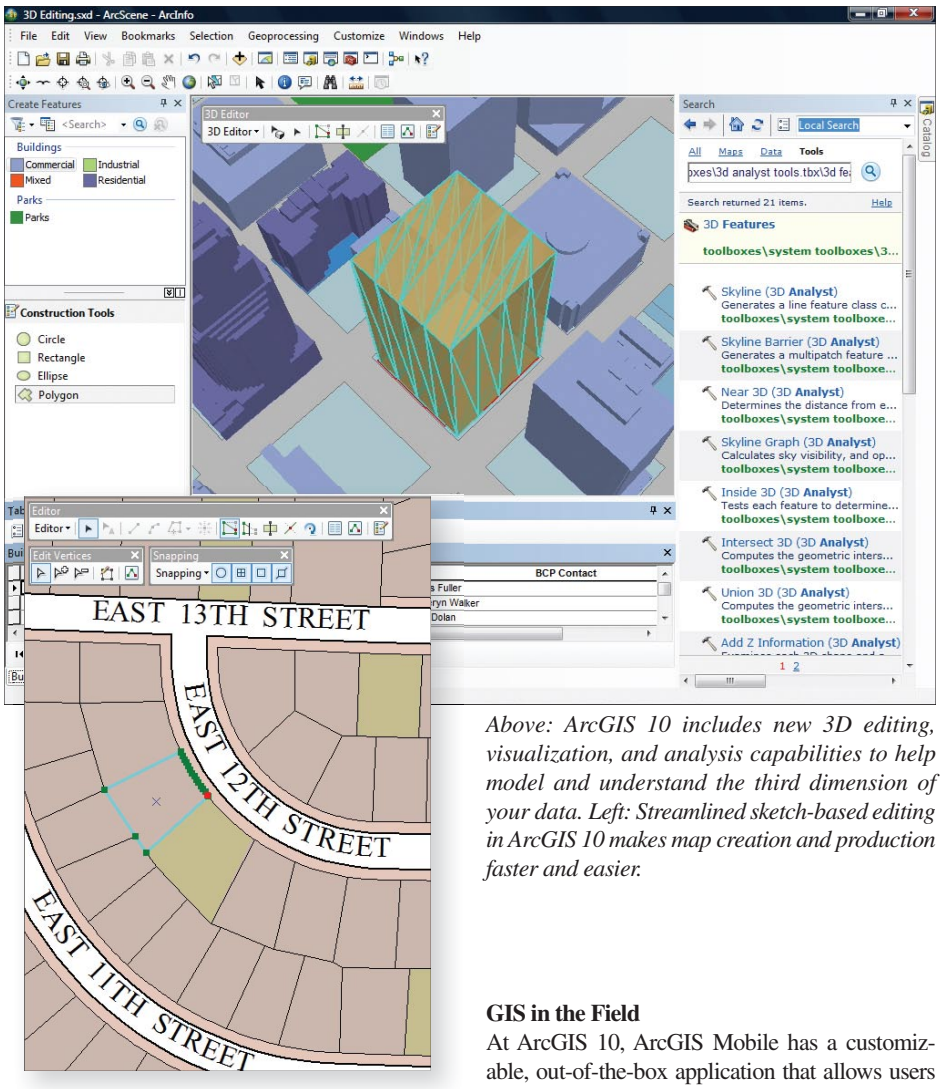
ArcGIS has always been the premier software for spatial analysis, and with this release, ESRI continues to advance geographic science with new tools. ArcGIS 10 includes Python scripting for automating common tasks and analyses. Using Python, the capabilities of ArcGIS can be combined with other scientific programming to create powerful solutions. Among the new analyses offered in ArcGIS 10 is location-allocation, which helps users understand how their facilities placements in a given network impact their ability to serve their customers.

The upcoming release also introduces the notion of time in both visualization and analysis. ArcGIS 10 lets users create, manage, and visualize time-aware data. Users can display and animate temporal datasets, as well as publish and query temporal map services. The ability to see data over time opens opportunities for more in-depth analysis.

With ArcGIS 10, it is much easier and faster to perform 3D visualization. In fact, at this release, ArcGIS becomes a full 3D GIS, offering 3D data models, editing, analysis, and visualization. As a result, users can do virtually everything they do in a 2D environment in a 3D environment.

Improved Imagery Use and Management

ArcGIS 10 enables better use and management of imagery on the desktop and also on the server. This release supports massive dynamic mosaics, resulting in fast performance. On-the-fly processing that was previously supported on ArcGIS Server is now also supported in ArcGIS Desktop.



Above: ArcGIS 10 includes new 3D editing, visualization, and analysis capabilities to help model and understand the third dimension of your data. Left: Streamlined sketch-based editing in ArcGIS 10 makes map creation and production faster and easier.

Moreover, the imagery management tools have been collected into one place to facilitate access to commonly used tools.

New Ways to Share

ArcGIS 10 offers tight integration with ArcGIS Online search and share capabilities and makes it easy to create and distribute projects that may include data, layers, maps, tools, scenes, globes, diagrams, and add-ins. It is also easy to discover and organize geographic data throughout the enterprise via the new Search service in ArcGIS Server.

GIS in the Field

At ArcGIS 10, ArcGIS Mobile has a customizable, out-of-the-box application that allows users to extend mobile projects to in-vehicle and tablet-based PCs. ESRI is extending this concept to the iPhone platform. Customers will be able to access a mapping application directly from the Apple iTunes App Store. ESRI is also providing a software development kit so organizations can build their own focused iPhone applications.

Availability and More Information

ArcGIS 10 is expected to ship during the second quarter of 2010. Find the latest information on ArcGIS 10, including podcasts and videos, at **www.esri.com/whatscoming**.

Improvements in ArcGIS Online Make Maps and Apps Sharing Easy

Ready-to-Use Basemaps and New Map and Application Galleries Allow Users to Easily Share GIS Work

Highlights

- Premium imagery is now available as a no-cost service.
- Updated map services provide more details.
- Improved sharing tools make it easier to discover useful geographic content.

ArcGIS Online has been built to enable ArcGIS users and developers to easily access tools and content that allow them to quickly build Web mapping applications that can be accessed by other users, including the broad public. It also supports collaboration among GIS users who need to find useful and authoritative content that makes their GIS work easier and facilitates the sharing of information with others who have a common interest.

New ArcGIS Basemaps

ArcGIS Online imagery, street, and topographic map services have been enhanced with the latest data, and coverage has been expanded to ensure that users have access to the most efficient and consistent data they need for their critical projects. These three map services are designed to deliver cartographic basemaps that can be quickly integrated with a user's local data or services to provide context for operational GIS overlays.

ESRI's imagery offerings have been combined into one new service—World Imagery. All previously available imagery offerings—World IKONOS Cities Imagery, World Imagery, and USA Prime Imagery—have been merged and blended with new, high-resolution imagery for the United Kingdom and other countries to create this new offering. The best data from each service was used to provide the optimal vintage, resolution, and coverage.

Enhancements have also been made to the World Street Map. These include feature enhancements to cartography at all scale levels and updates to the latest Tele Atlas street data and AND global road data at large scales. This visually rich and attractive basemap now also includes building footprints where available. In addition, the World Street Map has been expanded to include large-scale coverage for Colombia, Hong Kong, Japan, South Africa, and Thailand.

The World Topographic Map now includes more detailed global data and additional detailed maps for various U.S. cities. The map, a compilation of public domain, user-contributed, and commercial datasets, now provides coverage for the world using data from DeLorme, the U.S. Geological Survey, and other sources. The coverage for this basemap is worldwide down to approximately 1:150,000 meters; for the United States, down to approximately 1:20,000 meters; and for select U.S. cities, such as Portland, Oregon, and Philadelphia, Pennsylvania, down to approximately 1:1,000 meters. Detailed maps for Pasadena and Redlands, California, were recently added. Like the World Street Map, the World Topographic Map now includes building footprints where available.

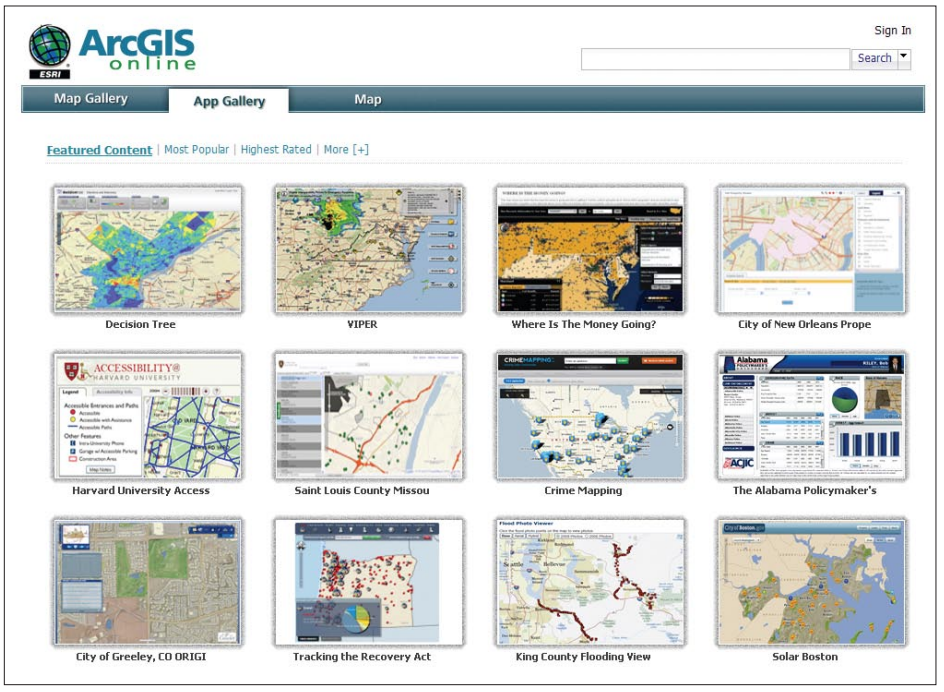
All ArcGIS Online map services have been migrated to the Web Mercator auxiliary sphere projection (WKID 102100): 256 x 256 pixel tiles with refined scales. This is the same tiling scheme used by Bing Maps and Google Maps, allowing users to more easily create mashups with other popular Web maps. All ESRI maps are now in this same projection, simplifying caching decisions for users.

This migration is in response to feedback from many ArcGIS users who requested that ESRI use a common map tiling scheme matching other popular online map providers. Users who have been accessing the map services in the previous tiling scheme will continue to be able to do so for a few more months. However, the content for these services will no longer be updated.

Share Maps and Apps Through ArcGIS Online

In ArcGIS Online, users can publish and share maps that they have created and have them featured alongside maps created and published by ESRI. These maps can then be used by others to create mashups that include various operational layers or thematic maps overlaid on basemaps. Some examples of user-generated maps that provide useful information include maps displaying current precipitation, wind potential, parcel boundaries, or recent events such as fires or earthquakes.

ArcGIS Online's built-in Web map application has been expanded to easily leverage these featured maps and other maps that users have published and shared. With one click, users can open any public map in ArcGIS Online inside the Web map application and add layers to create mashups. Through the improved search function, users can add any content that is publicly available in ArcGIS Online, as well as content from the broad Web or other GIS servers. Once the Web map has been created, it can be saved and shared with others who then may use it to add their own layers and, in turn, save it and share it again.



Users can add comments and rate featured Web mapping applications built by other ArcGIS users and developers.

ArcGIS Online also features Web mapping applications that include both maps and tools. These mapping applications provide a specific workflow or allow interaction, such as drawing or selecting items on the map, and have been built by the user community or ESRI using one of the ArcGIS Web Mapping APIs—Flex, JavaScript, or Silverlight/WPF. Examples include mapping applications from local governments to search for property information or public service facilities, track recovery spending by state, enhance emergency response mitigation and response services, and find suitable retail properties or locations to attract new businesses. All content in ArcGIS Online can be found through a simple keyword search that draws from the tags that users add to their items.

Users can share their maps and Web mapping applications publicly with the broad ArcGIS Online community or within specific groups. Groups allow users to collaborate privately on various projects and share content that is of common interest.

Users will have the opportunity to rate the content on ArcGIS Online and contribute comments. These peer-based ratings and comments can help improve the maps and Web mapping applications. Rating helps users who browse for maps quickly determine useful and high-quality maps, while comments can include feedback regarding how to enhance the usability of a Web mapping application. All this can benefit not only the online community of ArcGIS users but also the general public that in many cases consumes and interacts with these maps.

More Information

Join the ArcGIS Online community today and discover and share geographic content at **www.arcgisonline.com**.

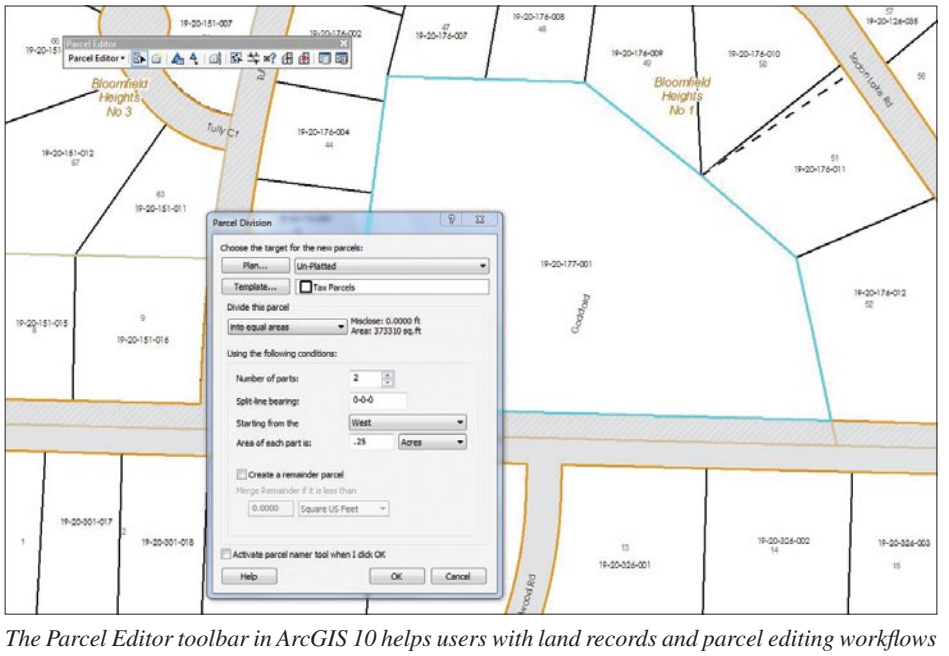
New Parcel Editor Toolbar Featured in ArcGIS 10

Free Toolbar for Land Records and Parcel Editing Workflows

The Cadastral Editor workflow tool that was introduced in the 9.3 release of the ArcGIS Survey Analyst extension has been improved to accommodate a wide variety of land records and parcel editing workflows. Available as a free toolbar in ArcGIS Desktop 10 (ArcInfo and ArcEditor), Parcel Editor replaces the ArcGIS Survey Analyst extension yet includes all the extension's Cadastral Editor functionality with new tools, an updated data model, and an improved user experience.

The Parcel Editor toolbar allows parcel managers, such as surveyors, tax assessors, and rights-of-way managers, to edit and maintain parcels from ArcGIS Desktop software's ArcMap application user interface. Using Parcel Editor, parcels may be created and edited by anyone with ArcEditor and ArcInfo licenses.

Parcel Editor is ESRI's most efficient technology for editing and maintaining parcel features. The tool provides industry-specific functions, such as split by area, parcel merge, and parcel traverse. In addition to editing performance, users may optionally benefit from the unique ability of Parcel Editor to support positional accuracy management of an entire GIS through the least-squares calculation of corner positions.



The Parcel Editor toolbar in ArcGIS 10 helps users with land records and parcel editing workflows to easily edit and maintain parcel features from an ArcMap interface.

More Information

For a preview of the new Parcel Editor toolbar before its final release, register to become part of the ESRI ArcGIS 10 beta program at **beta.esri.com**.

Taking Efficiency to the Next Level at City College of San Francisco

ArcGIS Server Based Central Repository and Accessibility for Facilities Management

Above: City College of San Francisco is spread across 300 facilities on 11 campuses. Left: CCSF's campus crime application locates incidents using a grid across the grounds and can be queried by campus, crime type, and date.

Highlights

- The ArcGIS Server built-in AJAX capability makes it easy to manage and deploy.
- Web applications were created on top of GIS for building cross-browser and cross-platform Internet applications.
- With its ESRI campuswide site license, CCSF employed existing GIS-knowledgeable staff.

Attended by more than 100,000 students each year, City College of San Francisco (CCSF) maintains and uses 300 facilities spread across 11 campuses in the City of San Francisco, California. People of diverse backgrounds, ages, and occupations have attended the college since its founding in 1935. CCSF is one of the largest community colleges in the country, and the college confers the most associate degrees in arts and sciences in the state of California.

College facilities are managed by two departments: Facilities Planning and Buildings & Grounds. Traditionally, these departments relied on senior engineers and personnel to maintain facility information, which was shared through paper plots or word of mouth. Some existing paper floor plan plots were digitized a decade ago for general reference, but records of maintenance and upkeep of buildings remained firmly entrenched in paper-based methods.

Although recent construction of several facilities introduced the use of computer-aided drawings, both departments lacked a system to easily manage and disseminate the data. This resulted in challenges when gathering information; time was lost searching for data and determining if it was up-to-date. The ability to decipher how many and where assets existed was difficult. The attrition of personnel was also a concern as valuable institutional knowledge was lost when staff members retired. Newly hired staff required a lot of time to learn about the facilities.

Seeking a System for Data Sharing

CCSF needed a centralized and flexible system to help organize and deliver facility information. Part of the system needed to assist the college with correctly identifying the current level of physical accessibility in all classrooms and buildings according to the Americans with Disabilities Act (ADA). This required the collaboration of several additional departments across the campus to deliver all the information on a publicly available online Web service.

After reviewing many software packages for functionality and ease of programming, CCSF chose ArcGIS Server. Says Mono Simeone, project manager, CCSF GIS Mapping Collaborative, "The software's scalability, performance and stability, enterprise capability, and built-in AJAX capability make it easy to manage and deploy."

CCSF facility management staff contracted with i-TEN Associates, Inc., an ESRI Business Partner located in Berkeley, California, which had previously digitized CCSF's facility data and made it accessible on an internal Web site.

Several departments, including Facilities Planning, Buildings & Grounds, the Campus Police, and Information Technology Services, and the American Disabilities Act and Health and Safety committees worked together to create the system. Now GIS server technology stores, manages, and displays facility and grounds data in a central repository for everyone to use.

From Paper to Empowerment

First, the team applied a data model to interior spaces or floor plans. ArcGIS Server, using an Oracle relational database management system (RDBMS), stores, edits, and displays the descriptive and spatial data accessible through a simple interface for both secure and public Web sites. Next, the team created Web applications with ArcGIS API for Microsoft Silverlight, an API for building cross-browser and cross-platform rich Internet applications on top of the GIS. The Web applications serve data for use throughout the college. "The creation of the applications was very straightforward," notes Simeone.

The first application provides access to ADA information at all campuses in the district. It displays features necessary for persons with mobility issues to navigate the campuses. These features include path of travel, parking for the disabled, accessible entrances, and elevators. The application offers several queries to find buildings, rooms, student services, and staff on campus. The result is a map with helpful features for navigation and a report on the room with a picture. The next iteration of the application will implement a routing service using ArcGIS, which provides point-to-point and optimized routing.

This successful application led to more meetings with campus staff from Facilities Planning and Buildings & Grounds. There was a lot of interest in viewing utilities campuswide, including identifying individual features. An application was developed allowing staff members to use a secure intranet site to display all underground and some surface utilities. "This was the first time we have been able to view all the utility assets at one time," says Simeone.

CCSF also has a campus crime application that allows incidents to be queried by campus, crime type, and date. Incidents within buildings are easily located using a unique space identifier from the GIS. However, incident locations occurring outside buildings are captured using a grid, or mesh, that covers the entire campus. Future plans include the development of a Web-based map service tool to capture x,y coordinate locations of incidents.

GIS Exceeds Expectations

Since the college maintains an ESRI campuswide site license, CCSF was able to add new GIS seats and employ existing GIS-knowledgeable staff. Both of these factors made the application implementation easy and economical.

The system now allows data to be centrally stored for more efficient management and sharing. Staff and administrators are able to view and query the facility data at any time from all over the CCSF campus. Departments can tailor a map service to meet their needs, and data can be updated and served to staff or the public in a timely manner.

This implementation of GIS for facility management has exceeded the goals created by the college. CCSF hopes to introduce GIS and facilities management as even bigger parts of how the college operates, manages its assets, and serves the community in the future.

More Information

For more information, contact Mono Simeone, project manager, CCSF GIS Mapping Collaborative (tel.: 415-239-3988, e-mail: csimeone@ccsf.edu), or Shreepad Ranadive, director, Application Development, i-TEN Associates, Inc. (tel.: 415-516-8633, e-mail: shreepad.ranadive@i10assoc.com).

A Bright Future at Puget Sound Energy

Washington State's Oldest Local Energy Utility Fine-Tunes Marketing Programs with GIS

Highlights

- ArcGIS is refining PSE's understanding of its customers and potential efficiency gains.
- Throughout PSE, groups are using GIS to make their processes more collaborative and efficient.
- GIS allows each business group to improve management and internal control.

Washington has always been forward thinking. When the state passed some of the most progressive renewable energy legislation in the United States in 2005—Bills 5101 and 5111—it was par for the course. The bill passing was prompted by a severe energy crisis in 2001, when the Columbia River experienced its lowest water levels in 60 years. The state decided it was time to diversify and become a leader in energy efficiency. The Energy Freedom Program was set up in 2006, committing $25 million in low interest loans and grants to provide the capital necessary to support production of green energy.

Washington State's oldest local energy utility, Puget Sound Energy (PSE), adapted quickly with a program that rewards customers with qualifying renewable energy systems. PSE continues to push the envelope for innovative ways of thinking about renewable energy and conservation programs. The utility is recognized by the American Wind Energy Association as the second-largest utility owner of wind energy facilities in the United States and owns two commercial production wind power plants. PSE recently garnered national recognition for a variety of energy efficiency achievements, including the prestigious platinum-level Energy and Water Management Award from the Secretary of the Navy and the 2009 ENERGY STAR Award from the U.S. Environmental Protection Agency for its efforts in energy conservation.

PSE has been supplying energy to customers for more than 100 years and today serves more than 1 million electric and approximately 750,000 natural gas customers around the Puget Sound region. To meet the electrical energy needs of its customers over the next 20 years, PSE implemented a 2009 integrated resource plan that directs the utility to add 1,100 megawatts (MW) of renewable wind generation and 1,064 MW of efficient energy to its existing generation portfolio of hydroelectric, wind, gas, and coal power plants. As energy efficiency becomes a leading resource addition, the utility has to become more innovative in targeting customers with energy savings potential and increasing their engagement with its energy efficiency programs. GIS technology is playing an increasing role in refining PSE's understanding of its customers and their potential efficiency gains.

A Lightbulb Moment

One of the easiest and most inexpensive ways for people to save energy is to replace incandescent lightbulbs with compact fluorescent light (CFL) bulbs. ENERGY STAR-qualified CFL bulbs use up to 75 percent less energy than conventional incandescent bulbs and can last about 10 times as long. To give customers incentive to trade in old incandescent bulbs and try new CFL bulbs, PSE created a Rock the Bulb program and a targeted marketing campaign to drive customers to events in their service areas.

After evaluating its options, the Energy Efficiency Services (EES) Group selected ArcGIS to assist in refining this energy efficiency marketing program. Using GIS, EES looked at hardware stores and the "big-box" home improvement stores and their proximity to customers. Creating a radius, EES selected customer and census-level household information to see if the stores were near service areas that housed a select number of customers who would be interested in turning in old lightbulbs for new ones. Using this data in planning and budgeting, the EES Group was able to estimate the number of participants that would attend energy efficiency events and from which ZIP Codes within the radius residents would respond to a variety of marketing and social marketing applications.

"In addition to making use of externally derived datasets," says Bill Hopkins, manager for strategic planning, PSE, "GIS enables PSE's EES Group to gain additional value from its existing data by bringing together separate datasets, creating new capabilities to guide marketing and program efforts."

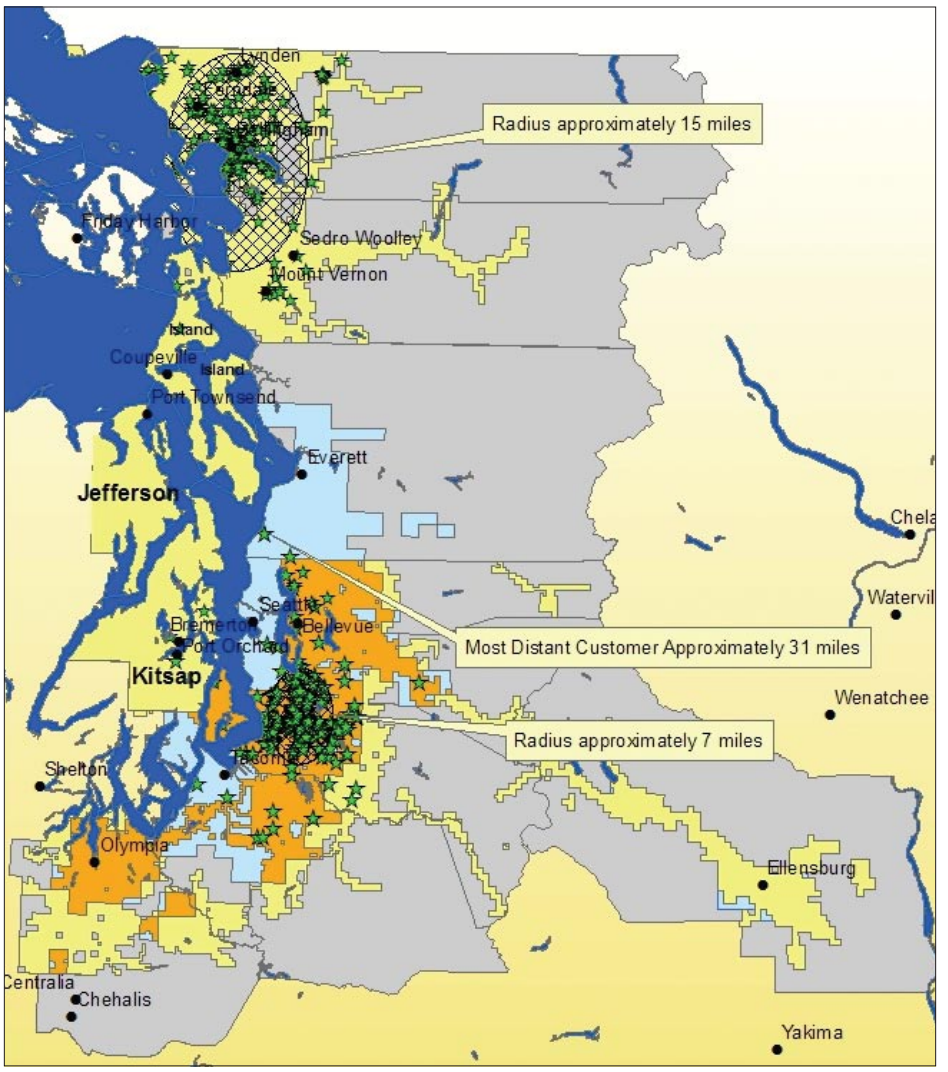
From the success of this program, GIS is being used to assist in refining other related marketing programs. By looking at customers in ArcGIS, EES can find out what type of housing customers reside in and determine which areas have a larger number of homeowners as opposed to high concentrations of renters. Because homeowners typically have more interest in incentive programs for switching out energy-hogging equipment, such as water heaters and furnaces, marketing to homeowners is more effective.

GIS also helps EES staff look at the demographic profile of different areas. Understanding who lives in each area helps fine-tune marketing messages by understanding how "green" an area may be as well as finding out whether there might be language barriers. Some locations may require that marketing materials be printed in more than one language to reach the appropriate people.

Moving to More Efficient Fuels

The Natural Gas Development Group saw the usefulness of GIS and used the technology as well. The group was interested in contacting households about converting from oil heat to natural gas. To target messaging to the appropriate people, household information was mined according to geographic area. From the information, the group created labels and maps for a campaign to contact households about conversion from oil heating to natural gas. This data-mining effort involved filtering all households in specific geographic areas and eliminating existing PSE gas customers. That filtered list was further reduced using data elements like type of heating fuel and proximity to gas mains. In the end, the group sent letters to households having a higher likelihood of becoming new PSE gas customers.

"GIS provides value to PSE by integrating customer and operations data with external data, such as assessor's household information, and creating tools like mainline lists and maps displaying where future customers live," says Liz Norton, manager, natural gas planning and development, Natural Gas Development Group. The group is currently exploring the integration of systems planning data to further identify loads on the system and areas in which to concentrate future growth.



This map shows plots of customers from two lighting big-box store events that occurred in fall 2008. The two contrasting distributions helped gauge radii of demographic factors for the Rock the Bulb analysis.

"GIS is much more than maps to us, because it provides a collaborative decision support tool for visualizing company data," adds Norton. "GIS has helped different groups and departments within PSE analyze many different datasets that traditional means cannot equal. GIS is a complementary tool that helps visualize data, improving decision making at all levels."

Groups throughout PSE are improving how GIS is being used. Efforts have helped close the gap between what can be done right now and what can be done in the future. Those collaborative efforts are happening now and will continue moving forward.

Next Steps

PSE has come a long way from its first use of GIS, producing maps to communicate projects internally and at community outreach program meetings. PSE hopes to continue realizing more widespread benefits of the technology. GIS allows each business group to improve management and internal control of information and have a means of analyzing and allocating their own resources.

For example, GIS is useful for energy conservation and efficiency programs by finding how surplus power in one geographic area can provide additional power elsewhere, in essence creating an additional energy supply. Hopkins explains, "GIS can help identify opportunities where combined electric and gas networks exist to reduce load on electric networks by moving customers to natural gas for heating when it's available in their area and there is enough capacity. This helps reduce electrical demand and can avoid costly upgrades to circuits."

More Information

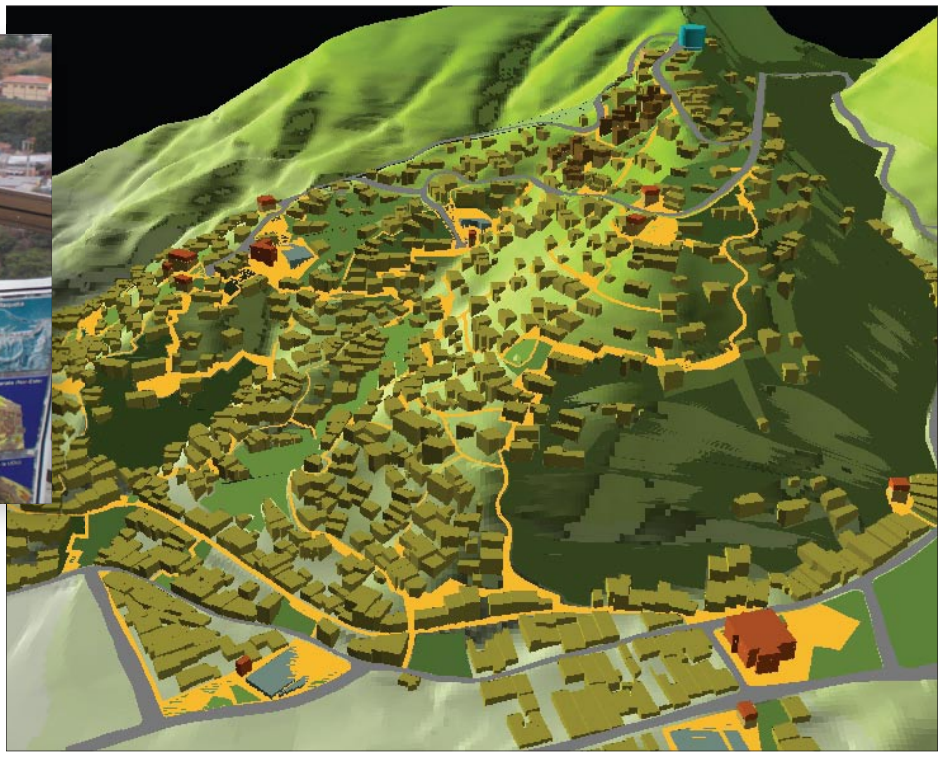
For more information, contact Michael Wehling, program coordinator, PSE (e-mail: michael.wehling@pse.com).

