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Governance of the NSDI

By Will Craig, President of the National States Geographic Information Council

The concept of the National Spatial Data Infrastructure (NSDI) has been around since the early 1990s, and the name has been in existence since 1994, when President Bill Clinton used it to label his executive order creating it. The name sounded strange when I first heard it; why *infrastructure?* Then I realized that *data is infrastructure*. Everybody else got it too. It was the first time the United States began to see data as infrastructure—equivalent to concrete roadways and metal pipes. This was the new information age, and data was the basis for economic growth and environmental integrity.

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California Selects GIS as One of the Six Key Enterprise IT Strategies

By Michael Byrne, Geospatial Information Officer, State of California

California is the ninth largest economy in the world, the largest agricultural producer in the United States, one of the most biologically diverse places on the planet, and a leader in science and technology innovation. It is the nation's most populous state and is also home to floods, fires, and earthquakes. It covers more than 160,000 square miles and has temperate rainforests, deserts, mountains, and a spectacular coast. Recently, I was flying from San Diego in Southern California to San Jose (about halfway up the state) with a colleague from another state, and as we landed, he turned to me and said, "This is a big place."

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GIS, Design, and Evolving Technology

By Jack Dangermond

More than 12,000 GIS professionals met in San Diego, California, in July for the 29th Annual ESRI International User Conference. Given current economic conditions, I appreciate the extra effort it took to make the trip to San Diego. I'd like to recap, for those who could not attend, some of the key points shared at the conference.

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GIS for Renewable Energy

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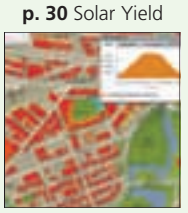

p. 32 Boston Solar

p. 33 Airflow

GIS is being extensively used in the quest to find and develop renewable energy resources, such as wind, solar, geothermal, and biomass energy. GIS is also being used to search for the best locations (considering natural and cultural resources) and to find the best corridors for transmission and distribution of resources.

GIS technology is supporting and underlying the progress of this monumental change. GIS is not only improving the way we produce and deliver energy but also changing the way we view our earth's resources. This issue of *ArcNews* explores some of the ways organizations around the globe are using GIS to foster renewable energy initiatives. (*See the GIS for Renewable Energy special section on pages 26–33.)*

Create and Deploy Mashups and Web Applications

Free Web Mapping APIs

ArcGIS Web Mapping APIs are now available for free for all noncommercial use, allowing mapping and GIS capabilities to be more easily embedded, consumed, and deployed in Web or desktop applications.

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New downloadable samples are published in the Web Mapping APIs Code Gallery weekly.

A Model for a "Virtual USA"

VIPER: Virginia Deploys Web-Based Emergency Management System

The Virginia Department of Emergency Management (VDEM) recently launched an emergency management system—the Virginia Interoperability Picture for Emergency Response (VIPER)—that has transformed how it prepares for emergencies and responds to disasters. The GIS-based enterprise platform integrates with numerous information systems and links with approximately 250 data feeds. It supplies a Web-based common operating picture and numerous analysis tools. Emergency commanders; first responders; and police, fire, and government officials can tap into a single information resource.

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USGS History, Part 1: 1884–1980

125 Years of Topographic Mapping

By E. Lynn Usery, Dalia Varanka, and Michael P. Finn, U.S. Geological Survey

On December 4–5, 1884, John Wesley Powell persuaded the U.S. Congress to authorize the U.S. Geological Survey (USGS) to begin systematic topographic mapping of the United States.

During the next 125 years, mapping techniques evolved from field surveys through photogrammetry to the computer-based methods currently used, and the scales and content of the topographic maps changed. It is the purpose of this two-part article to provide details of the USGS mapping processes through time and to help demonstrate that innovations by USGS employees and provision of public domain geospatial data helped spur the evolution and development of digital GIS and the commercial market for geospatial data and products of today. This first article describes topographic mapping

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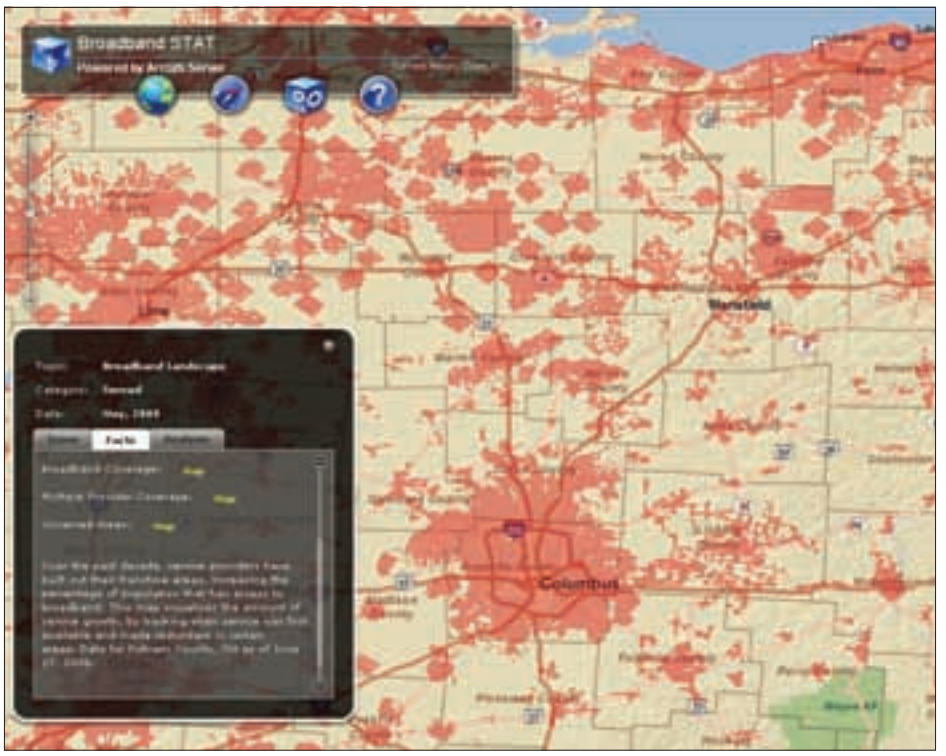
12 States Pick GIS to Help Build Broadband Coverage Maps

Highlights

- The plan is to make high-speed Internet more accessible.
- GIS combines service-provider data with street-level maps and local demographics.
- ArcGIS Server makes data and maps available to a wide audience over the Internet.

Twelve U.S. states and Puerto Rico have chosen solutions based on ESRI's ArcGIS software and technology to help develop broadband coverage maps and better position them for competitive funding available through the U.S. State Broadband Data and Development Grants Program. These states and territory selected ESRI Business Partner Connected Nation, a nonprofit corporation based in Washington, D.C., to implement ESRI's GIS technology-based solution to develop maps that identify areas where high-speed Internet service is available and unavailable across its state or territory.

The Grants Program implements the joint purposes of the American Recovery and Reinvestment Act of 2009 (ARRA) and the Broadband Data Services Improvement Act of 2008. ARRA pledges to inject $787 billion into the U.S. economy, and $7.2 billion of that is dedicated to improving U.S. broadband infrastructure. The Grants Program will provide approximately $240 million in competitive, matching grants to assist states in developing state-specific data on the deployment levels and adoption rates of broadband services and create publicly available statewide broadband maps. Another $200 million in grants is allocated in the first round of funding for sustainable broadband adoption programs and public computing centers. In addition, $3.6 billion in grants and loans is available in the first round for broadband infrastructure deployment.



BroadbandStat features easy-to-use tools for combining and viewing data.

The overall plan is to make high-speed Internet more accessible in areas currently without service and promote a wider adoption of Internet usage. Public and private entities are competing for the grants and loans. One of the criteria for qualifying is the use of public-private partnerships to promote grassroots-driven expansion of broadband and computer use, particularly among unserved and underserved populations.

Connected Nation specializes in establishing public-private partnerships to spearhead the initiatives and develop the maps. Nevada and Texas join a growing list of states partnering with Connected Nation, including Alaska, Florida, Illinois, Iowa, Kansas, Michigan, Minnesota, Ohio, South Carolina, and Tennessee.