Rosario C. Giusti de Pérez Brings Urban Planning to the Slums of Venezuela

The United Nations Center for Human Settlements reports that more than one billion people in the world live in slums and squatter settlements without adequate shelter and basic services. Worldwide, slums are considered to be residential areas in urban geographic areas that are inhabited by the poor. Because of these characteristics, urban planners can use GIS to manage geographic data about slum areas to show relationships, elevations, landmarks, slope, water sources, and other attributes that affect these urban populations.

Rosario C. Giusti de Pérez, architect and urban designer, exemplifies the importance of combining the human element of concern with the capabilities of technology to turn the tide of despair to one of hope and benefit for the community. Because of her many years of commitment to helping improve the quality of life in the slums (barrios) of Venezuela, ESRI recognizes Rosario C. Giusti de Pérez as a GIS hero.

Rosario C. Giusti de Pérez.



Barrio Los Claveles, Maiquetia, Venezuela, seen in ArcGIS 3D Analyst.

Despite the fact that Venezuela is an oil rich nation, approximately 50 percent of its people live in poverty. Those in urban areas have constructed shantytowns with homes made of plywood, corrugated metal, and sheets of plastic. Giusti de Pérez does not see these neighborhoods as targets for the bulldozer but rather as communities whose residents need to be involved in planning and redevelopment.

Many cities do not consider these squatter lands as communities and consider demolition to be a solution to urban blight. But this ruthless approach of displacement creates disorder, increases crime, and adds to the misery of poverty. A slum is more than corrugated tin and plastic; it is human faces, neighborhoods of people with social structures that protect and support their communities. Giusti de Pérez has spent the last 10 years working with people and using GIS as a means to understand how urban squatter developments are organized, which in turn offers the foundation for devising improvement efforts.

"When visualizing squatter developments as cities within cities, GIS helps us see the internal connections that constitute the barrio's underlying order, which is fully perceived by the residents of the area," notes Giusti de Pérez. "To fully understand social networks within a community, planners need to obtain information directly from the community. Inhabitants have knowledge about who belongs to each social group and how social groups connect. This is valuable data with a geographic element."

Giusti de Pérez advocates an approach that recognizes the slum inhabitants as being deeply rooted in their communities. As people who have a sense of belonging, they are territorial and fear relocation plans. People want to remain where they have their social relations. Giusti de Pérez, who holds a master's degree in urban design, initiated an approach to developing urban planning models that includes input from residents so that squatter settlements can become an asset to the city. "We need to collect information that is significant to residents," says Giusti de Pérez.

With this thought in mind, Giusti de Pérez developed a framework for sustainable improvement planning with the ultimate goal of advancing the residents' quality of life. The objective of this planning approach is to introduce what she calls "friendly interventions" into the as-built environment. In this model, residents agree on behavioral and building rules, such as sharing waste disposal to maintain clean open space and limiting building height so as not to impede natural light. These are simple resolutions. Of course, squatter communities have much more complex issues, such as unstable slopes, inadequate utilities, and insufficient schools. GIS allows planners and residents to visualize the answers to the questions they are asking: What would happen if we put a concrete fascia on the slope? How can we run sewers into this area? Where is the best location for an elementary school?

Proposed infrastructure systems for barrio Petare.

Giusti de Pérez uses GIS to create what-if scenarios and generate maps that show what a concept would look like, whom it would affect, and how it would help. These images go a long way in providing information that engenders community participation in planning.

The maps that Giusti de Pérez and Ramón A. Pérez, a GIS professional, were creating in the 1980s using ESRI's ARC/INFO began to be noticed. These GIS maps were instrumental in winning several national competitions against other urban planners who used CAD. Soon, several Venezuelan government institutions recognized that GIS is a clever tool.

"Barrio analysis is very complex," explains Giusti de Pérez. "GIS can take this mess of barrio data and organize it into something that makes sense. We would select a barrio, meet with its community leader, and explain that we wanted to help. The community leader would then invite other people from the community to a meeting, sometimes at a school or sometimes just on a slab made of some odd building materials. Together, we would identify what they needed and prioritize their concerns."

GIS was key to a three-year project in the barrio of Petare in Caracas to visualize and assess the area's urban built conditions and social networks. It proved essential to creating a sustainable planning strategy and for designing a development that fit both building and social needs within the conditions dictated by the geography of the site. With an ultimate goal of improving the quality of life, the urban planners worked with residents and identified 93 sectors within 82 hectares. Data included vehicular and pedestrian pathways, sector boundaries, social spaces, and built places. The group determined areas that were at risk for landslides and focused on building control policies for these areas.

Community concerns varied. In the Petare barrio, the community's main concern was accessibility to urban facilities and infrastructure. Residents wanted better drainage and solid-waste disposal. Priorities that were included on another barrio community's list were drainage, open space for children, and lighting. Each project was unique.

"Sometimes we can do a little and sometimes more," explains Giusti de Pérez. "We make our presentations using GIS, and people are glad to see what their community looks like. We use the ArcGIS 3D Analyst extension to create visualizations that show residents what their community could look like if they implemented changes. Based on community input and planners' assessments, we created site analyses that helped communities successfully request government program funding."

In 2008, Giusti de Pérez coauthored the book *Analyzing Urban Poverty: GIS for the Developing World,* published by ESRI Press. In it, she and Ramón A. Pérez offer a step-by-step approach to working with squatter communities and improving their neighborhoods. The authors provide several rules for using GIS to support sustainable communities. One rule is to create procedures for involving communities in collecting the information required for identifying their problems and opportunities. This will help planners with the problem of lack of data. Another rule is to identify the social relations and interactions of the populations with the open spaces in the community. This is more important than merely describing land use. Finally, the authors advise using ArcGIS Spatial Analyst ModelBuilder in hilly squatter developments to understand the rules of urban and social functioning and identify steep slopes, drainage patterns, and accessibility from the neighborhood to the city.

Giusti de Pérez is hoping to expand the use of GIS models for urban redevelopment and promoting its capabilities to identify real, sustainable solutions for improving the quality of life for millions. She is truly a GIS hero.

More Information

For more information, contact Rosario C. Giusti de Pérez (e-mail: rosario@esriven.com). Ramón A. Pérez is the founder and president of ESRI's Venezuelan distributor, Grupo ESRI de Venezuela, C.A.

Mapping Urban Inequalities with GIS

By Linda Loubert, Economics Department, Morgan State University, Baltimore, Maryland

Highlights

- ArcGIS is used to geocode 911 calls and crime data to socioeconomic and demographic data to determine a focus/study area.
- ESRI Business Analyst mapped all businesses around a proposed emergency shelter site.
- GIS is important to homelessness prevention.

Mapping urban areas can help cities target policies that are most efficient and effective for their communities, particularly for those who are less fortunate. However, finding a solution to a problem such as homelessness entails understanding the associated issues. GIS has become fundamental to that process.

Homelessness prevention, of course, should be the first priority. But when that has not taken place, it becomes necessary to have a structure ready to supply fundamental care and services. Finding a location for shelters gets to be a tricky situation for local governments because businesses find it undesirable to have homeless people close by and, therefore, resist their accommodation, hoping shelters will not be near their businesses or, as the slogan goes, Not in My Back Yard (NIMBY).

Social scientists at Morgan State University, Baltimore, Maryland, studied the impact of locating a permanent homeless shelter for the City of Baltimore with the intent of uncovering all perspectives of building a new structure. Their findings could be applicable to any city. Beginning with some statistics on homeless people, the study found a clear indication of the critical need for some type of permanent structure because

- More than 800,000 people may be homeless on any given day; 200,000 of them may be children (Burt, M. R., 2001. *What Will It Take to End Homelessness?* Washington, D.C.: The Urban Institute).
- During a typical year, 900,000 to 1.4 million children are homeless.
- Ten percent of all poor people may be homeless, even if only for a short while.
- Seventy-five percent of homeless individuals access services in central cities (*The Annual Homeless Assessment Report to Congress,* 2007).

When more than 50 percent of their income has to go for housing, this tends to push low-income people into homelessness even faster. Also contributing to the problem is that U.S. health care policies have removed institutional support for people with severe mental illness, along with a drastic reduction in long-term hospitalization for the mentally ill; this has pushed these individuals out into the streets.

The "visible" homeless people are generally overrepresented in central cities of large urban areas. In Baltimore, as in other cities, homelessness is a serious social and public health problem, so the city believed building a new emergency shelter for more than 200 people would help alleviate some of the problems for homeless individuals. Building the shelter, called the Housing Resource Center, is a strategy to address the City of Baltimore's 10-year plan to end homelessness. This project reflects various aspects of best practices to the extent that it integrates a 24/7 emergency shelter with an array of supportive services (health, counseling, and employment).

The study involved key stakeholders to understand the impact of this shelter as it related to homeless people, businesses, service providers, and neighborhoods located less than one mile from the proposed site. The study also included the developers of buildings for homeless people who could contribute design ideas that would incorporate safety measures for the shelter residents and the residents of the surrounding community, as well as appropriate architectural designs for the area.

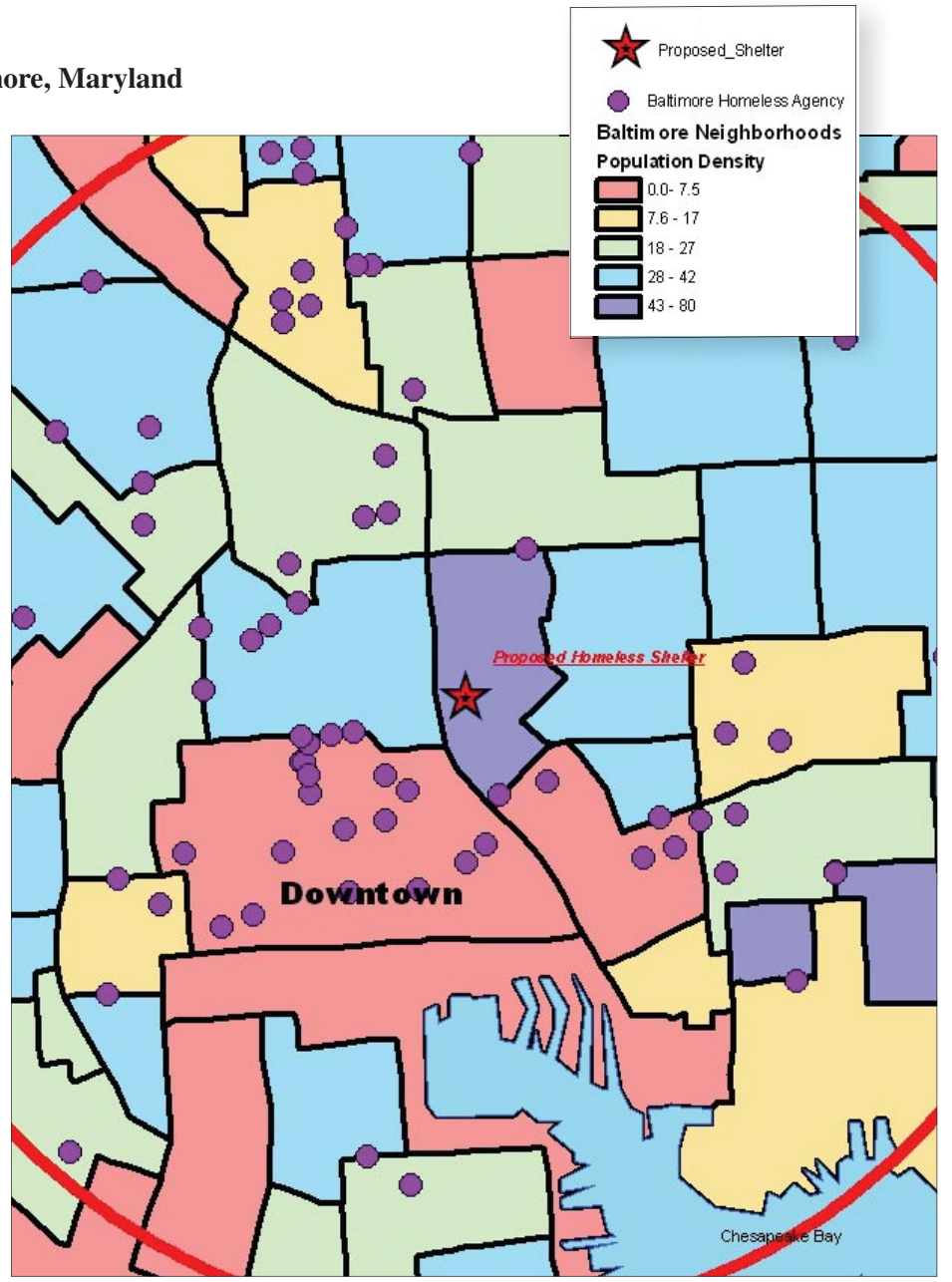
ArcGIS was used by the Institute for Urban Research at Morgan State through an ESRI university site license. Using its overlays and tools, the institute's researchers incorporated ArcGIS in this study beginning with community mapping; they collected information from the city, local businesses, and neighbors of the proposed site. They captured mobility patterns of homeless individuals using GPS. ArcGIS provided the tools to geocode 911 calls and crime data to U.S. census block groups, and socioeconomic and demographic data from the U.S. census was added to paint a picture of the focused area for analysis. The researchers took population density into account for defined neighborhood boundaries and the location of current service providers within a 1.5-mile radius (showing at least 60 percent of the providers of services to the homeless).

It should be noted that the City of Baltimore has only used temporary emergency shelters, scattered throughout the city, not a permanent one. Even though the neighborhood is densely populated, the study showed that the proposed location of the site would be in an unpopulated area of the neighborhood, under the viaduct of an interstate highway.

With ESRI Business Analyst, all businesses around the proposed site were identified. Businesses in the neighborhoods surrounding the proposed emergency shelter represent 13 percent of all businesses in the city. The area consists of the downtown district.

From this kind of study, the question naturally arises: Will the shelter bring more crime and/or disturbances? To answer this question, researchers geocoded emergency medical services (EMS) calls and other crime data to U.S. census block groups for 2004 and 2008. Since a private sponsor opened a multipurpose soup kitchen in 2007, within 1,000 feet of the proposed facility, the homeless traffic was assumed to have increased during that time; this gave good reason to use years 2004 and 2008 for analysis of crime and EMS data. Based on standard deviations, the results indicate that the proposed site would not increase crime with an influx of more homeless people.

The study concluded that businesses and neighboring communities possessed a rather negative view of having a permanent shelter in their area. Homeless people were seen as loiterers and panhandlers who sleep in public spaces and relieve themselves on private property and who should not be concentrated in one area of the city. Service providers and developers perceived homelessness as a societal health illness, with the need for compassion and effective policy to relieve the symptoms. The homeless individuals who spoke during the focus group study indicated that their desire for help was only for private residency, not group residency, as the proposed structure would provide.



This shows the population density for defined neighborhood boundaries and locations of current service providers within a 1.5-mile radius. Within this radius are at least 60 percent of the providers of services to the homeless.

Using ArcGIS Desktop and ESRI Business Analyst, the study concluded that the site would be in a sparsely populated area of a few blocks within a densely populated neighborhood that included some businesses. The crime and EMS data showed that no increase in crime would occur because of the site when standard deviations were examined.

Using GIS along with qualitative analysis, such as the focus group of stakeholders, cities can better understand the needs of the homeless population.

About the Author

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More Information

For more information, contact Linda Loubert, Ph.D., assistant professor, Economics Department (e-mail: linda.loubert@morgan.edu), or visit the Institute for Urban Research at **iur.morgan.edu.** Other key personnel for this study from Morgan State University were Mary Anne Akers, Ph.D., School of Architecture and Planning; Jonathan VanGeest, Ph.D., School of Community Health & Policy; Sidney Wong, Ph.D., School of Architecture and Planning; Azza Kamal, Ph.D., School of Architecture and Planning; and Marvin Perry, Office of Sponsored Programs.

The UN's Global Urban Observatory

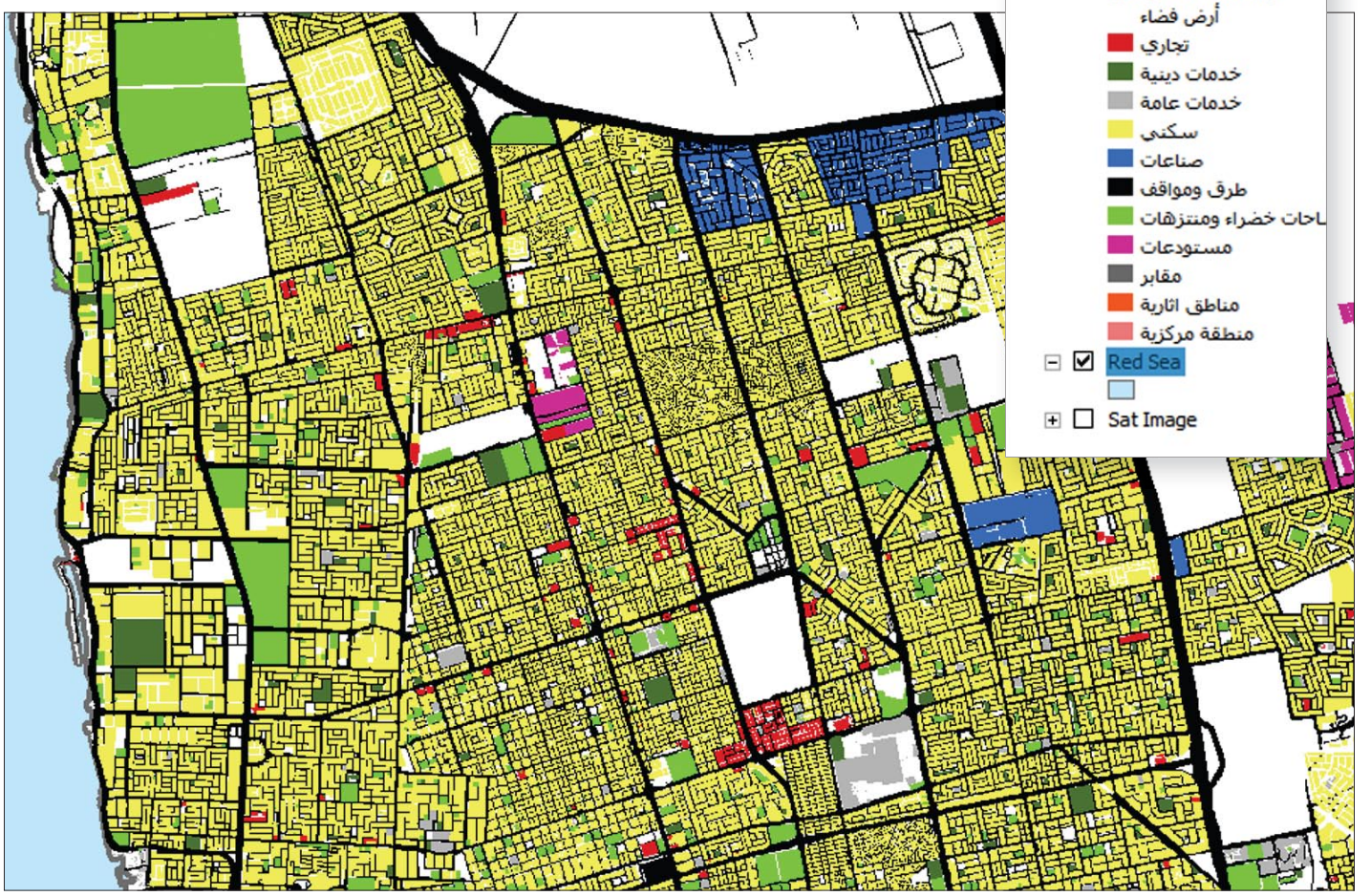
GIS Promotes Socially and Environmentally Sustainable Habitats

Highlights

- Observatory monitors urban indicators.
- Policy makers use GIS to meet sustainable city objectives.
- UN-HABITAT adds urban observatory to Good Practice list.

In the last half century, the human population has grown at a phenomenal rate, leaving many of the world's cities bursting at the seams and often without the resources to care for their residents. From 1950 to the close of the century, earth's human population doubled. The United Nations (UN) estimates that one-half the world's population (an estimated 6 billion people) lives in cities and predicts that by 2050, two-thirds of the world's population will live in cities. It also notes that 50 percent of these urban dwellers live in slum conditions with little access to shelter, water, sanitation, education, or health services.

Because sustainable urbanization is one of the most pressing challenges facing the global community in the 21st century, the United Nations launched the United Nations Human Settlements Programme UN-HABITAT. Its aim is to help policy makers and local communities find workable and lasting solutions for developing human settlements. UN-HABITAT promotes socially and environmentally sustainable towns and cities with the goal of providing adequate shelter for all.



This map shows land use in Jeddah City, Kingdom of Saudi Arabia.

UN-HABITAT is building a worldwide urban knowledge base via its Global Urban Observatory that will make it possible to monitor and evaluate urban conditions and trends. This global endeavor is supported by a network of local urban observatories, which are designated workshops that develop monitoring tools used for urban policy making. GIS is proving to be a useful technology for monitoring economic, social, and environmental development.

The Kingdom of Saudi Arabia's cosmopolitan city Jeddah Municipality launched Jeddah Urban Observatory (JUO) to provide information for planning and policy making. ESRI Lebanon sal, ESRI's distributor in Lebanon, designed a geospatial solution, built on ArcGIS, that improves the urban knowledge base by providing policy-oriented urban indicators, statistics, and other urban information.

Dr. Mohamad Abdulsalam, Jeddah Municipality's JUO chief supervisor and assistant to the deputy mayor for Environmental Affairs, notes, "The primary goal of building a GIS-based urban observatory is to use current data and ICT [information and communication technology] to effectively and efficiently disseminate among concerned decision makers and stakeholders information, knowledge, and expertise about a city's most current urban indicators, statistics, conditions, and profiles."

Staff can easily use JUO's GIS tools for spatial manipulation, simulation, and analysis and to display urban indicators. These indicators have spatial dimension. Indicators include variables of poverty, environmental degradation, provision of urban services, deterioration of existing infrastructure, access to secure land tenure, and adequate shelter. To date, JUO has generated 80 urban indicators and plans to define and generate 200 more.

The information technology infrastructure that supports JUO consists of two high-specification servers, 10 PCs, a local area network, and a high-speed DSL Internet connection. The GIS comprises ArcGIS Desktop and ArcGIS Server software. Through the use of Web-based GIS applications, JUO indicator data can be accessed and benchmarked at regional, national, and global levels. JUO has become the most important source of socioeconomic data in Jeddah.

GIS outputs help staff target need, monitor urban inequalities, assess the distribution of services, identify trends, and target resources for more effective allocation. For example, an adult illiteracy thematic map shows the percentage of male and female adults above the age of 15 who are illiterate. A transportation model displays various transport types within Jeddah's districts. A population density indicator map applies dots and graduated colors to show the population distribution across the city's districts. Although the GIS-based solution delivers advanced results, its tools are user-friendly, so it can be easily adopted by other Arab urban communities.

UN-HABITAT recognized ESRI Lebanon's JUO project by adding the unique information and monitoring initiative to its Good Practice list for cities to assess, identify, and monitor urban conditions. The performance of JUO is being monitored by His Highness Prince of Makkah Region as well as by Jeddah's mayor and municipality officials. "Jeddah citizens are truly the main beneficiaries of the project," concludes Manal El Sayed, ESRI Lebanon's GIS solutions manager, "as analysts and policy makers assess the extent of the city's problems and design the policies and interventions needed for achieving sustainable urban habitats."

More Information

For more information, contact Dr. Mohammed I. Abdulsalam, chief supervisor, JUO (e-mail: mabdulsalam@jeddah.gov.sa); visit ESRI Lebanon at www.esrilebanon.com; or contact Salim Sawaya, ESRI (e-mail: ssawaya@esri.com).

The Beacon of Hope Resource Center Maps the "New" New Orleans

GIS Gives Residents the Tools to Map Their Own Parcels

Highlights

- GIS analyses were graphically presented to residents and local government.
- Standard ArcGIS functionality seamlessly integrates public and community data.
- Residents are empowered through the use of ArcGIS.

In the direct aftermath of Hurricanes Katrina and Rita, the Beacon of Hope (BOH) Resource Center, a nonprofit focused on residentially driven neighborhood recovery, was founded on February 14, 2006, in New Orleans, Louisiana. The BOH started as a place where returning residents could find information about contractors or insurance companies and use a phone or fax machine, and it provided a physical locale for residents to meet and share information. From the outset, the BOH M.O.D.E.L. (mapping, outreach, development, empowerment leadership) for sustainable neighborhood revitalization and community empowerment was based on a community-led framework. It is implemented in each of the 12 Beacon neighborhood sites citywide. The Beacon of Hope administration and staff provide support services and training to residents that are active and engaged in their communities. One of the most important tools used to assess neighborhood conditions is parcel-level property condition surveys.

Setting its approach apart from the countless condition surveys that have been conducted in post-Katrina New Orleans, the BOH has always maintained that neighborhood surveys be conducted by the residents of the affected neighborhood. Interested neighborhoods contact the BOH to establish a new "Beacon" and are provided with supplies, training, and support to develop a "survey captain" system. The 2006 neighborhood condition surveys and maps were produced by hand, and results were discussed during community meetings to give residents an immediate picture of their neighborhood's recovery. Residents began to identify and report trouble areas to city authorities and act in a coordinated effort by utilizing the administrative structure put in place by the BOH. By conducting the surveys with neighborhood survey teams, residents controlled the data and its quality. During the summer of 2008, Milissa Orzolek, a University of Washington geography graduate student, helped BOH bring its survey production into the digital world by introducing the organization to the capabilities of ArcGIS Desktop software. While these maps and surveys were immensely popular, the growing time constraints of producing such maps and surveys, along with the more complex analyses residents now demanded, was too time intensive for BOH.

In August 2008, a successful pilot community-university collaboration called the Beacon of Hope/University of New Orleans Community Recovery Project (BUCRP) was started to assist the Beacon of Hope with mapping. Under the direction of Tina Marquardt, BOH Operations, and with the help of Dr. Michelle Thompson and graduate student Brian Baldwin, the BUCRP was able to continue the BOH mapping program. After an initial assessment, BUCRP determined that it should assist with development of a program to standardize survey instruments and data collection, as well as provide on-site training and implement BOH GIS protocol and practice.

This Oak Park map was brought to neighborhood meetings, and residents were impressed by the spatial representation of their survey data.

After using a free, one-year trial license, the BOH purchased an ArcView user license through a Tech Soup Donation to Nonprofit membership and began importing previously collected survey data into ArcGIS Desktop. Immediately, the value of using GIS for data analyses and graphic presentation, at first seen by small groups, was presented to hundreds of local residents and local government. Initial mapping results from 2006 data convinced local businesses not only to rebuild but also to expand from a temporary to a permanent Harrison Street Marketplace, a neighborhood event featuring crafts, food, and information. In 2009, the BUCRP worked with the Louisiana Recovery Authority to evaluate The Road Home Support and Shelter For Overcoming Homelessness organization's property condition data in the Beacon priority areas that identified a number of recipients who were unable to rebuild. Today, the mapped data provides a clear picture to local government regarding recovery progress, infrastructure problems, and blight.

Lack of adequate public GIS data and plotting hampered BUCRP until a partnership was formed with Lynn DuPont, senior planner/GIS coordinator from the Regional Planning Commission. The BUCRP remains a community/municipality/university partnership that continues to evolve. By late fall 2008, BUCRP produced a 1:2,100 condition map of the New Orleans Lakeview neighborhood with 7,197 parcels. This map was brought to neighborhood meetings, and residents were awed by the spatial representation of their survey data. While the survey results had been widely distributed, it was the visual representation of this data in digital and hard copy that awakened residents to the true picture of their neighborhood's recovery.

Using City of New Orleans parcel data, neighborhoods are split into survey team sectors, which are sections of roughly 50–100 parcels. There is one survey captain per sector. The survey team sectors are then imported into a spreadsheet, where they are ordered into a pattern based on walkability. Each of the survey captains receives a walking map that was created in ArcGIS Desktop, a printed survey sheet, and an overall map of their neighborhood that denotes where their specific survey sector is. Several meetings are held with BOH staff before the surveying to ensure that residents are comfortable with the maps and the surveying process itself.

When the survey data is finally collected by residents and input into a spreadsheet database provided to the data team manager, BUCRP completes the mapping and analysis. Each neighborhood is given one 24-inch by 36-inch hard-copy map, and all the finished maps are placed on the BUCRP Web site. This public availability of all data is another one of BUCRP's goals. The ability to collect survey data, create condition maps, and communicate the findings could not have been accomplished without developing a GIS implementation plan. The ability to replicate data through spreadsheet imports and provide consistent and reliable statistics, as well as seamlessly integrate public and community data, was due to the standard functionality that ArcGIS provides. The BUCRP is now focused on expanding the data structure into a personal geodatabase, creating mapping standards through the use of templates, and documenting methodology and metadata for future production. The goal of the BUCRP project is to ensure that BOH is self-sufficient in its future mapping and surveying projects. As an indication of its commitment, the Beacon of Hope Board voted in November 2008 to formally adopt GIS, as part of its ongoing operations, as a "BOH Community Data Information System."

While the effects of Hurricanes Katrina and Rita are slowly fading from the memories of those outside the Gulf Coast region, the role of GIS in community redevelopment has been an ongoing process that continues to evolve. Neighborhood associations, individuals, and community groups are realizing the important benefits that GIS can bring with community inventories. From following new construction and renovations to tracking blight to assist city code enforcement, residents are empowered through the use of GIS. Residents remain the engines for their own recovery and redevelopment using GIS. The model of public participation GIS that the BUCRP offers is one where residents have the tools and obligation to conduct their own surveys with the support of BUCRP to process and map condition data. Given the goal to collect data every three months, residents and public officials will have the benefit of using neighborhood, local, and regional information to plan from disaster to renewal for the city that will be a "new" New Orleans.

More Information

For more information, contact Dr. Michelle M. Thompson, University of New Orleans (e-mail: mmthomp1@uno.edu); Tina Marquardt, Beacon of Hope (e-mail: tina@lakewoodbeacon.org); Brian James Baldwin, University of New Orleans (e-mail: bbaldwin@uno.edu); or Milissa Orzolek, Beacon of Hope (e-mail: milissa@lakewoodbeacon.org), or visit the Beacon of Hope Resource Center at **www.lakewoodbeacon.org**, the University of New Orleans at **planning.uno.edu**, the Regional Planning Commission at **www.norpc.org**, or the Beacon of Hope/University of New Orleans Community Recovery Project at **planning.uno.edu/BUCRP/index.html**.

UN Uses GIS to Promote Peace and Provide Aid

continued from cover

Highlights

- UN maintains worldwide geodatabase to support highly sensitive and important decision making.
- GIS specialists lend support to UN field missions.
- Enterprise GIS supports Web-enabled application for sharing and situational awareness.

supporting those who work in departments and offices within the UN Secretariat so they can provide essential security for millions of people, as well as fragile institutions, emerging from conflict and recovering from humanitarian emergencies.

Providing Geographic Knowledge

The UN Cartographic Section (UNCS) is at the core of the UN Secretariat's geospatial initiatives. The UNCS staff provides geographic visualization to the Security Council sessions, analysis for the Department of Peacekeeping Operations and Department of Political Affairs, and cartographic support for the secretary-general reports. UNCS is also in charge of the GIS program of peace operations, managing GIS offices in 13 peacekeeping and political missions. Other information management teams, such as the GIS officers and cartographers in the Office for the Coordination of Humanitarian Affairs (OCHA), collaborate with UNCS to further extend the reach of GIS.

Throughout the UN, decision makers rely on geographic information products to support highly sensitive and important decision making. GIS data and analysis are used for boundary delimitation and demarcation, field mission planning and operations, humanitarian intervention, logistics, resource allocation, and critical analysis and visualization for situational awareness and security.

GIS officers are assigned to most UN field missions (both peacekeeping and political), resulting in a robust enterprise capability whereby the UN is making a great impact on building peace and stabilizing operations. With enhanced geospatial abilities, improved operations have allowed the peacekeepers, humanitarian response teams, and other UN partners to operate with more actionable information in the field and achieve greater success.

UNCS and other GIS teams within the UN Secretariat in New York City, New York, and in the field provide substantial GIS support to the decision makers, political analysts, information managers, and Security Council members, as well as operational GIS support, for mission planning, demining, peacekeeping, and humanitarian operations.

Defining Boundaries

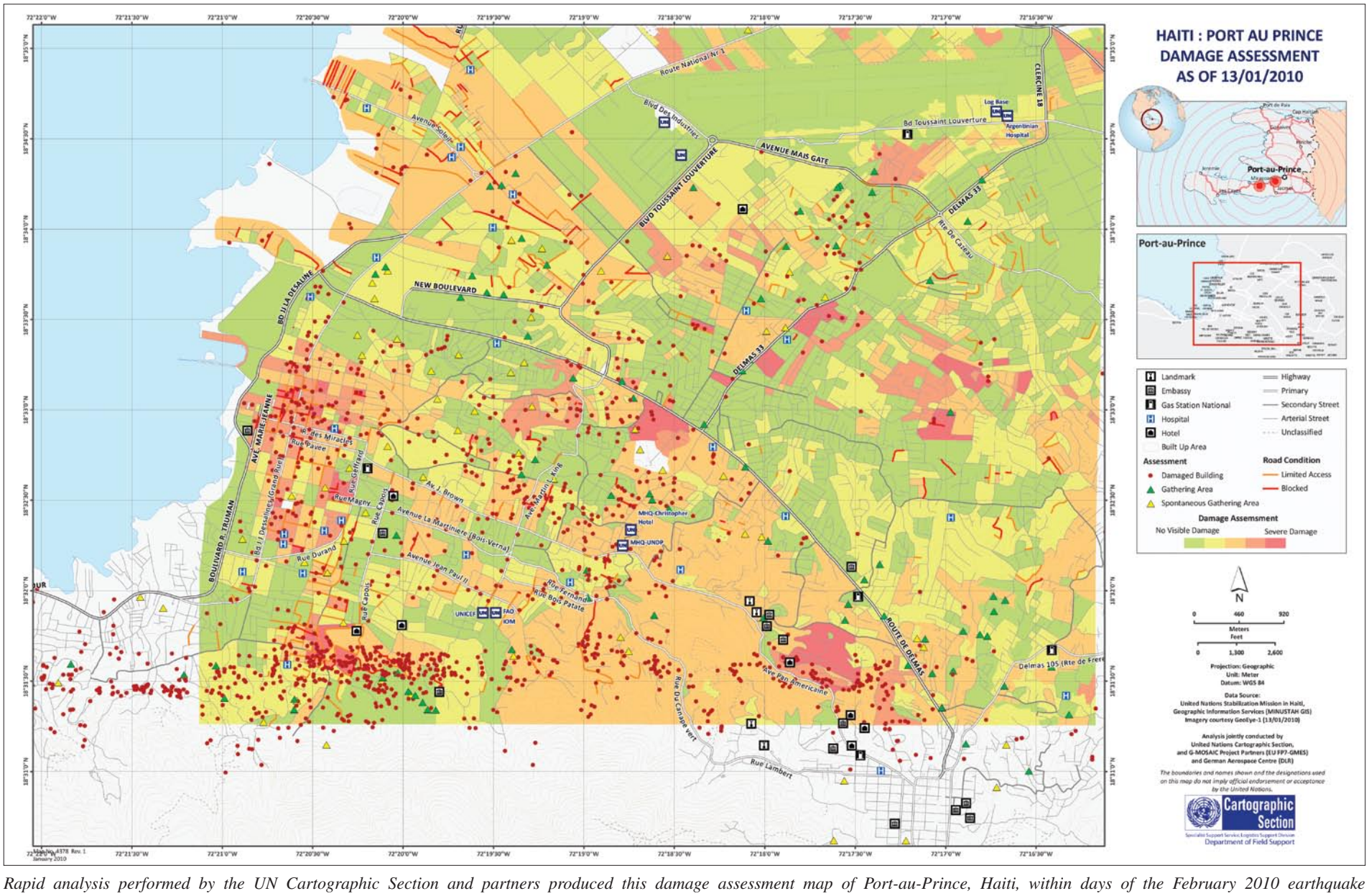
Establishing boundaries between countries is a prerequisite for peaceful neighboring relations. UNCS has been involved in many projects related to delimitation and demarcation between member states so that all parties have a clear understanding of their sovereignty limits. Using GIS, the UN has facilitated the definition of the Cameroon-Nigeria, Eritrea-Ethiopia, Iraq-Kuwait, Israel-Lebanon, and Turkey-Greek Cyprus boundaries.

With the UN International Boundary Information System (UNIBIS) project, UNCS is working to create and subsequently maintain a worldwide geodatabase on international boundaries. It will depict, as accurately as possible, their geometry, status, claims, dates of treaty agreements, and reference materials. The boundary geodatabase uses authoritative sources of information, such as treaty maps, coordinates, rulings, treaty text, and interpreted satellite imagery. Developed by UNCS in consultation with other international experts on boundaries, UNIBIS highlights potential conflict areas to support conflict prevention activities and enhance readiness for assistance on boundary demarcation issues.

Developing Peace and Security

Peacekeepers deploy to war-torn regions where no one else is willing or able to go and prevent conflict from returning or escalating. Since the organization's inception, UN peacekeepers have undertaken 63 field missions, which, among many other things, enabled people in dozens of countries to participate in free and fair elections and helped disarm more than 400,000 ex-combatants in the past decade alone.

In response to a recommendation in the Report of the Panel on United Nations Peace Operations, GIS is now part of the UN peacekeeping



Rapid analysis performed by the UN Cartographic Section and partners produced this damage assessment map of Port-au-Prince, Haiti, within days of the February 2010 earthquake (Map No. 4378 Rev. 1, courtesy UN Cartographic Section).

United Nations Secretary-General Ban Ki-moon, with United Nations Interim Force in Lebanon (UNIFIL) personnel, examining maps of the Blue Line in southern Lebanon (photo: UN Photos).

infrastructure and is used throughout the range of activities that peacekeeping missions must perform.

For example, GIS is a critical tool in the Darfur region of Sudan, Africa, where people have suffered great atrocities since conflict broke out in 2003. Since supporting the Darfur Peace Agreement in 2006, the UN continues to work closely with the African Union to bring peace to this conflict-ravaged area.

The African Union/United Nations Mission in Darfur (UNAMID) is using GIS to implement the Darfur Mapping Project. Detailed information about the region was previously unavailable, so mapping the area at a scale of 1:50,000 gives the peacekeepers detailed topographic information they can use to optimize operational effectiveness and efficiency. The GIS infrastructure enables information flows across offices and field missions for coordinated support to the region.

In Lebanon, after fighting erupted in 2006, the United Nations Interim Force in Lebanon (UNIFIL) began monitoring the cessation of hostilities, accompanying and supporting the Lebanese armed forces deployed throughout southern Lebanon, and extending humanitarian efforts. UNIFIL has since created the GIS-based Security Warden Information System (SWIS) to support UN security operations in the area.

The goal of SWIS is to provide security and military response teams with accurate visual information related to staff locations, along with other important locations, such as UN positions, evacuation or gathering locations, and incident locations. This mission-critical system supports the safety and security of approximately 9,000 UN staff in southern Lebanon.

Delivering Humanitarian Assistance

In addition to peacekeeping operations, the UN uses GIS to support another core mission—providing humanitarian assistance to people in need. OCHA, for example, uses GIS as a communication tool to evaluate the humanitarian situation on the ground as a natural disaster or complex humanitarian emergency unfolds. OCHA is responsible for the coordination of other humanitarian organizations that are grouped into nine humanitarian clusters: camp management, early recovery and reconstruction, education, emergency shelter, health, IT and communications, nutrition, protection, and water and sanitation. Most UN agencies, such as United Nations Children's Fund (UNICEF) and World Food Programme, also use GIS in their humanitarian assistance work.

Mission in Haiti

In its recent response to the earthquake in Haiti, the United Nations Stabilization Mission in Haiti (MINUSTAH) and UNCS are heavily using GIS to enable situational awareness and support operations on the ground. The MINUSTAH GIS unit has made available its basemap data layers for public use. It is also providing support to other UN entities, nongovernmental organizations, and member states that have deployed to Haiti.

UNCS has been focusing on providing the necessary support to MINUSTAH, as well as necessary information and situational awareness to senior management and UN entities around the world. It has created a GIS Viewer Web application to promote information sharing and situational awareness among all stakeholders. All relevant geospatial data received from various sources will be loaded into this application.

Prior to the earthquake, MINUSTAH used GIS to help the country deal with a series of disasters, including violent demonstrations over food prices that led to the collapse of the government, four deadly hurricanes that affected nearly a million people in 2008, and a school collapse that took the lives of 100 children.

Making a Difference

Staff members in departments and offices throughout the UN are making a difference in the world—from championing peace and delivering humanitarian aid to supporting environmental management; monitoring and mitigating climate change; and enforcing international laws, such as the UN Convention on the Law of the Sea.

This map shows peacekeeper deployments, headquarters, and areas of operations for the United Nations Organization Mission in the Democratic Republic of the Congo (MONUC) (Map No. 4121, Rev. 45, courtesy UN Cartographic Section).

The people of the UN take great risks in insecure situations to accomplish their missions and improve the lives of millions of people in need. In some of the most challenging environments and most remote areas of the world, where data, telecommunications, and energy are limited, they continue to succeed and use GIS to support their work.

More Information

For more information on how the UN is successfully using GIS, contact the UN Cartographic Section (e-mail: cartog@un.org).

The contact regarding this article is Salim Sawaya (e-mail: ssawaya@esri.com). AM

Pueblo County, Colorado, Grows Economy with GIS

Principles of Economic Gardening Help Local Businesses Thrive

Highlights

- Pueblo County uses ArcGIS Desktop to share analyses and data with clients.
- The GIS Department's consulting service has brought in $2.8 million of new revenue into the county.
- Nonprofit organizations are also benefiting from the GIS Department's guidance.

According to the United States Small Business Administration, small businesses have created 60 to 80 percent of net new jobs since the 1990s and employ approximately half of all U.S. workers. These facts are at the heart of the economic development philosophy of economic gardening.

Pueblo County, Colorado, has adopted the approach, which focuses on cultivating local businesses rather than landing large companies looking for a cheap place to do business. Instead of making a splash with 1,000 new jobs coming into the community, economic gardeners favor a job here, a job there for a slower, stable growth pattern. GIS is a key component in the process.

The Pueblo County GIS consultancy service works with many kinds of businesses in the area. It recently helped a local Web-based business improve its market penetration nationwide. This image shows market penetration areas in and around New York City in darkening shades of purple, customer prospecting from yellow to red, and the amount New York City customers spent in small to large blue circles.

"Businesses that are already in town are not fully focused on the bottom line," says Christopher Markuson, GIS manager, Pueblo County. "They're looking to improve business, but they're also looking to do what's right by their employees. We don't want a large company to come in, pay lousy wages, and then leave when the local economy strengthens or the workers demand higher pay."

Markuson learned about the approach from the nearby City of Littleton, Colorado, when he was searching for a way to develop businesses that would not only add to the quality of life in Pueblo County but also continue to support the area during economic downturns. "We were looking at communities that rode out the last recession in the late 1990s unscathed," he emphasizes. "There were a few, but Littleton was at the top of the list."

As it happened, GIS initially started in Pueblo County in the early 1990s to help the Chemical Stockpile Emergency Preparedness Program at the Pueblo Chemical Depot plan for any potential emergencies. Drawing from that experience, GIS use has been rapidly growing, providing services to almost every county department.

When it became clear that Pueblo County was moving into the area of consulting for businesses, the county looked into the various software options and selected the suite of ArcGIS Desktop, ESRI Business Analyst, ESRI Business Analyst Online, and the ESRI Business Analyst Segmentation Module to provide current, accurate data for its reports and to view it spatially.

The Right Location

Businesses across the county have heard about Pueblo County's GIS Department's consulting service, and business owners are scheduling appointments months in advance. The GIS team then meets with owners to find out about their concerns, interests, and current efforts, asking questions such as: Do you want to target advertising to reach a specific set of consumers? Are you looking for a good site for a new location? Then the team uses ArcGIS Desktop and its business extensions to analyze and map demographic and other data to share with the client.

"We have this interesting reputation around town as folks that are going to give you real, truthful answers to your questions," explains Markuson. "We'll tell people, 'No, the data doesn't support your plan to open a coffee shop where there are only 30 potential customers around you. It's just not feasible, and here's the evidence.'"

The GIS team members in Pueblo County work with many kinds of businesses in the area. They recently helped a local Web-based business that wanted to improve market penetration nationwide. The team and the business owners developed strategies to increase business in 14 of the company's top markets with advertising across various media, including television, radio, subway platform ads, and direct mail. They also identified the top ZIP Codes where people live who are searching for the company's product online and used that information to create Google AdWords and optimize the Web site for search engines. The campaign is successfully bringing in new revenue, and within a month of the campaign, the business created four new jobs.

Nonprofit organizations are also benefiting from the GIS Department's guidance. The Pueblo Community Health Center met with the GIS team for less than an hour to discuss an upcoming capital campaign. The team provided a targeted mailing list that resulted in a 63 percent increase in new donors.

"The GIS Department's consulting service helped us look through different characteristics for reaching the right donors," says Janet Fieldman, chief foundation officer, Pueblo Community Health Center Foundation. "The demographic analysis and mapping allowed us to get into the roots of our community and build our base quickly for the long term."

The center reached its five-year fund-raising goal of $15,000 in one year. Prior to this campaign, the center purchased mailing lists based on a few demographics, such as annual income and assets, but had not heavily reached out to individuals because of low return and low donor acquisition. Now that there are better data and analysis, and therefore more success, the center will increase future fund-raising goals.

The analysis and mapping using ArcGIS Desktop and its extensions also show the center where services and advertising should be located. "It allows us to decide on the right level of outreach based on the quantity of donors within particular geographic areas," adds Fieldman.

A few years ago, the local community college needed to increase enrollment by 5 percent. The GIS analysis gave the college information it could use to most effectively market the school. The college surpassed the one-year goal of bringing enrollment up 5 percent by increasing it 17 percent.

To date, Pueblo County's GIS Department's consulting service has tracked 58 new jobs emerging from the businesses it helped grow, bringing in $2.8 million of new revenue into the county. Most of these new jobs pay livable wages—$45,000 each on average—offer benefits, and have little potential to move out of the community in pursuit of a lower-cost alternative.

More Information

For more information, contact Christopher Markuson, GIS manager, Pueblo County, Colorado (e-mail: chris.markuson@co.pueblo.co.us).

Helping Big Business Make the Right Fit

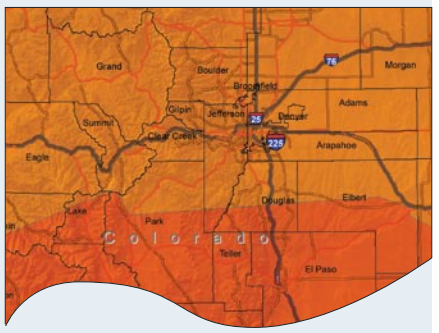
Though the emphasis in Pueblo County is on growing local business, the GIS Department also uses GIS to support efforts to bring in larger companies that the county feels will add to the quality of life for residents. The county recently used GIS to bid for a contract with Xcel Energy of Minneapolis, Minnesota, to bring a solar energy production facility to the area.

The facility's stakeholders initially believed another area in the state had the best location for solar radiation, but Pueblo County's GIS team showed that although the sun is not as intense as in the other location, Pueblo receives more sunlight per year, on average. Xcel Energy agreed, and the planned facility is projected to bring up to $900 million of taxable infrastructure into the county's property tax base and power more than 60,000 homes.

"You can look at databases all you want, but the maps were the things that got the attention of the governor, congresspeople, the energy companies, and many more people," says Christopher Markuson, GIS manager, Pueblo County.

More Information

For more information, contact Christopher Markuson (e-mail: chris.markuson@co.pueblo.co.us).



Using GIS to map mean sunshine and resultant solar productivity potential helped Pueblo County win a solar energy production facility bid.

How Prague Became Digital

Historical Town Creates Integrated Records with GIS

Highlights

- Complete changeover of technology from CAD to GIS
- Assurance of interoperability with land surveyors, utility network administrators, and city and state institutions
- Creation of a robust and universal module for Prague's geodata publication

Prague Castle.

Prague, a city of one million people, is the capital of the Czech Republic. It is renowned for the medieval Charles Bridge, Prague Castle, and its maze-like city center, infused with an antique atmosphere. However, what cannot be seen in the winding streets is the city administration's effort to create uniform digital records of engineering networks and property relations for the entire area quickly and effectively. This task, however, has not been an easy one.

Historically, unifying these records has been complicated by numerous factors, not the least of which was that prior to the late 1980s, all records were kept on paper. Then, when the first Unified Digital Map of Prague (UDMP) was created in the early 1990s, the various governments and agencies were expected to revise their own hard-copy maps and forward them to the city administration to be updated in their digital counterparts at intervals. However, as these sketches were waiting to be incorporated into the digital map, the rate of new construction grew, and the number of amendments to the digital map grew, which inevitably slowed down the updating process.

When information technology made a giant step forward, Praque officials sought to ensure up-to-date, consistent, and accurate data for the city's decision making. The result was a new concept of digital mapping, which began to take shape in 2007. Following an intensive program of investigation and comparison, ArcGIS technology was selected by the city for the core of its digital mapping program.

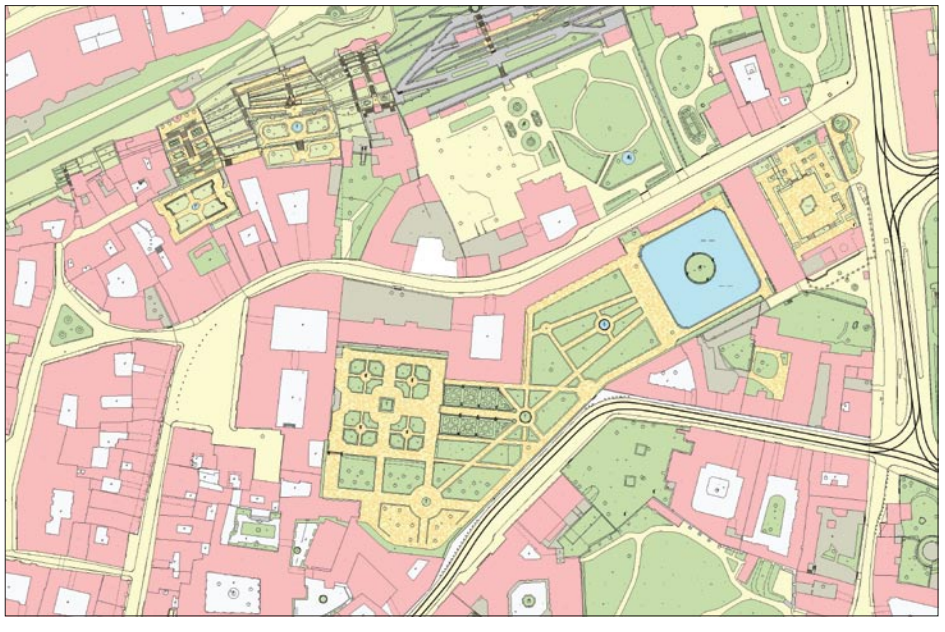
Because Digital Map of Prague (DMP) data is designated as a source for Prague information systems, especially for use in map applications and in relation to external information systems, the city decided to make a change in technology, upgrading from CAD to ArcGIS Desktop where work with data and its visualization is carried out. The geodatabase has become an environment for data structures in new work. For data distribution, the ArcGIS Data Interoperability extension is used. Special tools have been programmed, allowing searching of given areas; the data can be exported to various data formats and filtered by attributes, layers, and location. The tools also support organization of data download, such as comprehensive records of customers and information, price calculations, and the preparation of billing documents. The project was carried out with the cooperation of the NESS Czech, a.s., and T-mapy, s.r.o., companies.

The CAD data is transferred into a relational database, and attribute and topological check-ups are performed to maintain consistency of the data model and for the creation of derived data layers, which are then processed in the ESRI GIS environment. The verified data is regularly shared with the City Development Authority Prague, where detailed quality control is carried out. In case an error is found, the affected part of the data is returned to the supplier for reprocessing. The map's features are accompanied with information about the source from which they came and when they were added to the map. The system also stores the removed features, which allows the map's history to be tracked. Thus, the integrity of the database and the precision of the data model are maintained.

"When transferring data from the old UDMP to the new DMP, we discovered many errors and deficiencies in the topology and data accuracy," explains Jiri Ctyroky, head of the Department of Spatial Information/City Development Authority Prague. "Thanks to the transfer, we were able to remove them."

More Information

For more information, visit **www.urm.cz/en/digitalni_mapa_prahy**.



This map combines a detailed technical land-use map with a digital technical map.

GIS Keeps Local Governments Going

Budget crises and diminishing resources have become the unpleasant norm for many local governments as they continue to grapple with the economic downturn. Though many said good riddance to 2009, the worst may not be over for cities and counties around the United States. The National League of Cities recently reported that the situation for cities is likely to worsen through 2012.

As governments continue to face great challenges, including increased demands for services, many are finding that GIS technology provides ample ways to make the most of the money and resources they have.

In the field, mobile workers are using logistics tools to more effectively maintain infrastructure and provide timely service to citizens. In the office, fleet and mobile workforce managers use GIS technology to better manage fuel expenses and carbon emissions, as well as minimize overtime.

To bring new revenue into communities, economic development departments are using Web maps and demographic reports to give them the edge when competing for business. These same resources help existing businesses understand their customers and find opportunities for growth.

Understanding and visualizing geographic information are critical to most government operations. GIS shows relationships that are otherwise unnoticed, such as how mortgage fraud negatively impacts property assessments in an area, or mechanisms impacting business growth, such as how far people travel for a particular service. From the largest cities and counties to the smallest, GIS gives governments the tools they need to succeed. The following examples show various ways they are going about it.

Miami—A Hot Spot for Businesses to Boom

Warm days, tropical breezes, and Caribbean and Latin American influences make Miami, Florida, an inviting city. In this unique place, visitors, snowbirds, and a large number of foreign-born residents feel right at home.

To help businesses understand this diverse marketplace, the City of Miami's Division of Economic Initiatives teamed with ESRI Business Partner MSF Global Solutions, LLC, to create Miami Sites (**www.Miami-Sites.com**). This online mapping application gives business leaders around the globe an easy-to-use GIS-based resource with valuable site, market, and demographic information. The effort supports the city's economic gardening initiatives, which aim to grow existing businesses, as well as attract new businesses. Since its launch in fall 2009, the site has become popular across the globe, with 50 percent of its visitors being from outside the United States.

"We have entrepreneurs that are very interested in conducting business in Miami and are very competitive—they want to understand the communities," says Lisa S. Mazique, senior advisor for economic development, City of Miami. "The portal we created is instrumental in providing the information they need."

Creating a customized Web site tailored specifically for the city was a top priority. To do that, MSF Global Solutions used its Site Intelligence tool, ArcGIS Server, and the ESRI Business Analyst Online API to build the application and reporting capabilities.

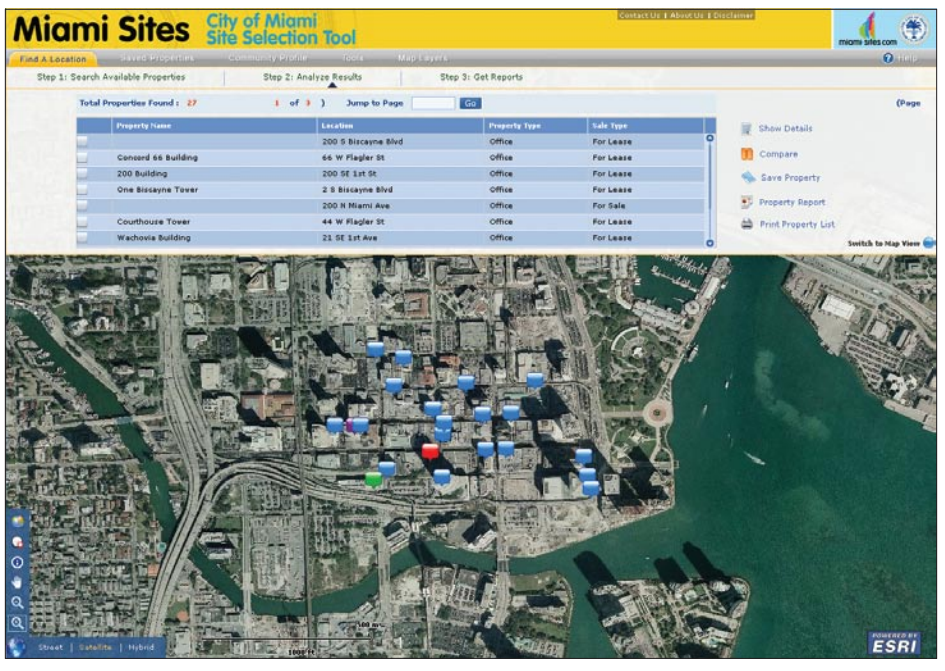
"We wanted to deliver one place where entrepreneurs could find reliable intelligence," explains Mazique. "To make sure that we were adding features and attributes that were important to us, we wanted our own tool, not a cookie-cutter solution. And it had to wrap around a really solid data product."

On Miami Sites, visitors find a detailed map of the area, including up-to-date satellite imagery from ArcGIS Online. Through the dynamic map, they can search the city's database of available commercial properties according to many factors, such as property type, square footage, and price. Other layers of information include zoning, contamination sites, land use, and historic/conservation. The search results are mapped, and visitors can view details, compare locations, and create reports.

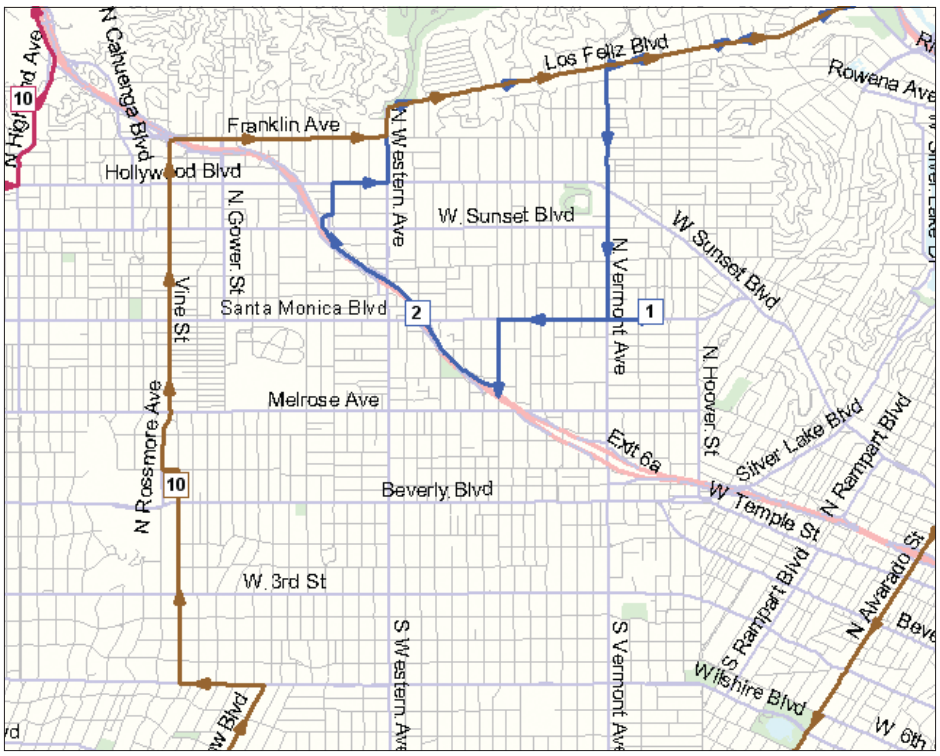
The GIS portal also gives stakeholders specific information about consumers in a given location, including income, housing, and market profiles. Detailed demographic and spending reports are accessible through the map or the Community Profile tab.

"It will give you a profile of the kind of individuals that live in a neighborhood and help you match your business to a particular market," Mazique says. "For a business to be successful, it needs to understand the backyard in which it's playing."

For more information, contact Lisa Mazique, senior advisor for economic development, City of Miami (e-mail: lmazique@miamigov.com), or Marseyas Fernandez (e-mail: marseyas@msfglobal.net).



A search for all available properties in the central business district of Miami, Florida.



SRCD vehicle routing in Los Angeles is a dynamic process with parameters that are in constant flux.

Los Angeles Dodges Unneeded Expenses with a Smart Routing Solution

In the predawn hours, crews from the Los Angeles, California, Bureau of Sanitation assemble in staging areas for assignment details prior to their daily deployment for the removal and disposal of recyclables and waste throughout the city's vast 450-square-mile service area with 1.5 million residential and commercial addresses.

In addition to its regularly scheduled pickups, the bureau's Solid Resources Collection Division (SRCD) collects bulky items, white goods (including refrigerators and washing machines), and dead animals. This service is scheduled by appointment for the 60 special-collection drivers who field more than 55,000 pickup requests each month.

Not so long ago, SRCD crews would meet with their supervisors each morning to map out the day's routes for special collections, but increasing service demands recently made it clear that the department needed a more efficient method for route planning.

After evaluating various systems, the department decided to implement a GIS that includes ESRI's ArcLogistics for point-to-point routing; RouteSmart software from ESRI Business Partner RouteSmart Technologies, Inc., for continuous routing applications; and ArcGIS Desktop and ArcGIS Server for mapping, analysis, and geodatabase management.

Now, when requests for bulk item collections and container service are received, the details are input into the central database and downloaded to PCs at the various dispatch centers. There, supervisors review the pickup requests and generate route maps before each shift. The maps and any last-minute instructions or route changes are then exported to the crews' personal digital assistants (PDAs), which they pick up in the dispatch office before beginning their daily assignments. Because ArcLogistics can automatically create and maintain routing folders in collection day order, it is a big time-saver for SRCD.