The Texas Department of Agriculture will work with Connected Nation to deploy GIS technology and develop its broadband maps. "We are excited about this new partnership," says Texas agriculture commissioner Todd Staples. "This relationship will help Texas close the digital divide between urban and rural communities in our state. By creating a broadband map, we will learn which areas are unserved and underserved. This critical knowledge will lead to developing projects that bring high-speed Internet to all Texans, which will enhance economic development, expand educational opportunities, and improve health care."

The first step of the state-based public-private partnerships is to support the sensitive task of compiling proprietary data from competing service providers. The next step is to create a complete picture of a state's broadband coverage using ArcGIS technology to combine the service provider data with detailed street-level maps and local demographics. ArcGIS analysis tools are used to identify and depict served, unserved, and underserved areas of broadband deployment. States and telecommunications service provider applicants for broadband stimulus funds can provide compelling evidence for their cases by using GIS visualization tools.

In Nevada, Connected Nation is assisting the Nevada Broadband Task Force, appointed by Nevada governor Jim Gibbons. Its efforts have already produced a statewide map that identifies rural and remote areas that can be targeted for infrastructure grant funding.

"My administration is committed to improving the availability of quality broadband service for all Nevadans," says Governor Gibbons. "To accomplish that goal, Nevada must be proactive in taking the steps necessary to ensure that we maximize the amount of broadband stimulus funding awarded to the state and its providers. Our partner's extensive experience working with other states to increase broadband availability and use will be a great asset to the Nevada Broadband Task Force as it works to achieve its objectives."

ArcGIS Server makes the data and maps available to a wide audience over the Internet. This makes it possible for agencies and companies involved in broadband initiatives to analyze where the greatest potential exists for establishing new service. The general public can access prepared maps; use an interactive map to find information, such as coverage and Internet speed available in its neighborhoods; and verify or challenge the reported coverage areas.

The GIS technology used to design these interactive maps includes BroadbandStat, ESRI's new rich Internet application (RIA) Web-based framework for viewing, analyzing, and sharing broadband service and related data. Developed by ESRI Professional Services staff in consultation with Connected Nation, the solution is based on ESRI ArcGIS Server technology and offers open access to extensive GIS capabilities to publish and share geographic data, maps, analyses, and models. Its dashboard-style display was created using the ArcGIS Web mapping API for Flex to provide the RIA user experience.

More Information

For more information about BroadbandStat, visit **www.esri.com/bbstat** or e-mail telecominfo@esri.com. For more information about Connected Nation, visit **www.connectednation.org** or e-mail info@connectednation.org.

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Governance of the NSDI

Continued from cover

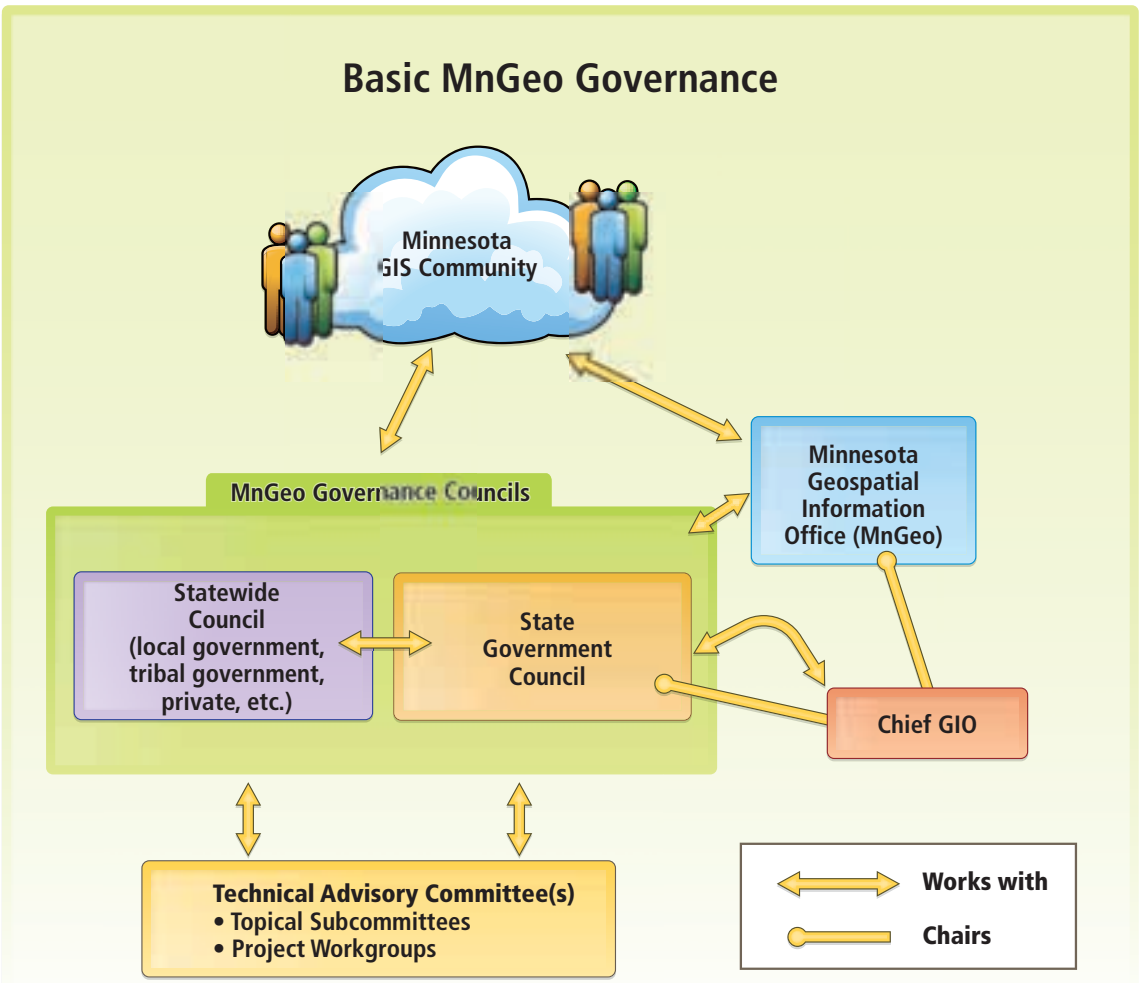
It was a wonderful concept—liberating and energizing—but we have gotten much less than I was hoping for over the past 15 years. There are only a few success stories. As I see the problem, we simply have not organized ourselves very effectively. This article describes the current geospatial governance structure in the United States, discusses current problems, looks at state models for success, and makes recommendations for doing things differently at the national level.

Through a directive from the Office of Management and Budget (OMB), we have put significant effort into identifying key data elements in that infrastructure and assigning responsibilities to develop and maintain that data. The Federal Geographic Data Committee (FGDC) is charged with coordinating those efforts but does not have the power to make or enforce rules. Federal agencies continue to create "stovepipes of excellence" and cooperate only when desirable to themselves, very rarely because of outside pressure. Equally important, the NSDI has a federal focus and often does not meet the needs of state or local government—let alone the private sector or public.

State governments have done a better job of coordinating their state spatial data infrastructures. Ironically, they have gotten funding from FGDC to develop the strategic and business plans necessary to make the transition. Many states have geographic information officers (GIOs) to coordinate state-level activities and advisory councils composed of other stakeholders to help coordinate the activities of municipal, county, and tribal governments. A similar approach should be used at the federal and national level to create the governance structure that will allow us to finally reach the full potential of the NSDI.

Cracks in the system are becoming apparent to Congress. In June 2009, the Congressional Research Service published a report called *Geospatial Information and Geographic Information Systems (GIS): Current Issues and Future Challenges*. The report tries to address the questions of "how effectively [is] the FGDC . . . fulfilling its mission" and "how well is the federal government coordinating with the state and local entities" (see **www.fas.org/sgp/crs/misc/R40625.pdf**).

On July 23, 2009, the Energy and Mineral Resources Subcommittee of the House Natural Resources Committee held an oversight hearing on federal geospatial data management. Rep. John Sarbanes of Maryland quoted a U.S. General Accounting Office (GAO) report from his briefing material saying that only 4 of the 17 [*sic*] FGDC member agencies were in compliance. A video of that hearing and written testimony of witnesses is online at **resourcescommittee.house.gov/index.php?option=com_jcalpro&Itemid=27&extmode=view&extid=278**. Most of the discussion in the hearing was about eliminating redundant data collection. Not much was about filling gaps.