The city also uses GIS to create routes for replacing old trash containers. Using GIS to analyze workload and improve productivity of existing staff saves the city $400,000 per year in salaries.

Observes Sal Aguilar, GIS manager at SRCD, "With the automation and optimization of our routing procedures, we have realized a significant cost/time benefit as well as the capability to provide better service to our customers."

Using ArcGIS, Aguilar is also implementing the concept of operational route-based analyses (ORBA) on all (more than 2,500) continuous service routes and neighboring routes to fine-tune the trash pickup balance between them. "We look at the operational parameters of the routes and display them spatially to analyze the relationships between them and determine where improvements can be made," says Aguilar.

Vehicle routing is a dynamic process with parameters that are in constant flux. There is always the potential for unplanned roadway construction, temporary speed limit changes, accidents, congestion, and so on.

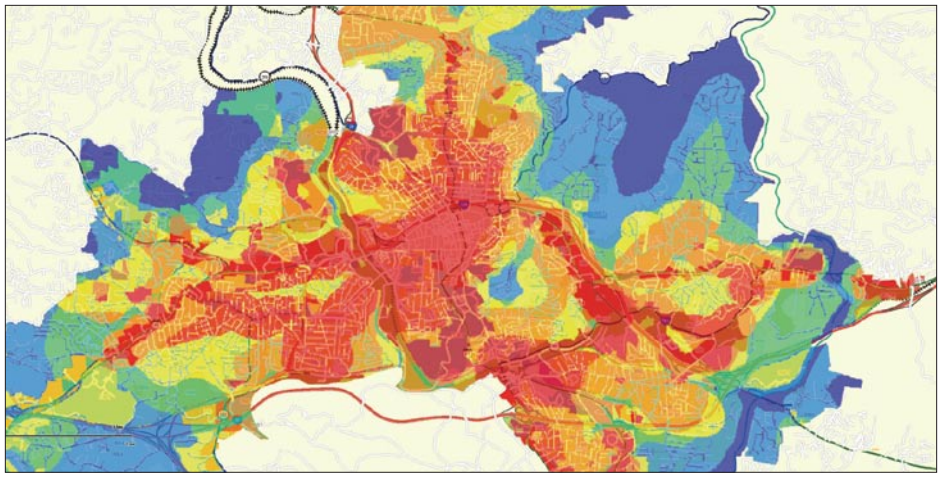
"I believe that GIS can play an integral role in any routing operation. The ability to take data that has formerly been looked at in a tabular format and can now be spatially referenced, analyzed, then automatically mapped provides a powerful management tool for operational awareness," concludes Aguilar.

For more information, contact Salvador Aguilar, Jr., environmental engineer associate, City of Los Angeles (e-mail: sal.aguilar@lacity.org).

Asheville, North Carolina—Placing a Priority on Economic Development

The City of Asheville is the largest city in western North Carolina and serves as the regional hub for business and other community amenities. Like many cities across the country, Asheville is concerned about increasing investment and attracting new businesses, as well as retaining existing jobs and companies in the region. To do that, the city has created Priority Places, a Web-based GIS tool that promotes economic development by enabling citizens, business owners, investors, and government agencies to identify optimal locations for their activities (**gis.ashevillenc.gov/mapasheville/priorityplaces**).

Choosing the right location is an important decision that can ultimately determine the success or failure of any new business. To facilitate the long-term economic growth that thriving businesses can provide, several years ago Asheville began looking for an analytic approach to business siting that would leverage the city's wealth of economic development data. The ideal solution would be



Priority Places application for the City of Asheville, North Carolina.

Web based and easy to use. Further, it would allow individual businesses to select and assign weights to decision factors that they consider important rather than simply adapt their projects to preselected sites. Most importantly, it would generate customized priority maps based on the criteria selected, highlighting those locations that best meet the business owners' requirements.

The city selected ESRI Business Partner Avencia Incorporated of Philadelphia, Pennsylvania, to build the application, leveraging the company's DecisionTree software product, a set of Web-based high-performance geographic planning and prioritization tools that make complex site optimization calculations in less than one second. Leaders in the Office of Economic Development selected the business siting factors that they wanted in the application, including proximity to interstate exits, regional airports, existing utility infrastructure, and state incentive areas.

Priority Places was officially launched in 2008 and provides an interactive user interface that displays each decision factor as a slider bar. The city recently updated the application with the ArcGIS API for Flex, which incorporates a new user interface with the rich, interactive features.

On the site, users choose the importance of each decision factor by moving the appropriate slider bar from the neutral position (0) to a preference value ranging from -5 (avoid proximity) to 5 (prefer proximity). Decision factors can be selected and valued in any combination to provide truly customized site selections. The system then returns a heat map highlighting the areas that best match the specified criteria, and users can zoom in to view additional layers of data that can further enhance their decision-making powers. These layers include railways, flood hazard areas, zoning districts, and city-owned surplus and sale-pending properties. Additional features include geocoding, customized map color palettes, transparency controls, and the ability to create bookmarks of specific map views that can be quickly returned to at a later date.

Priority Places has also been integrated with ESRI's Business Analyst Online API, enabling users to produce an array of reports on demographic and economic characteristics, retail expenditures, and housing for areas surrounding each selected location.

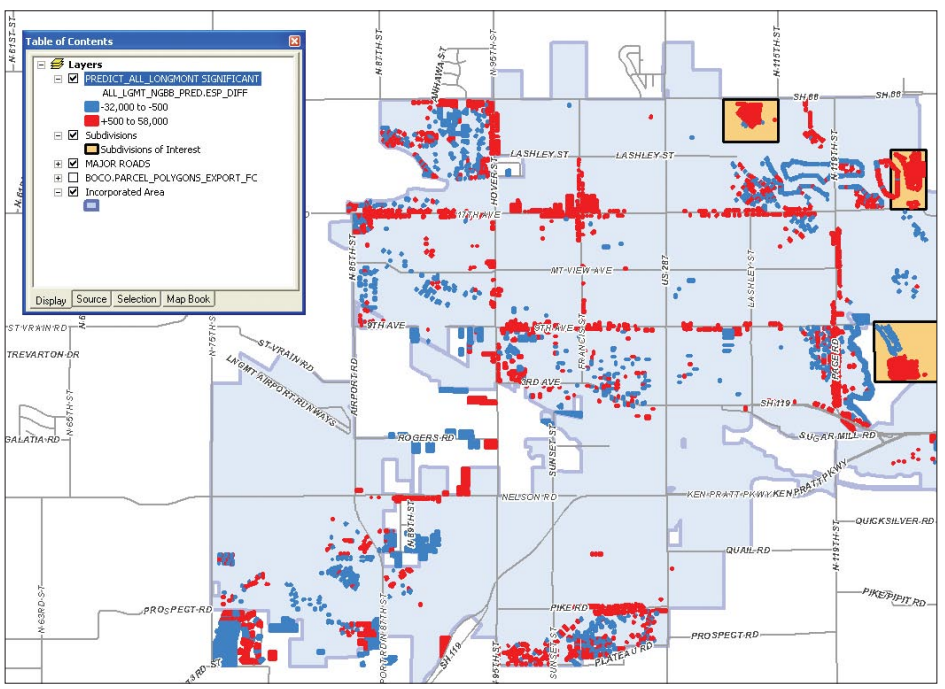
For businesses looking to establish themselves in Asheville, Priority Places provides access to information and analysis that might otherwise be out of reach.

For more information about Priority Places, contact Jason Mann, GIS and Application Services manager, City of Asheville (e-mail: JMann@ashevillenc.gov). For more information about DecisionTree, contact Tamara Manik-Perlman, DecisionTree project manager, Avencia (e-mail: tmanik-perlman@avencia.com).

Boulder County, Colorado—Keeping Property Assessments on the Up-and-Up

County assessors strive to deliver independent, fair evaluations of property values. But in 2007, as the housing market began to crash and foreclosures rose, accomplishing that mission grew more difficult. Foreclosures can depress property values and potentially skew valuations. As Boulder County, Colorado, quickly discovered, foreclosures can also artificially inflate property assessments when they are a result of mortgage fraud.

The Boulder County Assessor's Office has become well acquainted with the tactics of mortgage fraud and the effects it has on communities. During its 2009 mass reappraisal, the GIS team and appraisers decided to take a closer look at areas with high numbers of foreclosures to ensure the accuracy of their reports. Initially, the statistics appeared sound, but after conducting GIS analysis, the team began to see a different story unfold, especially in the City of Longmont, a foreclosure hot spot with approximately 650 between July 2006 and June 2008.



Mapping data with GIS changed the way Boulder County, Colorado, analysts looked at statistics.

The county's appraisers uncovered 15 suspicious sales in Longmont, 5 of which the Colorado Division of Real Estate deemed fraudulent. The big surprise came when subsequent GIS analysis showed that the high sales prices of these properties were improperly affecting the values of homes in communities miles away.

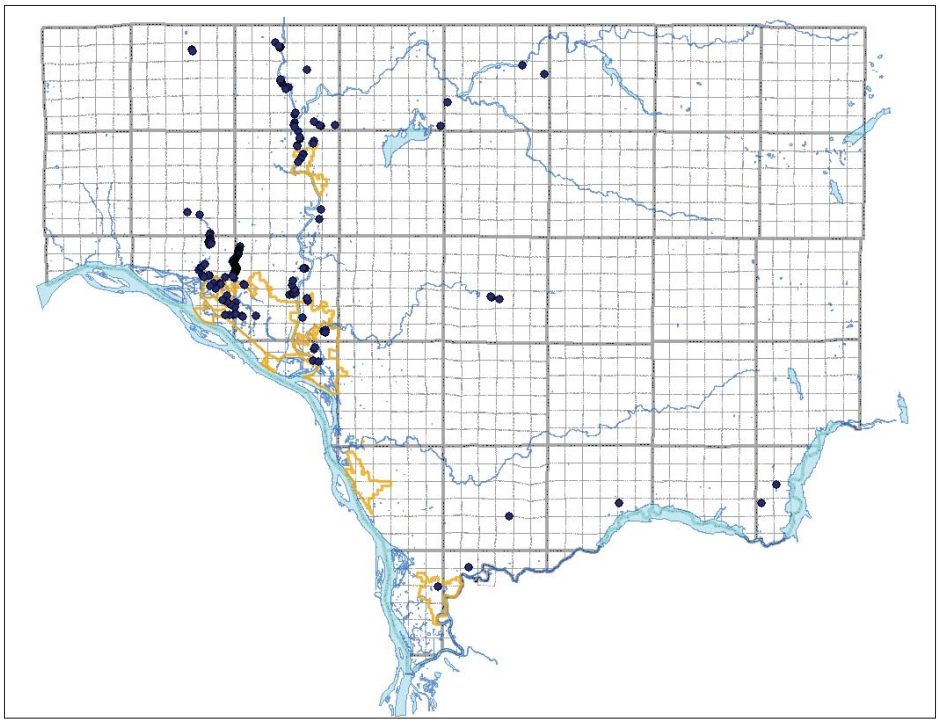
The 15 suspicious properties in Longmont had relatively high sales figures for the neighborhood, but the appraisers noticed something curious—these homes did not have the most desirable characteristics in the neighborhood. In some cases, they were on interior lots in golf course communities or were right next to a busy road. Though they had less desirable features, they sold for more than those with greater appeal.

The regression analysis from the business analytic firm SPSS, Inc., was exported into ArcGIS software and showed that, with the suspicious sales included, 40 percent of properties were falsely inflated for a total of $7.8 million, or falsely deflated for $5.5 million. The net difference was an increase of $2.3 million.

The range of influence of suspicious sales, when included in the mass appraisal process, extended well beyond the neighborhoods in which they occurred. "Realizing how far reaching the implications [would have been] if we had not caught the mortgage fraud was a huge wake-up call," says Danielle Simpson, residential real estate appraiser, Boulder County Assessor's Office. "Seeing that the impact could occur as far as six miles away from the property with fraudulent transactions was something we would not have guessed."

Though the statistics were technically compliant, appraisers were unable to see the full picture without visualizing the information. "Mapping the data with GIS changed the way we looked at our statistics," Simpson adds. "It was really interesting and educational to present data spatially instead of on spreadsheets and have appraisers understand in a whole new way how what happens in one place affects what happens in another."

For more information, contact Brooke Cholvin (e-mail: bcholvin@bouldercounty.org) or Danielle Simpson, residential real estate appraiser, Boulder County Assessor's Office (e-mail: dsimpson@bouldercounty.org).



Noxious weed locations in Cowlitz County, Washington, captured in the field with GPS and imported into an enterprise geodatabase.

Cowlitz County, Washington—Sharing the Wealth of GIS, Enterprise Wide

Since GIS is valuable across disciplines, governments are finding creative ways to get the technology into the hands of staff members. Cowlitz County, Washington, for example, found that an enterprise license agreement (ELA) provided the best way to support GIS initiatives across the organization while still meeting budget constraints.

Located in the southwestern corner of Washington State and home to approximately 100,000 residents, the county wanted to advance its existing GIS to improve services and operations. After acquiring an ESRI Small Government ELA in July 2008, data management soon moved to a centralized geodatabase, experts across disciplines began contributing authoritative data, and more employees were using GIS.

David Wallis, GISP, chief appraiser, Cowlitz County Assessor's Office, says, "We've moved away from having scattered shapefiles into a world where we have an enterprise geodatabase set up on a server, and we have GIS for the increasing number of users who want to create their own datasets. We have 100 users in the county now instead of 8."

Terry McLaughlin, the Cowlitz County assessor, manages the small GIS department—2 employees, down from 11 in previous years due to budget constraints. The Assessor's Office is responsible for maintaining a county basemap, which had been the primary GIS initiative for some time, though other departments used GIS for activities such as environmental review and permitting.

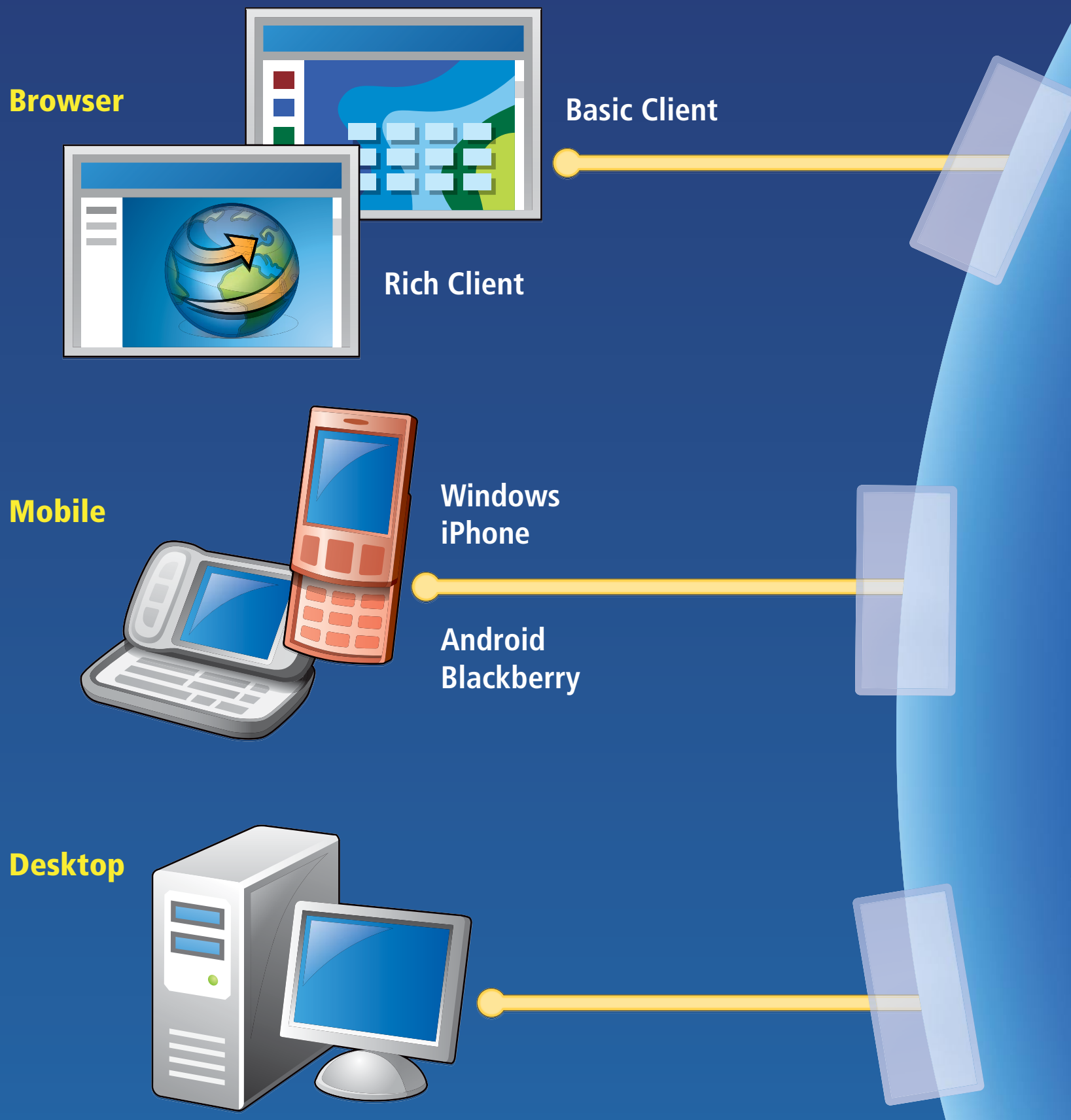
"Getting the enterprise license agreement has opened a lot of doors," notes McLaughlin. "Though our budget hasn't grown, we can now give more people access to GIS as well as extensions and server GIS."

The county's approach to acquiring and managing data is also changing. Historically, staff members sent data requests to the GIS department, which would then deliver data and maps. With the new model, experts in each department are beginning to use GIS to create their own datasets. "They are working with data more deeply than we ever could because of their expertise. We want that model to flourish," says Wallis.

For more information, contact David Wallis, chief appraiser, Cowlitz County Assessor's Office (e-mail: WallisD@co.cowlitz.wa.us.or). For more information about ESRI's enterprise license agreement, visit **www.esri.com/ela**.

As governments continue to lead and innovate in the midst of the economic crisis, GIS continues to support their efforts with tools that enhance their efforts. To learn more about GIS for local government, visit **www.esri.com/localgov**.

ArcGIS® System



The ArcGIS system is for people who rely on accurate geographic information to make decisions. It facilitates collaboration and can be implemented on individual local desktops or across desktops and browsers leveraging central servers. ArcGIS can also be hosted in the cloud.

ArcGIS

Using and managing maps and geographic information

- Mapping
- Analysis
- Collaboration
- Editing
- Design
- Compilation

www.esri.com/arcgis

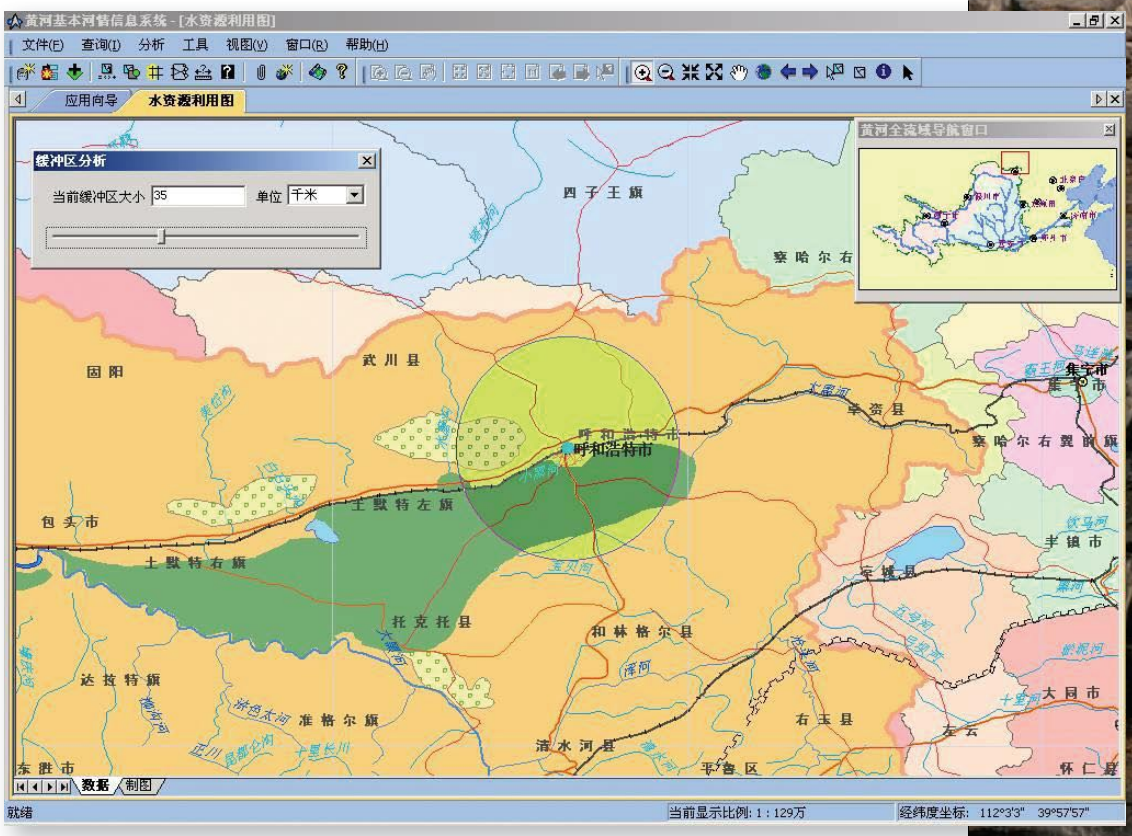
ESRI

The Digital Yellow River Project

GIS Plays Important Role in Managing China's Yellow River Basin

Highlights

- GIS efficiently and accurately simulates the river's behavior.
- Digital river users can edit and query data, visualize scenarios, and print topographic and thematic maps.
- Users can easily share information by uploading or downloading files via the Internet.



Spatial analysis from the Yellow River Basin Geographical Information Center (YRBGC).

The Yellow River's destiny is tied to its geography. A dichotomy to the people who inhabit its shores, the second-largest river in China has been called both "the cradle of Chinese civilization" and "China's sorrow."

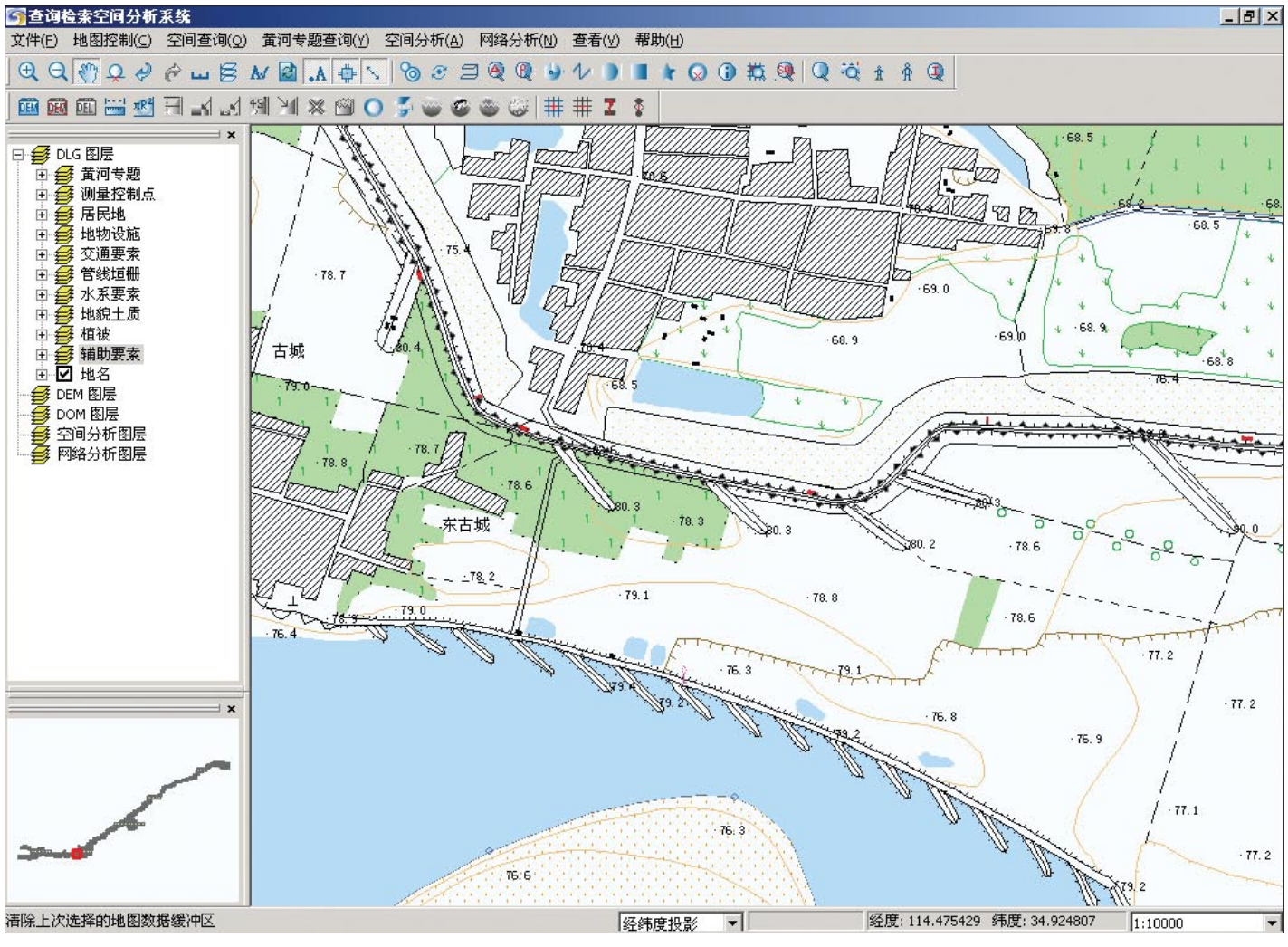
From its fertile shores, several northern Chinese civilizations sprang and prospered, but because the river flows across a large expanse of fine-grained, porous silt in the Loess Plateau, it carries a large amount of sediment. The silt deposits build up the riverbed until it is high above the surrounding plains. Even a minor rise in water level can cause the river to burst its banks. Unable to return to its breached course as the flood recedes, the river changes course and finds a new way to the sea.

Frequent devastating floods on the Yellow River, which takes its name from the yellow-colored silt it carries, account for some of the deadliest natural disasters ever recorded. The river has changed its course 26 times in 2,000 years, and hundreds of thousands of lives have been lost.

For centuries, the Chinese have tried to prevent the flooding, but the river almost always seems to have its way. As China's population grew, increased settlement on the Loess Plateau began a cycle of deforestation, overcultivation, soil erosion, and increased silt runoff that has accelerated flooding and land-use problems in the Yellow River basin. Silt buildup worsens as the river flow lessens across the floodplain, which happened as more and more river water was diverted for irrigation. Pressure to seek viable strategies for taming the river mounted.

Taming the River with Technology

The Yellow River Basin Geographical Information Center (YRBGC) began to use ArcGIS in 2001.



The YRBGC performs a spatial query.

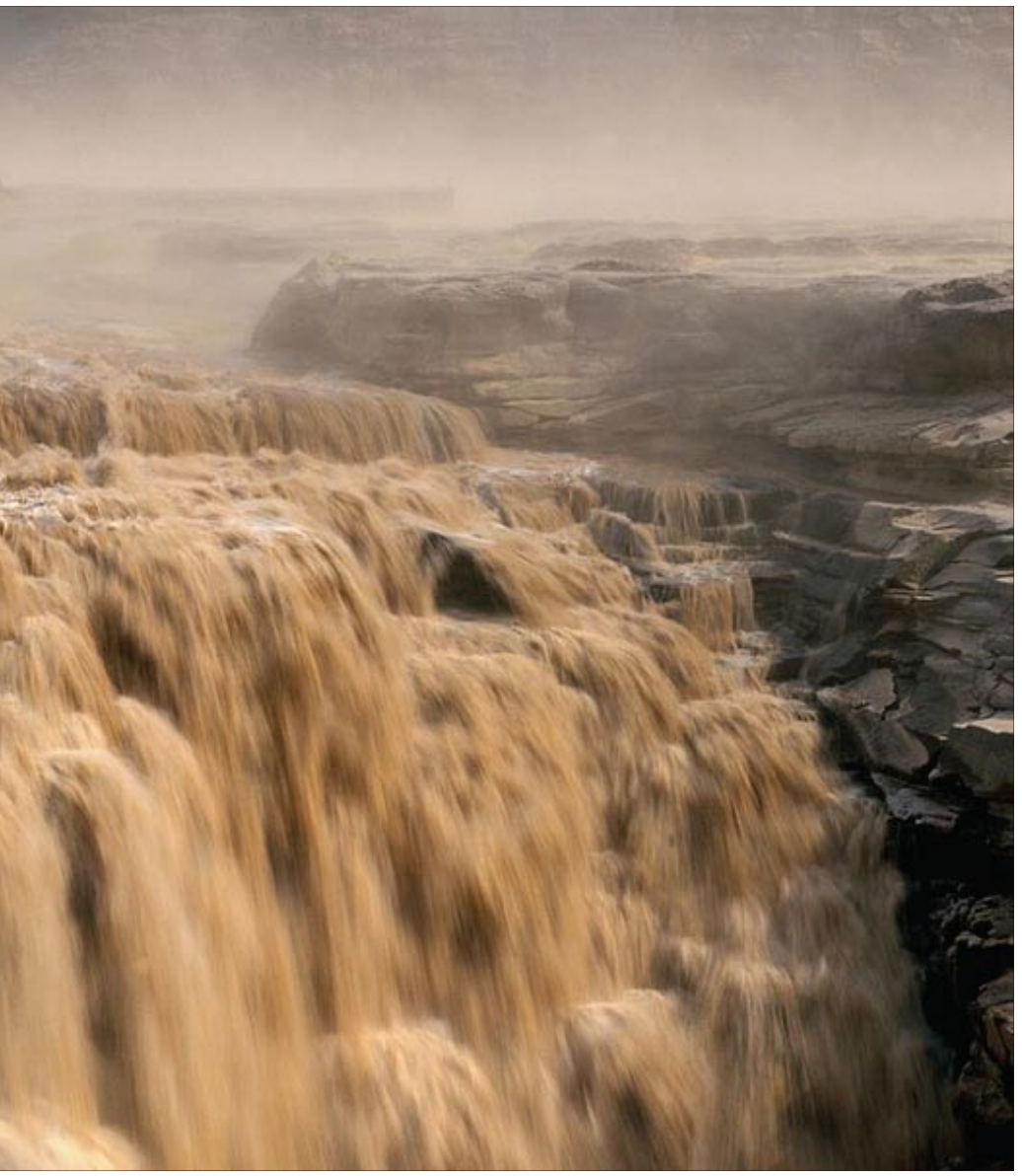
There are now approximately 100 users. In 2002, the Chinese government, with financing from the Asian Development Bank, began construction of the Digital Yellow River project to address the ongoing challenges of the Yellow River, including flood threats, water distribution, water pollution, and soil erosion. Managed by the Yellow River Conservancy Commission, the Digital Yellow River project is still in its early stages of development, but the GIS platform construction was completed in 2009. The result is an integrated digital platform and a virtual environment where natural resource, economic, and social data is analyzed and studied. The visualization and modeling capabilities of GIS software play an important role in these efforts.