OMB, FGDC, and NSDI

The current federal geographic governance structure has a long history. In 1953, the federal executive OMB issued Circular A-16. Originally aimed at federal surveying and mapping activities, that circular has been revised several times and is now titled *Coordination of Geographic Information and Related Spatial Data Activities.* Circular A-16 is the basis for all federal geospatial data coordination efforts. OMB is a cabinet-level office, monitoring the performance of the various federal agencies that report to the president, guiding them when they stray, and making recommendations for future presidential budgets. This is a powerful office, but it has tended to delegate geospatial data coordination to FGDC.

FGDC was created in the 1990 revision to OMB Circular A-16. This is when the circular began looking at spatial data use and coordination across federal agencies. The committee consists of leaders from 30 federal agencies—up from 18 listed in the 2002 revision of Circular A-16. It is chaired by the secretary of the interior. The strength of the committee is determined by the strength of personalities running it, and that strength has varied over the years. Not all member agencies are fully committed, as indicated at the oversight hearing.

When the NSDI was created in 1994 by President Clinton's Executive Order 12906, its purpose was to "support public and private applications of geospatial data in such areas as transportation, community development, agriculture, emergency response, environmental management, and information technology." Responsibility for implementation was given to FGDC. With minor modifications to provide a special role for the new Department of Homeland Security, President George W. Bush continued the NSDI in his Executive Order 13286 in 2003.

There were weaknesses in all this. One of the things that went wrong fairly early was a fixation on *framework data*. These were the seven data layers that were seen as first steps toward fulfilling the vision of the NSDI: geodetic control, orthoimagery, elevation and bathymetry, transportation, hydrography, cadastral, and governmental units. Circular A-16 describes these as the seven "themes of geospatial data that are used by most GIS applications." In fact, I most frequently use land-use and soil data for my environmental work and socioeconomic data for my urban planning work. But, these seven were seen both as easy first steps and as a solid frame to which other data could be referenced. To be sure, Circular A-16 lists some 34 data categories and assigns each to a federal agency, but few agencies are working on their assignments. Land use is not in the list of data categories—along with many other elements that we all find useful in our daily work.

It turned out that framework data was not so easy to complete or coordinate. The National Academy of Sciences points out that the Federal Emergency Management Agency (FEMA) needs land surface elevation data that is about 10 times more accurate than data currently available (2007) for most of the nation. The transportation layer is maintained in various forms by agencies including the U.S. Census Bureau and Department of Transportation, the latter having several different versions. The cadastral layer effort soon abandoned securing data on all private landownership and even smaller federal land holdings, leaving only large federal holdings, like Yellowstone National Park, and Public Land Survey corners.

One of the best success stories is GPS, something that was not seen as part of the NSDI. This technology was developed by a federal agency (the U.S. military), but kept relatively secret with only degraded access to it until 2000 when President Clinton opened the door for public access. Today, GPS is a multibillion-dollar industry with devices on the dashboards of cars, in cell phones, and even on dog collars. This happened within a single agency and outside our national data governance structure.

We knew early on that data could not be developed without a partnership between the federal government on the one hand and state, local, and tribal governments on the other. Those relationships were required in Clinton's NSDI executive order. They were underscored in a series of reports from the National Academy of Sciences. The first of these was *Toward a Coordinated Spatial Data Infrastructure for the Nation,* which predated Clinton's executive order and set the stage for it. Perhaps the most relevant today is the 2003 report, *Weaving a National Map: Review of the U.S. Geological Survey Concept of* The National Map, that envisioned a national quilt of high-resolution local data that could be rewoven into a national blanket of uniform quality.

Data for the Nation

The National States Geographic Information Council (NSGIC) and others are starting to use the phrase *for the nation.* Imagery for the Nation (IFTN), Transportation for the Nation (TFTN), and Elevation for the Nation are examples of this new approach in labeling. To NSGIC, this term means something quite specific: data is available nationwide, it has sufficient spatial and topical resolution to meet the needs of all levels of government, and resources are available to keep the data current. The processes for conceiving, developing, and maintaining such data are described with 20 discrete criteria on the NSGIC Web site. Only a few data themes exist that meet these criteria.