To study the natural phenomena occurring in the river, the project collects data via remote sensing and GPS verification. Data storage and processing, mathematical modeling, and support for scientific decision making are other components of the system. Powered with ArcGIS technology, Digital Yellow River is focused on forecasting rainfall and monitoring rising water levels and sources of pollution while seeking new strategies for flood prevention.

This work will help realize the project's goals of promoting economic stability in the region, securing an efficient management plan for the physical river, and advancing a fundamental change in the traditional concepts and approaches to controlling the Yellow River.

Simulating the River's Erratic Behavior

ArcGIS Desktop software, including the ArcGIS Spatial Analyst and ArcGIS 3D Analyst extensions, was implemented to develop the digital river. "GIS provides the technical support for much of the work in the digital river's development," says Gao Qingfang, department head of the Mapping Information Engineering Institute of the Yellow River Engineering Consulting Co., Ltd. "We can efficiently and accurately simulate the river's behavior and assess locations, query



The Yellow River takes its name from the yellow-colored silt it carries.

data, and perform analysis, which enhance our decision-making ability."

GIS is used for collecting map data and building the database for digital line graphs, document object models, and digital elevation models. With the geodatabase, digital river users can edit and query data, visualize scenarios, and print topographic and thematic maps. Data management and system maintenance have been simplified with the centralized system, and with the browser/server setup, users can easily share information by uploading or downloading files via the Internet.

Six data centers were created, including one each for flood control, water regulation, water and soil conservation, resource protection, project management, and e-government. Additionally, a mathematical simulation based on six models is under development, which will provide valuable assistance in flood forecasting, water and sediment regulation, and the construction of flood control projects. The mathematical simulation will provide the basis for the next stage, the nature-economy-ecology coupling system.

To be harnessed, the Yellow River has to be considered comprehensively. This involves studying the natural environment, as well as the economies surrounding the river. When the project is complete, the Digital Yellow River will facilitate the comparison of multiple scenarios in the context of the big picture. This will enable informed decision making regarding major infrastructure projects.

As this digital river technology matures, it will serve as a model application for other major river systems.

More Information

For more information, contact Hu Jie, Mapping Information Engineering Institute of the Yellow River Engineering Consulting Co., Ltd. (e-mail: Hujie519@163.com).

Using ArcGIS Desktop to visualize a dike project in 3D.

GIS Improves Water Management in Saudi Arabia's Eastern Region

By Hussain Ammar and Haytham Abd El-Moniem

Highlights

- ArcGIS supports extensive functionality within a multiuser/multiapplication environment.
- GDWER manages its underground assets with GIS.
- ArcGIS technology successfully integrates with the SCADA system.

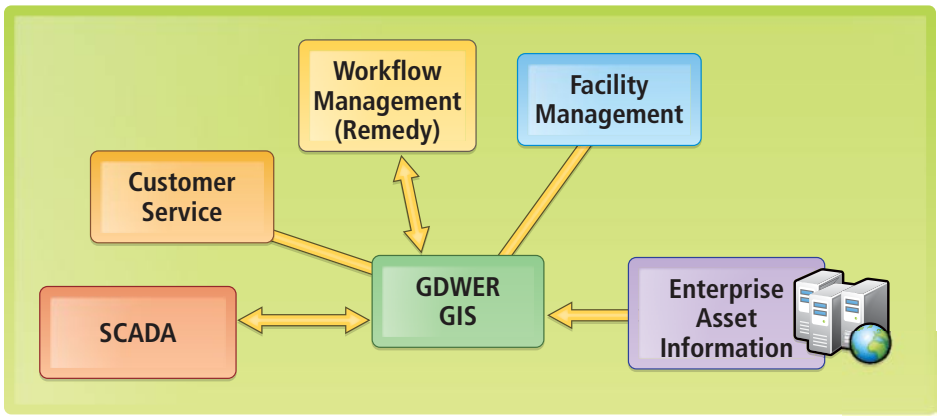
The General Directorate of Water in the Eastern Region (GDWER), Kingdom of Saudi Arabia (KSA), is actively engaged in providing all types of water services in the eastern region of KSA. The organization's principal responsibilities are to design, develop, and implement all water and wastewater network projects, as well as water treatment projects. GDWER also aims to establish a solid structure for the successful operation of water and wastewater utilities.

implement an enterprise GIS solution utilizing ESRI's ArcGIS Server technology.

A unified, spatially enabled water and wastewater data model was built as the basic foundation for the project. The data model represents all water and wastewater elements, such as wells, pipes, treatment plants, fittings, and house connections. GDWER is now using the GIS solution to manage its underground assets.

Key to the success of the GDWER strategy was the implementation of the enterprise asset management (EAM) system. The implementation of an enterprise GIS system enabled GDWER to successfully integrate the EAM system and its location-based asset information, such as pipes, meters, and water treatment plants, with the associated attribute data stored in GIS.

The GIS was successfully integrated with the SCADA system for the well network. The integration allows the GDWER SCADA system to be a part of the central IT network and information



The GDWER SCADA integration workflow.

GDWER is located in Dammam, the capital and largest city of the eastern region, situated on the coastal strip of the Arabian Gulf and bordered by the gulf on the north, east, and south. Other cities that surround Dammam are Khobar, a thriving modern economic hub; Al-Dhahran, headquarters for Saudi Aramco, the largest oil company in the world; and Qatif, a well-populated fishing and agricultural town. Together, these cities have a population of two million people. There are 600,000 people living in the city of Dammam.

Every year, GDWER receives thousands of calls in its service center from people reporting issues such as burst pipes and interrupted water supply. The directorate has a duty to respond quickly to these incidents. However, it wasn't always easy to establish precisely where the problem had occurred. Previously, GDWER had islands of technology and silos of information around the directorate. Data was not shared and was often duplicated.

After a thorough evaluation process, GDWER selected Moammar Information Systems (MIS), ESRI's distributor in Saudi Arabia, in association with ESRI Northeast Africa (ESRI NeA), to

Integrating the Remedy system with the GIS system by viewing the incident location on the map.

infrastructure for quicker response to any malfunctions or anomalies occurring within the well network systems.

GDWER implemented a call center using Remedy software. When the call center receives a customer call, the system initiates operational response, then uses a predefined workflow to manage event tracking and logging. The workflows developed within the Remedy system allow GDWER to define and manage its standard operating procedure to support the call center system. The workflows will analyze the system's automated response to an event and escalate the response to a higher level if required.

Through the Remedy system, the user can automatically record an exact location for each event in the network and analyze it to determine the impact on the surrounding area. Using the map location as a reference, the system can then identify assets GDWER has at any particular location and dispatch work crews to respond to the event.

About the Authors

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More Information

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Locating, Appraising, and Optimizing Urban Storm Water Harvesting Sites

Central Business District of Adelaide, South Australia

By Matthew D. Shipton and Sekhar V. C. Somenahalli

Highlights

- GIS is helping make South Australia more drought resilient.
- GIS is used in the creation of strategic water resource plans.
- Specific storm water harvesting benefits are identified and maximized with GIS.

Storm water is surface water runoff generated from rainfall. It is created when rainfall intensity exceeds infiltration capacity. This often occurs when rain falls on hard, impermeable surfaces, such as footpaths, car parks, and roads. In urban areas, this water then typically flows untreated via storm water drains into local watercourses.

Harvesting collects and stores storm water before it enters natural environments so that it can be reused at a later time as an alternative to water from water mains. Before it is reused, captured storm water may be treated to improve its quality. Recycled storm water is typically used for nonpotable demands that do not require a high level of treatment, for example, irrigation, toilet flushing, car washing, and certain industrial and commercial uses.

Harvesting storm water reduces the detrimental impacts that urban development can have on rivers. It reestablishes more natural river flow regimes and improves the quality of the water in rivers. In addition to the environmental benefits, storm water harvesting can also be financially attractive to both its suppliers and users. Harvesting storm water reduces demand for water from water mains, delays the need for major new water resource infrastructure, increases water security, and has low pumping costs since the source is often close to the point of use (i.e., it is generally harvested and used in the same urban area).

Storm Water Harvesting and GIS

Though beginning as a master's research project, the study described below was extended by the University of South Australia, through its ESRI site license, to include detailed hydrological modeling of individual storm water schemes. The team performed this analysis using the Environmental Protection Agency specialist storm water modeling GIS (EPA SWMM). The objective was to verify claims made in the South Australian government's Water for Good plan, with results to be published later in 2010.

This study demonstrates the value of GIS to storm water managers through the assessment of harvesting opportunities in the central business district of Adelaide, South Australia. Adelaide is the largest city in the driest state in the world's driest inhabited continent.

Data used in the study was obtained from various sources, including the Australian Bureau of Meteorology; the South Australian Department for Environment and Heritage; the South Australian Department of Planning and Local Government; and the South Australian Department of Water, Land and Biodiversity Conservation.

The team members identified areas suitable for storm water harvesting in ArcGIS Desktop by analyzing land cover, land use, and topography. They defined suitable areas as having

- Predominantly impermeable surfaces, such as concrete or asphalt pavement
- An appropriate land use (that is, one that did not pollute the quality of the runoff from that area)
- A natural drainage pattern that facilitated the collection of storm water from a large area without significant earthworks

First, the team defined each part of the study area as permeable, semipermeable, or impermeable. This categorization was derived from a reclassification of detailed land-use data based on assumptions regarding the average permeability of each land use. The output was then refined using local site-specific information, Normalized Difference Vegetation Index (NDVI) data, georeferenced aerial photography, and the Digital Cadastral Database (a source of legal land parcel data that, among other things, contains data on roof materials). The refinement allowed corrections, such as the alteration of the botanic gardens from being defined as impermeable—because its land use was public institution—to being permeable, based on its high NDVI and land cover as determined by aerial photography.

Next, the team identified all the roads and the areas in proximity to them in the study area. It was assumed that storm water runoff in these areas would be particularly polluted by contaminants from cars. These contaminants would likely include heavy metals, hydrocarbons, particulates from vehicle exhausts, debris from tires and brake linings, ultrafine platinum from worn catalytic converters, and lead salts from batteries. Most of the roads in Adelaide's central business district are laid out in blocks. Each side of the main blocks is 150 meters long. Areas in proximity to roads were defined as being less than 60 meters from a public road, since this is slightly less than half of 150 meters. The areas identified by the buffer that were more than 60 meters from a road were then intersected with the previously described impermeable areas layer. This procedure identified 245 separate areas that were impermeable and not close to a road. From these potentially suitable areas, sites that were less than 100 square meters were excluded on the grounds that they would not be economically feasible for harvesting storm water. This reduced the number of potentially suitable sites to 28.

Storm water harvesting areas modeled in proximity to public roads.

Then, the team spatially joined information from a digital elevation model (DEM) with a 3-meter resolution to the polygons representing the 28 remaining potentially suitable sites. This enabled the average slope across each site to be calculated. Sites with a greater slope would generate more runoff per unit area per unit of time. The DEM was also used to define the main catchments and subcatchments in the study area (using the Arc Hydro extension). The team members calculated the number of subcatchments that each of the 28 potentially suitable sites covered. The number ranged between one and four. Those covering one subcatchment were deemed better suited to storm water harvesting since surface water runoff in them would drain to a single point.

The team ranked the suitability of the 28 remaining sites and visited the 10 most suitable sites to confirm if harvesting could be done within the available space; would not negatively impact existing land uses; and would be practical, given the local topography and existing drainage infrastructure. This process led to the removal of sites, such as cemeteries, that would be inappropriate for storm water harvesting.

Among the remaining potentially suitable sites, there were two that were highly suitable. These were the grounds of Adelaide Festival Centre and the land occupied by the University of South Australia's City East Campus and the main Adelaide University City Campus. These two areas are not highly permeable, less than 100 square meters, close to roads, or flat.

The next task using GIS was to examine if and how the most suitable harvesting sites could be connected by storm water infrastructure to form one storm water harvesting scheme. This would have economies of scale, since the project would then only require one treatment and storage solution. This task was completed using EPA SWMM.

Once the infrastructure layout of the optimal scheme had been determined, the team used EPA SWMM to model each of the harvesting sites' vulnerability to flooding after heavy rainfall. EPA SWMM was also used to determine the likely impact of climate change (reduced rainfall) and urbanization (increased impermeable area) on harvesting yields at each of the sites.

Conclusion

In South Australia, storm water harvesting is increasingly regarded as an untapped, sustainable water resource. This study demonstrates how GIS can be used to plan storm water harvesting schemes at both a strategic level by way of options appraisal and at a design level via hydraulic simulation. GIS provides decision makers with information that enables them to maximize system performance (storm water yield), economic feasibility (payback period), and public acceptability of harvesting schemes while reducing environmental degradation (caused by polluted storm water) and risks to public safety.

The GIS modeling undertaken with ArcGIS Desktop, Arc Hydro, and EPA SWMM in this study identified a number of potentially suitable areas in Adelaide's central business district that could be used as storm water harvesting catchments. A simulation of a harvesting scheme that used four of the most appropriate catchments found that 330 ML of reusable storm water could be collected every year. This finding should be interpreted with due regard for both the untreated quality of the harvested storm water and the irregular timing at which it would be available.

About the Authors

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Underwater Vehicles Provide In-Depth Water Supply System Bathymetry

City of New Bedford, Massachusetts, Develops New Methodology with GIS

Satellite image of New Bedford's Five Pond System. Inset: An Iver2 autonomous underwater vehicle just below the surface on a mission.

Highlights

- Rapid bathymetric production is achieved through the merger of affordable AUVs and ArcGIS.
- GIS helps cut through computational complexity and difficult visualization for better decision making.
- Advances in AUV technology provide a cost-effective solution to bathymetric data collection.

Until recently, the City of New Bedford, Massachusetts, had to operate with century-old reservoir survey data to support the city's decision making for economic development issues. Emerging technologies in GIS and autonomous underwater vehicles (AUVs) have presented a solid foundation on which to base a methodology for an accurate and modernized visualization of bathymetric data. The concept of using AUVs in conjunction with GIS provides an attractive alternative to develop the required bathymetric data needed for a host of contemporary water management requirements. The goal of the project described in this article was to make bathymetric visualization a simpler, quicker, and more affordable process.

The opportunity to employ GIS for bathymetric surveying was based on the need to provide output data to the customer. During summer 2008, the Advanced Technology and Manufacturing Center (ATMC) at the University of Massachusetts Dartmouth was approached by the City of New Bedford to survey a reservoir pond system, which they decided to jointly conduct using AUVs. ATMC was already using ArcGIS for several projects with the City of New Bedford and decided to exploit this software to ingest, archive, and process the vast amounts of data collected by the AUVs. This technology offered a cost-effective method to obtain accurate and up-to-date information on the pond system and a level of detail not previously possible.

The methodology used in this assessment made use of multiple Iver2 AUVs' sampling capacity, providing tens of thousands of data points per pond, compared to less than 100 sampling points as used in the manual depth hydrographic survey performed over a century ago. Modern GIS interpolation techniques provide an evaluation of a pond's bathymetric features by creating a high-resolution assessment of the pond's geometric characteristics. In doing so, the volume calculation techniques are more accurate than traditional methods, and a confident assessment can be provided. Prior to the development of this technology, updating bathymetry data required hundreds of manually obtained depth readings at a huge labor cost with results far less accurate than what was accomplished using ArcGIS and modern AUVs.

Data was collected using the AUV technologies mentioned above, and analyses of the results were done using a combination of existing and custom-developed software tools.

Benefits of the Merger of Technologies

The concept of summing all scattered points to find the average depth will produce a biased result since the data is not uniformly distributed. ArcGIS provides tools that can approximate a uniform distribution of the depth measurements. By collecting thousands of depth samples per pond, the ATMC team was able to estimate the depth values at uniformly distributed locations. To produce an average depth estimate for the pond, depths at uniform locations are required. By collecting the depth values measured throughout each mission within a given boundary (the surrounding edge of each body of water), the GIS was then used to produce the pond floor through an interpolation process that essentially considers nearby points and trends. From here, the software assigns estimated depth values as a pixelated area across the entire region of the pond. Having created a uniform distribution, an assessment of average depth can be made based on the number of points factored and the accumulated depth. The interpolation methods used provide an accurate way of estimating the average depth.

Interpolating Data

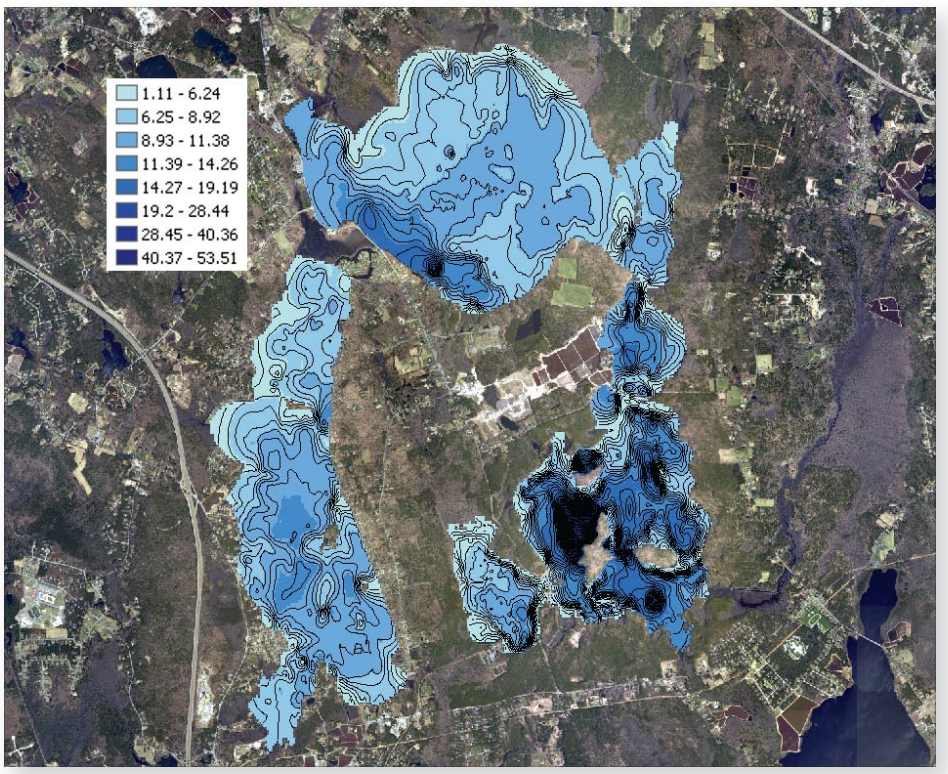
Once the physical data collection is completed, the GIS provides postprocessing analysis, allowing the user to translate the data into a visual rendering. The GIS produces a layering of the entire study area on its global mapping system. Given the data, ArcGIS provides a variety of interpolation methods that estimate the unknown values for the entire study area. The goal is to create surfaces that represent an accurate and logical depiction of the data. Any location's values are estimated based on the values of points nearby. By using a selection of embedded algorithms, GIS converts recorded points into a practical, visually appealing depiction, simplifying a user's task of interpreting relatively complex data.

By making use of these embedded features, such as the several interpolation techniques, the points collected are computationally grouped into bodies of corresponding colors or depths. This method of interpolating depths enables simplified understanding of what is actually occurring on the pond's floor, an otherwise difficult and impractical task. These hydrographic surfaces are then used for volume calculations.

Because the two platforms were not immediately compatible, the ATMC team developed several utilities to facilitate moving the raw data output from the AUV to ArcGIS. These utilities enable fast generation of bathymetric surfaces; the outputs were typically generated within 15 minutes of mission completion. The utilities consist of algorithms that ingest the raw data from the Iver2 and produce an ArcGIS software-compatible file format, which is then converted into a feature class, necessary for ArcGIS manipulation.

Quick and Cost Effective

The effort described here—which paired modern GIS functionality with low-cost, highly capable, person-portable autonomous underwater vehicles—demonstrated robust bathymetric surveying in ponds, watersheds, and coastal systems. This state-of-the-art technology is more accurate than techniques used in the past. Manual bathymetric sampling is slow, impractical, expensive, and inaccurate compared to the techniques used in this modern assessment. Modern GIS interpolation techniques can exploit the data collected by an AUV and provide an evaluation of bathymetric features by creating a high-resolution assessment of the pond's geometric characteristics. In doing so, the volume calculation techniques are more accurate than traditional methods and, once developed, allow quick turnaround in future surveys.



This shows the New Bedford pond system with bathymetric overlays.

More Information

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Enterprise GIS Takes Off at Phoenix Sky Harbor International

Highlights

- The enterprise GIS is stored in Oracle Spatial and accessed through ArcSDE.
- The GIS includes business tools for managing the airport's operations and growing number of assets.
- About 85 staff members, who are neither GIS specialists nor technicians, access the GIS weekly.

Already one of the 10 busiest airports in the world, with approximately 1,500 flights, 100,000 passengers, and 700 tons of cargo daily, Phoenix Sky Harbor International Airport generates an economic impact of more than $90 million a day for Arizona's largest metropolitan area.

With a growing pool of travelers and cargo relying on the airport for safe passage to a final destination, the City of Phoenix recognized that its Aviation Department needed an enterprise-wide GIS that would combine data locked in existing information systems into a single user interface and could serve more than 200 airport personnel simultaneously. Such a system would not only improve customer service and safety, but it would also allow users to effectively manage their work activities by providing accurate and current information.

"We recognized the need for an enterprise-class information system to support changes from planned development," says City of Phoenix assistant aviation director Carl Newman. "We were confident that with these increased efficiencies, GIS would pay for itself over time."

A major requirement was that a significant number of staff, who are neither GIS specialists nor technicians, would need to access the GIS weekly to review or plan maintenance work orders, check interior space measurements and calculate rates for airport tenants, create area maps with aerial images showing existing conditions and planned improvements, insert maps into slide presentations for management, and output maps and data for internal and external reporting.

In 2007, the city and its Aviation Department made the decision to move forward with GIS technology and selected ESRI Business Partner Woolpert, Inc., a design, engineering, and geospatial firm located in Dayton, Ohio, with experience in the airport industry, to assist with the implementation.

All the data for the GIS is stored in Oracle Spatial and accessed through ArcSDE. Aviation Department personnel—about 85 unique users from the Aviation Department's 10 divisions—use the resultant system via a Web portal built on the ArcGIS Server platform. The enterprise GIS also includes business tools for managing the airport's operations and growing number of assets.

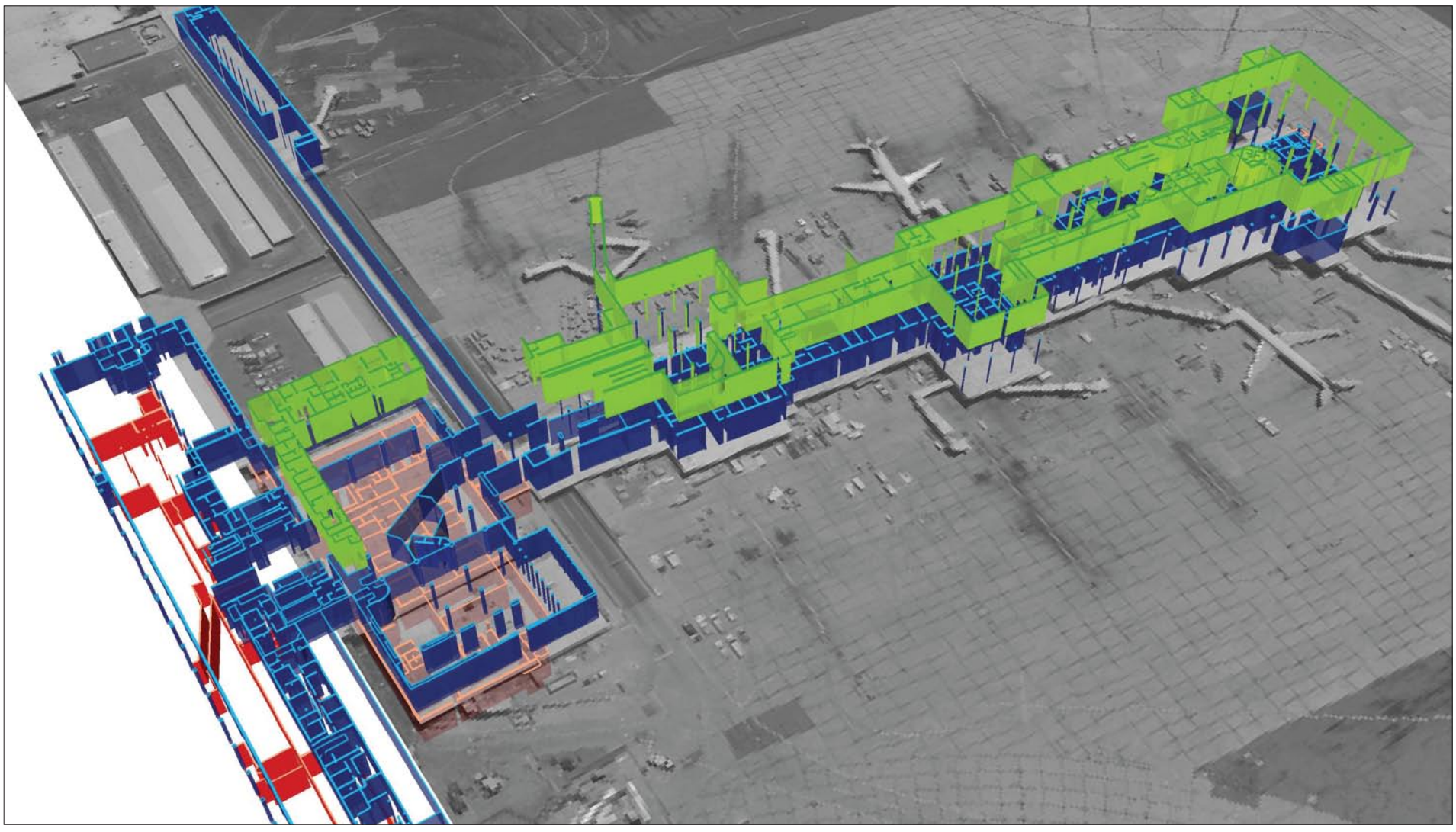
"Before 2007, data on interior and exterior assets was maintained in several systems, which weren't always compatible," explains Michael Youngs, Phoenix Aviation Department GIS program manager. "If someone asked a basic question like, 'How many fire extinguishers do we service?' there was no easy way to answer."

Information on the Fly

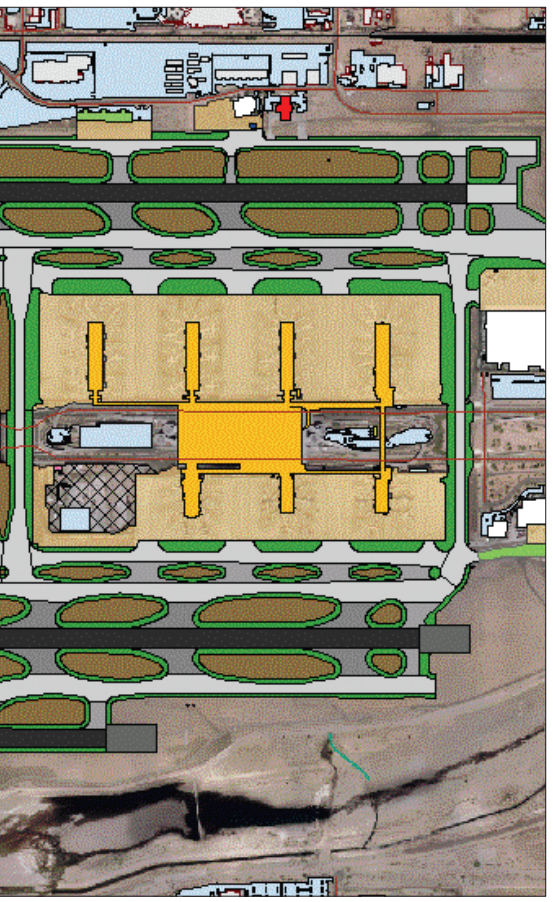
The airport's enterprise GIS features an abundance of data, sophisticated technology, and reengineered business processes. The enterprise system gives airport employees access to

- Aerial photography and digital orthophotos of areas surrounding the airport operations area
- Aboveground features and underground utility data
- A geodatabase design with 300 feature classes, from smoke detectors and passenger assistance monitors to noise contours and 3D roof prints
- Interior floor plan data and attribution for buildings in and around the airport, collected via floor plan surveys and CAD drawing conversions
- An intranet viewing portal based on ArcGIS

GIS portal users can access this overview map of Phoenix Sky Harbor International Airport.



The airport stacked floor plans are available in the GIS.



Server technology
- Information that was integrated from the previously existing systems
- Ten servers in multiple clustered environments, which provide performance, reliability, and availability, including a redundant failover system at a remote location in case of system outages

What users cannot get in self-serve mode from the portal, they get by submitting requests to the GIS group. User requests, about 16 per month, typically involve oversized, data-rich maps; custom reports; or complex queries. "We're getting repeat requests now because users understand what we can do for them," says Jamie Ritchie, the department's GIS coordinator.

For example, to assist the Operations Department, the GIS group created new emergency evacuation maps, which had been difficult to update and reproduce. These maps, complete with exits, assembly areas, and varying "you are here" orientations, were saved as PDF files on DVDs so tenants could print and post maps and share them with employees. Explains Youngs, "We could produce these because we have very accurate interior building data, which is atypical for airport GIS programs."

To assist the Fiscal Management Department, the GIS group completed a space accounting and reconciliation project. "In one day, we generated maps and reports identifying discrepancies in actual versus leased square footage," Youngs adds. "Without the GIS, this would have been labor intensive using a wheel and tape measure and taken a month or longer."

Phoenix Sky Harbor International Airport is currently developing the PHX Sky Train, which by 2013 will begin transporting passengers to and from the airport, reducing the number of vehicles, easing traffic and curb congestion, and providing a seamless connection with the regional light rail system.

"We saved on startup costs for the train project because we provided engineers with digital terrain models, contour data, and orthophoto imagery from the GIS," Youngs explains. "So they didn't have to collect that data again."

Custom Tools Streamline Daily Business

A critical application for portal users is the GIS interface with Phoenix Aviation Department's work order management system. When a maintenance worker must replace air conditioning equipment, for example, the worker accesses the portal to find the exact location and other equipment nearby due for maintenance. This exercise maximizes productivity, as it combines activities.

"Uniting the GIS with the work order management system allows us to plan efficiently, and it's just one way the GIS is saving money," says Youngs.

Another custom application helps users manage airfield signage. Employees can access signage locations and images through the portal, plan and track maintenance, and generate reports to show compliance with Federal Aviation Administration (FAA) standards.

The ArcGIS Server interface with the computer-aided dispatch system allows dispatchers to access geographic data when addressing calls. "We're now considered the official source of data for airport police and fire dispatch," says Newman.

One of the newest features to the airport's GIS is a project planning tool that allows users to add a proposed project location to the GIS, query the system, and run reports to detect potential conflicts, such as affected utilities and other projects planned in that area. More business tools are planned. According to aviation director Danny Murphy, "Our goal is to produce a tool for every business function at the airport that relies on location information."

Naturally, some operating practices needed to be revamped before GIS was implemented. For example, Aviation Department workflows were redesigned so that changes in the field, such as new construction, retrofits, maintenance, and tenant improvements, could be intercepted, captured, and recorded in the system by the airport's GIS technicians. Described as the heart and soul of the data maintenance operation, the GIS enables the technicians to update the system constantly, with most changes being completed within days.

The same group conducts random field checks using GPS and surveying equipment and audits interior spaces to verify data on converted CAD drawings. Employees who observe an update, such as an airfield light not captured in the GIS, can use the system's redline tool to identify the change so it can be validated in the field and included in the GIS.

Youngs and Ritchie train employees on portal navigation and procedures for requesting custom maps and reports. Youngs routinely gives project updates to management at all levels. "We continue to show everyone what the capabilities are and keep our customers engaged and excited," says Youngs.

More Information

For more information, contact Mike Youngs, GIS program manager, City of Phoenix Aviation Department (e-mail: mike.youngs@phoenix.gov).

GIS Delivers for Lithuanian Bakery

Cutting Costs and Optimizing Truck Usage with GIS-Based Logistics

Highlights

- Reduce routes and mileage by 25 percent with the ArcLogistics software solution.
- Vehicle efficiency is increased 20 percent.
- Implementation was completed in two hours; training finished in two days.

Bread is big business in Lithuania. Most bread in the country is supplied by UAB Vilniaus duona, the oldest and largest bakery in Lithuania. Vilniaus duona runs three bakeries and two distribution centers from which wheat and rye breads and bakery goods are produced and delivered to 2,000 stores.

While Vilniaus duona is the most popular bread producer, with a market share of 34 percent and 2008 revenues of EUR 34.5 million, there is room for efficiency through optimization. To accomplish this, Vilniaus duona realized that optimizing delivery of its products was very important. Skyrocketing logistics costs in the last few years, from increasing fuel prices to rising costs of vehicles and other delivery assets, mean that having a clear picture of the amount spent on product delivery can contribute to a healthy bottom line.

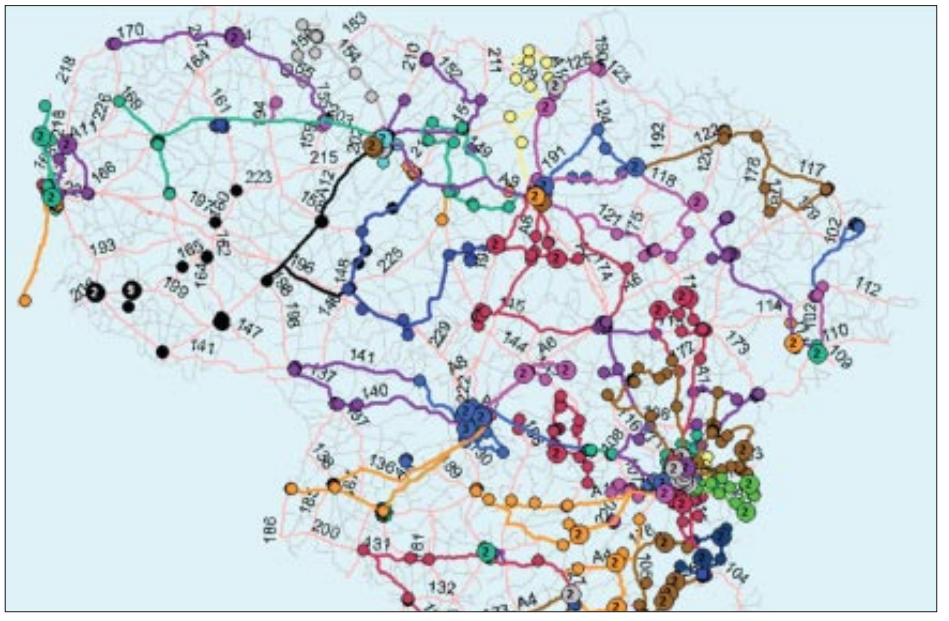
Bringing Product Delivery into the 21st Century

The company runs up to 100 routes each day, with an average route distance of 130 kilometers. These routes have been organized manually with paper maps. Dainius Buknys, logistics manager at Vilniaus duona, explains, "Our transport manager could be seen staring at a map containing multitudes of flags, notes, Post-its, and dots. And with so many routes, you can imagine how many maps he had and how often he had to change them. The maps would wear out quickly and have to be replaced."

To optimize the routing process and ensure they have a handle on costs, managers at Vilniaus duona set out to find a delivery route solution that provides accurate information to everyone, from managers and employees to the contractors delivering products. Another requirement was to see the routes on a map, not just a spreadsheet of delivery stops.

ArcLogistics, a GIS-based software solution, was chosen after an intensive survey of available options. Vilniaus duona chose the ArcLogistics software solution because it provides realistic routes and schedules that are flexible and easy to edit.

With ArcLogistics, Vilniaus duona was soon able to solve scheduling problems that took into account several aspects of its operation, such as truck capabilities and time windows. So the company had not only replaced the paper maps but was also creating optimal routes that helped it save in several aspects of the operation while considering the big picture. The company can also change the routes manually, which further helps with scheduling, cutting fuel costs, and improving customer service.



Visualizing where stops are made helps staff and drivers make the best decisions when routing products for delivery.

Quick Implementation and an Easy Workflow

Implementation and training were completed in one week with no cost overruns. Adds Buknys, "As a profitable company, we didn't want a solution that would take a long time to be implemented. We wanted to move fast once our decision was made."

The workflow for the company today is straightforward. Order information is stored in a Movex business system, which is a common enterprise information technology system found in manufacturing and distribution companies in the Nordic region. During the implementation process, all client locations were geocoded and x,y coordinates imported into Movex. When routing is needed, such as creating a new route or reviewing existing routes, Movex information—including the coordinates of client locations, delivery volume, delivery time, and route number—is imported into ArcLogistics. A variety of reports can then be created directly from the software for the transportation managers.

Staff can also look at maps on-screen, simulate potential routes, and change them if necessary. For example, when looking at routes in the city of Vilnius, two were found to go to the same destination. It was an easy decision to cut one of the routes, saving time, resources, and money. In Utena, a daily route was decreased by 70 kilometers.

Vilniaus duona needs to ensure that its breads and bakery goods are fresh when delivered. The company uses six cross-dock stations—facilities that transfer goods between vehicles so a warehouse is not needed. With the ArcLogistics software solution, it discovered that a cross-dock station in Taurage could be closed while still serving the same number of customers. In another instance, logistics managers placed a new cross-dock station that eliminated 900 kilometers of travel per day.

GIS Leads to Logistics Efficiency

Vilniaus duona has new insight when negotiating with partners. Since the routes can be seen on a map, everyone is on the same page, with all the information they need to make informed decisions. Vilniaus duona knows exactly what its routes look like, how many miles it needs to cover, and how many trucks and drivers are required. Finding new transportation providers is now easier because the company knows exactly what it needs.

"The software gives us the feeling that everything is under control and there is nothing that will happen unexpectedly," says Buknys. "The managers are happy knowing this, and the employees are happy because they have tools they can use to fulfill their tasks."

Vilniaus duona has seen many benefits since implementing ArcLogistics. Total route distances have decreased 5,800 kilometers per day, or 175,000 kilometers per month—a 25 percent decrease. Thirty routes, or 25 percent of routes, were eliminated.

Just as important, the software empowers employees to find solutions. "All these changes were made because we had our new logistics software solution," says Buknys, "which is a great tool to help us look at problems quickly and find more accurate results." Vilniaus duona found that the payoff of using a GIS-based logistics package was worth the effort, and it found that out soon after implementation.

More Information

For more information, contact Dainius Buknys, head, Logistics Department, Vilniaus duona (tel.: 370-682-601-91, e-mail: Dainius.Buknys@vduona.lt).

Server GIS Buses in Change for Danish Public Transit Agency

Highlights

- Complicated and time-consuming workflows and processes are streamlined with a solution based on ArcGIS Server.
- New system promotes better integration between internal IT systems.
- Route planning tools ensure better transit service to outlying communities.

Movia is Denmark's largest public transit agency, serving 214 million passenger trips per year in the Greater Copenhagen area and parts of eastern Denmark. With 570 bus lines and 9 local train lines in its coverage area, Movia strives to meet the daily transit needs of 2.4 million inhabitants with an employment base of 1.2 million jobs.

As a public transit agency, planning and maintaining bus routes are vital parts of its business, but until recently, the workflows and processes of transit planners were not as efficient and streamlined as Movia would have preferred. Movia has many dedicated employees, but the transit agency's computer systems and internal processes needed a technological boost to streamline its business processes.

When planners needed vital transit planning data, such as demographic characteristics and location of educational facilities for route planning, it became evident that Movia's systems made workflows and processes too time consuming and complicated. The agency concluded that to meet the increasingly higher demands from its customers, it had to make some technical updates to provide the best possible customer service and communications.

Movia set some goals that it believed would make the company a global leader in the transit industry. The agency's main goals were to design a more efficient workflow, increase customer service by providing real-time transit information, and create an integrated planning system where all the vital parts of transit planning and operations are integrated into one solution. Movia also wanted to have access to relevant data to perform analyses and forecasting to enhance its transit planning.

"The core idea was to improve transit planners' workflows," says Movia IT manager Carsten Bo Jacobsen, "by ensuring that they all had the relevant information readily available to them on their screens."

The integrated system that Movia was seeking did not exist in an off-the-shelf software solution. Therefore, the company sought a strategic cooperative relationship that could assist in developing and maintaining the desired solution. Movia found that Informi GIS A/S, ESRI's Danish distributor, offered the best solution and support to accomplish its goals.

"We chose a GIS platform, key in the IT architecture," says Jacobsen, "as we believed that in travel planning and customer information, the map is the key element." Movia selected Informi GIS and ArcGIS Server because, at a strategic level, the pairing had the most to offer in relation to GIS collaboration and product development.

Building on ArcGIS Server, Informi GIS and Movia developed GeoTransit, a whole new range of transit applications that seamlessly integrated the information from Movia's existing systems with spatial data maintenance tools. GeoTransit supports Movia's enterprise-wide business processes by providing the tools to maintain the spatial location of stops, routes, patterns, and fare zones along with the ability to integrate current schedule information, passenger counts, predictive travel time information, and real-time road closure information.

Integrated Systems Make the Buses Run on Time

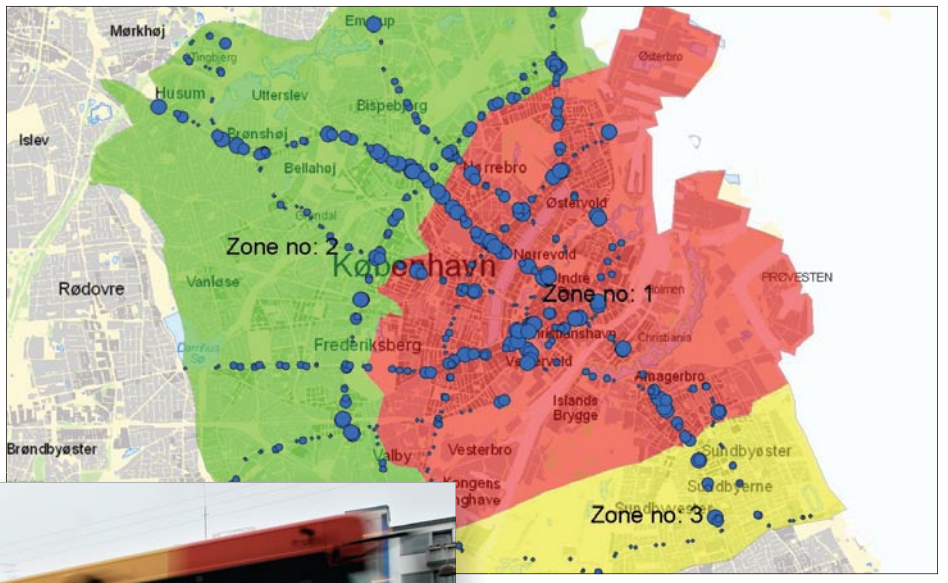
Before GeoTransit was developed, it could take three days for a driving plan to be assigned to a bus route through a specific area because the required information was located in many different systems. Now that all the systems have been integrated, it takes only a day to complete the same task. The process has become much easier to manage because the system provides direct access to all relevant information, and having more efficient workflows has reduced the time needed to train new transit planners.

With GIS as a central part of the IT architecture, data that originally did not have a spatial reference is now linked in the GIS. This gives Movia the ability to better analyze stops by identifying passengers within a specific service area. Movia has also found it useful to identify the busiest bus stops in a service area and show how many buses are running daily at one stretch to ensure efficient route planning. To provide passengers with bus arrival information at select stops, Movia calculates travel speed on selected lines and transmits this information to kiosks. Using the GeoTransit solution, Movia is also able to divide the number of passengers and road map hours into geographic areas to better serve outlying communities.

The GeoTransit integrated solution also opens up new possibilities. "We are on track to lift up to a level where GeoTransit not only is a transit planning solution but also provides vital transit decision support," explains Mogens Buch-Larsen, vice president, IT, Finance and Human Resources, Movia. "In the future, we will move in a direction where we can ask the system to make recommendations as to how an optimal network appears based on employment, education, commuting, and demographic data patterns. The system has improved efficiency and allows the analysis of a much wider range of parameters."

Movia's GeoTransit solution meets the needs and requirements of a modern transit agency driven to compete with other, more individual modes of travel, such as automobiles. It has allowed more efficient and accurate route planning, ultimately improving the company's overall bottom line. Additionally, GeoTransit has improved opportunities for providing customer information, which in turn has helped increase customer satisfaction and will ensure that more passengers see Movia as a viable transit alternative.

With more than 15,000 bus stops, 112 local train stations, and 338 kilometers of train tracks loaded into the GIS system, it is now possible for Movia to gather and analyze valuable data for planning, managing, and monitoring daily transit traffic into one integrated system.



Above: Passenger counts by transit service area. Left: A public transit bus during rush hour.

More Information

For more information, contact Mogens Buch-Larsen, vice president, IT, Finance and Human Resources (e-mail: mbl@moviatrafik.dk), or Carsten Bo Jacobsen, IT manager (e-mail: cbj@moviatrafik.dk), both of Movia.

Road Status and Damage Assessment Tool Aids Emergency Operations in New York

Highlights

- Emergency data collection requirements are met with ArcGIS Engine.
- With GIS, lag time between obtaining and providing a report is minimized.
- Decision makers easily view critical information in the ArcGIS Server software-based RSDA Viewer.

The New York State DOT's ArcGIS Server environment provides complete road status and damage assessment information to emergency operations staff in its main office, regional office, and emergency operations center. Inset: Weather can seriously affect New York State road conditions.

New York State comprises 62 counties and more than 114,000 miles of public highways and roads. Geography varies widely across the state. The New York City metropolitan area dominates the Downstate Region of New York, and other large cities are spread across the state, including Albany, Buffalo, Rochester, and Syracuse. The Adirondack and Catskill regions are covered with mountain peaks and lush forests. Much of the remaining area of New York, including the central Finger Lakes and western New York, are largely rural and dotted with small communities, farms, and wineries.

The New York State Department of Transportation (NYSDOT) is responsible for more than 15,000 miles of state-owned roads, which vary from divided multilane interstate expressways to two-lane roads in rural areas, as well as all 20,000 bridges in the state. When a weather event or other incident that has a major impact on the highway system of one or more New York counties forces the governor to declare a state of emergency, NYSDOT resources are activated to assist in assessing and repairing damage to all public highways, including local streets, in those counties.

During emergencies, it is critical for NYSDOT to be able to collect and report current road status and damage assessments in a consistent and timely manner. This information enables NYSDOT supervisors and managers to deploy limited department resources most effectively. In addition, NYSDOT has a responsibility to provide current road status information and report on the progress of response activities.

Until approximately January 2008, NYSDOT had used its now legacy GIS tools to assist with emergency response for many years. Since the mid-1990s, one GIS application, the Emergency Road Status tool, had been used in the field by assessment teams to report the current status of the highway network using shapefiles. The system was simple to use and effective for the most common events in the Northeast, such as severe snowstorms. Then, when widespread flooding hit New York in June 2006, NYSDOT quickly developed a server-based application, the Damage Assessment Reporting System (DARS). DARS provided assessment teams with a browser-based form to enter detailed reports on damaged highway infrastructure, including the feature (e.g., culvert, bridge, pavement), the location, the type of damage (e.g., culvert plugged, culvert washed out), and other related information. An Internet management service provided an operational map of assessments collected with DARS.

Each of these systems quickly highlighted the shortcomings of the other. The Emergency Road Status tool did not have the functionality to collect detailed damage assessments and required too much time and effort to transmit reports to the main office. DARS lacked the more intuitive map-based interface for data entry and required an internal network connection. Assessment teams that could not connect to the Internet would not have direct access to the application.

In late 2007, NYSDOT's GIS group began work with ESRI Business Partner Fountains Spatial, a GIS consultant in Schenectady, New York, to develop the Road Status/Damage Assessment (RSDA) system. RSDA would be a single GIS-based application that would improve on the functionality of the legacy systems to fully meet the department's emergency data collection requirements. As a foundation technology for the application, NYSDOT and Fountains Spatial quickly settled on the ArcGIS Engine development environment to fully leverage ArcObjects and the geodatabase.

The primary component of the Road Status/Damage Assessment system is the field tool. The user interface includes the map, basic navigation tools, and separate interfaces for coding road status on the street network and point-located damage assessments. The RSDA field tool allows assessment teams to compile road status and damage information in a local file geodatabase without a network or Internet connection. The contents of the pull-down menus are based on domains in the RSDA geodatabase, so adding a new damage type to the application requires a simple geodatabase change rather than code changes. The field tool is also capable of using GPS coordinates to find a current location or place a damage assessment location.

A major goal for the project was to minimize the lag time between obtaining a report in the field and providing that report to decision makers in the command centers. The development team accomplished this by providing communication between the RSDA field tool and a multiuser geodatabase. When an NYSDOT network connection is available (through a field office or secure VPN), RSDA will transfer new and revised reports to the enterprise geodatabase using the Upload tool. This capability greatly improves reporting speed.

The first true test of the Road Status/Damage Assessment tool came in December 2008 when an ice storm severely crippled New York's Capital District and surrounding areas. Columbia County was hit especially hard with downed trees and power lines, effectively shutting down much of the state and local highway system. The emergency operations center (EOC) began sending out assessment teams with RSDA on Sunday, December 14. Comprehensive information on the status of the highway system, as well as detailed damage assessments, was uploaded to the enterprise geodatabase, and the road status was continually updated during the week. Decision makers in the main office incident command center and the local EOC could easily view this information in the ArcGIS Server software-based RSDA Viewer.

The NYSDOT emergency operations center used information collected by RSDA to prioritize repair and cleanup work. The map-based view of damage assessments provided crews with a view of problems nearby, allowing more work to be accomplished on a single trip. The RSDA Viewer was provided (via Citrix) to Columbia County's EOC. By using the same operational picture at both locations, the state and county were better able to coordinate their response activities.

RSDA reports also allowed NYSDOT to communicate the condition of the highway system to emergency services, utility providers, and the community. For example, the EOC helped school superintendents make decisions on school closings by providing summaries of road closures and conditions for each school district.

After the event, emergency operations staff gave RSDA high marks for assisting in their emergency response efforts. The EOC reported that new teams with no RSDA or GIS experience had a working familiarity with the application with just 5–10 minutes of instruction. Almost 100 damage assessments and road status updates for every public road in Columbia County were successfully uploaded to the enterprise database.

Much of the success of the RSDA implementation may be credited to the iterative development process. Samples of the user interface were built in the first three weeks, enabling the team to make good early decisions about workflow and usability. A few weeks later, a prototype was provided to a pilot group of individuals responsible for emergency operations for their comments and feedback and incorporation into subsequent development. Before a final version of the tool was accepted and deployed, NYSDOT's emergency operations center used a prerelease version of RSDA in a full-scale, statewide drill. Again, the project team evaluated and incorporated comments from the user community in the final version.

Developing applications for emergency response is a special challenge. The system must be easy to deploy and use and must work as designed under difficult circumstances. The response to the ice storm demonstrated that NYSDOT achieved its goals for the Road Status/Damage Assessment system. Use of GIS technologies was key to meeting these goals.

More Information

For more information, contact Kevin Hunt, GISP, NYSDOT GIS manager (e-mail: khunt@dot.state.ny.us).

School District Charts Path to Transportation Management System

GIS Powers New Brunswick Student Transportation Services

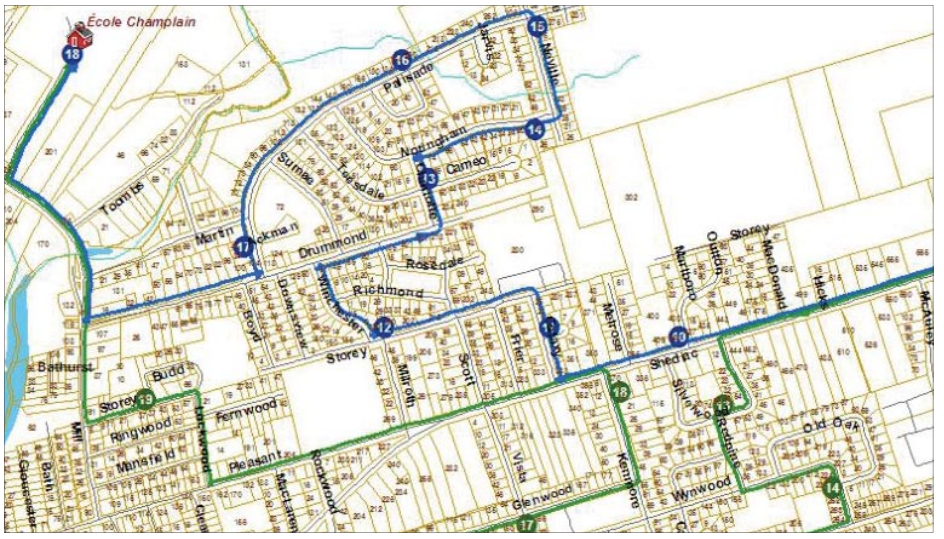
Highlights

- ArcGIS software-based application automatically assigns bus stops to students and provides daily updates to users.
- Bus drivers and school administrators can instantly view detailed maps.
- Student demographic data is automatically fed into the GIS application, resulting in accurate and timely updates.

District Scolaire 01 is a French-speaking school district that serves almost half the province of New Brunswick, Canada, including the three major cities, Fredericton, Moncton, and Saint John. Prompted by rapid population growth, the school district overhauled its manual transportation planning system and built a dynamic application that enables safe, efficient, consistent, and punctual student transportation.

The district implements an important safety policy stating that students from kindergarten to grade 5 should not have to walk more than 300 meters from the bus stop to their homes. To ensure this policy was being met, district employees would venture out into the field and physically measure the distance from bus stops to students' homes, then plan routes on paper. This process could take months to complete, and rapid population growth and movement were preventing the district from being able to effectively guarantee the policy.

Adding to this challenge was the fact that student address information was being stored in a Microsoft Access database, and anytime students would move between districts or change addresses, the information would be input manually. Because the provincial standard was based on a single user database, there was limited access to student records, and the process did not provide a spatial view of the region to assign bus stops.



A map created in ArcGIS that shows bus routes and stops.

In 2005, the district took the initiative to develop its own student transportation management system that would overcome these limitations. The solution: District Scolaire 01 developed an application that could automatically assign stops to students and provide daily updates to users. District staff no longer had to manually plan routes on paper and could now take advantage of a much quicker, more accurate process for bus route planning.

To build the application, the district worked with the Canada Post postal code database and Service New Brunswick's Civic Address Database (CADB) to validate and geocode student and bus stop addresses. It invested in ArcGIS Desktop technology with the ArcGIS Network Analyst and ArcGIS Publisher extensions to automate the process of analyzing bus route scenarios and to

- Visualize geographic information, planning and managing school bus routes and analyzing and redefining school zones.
- Ensure respect for district policies on walking distances.
- Better respond to inquiries to generate digital maps for district reports and school administrations.

The district also built a public-facing Web application that lets parents, students, real estate agents, and other members of the general public search for bus stops and school assignment by postal code.

At the click of a mouse, district staff, bus drivers, and school administrators can view a detailed map of school zones and bus routes within this dynamic district. Student demographic data is automatically fed into the application on a daily basis, which means that the information is always accurate and up-to-the-minute.

"The integration of GIS lets us complete all of our measurements and planning right here in the office so that we rarely need to send resources into the field," says Eric Nadeau, transportation manager, District Scolaire 01. "What used to take up to a month to complete can now be done in less than a week."

Using ArcGIS Desktop, district staff can conduct detailed data analysis when planning bus routes, which has significantly reduced the amount of time that empty school buses remain on the road, saving the district money.

School zones that used to take months to reorganize can now be redefined in less than a week. Parents, students, and other members of the general public can keep up-to-date on changes by plugging in their postal code to view the most current school zones and bus routes.

Most importantly, the district can now honor its walking distance policy to ensure the safety of its students and provide consistent busing service**.**

The district is planning to switch its Web application over to ArcGIS Server so that it is fully GIS enabled and draws from the same data as its internal application.

More Information

For more information, contact Eric Nadeau, transportation manager, District Scolaire 01 (e-mail: eric.nadeau@gnb.ca).

ESRI International User Conference Combines Visionary Thinking and Practical Applications

2010 ESRI UC Attendees to Explore the New Generation of GIS

The 30th annual ESRI International User Conference (ESRI UC) will take place July 12–16 at the San Diego Convention Center in California. Attendees from the global community of GIS professionals will find that for one week, in one place, they have everything related to GIS at their fingertips.

"Our users are inspired people doing important work with GIS," says ESRI president Jack Dangermond. "They continue to astound us each year with the quantifiable, meaningful, powerful differences they're making in the world. We want to produce an event of great use and meaning to them, something both informational and empowering. The user conference should provide everything a user needs, whether it's help with a project or finding out what the latest ESRI technology can do for their organization. It's a forum where creativity and new ideas are appreciated and shared."

Left and below: GIS professionals will find that for one week, in one place, they have everything related to GIS at their fingertips. Above: Jack Dangermond presenting at the UC plenary.

Geospatial Technology, GeoDesign, ArcGIS 10, and More

As the world's largest GIS conference, the ESRI UC has a broad and deep agenda that focuses on geospatial technology developments, best practices, and tips and tricks. Attendees will find a wide range of technical workshops, user presentations, GIS concept and industry focus sessions, and Special Interest Group (SIG) and Regional User Group (RUG) meetings. The Plenary Session will offer engaging speakers, technology demonstrations, prestigious awards, and a special youth presentation. Past speakers have included Ralph Nader and Dr. Jane Goodall. The Map Gallery is a collection of illustrative maps from more than 100 countries, and there are special displays from organizations such as the National Geographic Society and the Smithsonian. And the Exhibit Pavilion houses many hardware, software, solution, and data vendors.

The summer release of ArcGIS 10 will be a major emphasis this year. Modern interfaces, mapmaking time-savers, easier data creation and management, enhanced editing and sharing capabilities, and new ways to perform analysis and modeling are just some of the improvements.

Unmatched in Highlights

There are a number of conference highlights, which add to the ESRI UC experience. There is a User Software Applications Fair where participants show custom applications and maps that meet specific end-user requirements. There is also an ESRI Showcase with special areas featuring federal, defense, and public safety GIS applications.

Midweek, the Special Achievement in GIS (SAG) awards honor organizations for their extraordinary use of GIS, having demonstrated vision and leadership in applying the technology to better serve society, such as faster 911 response and information-rich public Web sites. The GIS Kids Camp caters to families, providing children of all ages with a way to explore GIS. The popular Thursday Night Party, open to ticketed guests, always boasts a new theme, ranging from Mardi Gras to a Renaissance Faire to Oktoberfest. Another draw is the Spatial Outlet and Bookstore, which sells souvenirs and award-winning GIS and ESRI Press books; it also hosts author signings.

Play a Part

Attendees have an important role in making the conference a success and worthwhile for their peers. GIS work can be showcased during the Plenary Session; videos, screen shots, and images from users will be used in Dangermond's presentation (submission deadline: **May 28**). Map Gallery and Virtual Map Gallery participants will share their paper and digital maps to illustrate the power of GIS (submission deadline: **June 14**). Lightning talks, which debuted and proved popular at the ESRI UC last year, are quick user presentations given in five minutes or less; even more talks will be featured this year throughout the conference week.

SIG and RUG meetings are available for hosting and ideal for collaborating with others of the same interest, industry, or region. The Academic GIS Program Fair gives representatives from higher education GIS programs a place to discuss their offerings with attendees, touch base with alumni, and meet students from the Student Assistantship Program. More information about participating is available at www.esri.com/uc.

Why Attend?

In a nutshell, attendees will be able to

- Access more than 70 hours of learning, training, and networking relating to hot topics such as geodesign, cloud computing, Web 2.0, and green government.
- Connect with like-minded peers, industry thought leaders, and ESRI staff and business partners eager to share their guidance and motivations.
- Take away practical and proven applications and methods.

The registration deadline is **May 21.** Special rate hotel rooms can also be booked online at www.esri.com/uc. Staying in downtown San Diego at a participating conference hotel offers the best value and convenience when it comes to travel, amenities, networking, and attending events at the convention center. Special rates are not guaranteed after **June 10.**

More Information

This event is for all ESRI GIS users. To learn more, register, reserve rooms, and participate, visit www.esri.com/uc. There is also a **customizable letter of justification** to attend available for download. Note, a certain number of complimentary conference registrations may be available with your organization's ArcGIS software maintenance plan.

Concurrent Events

- ESRI Business GIS Summit
- ESRI Education User Conference
- ESRI Homeland Security GIS Summit
- ESRI Survey & Engineering GIS Summit
- ESRI Defense and Intelligence Executive Track
- ESRI Senior Executive Seminar
- Remote Sensing and GIS
- Climate Change GIS Special Program

Online Conference Community

Stay connected before, during, and after the conference by tapping into the online conference community:

- @ESRIUC
- Official ESRI UC
- esriuc
- UC Insider blog
- RSS feeds

The Numbers

- 40 tracks
- 300 exhibitors
- 275 technical workshops
- 600 user presentations
- 600 map posters and special displays
- 100 special interest, regional, and user group meetings

An Ecofriendly Conference

ESRI, its business partners, and the San Diego venues have taken steps for the last several years to put on an ecofriendly event. Examples of this include using reusable materials and recycled paper for promotional items, such as tote bags and agendas; making previously printed items only available on the Web; selling organic T-shirts in the Spatial Outlet store; offering recycling bins, water in bottles that use less plastic, biodegradable food service items, and food purchased from local growers when possible; and encouraging and promoting resources for carpooling and renting a bike as transportation for the week.

Outstanding Events for Users in Europe, the Middle East, North Africa, and Latin America Announced for Fall

Middle East and North Africa User Conference Focuses on How GIS Is Evolving

2009 ESRI Middle East and North Africa User Conference

The 2009 ESRI Middle East and North Africa User Conference (MEAUC) took place November 10–12 in Manama, Bahrain, at the Diplomat Radisson Blu Hotel. MEAUC is a resource for ESRI users in the Middle East and North Africa, serving as a forum to learn about and discuss GIS updates and projects. It's also a place for attendees to build relationships with other members of the international ESRI user community. The MEAUC was held under the patronage of His Excellency Sheikh Mohammed bin Mubarak Al Khalifa, Deputy Prime Minister for the Government of Bahrain.

More than 450 professionals from different industries and with varying levels of GIS experience gathered last fall to get their questions answered, address today's trends, and see how to achieve more GIS-driven results in their organizations and communities. Attendees heard from ESRI president Jack Dangermond, saw the latest GIS tools and applications, heard about time-saving tips and tricks that further GIS investments, met with ESRI staff and business partners, and more. Al Khalifa deputized His Excellency Sheikh Ahmed Ateyatalla Al Khalifa, Minister of Cabinet Affairs for the Kingdom of Bahrain, to attend the conference in his stead.

During the Plenary Session, Dangermond discussed his vision for GIS and its impact on our world. He explained that GIS is being more widely recognized as an indispensable tool for analysis and decision making.

From executives and managers to GIS end users, attendees were able to extend their GIS knowledge and skills. Technical workshops led by ESRI product managers, and paper sessions on successful GIS applications, provided ways to get solutions to technical issues and cost-saving ideas for specific markets. The conference featured GIS best practices from a broad range of communities across the region and industries spanning the public and private sectors.

"GIS is slowly transforming into a pervasive technology," said Dr. Ghulum Bakiri from MicroCenter, ESRI's distributor in Bahrain, "and many countries in the region are embarking on a national NSDI [National Spatial Data Infrastructure] initiative to act as the platform of choice for integrating diverse islands of information that exist in various departments and government organizations."

More information about future conferences is available at **www.esri.com/meauc**.

2010 ESRI Europe, Middle East, and Africa User Conference

The 2010 ESRI Europe, Middle East, and North Africa User Conference (EMEA) will take place October 26–28 in Rome, Italy, at the Ergife Palace Hotel. The EMEA is being hosted by ESRI Italia, ESRI's distributor in Italy. This union of the European User Conference and Middle East and North Africa User Conference gives users from these regions the chance to connect with an even greater ESRI community. There will be paper sessions, technical workshops, and other activities and events that will explore how to apply geography and technology to solve problems, increase return on investment, and help create better businesses and communities. More information about the 2010 conference will be available online soon at **www.esri.com/emea**.

2010 ESRI Latin America User Conference

The ESRI Latin America User Conference (LAUC) is in its 17th year and is being hosted by SIGSA, ESRI's distributor in Mexico. The 2010 LAUC will be held September 22–24 in Mexico City at the Sheraton Maria Isabel Hotel and Towers, located on Paseo de la Reforma and overlooking the famous Angel of Independence monument. Between 800 and 1,000 professionals are expected to attend the conference.

LAUC is the premier event for GIS users throughout Latin America. Participants are able to create valuable relationships with their peers, meet with key contacts—from ESRI staff and business partners to the region's industry leaders—and find out everything they need to know to launch and grow successful GIS projects. Learn more at **www.sigsa.info/lauc2010**.

More Information

For a complete listing of ESRI events worldwide, visit **www.esri.com/events**.

ESRI CIS Opens in Moscow

DATA+, a longtime ESRI international distributor in Russia, recently reorganized, and ESRI CIS was formed as ESRI's distributor in the Commonwealth of Independent States (CIS). Originally founded by the Institute of Geography of the Russian Academy of Sciences and ESRI, DATA+ has served and continues to serve as a touchstone for GIS sales and support in the CIS—a political and economic entity that was created within the territory of the former Soviet Union to preserve the economic and political ties among the countries that became independent after the Soviet breakup.

According to Yulia Bystrova, director general of the new office, "The opening of ESRI CIS allows us to better represent the interests of ESRI in the CIS and promote the growth and maturity of the GIS market in Russia and in other countries of the CIS. ESRI software has been used in the region for more than 17 years, and the addition of ESRI CIS will provide better support for both end users and partners."

Countries included in the ESRI CIS territory are Russia, Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The subdistributor network within the ESRI CIS market consists of 25 companies, including DATA+. The management of this network will become one of the most important tasks of the new company.

DATA+ will now focus on professional services, including application development, Web services, implementation, and the production of digital maps. Joint activities between ESRI CIS and DATA+ will include the organization of user conferences, training, language localization of software products, and publication of the quarterly *ArcReview* magazine.

With vast petroleum deposits located within the CIS, regional oil and gas producers continue to be among the major users of ArcGIS software. Together with subsidiaries and related agencies,

there are approximately 150 petroleum companies in the region that use ESRI's software solutions.

In addition, there has been significant progress in the application of GIS technology in government agencies. Federated GIS systems have been implemented at the Emergency Committee of Russia, Land Cadastre and Ministry of the Interior of Kazakhstan, and the Land Cadastre of Belarus. DATA+ has also developed many joint projects with both national and international organizations.

ESRI CIS plans to expand its GIS training efforts. Bystrova says, "In 1997, we initiated the University Support program, and we have helped organize classes and provided ESRI software and training materials to more than 190 institutions of higher learning in CIS countries. We plan to further expand the education market in our region, especially in those CIS countries that are beginning to look for an advanced and reliable technology for their economies.

"Looking to the future, we have a dedicated team working on Web services for our enterprise clients and expect Web-based GIS services to grow rapidly in the coming years."

More Information

For additional information about ESRI CIS, visit **www.esri-cis.ru**.

Designing GeoDesign

Summit Sets Course for Coupling GIS and Design

At the first GeoDesign Summit, held in January 2010, ESRI president Jack Dangermond said that the concept of incorporating geographic knowledge into design has been happening for a very long time.

"GeoDesign is going on. It has been going on for hundreds of years," Dangermond noted, pointing to examples in farming, urban planning, and site selection for stores. Farmers, for example, have always taken geography into account when deciding what crops would be appropriate to grow on their land and where to locate their farms (e.g., near a water source for irrigation).

Because of pressing planetary problems that need to be solved, Dangermond and a group of thought leaders from academia and a variety of professions believe it's time to better integrate geospatial technologies, such as GIS, with design. During the summit, they also discussed future GeoDesign education and training options and how to provide designers with the tools they need to better create and analyze designs.

The University of California, Santa Barbara; the University of Redlands; and ESRI sponsored the inaugural 2010 GeoDesign Summit at ESRI's corporate headquarters in Redlands, California. More than 170 academics and professionals attended from fields such as geography, architecture, GIS, urban planning, engineering, conservation, and forestry. Besides listening to keynotes and lightning talks on GeoDesign and how it's being used, they also attended "idea labs" to create agendas for GeoDesign theories, education, future technologies, 3D visualization, and analysis in design and other topics.

The summit brought together thought leaders in GIS, architecture, design, conservation, and many other fields, including Michael Goodchild, professor of geography at California State University, Santa Barbara; Carl Steinitz, research professor at the Graduate School of Design, Harvard University; Kim Tanzer, dean of the School of Architecture at the University of Virginia; and William B. Rogers, president and CEO of the Trust for Public Lands.

"We are at the beginning of what many of us see as a new field," said Thomas Fisher, dean of the College of Design at the University of Minnesota, in his Keynote Address.

With the world facing what he called "exponentially increasing stress on the systems we depend on," such as natural ecosystems and building infrastructure, there's a great need to use spatial data and technologies in planning and design to tackle problems, such as those associated with global warming, threats to species, and poorly designed infrastructure.

"GeoDesign changes geography by design (not all design changes geography and not all geographic change is by design)."
—Carl Steinitz

"One of the powers of GeoDesign is it makes these problems visual," Fisher added. "They are easier to ignore when they are abstractions. Because we have been designing the world without data-rich knowledge of consequences, we've created a situation where we've made ourselves vulnerable as a species, which to me gives urgency to GeoDesign. This is something we don't have a lot of time to develop."

The purpose of the two and a half-day summit was to

- Define and formalize the term *GeoDesign* and its methodology.
- Promote and advance GeoDesign research and education.
- Discuss how to go about creating better GeoDesign technologies/tools.
- Talk about how to more deeply couple design with GIS and other geospatial technologies.
- Prepare a set of use cases to show what GeoDesign can accomplish.

In his opening remarks, Dangermond spoke about the great potential for GeoDesign, described by some as a pairing of design and GIS. It unites the art and creativity of design with the power and science of geospatial technology. As one, GeoDesign can produce more informed, data-based design options and decisions.

"The notion of integrating these two fields is very exciting to me," Dangermond told the gathering. "We have a kind of continuum from measurement to making decisions that integrates all our ways of doing things into new processes."

Dangermond said that fast-accelerating improvements in geospatial technologies will, consequently, hasten advances in GeoDesign. New design-friendly capabilities and tools in the upcoming release of ESRI's ArcGIS 10 will help professionals apply GeoDesign methodologies to problems and challenges related to anything from climate change to pandemic diseases, environmental protection to food production, and resource conservation to infrastructure improvements.

"Geospatial technology is migrating to the Web and will be used by practically everyone in some way or other," Dangermond said. "This environment is a new style for how geography will be served and how it will affect us. It will touch not simply a few researchers, GIS professionals, or those who work with geographic information, but it's affecting virtually everything that people do."

According to Dangermond, improvements in GIS, the explosion of location-based services, faster computers, more bandwidth and storage, a boom in mobile devices, and the emergence of cloud computing will also speed GeoDesign along.

"For some of us, that's all brand new," Dangermond said. "Some people describe this as 'disruptive' kinds of technology. For me, it's just another step in the evolution of the enabling technology that allows us to bring these new ideas to fruition.

"Organizations also are beginning to serve geographic knowledge, which is providing a new infrastructure to build on top of, hopefully, the design notions that come out of the summit," Dangermond continued. "Agencies will not be providing data files or maps. They will be providing services, and these services will be a new framework. Just like the Apple iPhone is providing a framework for all kinds of apps, these geospatial services—and the ability to build creative applications on top of them—will explode our field and the general interest in designing our future."

Fisher spoke passionately about how there's little time to waste. "A lot of what we have been designing—our cities, our buildings, our landscapes—have been designed without a lot of information about the consequences of our actions on other species, on distant populations, on future generations. As GeoDesign can bring data to bear on those design decisions, it will profoundly change the way we live and inhabit the planet. Through innovation, we can rethink the way in which we inhabit the planet, we can rethink the way we use resources, and we can prolong our ability to sustain ourselves. GeoDesign's time has come, and it's none too soon."

Dangermond concurred. "We need this right now," he said. "We need to not only understand what's occurring on the planet, but we also need to take more proactive involvement in designing what occurs. Then we have to promote those designs, those creations, those expressions in our mind's eye to the rest of society. That's the challenge."

Bran Ferren, chief executive officer of Applied Minds, Inc., presents at the GeoDesign Summit.

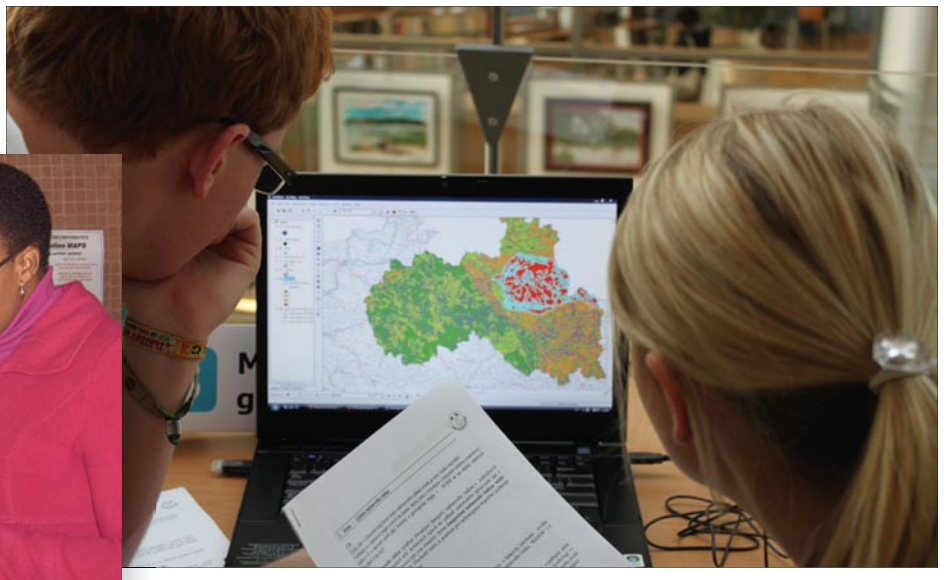
ArcGIS Desktop 10

During the summit, ESRI's Matthew Baker, Nathan Shephard, and Bern Szukalski demonstrated to the group current tools and services and soon to be released technology that will assist designers in their work. Baker's demonstration focused on the modeling, sketching, and feedback capabilities in ArcGIS Desktop 10. Shephard demonstrated new design-friendly capabilities in the 3D Analyst extension. Szukalski showed the audience ArcGIS Online resources that, for GeoDesigners or Web mappers, serve as what he calls an "excellent substrate" of content, such as ESRI's updated World Imagery map services and its new World Street Map services, and also Bing Maps for Enterprise, aerial, hybrid, and roads.

More Information

To read an expanded version of this article, see the February 2010 edition of *ArcWatch* at **www.esri.com/designinggeodesign**.

Tap Into the Global Celebration on GIS Day 2010



The City of Johannesburg, South Africa, had its sixth annual GIS Day event.

In Liberec, Czech Republic, nearly 1,000 visitors, 31 schools, eight organizers, and six partners participated.

The 12th annual GIS Day celebration will be held **Wednesday, November 17, 2010.** GIS Day takes place every year during Geography Awareness Week, a geographic literacy initiative sponsored by the National Geographic Society. GIS Day is an international grassroots event; thousands of GIS users worldwide invite guests to attend GIS workshops, tour map galleries, watch hands-on GIS technology demonstrations, learn about educational and career opportunities, hold rallies, and much more. Regardless of the type of event, they have a common purpose—to show others the benefits of GIS and how it is used to improve our world.

"Because of our inventive and dedicated users, GIS Day continues to gain momentum," says ESRI president Jack Dangermond. "It's celebrated in more than 80 countries on six continents. The spirit of collaboration is very powerful, and GIS Day is one of the ways we can share geospatial technology and take important steps toward the next generation of GIS."

What You'll Gain

GIS Day is a stimulating and fun break from the everyday; it benefits both attendees and hosts. Past participants have used the event as a chance to

- Show colleagues how they contribute to their organization.
- Share work done by their GIS department.
- Demonstrate work involving geospatial technology to potential clients.
- Raise awareness about the GIS services offered at their organization.
- Get local government involved, for example, making a GIS Day proclamation.
- Educate youth about geography and GIS technology.
- Give back to the community by offering free GIS education and community-building events, such as hands-on-learning, map poster displays, and scavenger hunts.

How to Participate

Whether you're new to GIS Day or a seasoned veteran of the festivities, there are plenty of resources to help plan an event. Begin by brainstorming ideas with colleagues, visiting the GIS Day Web site (**www.gisday.com**) to register your event and download the free materials, then connecting with your community to get the word out.

Need some more ideas? There are plenty of examples available of how organizations and communities have commemorated GIS Day. Here are a few events from last year to get those creative juices flowing.

Abu Dhabi Systems & Information Centre

In honor of GIS Day, the Abu Dhabi Systems & Information Centre (ADSIC), located in the United Arab Emirates (UAE), hosted a hologram presentation given by Dangermond. This was one of the biggest GIS Day events in 2009, with approximately 5,000 people in attendance, and it was only the second time the city has joined the celebration. What became a two-day event, showcasing GIS champions and complete with an exhibition, was held under the patronage of His Highness General Sheikh Mohammad bin Zayed Al Nahyan, Abu Dhabi Crown Prince, Deputy Supreme Commander of the UAE Armed Forces and Chairman of the Abu Dhabi Executive Council.

Abu Dhabi hosted a GIS Day event with approximately 5,000 people.

Dangermond's enlarged, full-length virtual presence at the Abu Dhabi National Exhibition Center highlighted ADSIC's Abu Dhabi Spatial Data Infrastructure (AD-SDI) program. "[This] will provide a foundation for what I call the next generation of GIS applications—GeoDesign—not simply observing geography, but designing the future . . . integrating the science and information side with the creative, right-brain design side . . . People will be able to evaluate quickly the consequences of different, alternative designs."

City of Johannesburg

The City of Johannesburg, South Africa, had its sixth annual GIS Day event last year, introducing the Joburg2009 aerial photography and oblique imagery. The city manager commented on imagery's crucial role in a large city to reduce fieldwork and the importance of coordinating imagery across municipal boundaries.

Other staff members from city departments enthusiastically detected changes between the new and old (2006) aerial photography. Emergency Management Services commented on how oblique imagery will assist in calculating the water pressure required to reach the top of area buildings.

Also, guided tours gave the Corporate GeoInformatics (CGIS) staff an opportunity to demonstrate and generate awareness about GIS applications in local government. Approximately 300 visitors were taken through the online maps Web site and received GIS information packets.

Liberec, Czech Republic

GIS Day was recognized for the ninth time last fall in Liberec, a town located in northern Bohemia and the seat of the Regional Administration. The number of participants has increased every year, so Liberec had a weeklong program ready, turning the 2009 holiday into the longest celebration of GIS Day in the Czech Republic.

The main program was prepared for schools; classes learned GIS basics, had access to ArcGIS workstations, and played a competitive knowledge geogame called "Maps Wandering." The organizers used children's natural curiosity to fuel tasks in which the students used interactive Web maps or ArcGIS applications to find solutions.

The regional library held an exhibition of maps, and one entire day was devoted to the "GeoCup" event, a GIS skills competition between university students from the Czech and Slovak republics. Another highlight was a GIS Day video prepared for the entire Czech Republic by children's television, which also provided news footage and youth-conducted interviews during the events. Nearly 1,000 visitors, 31 schools, eight organizers, and six partners participated.

McLean County, Illinois

GIS Day in the Land of Lincoln—McLean County, Illinois—was another success. The daylong open house focused on GIS demonstrations, presentations, a geography quiz, and prize drawings including a TomTom portable GPS navigation tool. The gathering was a collaborative effort by several local governments, academia, and national sponsors. Attendees included elected public officials, planners, engineers, assessors, students, government employees, information technology professionals, and the general public.

The morning session included a proclamation, declaring November 18, 2009, as GIS Day by the local leadership. This was signed by McLean County board chairman Matt Sorensen, City of Bloomington mayor Steve Stockton, Town of Normal mayor Christopher Koos, Illinois Wesleyan University president Richard Wilson, and Illinois State University president Alvin Bowman. Sorensen cut the GIS Day cake, which included a tribute to the 200th anniversary of U.S. President Abraham Lincoln's birth.

Washington State Department of Transportation

Geography Awareness Week and GIS Day 2009 were observed at the Washington State Department of Transportation headquarters in Olympia and offices in Tumwater. More than 800 people stopped by the GIS displays. The main feature of the week was the annual GIS seminar. Presentations included the Howard Hanson Dam & Green River Valley Flood Impact Assessment; Light Detection and Ranging (LiDAR) and Its Application on the SR 410 Landslide; and SR View 3, Traffic Planning Trends, and Other Transportation Data Office Initiatives.

More Information

Save the date, November 17, 2010, and start planning your GIS Day activities by visiting **www.gisday.com**.

Join the GIS Day Discussion

Stay connected to GIS Day throughout the year:

- Follow GIS_Day on Twitter.
- Become a fan of the GIS Day page on Facebook.
- Post a question or idea on the GIS Day Discussion Forum on the ESRI Support Center (**support.esri.com**).

NATIONAL GEOGRAPHIC™

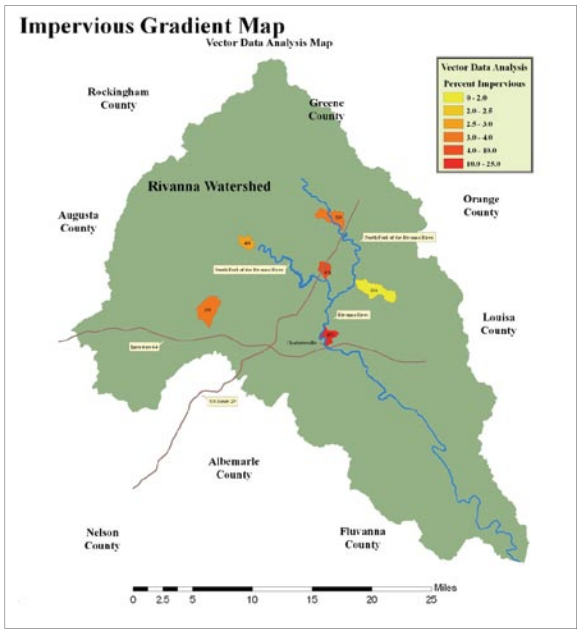
"Geo Learning"

A column by Daniel C. Edelson,
Vice President for Education, National Geographic Society

A Revolution in Geographic Education: Virginia's Geospatial Semester

A high school class in which students learn to use ArcGIS Desktop tools, work on real projects in their community, *and* get college credits . . . sound too good to be true? Well, it's not.

Professor Bob Kolvoord of James Madison University in Harrisonburg, Virginia, has created the Geospatial Semester, a course that is currently being taken by more than 300 students in 12 different school districts across the state of Virginia. Students who enroll in the course have the option of receiving course credit from James Madison, a four-year public university, if their work meets Kolvoord's standards. Because he and a colleague work directly with the participating teachers and students, their work almost always does.



Map showing the percentage of impervious surfaces in the Rivanna Watershed. (Courtesy of Paul Rittenhouse and his Geospatial Semester students at Western Albemarle High School in Crozet, Virginia.)

The most exciting thing about the Geospatial Semester to me is the way it engages students in inquiry-based learning throughout. In my experience, too many introductory GIS courses are taught in the style that I call "peas and carrots," as in, "If you eat your peas and carrots now, you'll get to have dessert later." In the peas and carrots approach to learning GIS, students struggle through days and weeks of learning the mechanics of GIS in the hopes of one day actually getting to work on an interesting problem. How many classes in GIS consist of going through menu options one after another or learning how to do operations without knowing why you would use them?

In Kolvoord's approach, students spend the bare minimum amount of time learning the mechanics of GIS and begin working on interesting, real-world problems from the start. They add to their repertoire of GIS skills by working on increasingly challenging projects, some of which are taken from the book *Making Spatial Decisions Using GIS* (ESRI Press, 2008), written by Kolvoord and collaborator Kathryn Keranen, a pioneering high school GIS educator. *Making Spatial Decisions* is the fourth volume in ESRI's award-winning Our World GIS Education book series designed for classroom use.

While learning GIS skills is important, the primary focus of the class is the real-world project that every student does. Each student completes a community-based research project involving spatial reasoning and decision making. Student projects have included work with The Nature Conservancy, various city and local governmental agencies, and private businesses.

Their projects have included exploring the water quality in the creeks, streams, and rivers that make up a local watershed; identifying appropriate sites for cellular towers or wind turbines; and creating community evacuation plans. In the process, students develop their critical thinking, spatial reasoning, communication, and teamwork skills, while addressing a problem that's important to them and their community.

The projects require students to work cooperatively in teams and connect them to their local community as they pursue a solution to their particular problem. The solutions to these community challenges are not simple and require the students to assess the impact of their solution on different constituencies or stakeholders. As Kolvoord describes it, "[The students] get a good look at a rich tapestry of complications that challenge workers every day as they struggle with these types of problems."

Since its beginning in 2005 in four schools, more than 1,000 students have already passed through the Geospatial Semester. Kolvoord is quick to credit the teachers for the success of the program. Not only do the teachers need to develop GIS skills themselves, they also need to be expert at guiding students in doing independent projects.

Kolvoord is now starting to think about how to scale the program up. He envisions it being a nationwide program one day but recognizes that the biggest challenges are limited GIS expertise in schools and the difficulty of finding organizations that will work with students on projects. However, he sees great promise in the GeoMentor program as a way to overcome these challenges.

I can see it now . . . a high school class in thousands of communities across the United States, in which students learn to use ArcGIS Desktop tools, work on real projects in their community, get college credit, *and* work with a GIS professional as a mentor.

More Information

For more information, contact Daniel C. Edelson (e-mail: dedelson@ngs.org). Visit the GeoMentor program at **geomentor.org** and National Geographic Fund for Geo-Literacy at **www.nationalgeographic.com/foundation/geographic_literacy.html**.

"Crossing Borders"

A column by Doug Richardson,
Executive Director,
Association of American Geographers

The Library of Congress: Geography's Treasury

It's been 25 years since the AAG held its annual meeting in Washington, D.C., so attendees from around the world will have a lot to do this spring when it comes to catching up on the extraordinary cultural and geographic research institutions in this famously archival city. What better place to start than the Geography and Map Division of the Library of Congress?

Several major events at the AAG Annual Meeting will help geographers and GIS specialists experience the Library of Congress (LoC), with a special focus on the treasures and scholarly resources of its Geography and Map Division. But as it is the largest library in the world and holds extensive historical and current GIS, book, and periodical collections on every imaginable geographic topic, a brief history of the collection might both whet your appetite and prepare you for the sheer volume of its holdings.

The Library of Congress

Briefly, the Library of Congress was established by an act of Congress in 1800 upon the transfer of the capital from Philadelphia, Pennsylvania, to Washington, D.C. The legislation initially envisioned a reference library for Congress only, containing "such books as may be necessary for the use of Congress—and for putting up a suitable apartment for containing them therein . . ."

The original library was housed in the Capitol itself until August 1814, when our colleagues from Britain visited and set fire to the Capitol Building, burning and pillaging the fledgling library in its cozy apartment, together with its comfortable leather chairs and globes, and its modest collection of books and maps. Fortunately, however, Americans are not ones to let minor slights fester, and within one month, retired U.S. President Thomas Jefferson offered his entire personal library as a replacement. Jefferson had spent 50 years accumulating books, "putting by everything which related to America, and indeed whatever was rare and valuable in every science," and his library was considered one of the finest in the country. The ecumenical nature of his collection, reflecting a voracious curiosity on all subjects, fundamentally altered the philosophy and rationale behind the collecting policies of the LoC, which then saw its mission as a repository for open scholarship on every conceivable intellectual pursuit.

In 1897, the Library of Congress was moved to one of my favorite Washington landmarks, the impressive Italian Renaissance Jefferson Building, which is today the jewel among three Library of Congress buildings clustered near the U.S. Capitol. The central Reading Room of the Jefferson Building is one of the most beautiful odes to the love of knowledge in Washington. It is simply not to be missed.

The Geography and Map Division

But, of course, of most importance is its unparalleled collection of maps and related cartographic, GIS, and geographic reference materials. The Library's original Hall of Maps and Charts has now become the Geography and Map Division, occupying an area of 90,000 square feet in the Library's James Madison Memorial Building. Annual additions to the Geography and Map Division's collections average 60,000–80,000 maps and 2,000 atlases. The many rare and valuable maps and atlases in the collection include the recently acquired 1507 Waldseemuller map, original prints chronicling Napoleon's adventures in Egypt, and the 1482 printed edition of Claudius Ptolemy's *Geography.* The Geography and Map Division holds, preserves, and makes available to the public the largest and most comprehensive collection of maps and atlases in the world.

AAG and the Library of Congress

To help guide you through this magnificent collection, Dr. John Hébert, director of the Library of Congress, Geography and Map Division, will deliver a special plenary presentation at the AAG Annual Meeting on the Library's geographic collections, its dynamic plans for the future, and how to access it for research and pleasure. Hébert's plenary talk on April 15, 2010, is cosponsored by the Washington Map Society.

An AAG field trip to a rare Library of Congress open house event—exclusively for AAG Annual Meeting attendees—will take place on Saturday, April 17. During the open house, the graceful Geography and Map Reading Room will host a unique exhibit of both modern and historic maps, atlases, globes, and terrain models, dating from the 14th century to 2010, followed by a "behind the scenes" guided tour of the Library's vault of priceless cartographic treasures.

Geography Reference and Online Services

The Geography and Map Division also employs very helpful reference librarians who will respond to requests "that cannot be answered by a library in the inquirer's locality." While this is a great service, they are quick to note that they cannot undertake extensive research projects or assist in preparing bibliographies, term papers, or other academic assignments (sorry, students).

As might be expected, numerous digital maps and GIS and other geographic resources are increasingly available online as well from the Library of Congress for both researchers and the public. A good place to start is **www.loc.gov/topics/maps.php**. But the AAG Annual Meeting in Washington, D.C., from April 14–18, 2010, will offer a unique opportunity to experience firsthand the dazzling array of cartographic wonders at the Library of Congress. I look forward to seeing you there.

Doug Richardson
drichardson@aag.org

More Information

To register for the AAG meeting, visit **www.aag.org**.

Training Without Travel

continued from cover

Students watch lectures and demos, ask questions of the instructor, participate in class discussions, and complete course exercises. The instructor can even shadow students' computers to see how they're doing and offer assistance.

An Internet connection and phone are all that's required. ESRI hosts the latest version of all software needed to complete course exercises. Students don't need to have it installed on their computers.

ESRI now offers two of its most in-demand courses, *ArcGIS Desktop II: Tools and Functionality* and *Building Geodatabases,* via the online Virtual Classroom. Other popular instructor-led courses available via the Virtual Classroom are

- ArcGIS Desktop III: GIS Workflow and Analysis
- Creating and Analyzing Surfaces Using ArcGIS Spatial Analyst
- Working with Geometric Networks for Utilities
- Working with CAD Data in ArcGIS Desktop
- Geoprocessing Raster Data Using ArcGIS Spatial Analyst
- Introduction to ESRI Business Analyst
- Developing Applications with ArcGIS Server Using the Java Platform

Virtual Classroom courses are offered in the United States and Canada. View schedules for all Virtual Classroom offerings at **www.esri.com/virtualclassroom**.

ESRI also has over 50 learning centers in most major cities across the United States to make training convenient. Visit **www.esri.com/trainingmaps** to find a training location near you.

Desktop GIS

Using Lidar Data in ArcGIS—Learn how to derive terrains, digital elevation models (DEMs), and intensity imagery from lidar data, then use them for advanced 3D modeling and analysis. The convenience of Web-based training means you can take this course when and where you prefer. *Web Course*

Server GIS

Building Web Maps Using the ArcGIS API for JavaScript—Are you being asked to create high-performing Web maps to share your organization's GIS content on the Web? This course covers how to create rich Web maps that are fast and easy to use. *Instructor-Led Course*

Extending ArcGIS Explorer for Developers—In one hour, learn how you can rapidly develop a user-friendly front end for GIS data or ArcGIS Server services. *No-Cost Web Training Seminar*

Mobile GIS

Building Applications Using the ArcGIS Mobile SDK—This course is for developers who want to design and build custom mobile applications for deployment in the Windows 32 (Tablet PC) and Windows Mobile (smartphone and Pocket PC) environments. *Instructor-Led Course*

Authoring and Serving ArcGIS Mobile Projects—GIS professionals can learn a recommended workflow to successfully create and deploy an out-of-the-box ArcGIS Mobile project. *Instructor-Led Course*

For More Information

ESRI Training Web Site:	**www.esri.com/training**
ESRI Training Matters Blog:	**www.esri.com/trainingblog**
Instructional Series Podcasts:	**www.esri.com/podinstruct**
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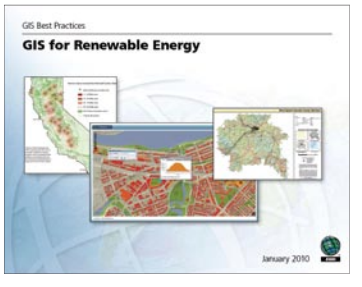
Free E-book

GIS for Renewable Energy

ESRI is pleased to make available *GIS for Renewable Energy,* an easy-to-access, no-cost booklet featuring articles from ESRI publications showing how GIS is helping scientists and technologists find and take advantage of alternate energy sources.



Begun three years ago, ESRI's Best Practices series now contains more than 30 e-books that cover a wide range of topics in GIS, such as science, retail business, law enforcement, and air quality. These e-books are instantly available online at no cost. Published as PDFs with color illustrations, these e-books can be read online at the ESRI Web site or downloaded and printed. Additional titles will become available frequently.

See Complete List

For a complete list of GIS Best Practices e-books currently available, visit **www.esri.com/bestpractices**.

ArcGIS Server Disseminates Geospatial Services

ESRI's ArcGIS Server adds geographic data and analysis to Web applications that serve organizations and communities in a variety of ways. To submit your ArcGIS Server site address and view other Web sites powered by ArcGIS Server, visit **www.esri.com/serversites**.

Town of Gilbert
www.gilbertmapping.com
The Town of Gilbert, Arizona, built this viewer with the ArcGIS API for Silverlight/WPF. The viewer uses enhanced identify and measuring tools, a map service selector, and search tools through a Web service.

Sutherland Shire Council, Australia
mapping.ssc.nsw.gov.au/Sutherland
Using this server site, citizens can find council facilities, like halls, libraries, and playgrounds. This application includes aerial photography (1930–2006), contours, storm water, waste pickup, zoning, environmental, and planning details. It also has a zoom feature and a drawing toolbar to add, move, and change graphics and print preview. The site was created with the ArcGIS API for Flex.

USA Swine Flu and Health Care Resources
www.healthlandscape.org/h1n1
The current H1N1 (swine flu) outbreak, and its still unknown virulence and mortality rate, can act as a wake-up call to state and local health policy makers and planners who will guide the nation's response. Created with the ArcGIS API for Flex, this interactive map provides county-level counts of H1N1 cases and details on the health care resources and the health care workforce in the United States.

Hanover County
www.hanoversites.com
HanoverSites.com is an economic development tool that helps people and businesses find available sites in Hanover County, Virginia. It was developed by ESRI Business Partner Timmons Group using the ArcGIS API for JavaScript.

URISA's 48th Annual Conference for GIS Professionals

Announcing GIS-Pro 2010

Since 1963, URISA members and friends have convened annually to learn about, share, and discuss all things geospatial. And now, the name of URISA's annual conference has been updated to better reflect that focus. URISA is pleased to announce GIS-Pro 2010: URISA's 48th Annual Conference for GIS Professionals. The first conference under the new banner will take place September 28–October 1, 2010, in Orlando, Florida.

Along with the new conference name, GIS-Pro will reflect what GIS professionals are looking for in a modern conference. Gone are restrictive conference tracks—what's in are coordinated themes, designed to move the conversation forward and interactively share information among conference participants. These themes will include

- **Value of GIS—**The value of GIS can theoretically be quantified in terms of return on investment (ROI), but the methodology for determining ROI for GIS has not been standardized. Proposals on this topic could include information on measured return on investment (as opposed to estimated cost-benefit analysis performed prior to implementation); various methods for funding and justifying funding for GIS implementation; and ways to articulate the financial/liability, economic, social, or environmental impact of GIS for a jurisdiction, region, or organization.
- **One Government—**This concept is about multiple jurisdictions and overlapping levels of government (federal, state/provincial, regional, local) acting collaboratively. Proposals could include data sharing challenges and approaches; standardization and integration of data, applications, and services; and collaboration and communication that leads to a "one government" approach.
- **Stewardship—**The notion of stewardship is one of service and support to a community of data users. Often, stewards have a vested interest in maintaining particular data for their organization but no mandate (or funding) to maintain it for the rest of the community. Proposals could include data management, maintenance and integration topics, metadata issues and processes, data governance approaches, and methods for treating data as an infrastructure or other asset.
- **Data-Based Decisions—**This is a hot topic in 2010 at every level. U.S. congressional hearings are even focusing on ways to drive decisions based on data and "place." Proposals could include Web 2.0 and social networking tools as a means of bringing information together and presenting it appropriately to everyone, promoting GIS use to decision makers, developing better ways to visualize change spatially and temporally, and managing interdependent information infrastructures with geospatial tools and techniques.
- **Training and Education—**With geospatial technology changing more and more rapidly, the need for high-quality training and education continues to grow. And with the economic downturn, training budgets have taken a significant hit. Proposals could include ideas and tactics for promoting K–12 geographic/geospatial education, use of social networking tools for training, and information on technology updates and issues.

More Information
Make URISA your preferred provider for GIS professional development and management training. For further details, visit **www.urisa.org**.

"Managing GIS"

A column from Members of the
Urban and Regional Information Systems Association

Thoughts on Technology Coordination

By Lee N. Hartsfield, GISP, GIS Coordinator, Tallahassee-Leon County, Florida

Merriam-Webster's Ninth New Collegiate Dictionary defines *obstacle* as something that stands in front of or impedes progress or achievement.

You are just being an obstacle . . . again. Why won't you let me do this? We have to do this now! We don't have time for these delays! My customers have to have this or they're not going to be happy when I tell them that you are just being difficult!

Have you heard these? Have you been told by your manager to stand your ground, but don't make waves? Alternatively, does your manager sometimes ask you the same questions?

In meeting the challenges of technology coordination, the GIS professional must frequently assess which ideas promote progress or achievement and which ideas could jeopardize systems and/or data integrity. With our ever-growing technology, change comes rapidly and sometimes with little warning. It is little wonder that our customers have a difficult time understanding our efforts and motives.

The City of Tallahassee

The City of Tallahassee is the capital of the State of Florida and the county seat of Leon County. In May 1990, the city, the Leon County Board of County Commissioners, and the Leon County Property Appraiser's Office entered into an Interlocal Agreement to create a joint Geographic Information System, the Tallahassee-Leon County GIS. As GIS coordinator, I lead a group of 15 professionals, which form GIS Central. GIS Central provides support services to each of the principal partners. These services include system administration, database management, Internet/intranet development and support, application design and support, and map analysis expertise.

As a GIS coordinator, my chief responsibility is to manage the GIS program as determined by policies and procedures or best practices. In either case, these may be determined by others with or without my direct input. The challenges are many and their number grows as our technology expands. We must be consistent, be clear in our communications, enlist the help of competent staff, and manage expectations, if we are going to be successful.

Communication skills are essential in any customer or client relationship, and there are scores of books written on the subject. In my experience, listening is the hardest part of communication. If I feel like I am being attacked, I take a defensive posture and dig into my position. I hear mortar fire and I dig my foxhole. I only come up to aim and shoot at my adversary. Yes . . . on occasion, I have shot a messenger or two. The ironic part is I get angry when someone fires back at me. This situation almost always leads to some kind of wrestling match and more times than not, the contest is exhausting and very unproductive. How do I change the outcome if I am not happy with the results? I must recognize that the first challenge begins with me. I must slow down and listen carefully to my customer or client. My response must be clear and address the matter effectively. If my response is based on policies and procedures or best practices, then their argument may be with the policies and procedures and not me personally.

I have been known to suggest to staff that I supervise, you have a choice to deal with process or personality. I believe that most of us prefer personality, especially if we find someone that agrees with the way we do things. However, put two strong-willed people in the middle and you usually get conflict. If these people have a little stubborn streak in them (I have also been guilty of this a time or two), then it seems that resolution only occurs after sending it up the chain of command. Remember, their position can be changed, if the proper authority provides that alternative. The resolution often indicates a winner or a loser, but ultimately both sides have disappointed their respective managers. Even under the best of circumstances, if we accomplish things based on who we know, then what happens when they leave or change positions? Process gives you the best recourse. It establishes the policies and procedures and best practices and how we deal with them. It can be time intensive and not much fun, but it will provide us with a common basis for any discussion that we may have.

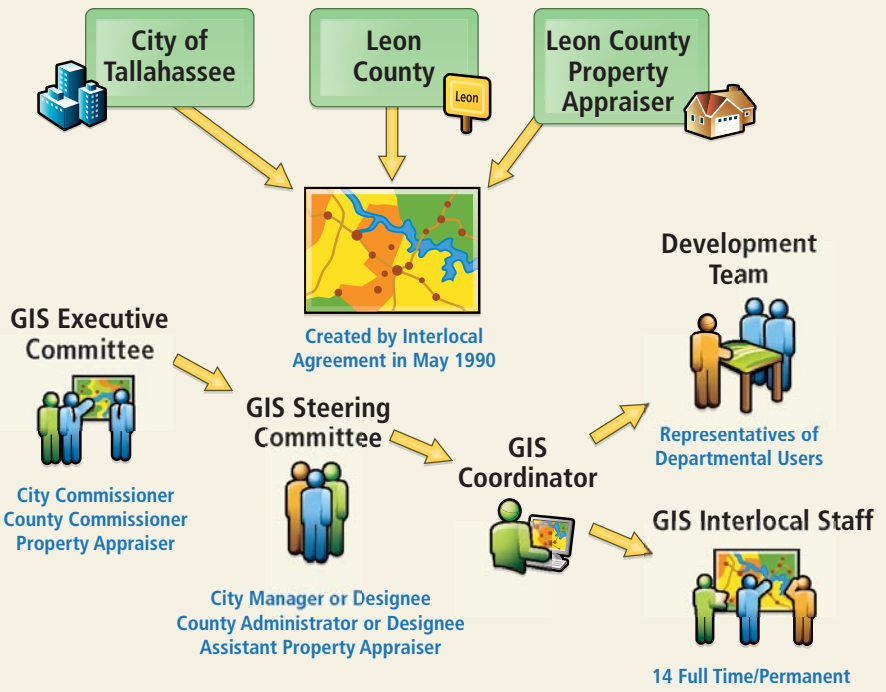
Here are some comments that a manager may need to address:

I don't have time to change the policies and procedures. This is not a big deal. Can't you do it just this one time?

I have to confess that I fell into this one a couple of times. Helping out . . . being the "go-to guy." Yes, you can get away with it from time to time. However, I must admit that it impacts the future relationship and behavior with the individual that you just saved by fudging the rules.

Well! You did it before, why not now? Why is this so different?

Consistency in how we manage expectations is another critical skill. Our customers and our customers' customers need their expectations properly managed. Remember, if you don't assist your customers in establishing reasonable expectations (within your resources and within accepted policies and procedures), they will most certainly establish unreasonable expectations for you. Don't promise what you can't deliver. Likewise, just because you can do something



From top to bottom, the organizational structure ensures the appropriate oversight, participation, and involvement in Tallahassee-Leon County (TLC) GIS.

doesn't mean you should. This is a tough one to swallow for the real creative geniuses that we have in our organizations. If we don't clearly understand what impacts our actions may cause, we must slow down and examine them carefully. We have the policies and procedures in place to protect one of our most valued items—information. Careless or not properly processed changes may very well jeopardize our investment.

Following these suggestions can be difficult in any organization, but it becomes even more difficult as the organization grows. To survive, you must empower staff to "stand in front of" your investment of information. They must recognize that some will call them an obstacle. However, they are only protecting what needs to be protected. They must be familiar with the policies and procedures and best practices. They will require ongoing professional training to keep up with the latest in best practices as defined by the industry and implemented by your organization. They will need to keep a personal touch without deviating from the established processes.

I have been and will continue to be an obstacle that stands between ill-conceived changes outside of accepted policies and procedures and best practices. However, I hope to be able to recognize when changes to the accepted policies and procedures and best practices are required. In those cases, I need to rely on processes established by the organization to change them. This will usually take time. However, if I have properly communicated the expectations of those in authority that I represent, then it should surprise no one. Finally, I must be open to change when change is required and understand that technology is ever evolving.

Technological innovations of today make obsolete the boundaries of yesterday, and may we never be an obstacle to progress or achievement.

About the Author

Lee Hartsfield has been the Tallahassee-Leon County (TLC) GIS coordinator since 2000, and he has worked in local government since 1992. In his role as TLC GIS coordinator, he manages and facilitates a joint GIS program for the City of Tallahassee, Leon County, and the Leon County Property Appraiser's Office. He has an M.S. in geography from Florida State University and is recognized as a GISP. He is past president of Florida URISA and on the Board of Directors for the Seven Hills Regional User Group for GIS. He has been and continues to be involved in grass roots efforts to form a statewide GIS consortium for the State of Florida. The Tallahassee-Leon County GIS received ESRI's SAG Award in 2008.

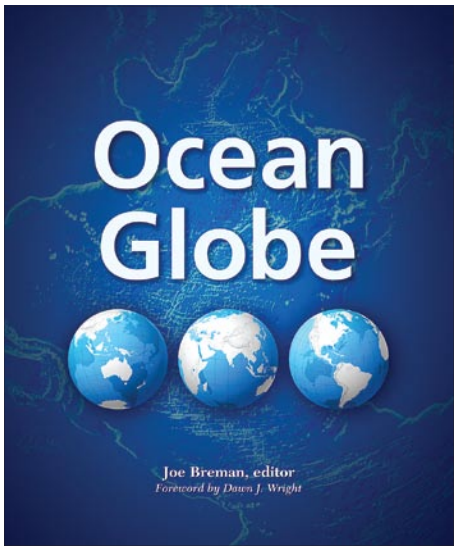
More Information

For more information, contact Lee N. Hartsfield (e-mail: HartsfieldL@leoncountyfl.gov).

New ESRI Press Book Available

Ocean Globe Sheds Light on Advances in Seafloor Mapping

Ocean Globe details recent progress in seafloor documentation, bathymetry, and related GIS ocean and marine mapping projects. There is particular focus on bathymetry—the study of underwater depth of the third dimension—within the context of work done to collaboratively map and study the ocean floor. The contributors to *Ocean Globe* deem collaborative mapping as key in changing the future of bathymetry, and *Ocean Globe* presents their methods, formulas, problems, and the solutions they applied in these efforts.



Themes, such as physical, social, economic, biological, and ecological change, as they relate to oceanographic mapping are present throughout. In addition, each chapter portrays a different facet of maritime research that relies on ocean floor mapping for its success. The need and emphasis for better conservation in addressing the diversity of the world's oceans and seas are also conveyed.

With a shared goal of joining disparate data collected over decades, the contributors of this volume turned to GIS as a tool for sharing information and advancing the science of bathymetry.

Ocean Globe is edited by Joe Breman, lead GIS architect for Akimeka, LLC, in Maui, Hawaii, and includes an introduction by Dawn J. Wright, professor of geography and oceanography at Oregon State University. It was written and edited for an international audience of GIS users, ocean and marine instructors and students, and others interested in coastal management and marine mapping trends. ISBN: 9781589482197, 294 pp., $64.95

More Information

For more information about this book and others from ESRI Press, visit **www.esri.com/esripress**.

ESRI Business Partner Offerings

ESRI maintains relationships with more than 2,000 business partners that provide focused assistance to our customers. These partners have extensive experience providing GIS solutions and services across several industries. Our partners offer solutions and services that range from custom ArcGIS applications to complete system implementations. In this issue, we would like to recognize a few organizations that have been ESRI partners for 20 years or more. For a complete list and description of our partners and their offerings, visit the ESRI Web site at **www.esri.com/partners**.

Infrastructure Development
Photo Science Geospatial Solutions
www.photoscience.com
Corridor Analyst
Corridor Analyst is an extension for ArcGIS that facilitates the siting of linear infrastructures, such as electric transmission lines and pipelines. It allows users to infuse stakeholder input into the siting process through collaborative suitability modeling procedures, identifies preferred corridors, and automates the evaluation of alternative routes. Corridor Analyst helps users implement the EPRI-GTC Transmission Line Siting Methodology.

Enterprise Utilities
Telvent
www.miner.com
Designer Express
Designer Express is a new ArcGIS software-based sketching product in the ArcFM solution of utility tools. It offers a full suite of editing tools, as well as posting, plotting, and cost estimate reporting, so engineers can quickly create utility network design sketches and cost estimates without the overhead of compatible unit integration. Designer Express is a graphic design application for utilities that lack an integrated work management system or do not have accounting-based requirements built into the design process.

One Call Ticket Management
Pro-West & Associates, Inc.
www.prowestgis.com
One Call Ticket Management System
The One Call Ticket Management System (OCTMS) works with one call center tickets and integrates with positive response systems. The OCTMS receives tickets from state one call systems and distributes them through a Web-based ArcGIS Server application. Locators can view ticket locations, print tickets and maps, and edit tickets in single or batch mode in a real-time, mobile environment. OCTMS lets users view ticket records and maps simultaneously, use internal GIS data, perform automated ticket splitting, and eliminate fax/e-mail record sorting, and it provides an easy-to-use ticket history search.

Geospatial Intelligence
BAE Systems
www.baesystems.com/gxp
SOCET GXP
The Spatially Enabled Exploitation module for SOCET GXP connects image analysts directly to ESRI geodatabases. Users with limited photogrammetry experience can populate the ESRI geodatabase to answer critical questions using temporal, spatial, and attribute queries. Analysts who are more familiar with ESRI tools can access the ArcGIS Desktop application ArcMap directly from SOCET GXP with the added benefit of using SOCET for ArcGIS with optional extraction in a SOCET GXP stereo multiport. ArcMap stores and retrieves feature data, while SOCET GXP displays vectors on the imagery with the associated sensor model.

System Architecture
VESTRA Resources Inc.
www.vestra.com
The Trio
The Trio from VESTRA is a set of add-on components to the Cityworks product line that leverages ESRI software and optimizes GIS performance. Consisting of an online service request, dashboard, and GIS system monitor, the Trio enhances client and public interaction by providing flexible, easy-to-use solutions for a variety of applications.

GIS Services
CDM
www.cdm.com
ArcGIS Server Web GIS Implementation
Among CDM's full suite of GIS implementation services, the company is currently focusing on helping clients update their legacy ArcIMS Web GIS applications to ArcGIS Server technologies. This includes feature-rich .NET, Flex, Silverlight, and JavaScript-based solutions that are focused on particular aspects of an organization's operations.

Hawaii, Thailand, and Washington—Have T-Shirts, Will Travel!

Kathy Baxter, business process analyst, Planning and Development Services, Snohomish County, Washington, chose to wear her ESRI T-shirt while planning her hike to the top of Diamond Head in Hawaii. Good job!

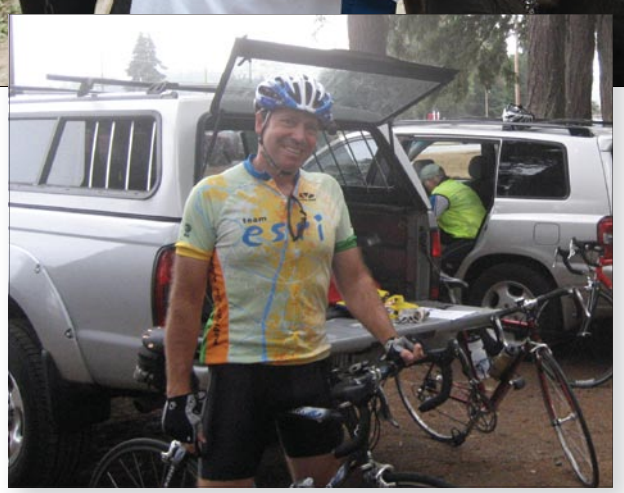
John Montre, reference librarian, Pius XII Memorial Library, Saint Louis University, St. Louis, Missouri, enjoyed an "eco-vacation" to Thailand and visited the elephants at the Maesa Elephant Camp and the Elephant Health Care Unit. Happily, he got snapped while wearing his brand-new ESRI T-shirt (since his "vintage" ESRI shirt from 1999 had worn out!).

Alan B. Smith, GIS technology specialist, Geographic Services, Washington State Department of Transportation, wore his ESRI Cycling Jersey on the 2009 Tenino-Rainier-Yelm-Bucoda Bike Rally, a 100-mile ride through rural Thurston and Lewis counties.

Wear an ESRI T-shirt in a unique location and send a photograph to *ArcNews*. Photos will be considered for use in *ArcNews,* the expanded T-shirt section at *ArcNews* Online, or both. While digital photos sent via e-mail (tmiller@esri.com) are preferred, prints or slides can be sent to Thomas K. Miller, *ArcNews* Editor, *ArcNews* T-Shirt Feature, ESRI, 380 New York Street, Redlands, California 92373-8100 USA. See *ArcNews* Online at **www.esri.com/arcnews**.

Kathy Baxter

John Montre



Alan B. Smith

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Exclusive *ArcNews* Online Articles

The Spring 2010 issue of *ArcNews* Online (**www.esri.com/arcnews**) presents the following exclusively online articles:

Philadelphia Police Use a Myriad of GIS Tools
For the Philadelphia Police Department, enterprise GIS provides commanders and frontline staff with the ability to make sense of millions of historic incident records.

Enterprise GIS Eliminates "Geographic Information Chaos" in Medellín, Colombia
For more than 21 years, GIS has steadily grown within Medellín to include most other departments including finance, public works, environment, social welfare, education, and transport and traffic.

AZRocks!: GIS Guides Avid Outdoor Climbers
With GIS, the AZRocks! Group identified new climbing areas in the state of Arizona.

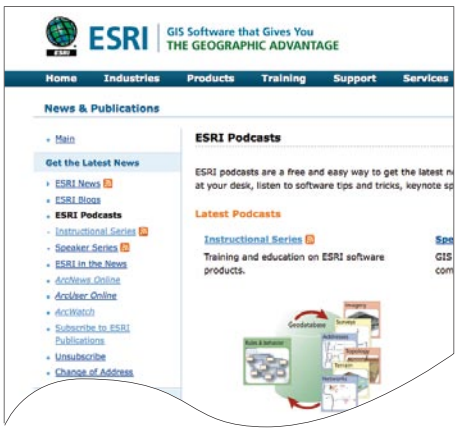
Eradicating Rats on Lehua Island, Hawaii, with the Help of GIS and GPS
GIS and GPS technologies were critical to help eradicate invasive rats on Lehua Island, managed by the Hawaii Department of Land and Natural Resources and federally owned by the U.S. Coast Guard.

Also, look for the expanded ESRI T-shirt section online, as well as new supplemental podcasts.

Listen to ESRI Podcasts

ESRI podcasts are a free and easy way to listen to users share their experiences, get the latest news and information from ESRI, and learn software tips. ESRI Speaker Series podcasts feature GIS technology insights from users, business partners, and ESRI staff. ESRI Instructional Series podcasts focus on new and updated software features. Podcasts can be downloaded and listened to on a computer or portable MP3 player.

More Information
To check the availability of new podcasts and subscribe to the podcast feeds, visit **www.esri.com/podcasts**.



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Trichloroethylene contaminant plume at an industrial facility on the coast. Sand and rock layers shown plunging below the ocean.

Ocean, sand and bedrock layers cut away along shoreline and dock to reveal the plume. Aerial photo of the site was used to texture map a 3D CAD model of the facility buildings and the ground surface and ocean layer.

Ocean

Sand

Bedrock

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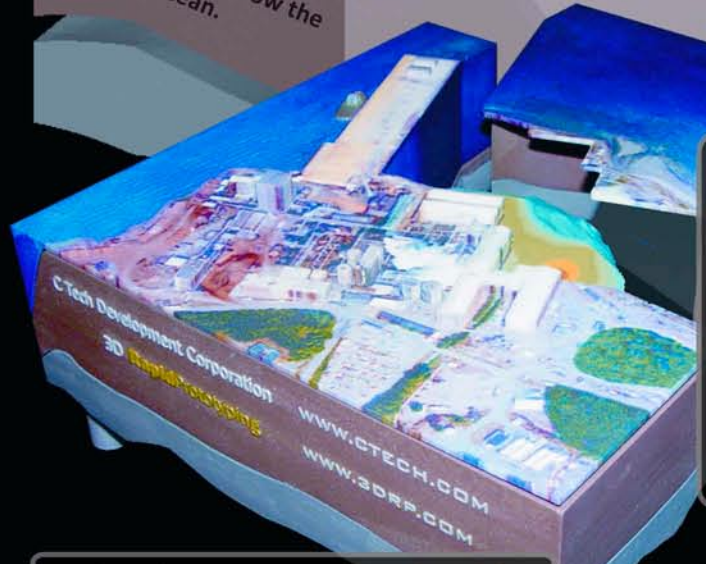

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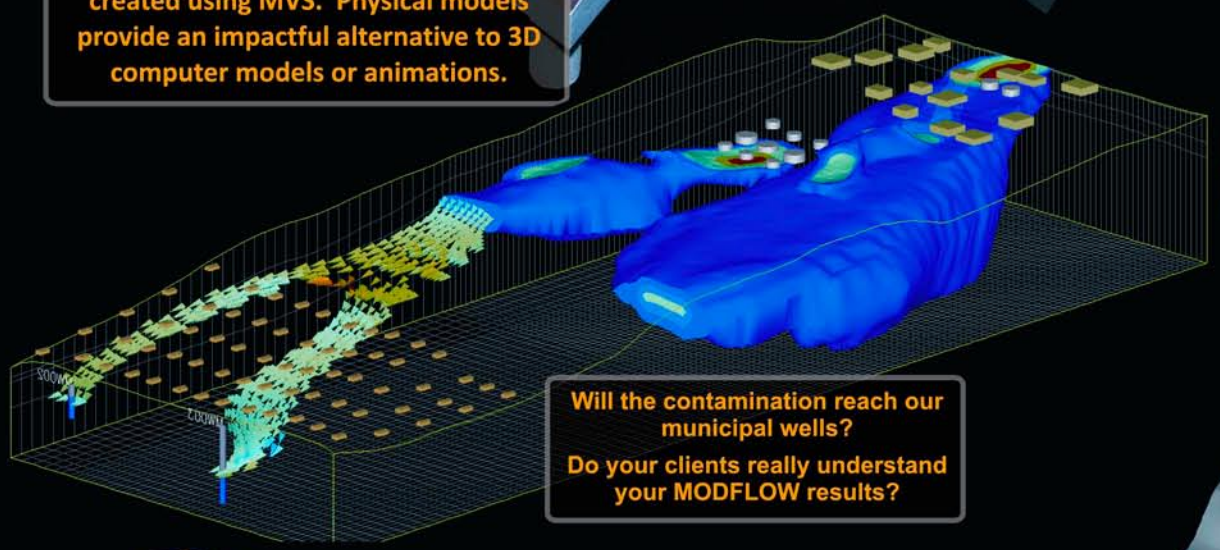

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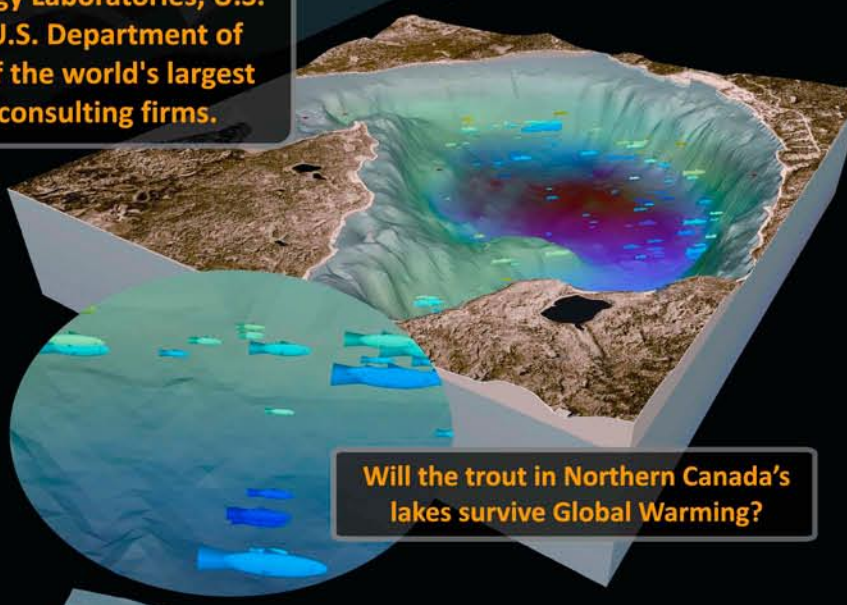

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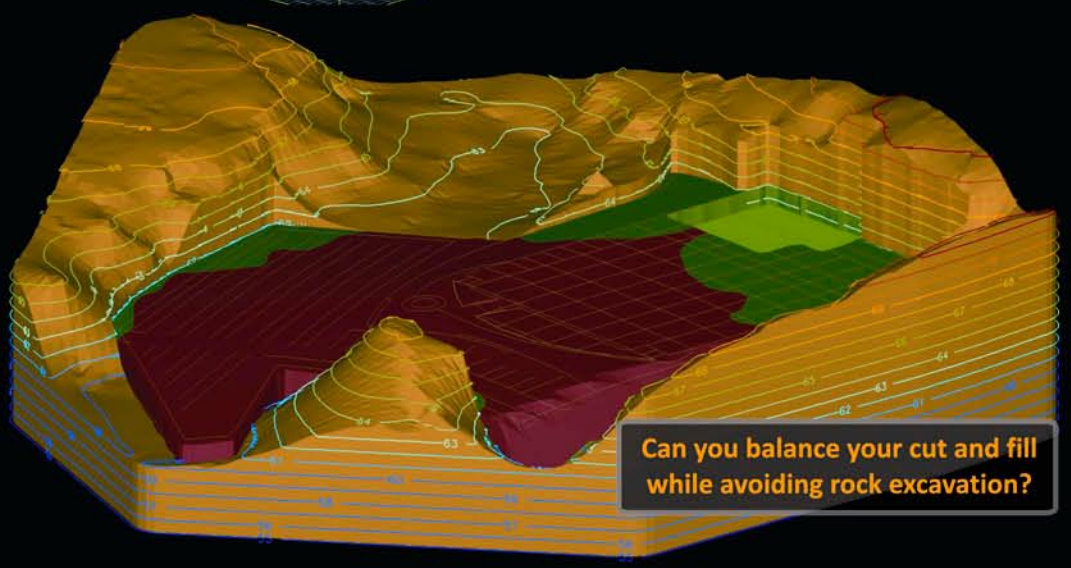

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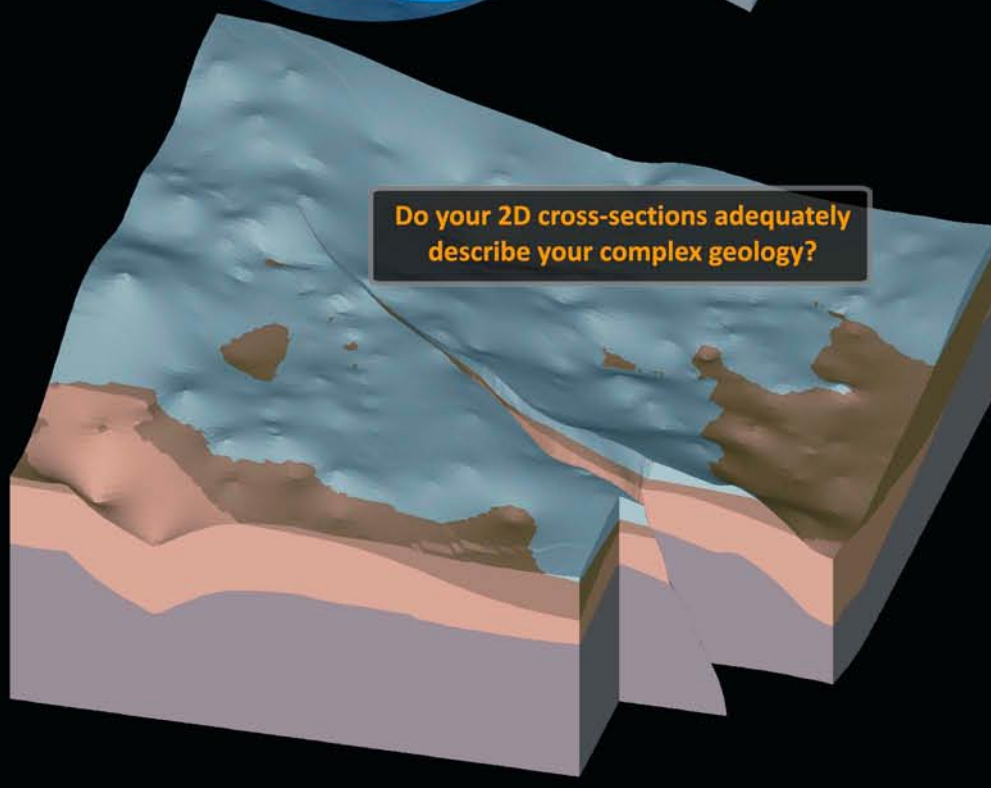

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