There are four ways to produce data that meets the needs of all levels of government. The traditional way is for federal programs to deliver data at sufficiently fine resolution to meet everyone's needs. A good example of such a program is the Soil Survey Geographic Database (SSURGO) county soils maps provided by the Natural Resources Conservation Service; these maps provide sufficient detail for state and local applications, though not for individual farmers who want to manage their fields intensively. Also, the Census Bureau provides population and housing data at the block level and above—again, sufficient for all but the most detailed local needs. The National Wetland Inventory and the National Hydrography Dataset also fall into this category. Not many other examples exist. I call these "happy accidents." They almost always involve a federal partnership with state or local government, but those partnerships are matters of convenience and not the result of our governance structure.

A second way to meet the needs of all levels of government is through federal programs that allow state and local governments to participate through buy-up options. The IFTN program, proposed by NSGIC, starts with the U.S. Department of Agriculture's (USDA) 1-meter National Agricultural Imagery Program and allows locals to add sensors (e.g., four-band) and expanded coverage into nonagricultural areas. IFTN also provides for the business needs of local government with a higher-resolution 1-foot program that would be administered by the United States Geological Survey (USGS). This component also has buy-up options that include 6-inch resolution, true orthophotographs; increased horizontal accuracies; and other features important to local government. Ideally, states would coordinate the many local requirements and funding, making it easier for USDA, USGS, and their contractors to meet local needs.

A third way to meet the needs of all levels of government is for local government to collect data that meets its needs, with state and federal governments rolling this data up to summary levels

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sufficient for their more general needs. This is actually fairly rare, but I have a good example from McLeod County in central Minnesota. The county wanted 1-foot contour data and worked with several local cities and a watershed district to contract for services. USGS needed only 10-foot resolution for its National Elevation Database, but contributed financially so it could access the finer data, process it, and publish a 10-foot summary of the original county data. The Minnesota Department of Transportation also contributed to the effort. This partnership was recognized in 2008 with a commendation from the governor of the state of Minnesota.

A fourth approach is for the private sector to get involved and create something that has value to the nation—enough value to support the enterprise. A number of popular Web providers of maps, travel directions, and aerial photos are doing a great job of delivering this kind of information to the public; much of the data comes from government sources, but it is delivered in useful packages by private firms. Ideally, we would base other work on public/private partnerships, so government has a say in the nature and availability of the final product. We lack good models on how this should work, but the potential is there.

Parcels and Addresses

Parcels and addresses are especially useful pieces of the NSDI from my perspective. They present a conundrum for federal partnerships. Many federal agencies need such data for their day-to-day operations or in emergencies. This data is typically created and maintained by local government, but there is no systematic way for this local data to flow up to state or federal agencies as described in the third option above for delivering data for the nation.

Illustration by Suzanne Davis, ESRI

There is no system for collecting and organizing local data, so federal agencies collect their own data. Taxpayers foot the bill for multiple versions of the same data. No governing body in Washington has responsibility for resolving the conundrum—addressing the fragmented landscape.

Data on addresses is the most vexing because it is the closest to being ready for widespread sharing. The Census Bureau and the U.S. Postal Service have nationwide databases but share only with each other. A 1982 Supreme Court decision supports the Census Bureau decision to not share its Master Address File with local government. That decision was based on the court's understanding of congressional intent in writing Title 13 of the U.S. Code forbidding access to internal Census Bureau records, not on any intrinsic right of privacy. The past 27 years have brought significant developments in technology and business databases, making moot decisions about unknown addresses.

Most recently, the Census Bureau has spent millions of dollars hiring out GPS work to add an x,y coordinate to every front door in America. For some reason, this information is also held as nonpublic. I could easily see a system where I provide my address to the Census Bureau and it returns my x,y coordinate. Local governments and 911 authorities would love to have this information for their business needs but do not have the funds to collect this data themselves and cannot get it from the Census Bureau. I am not talking about internal and possibly illegal housing units, just about the front door that anyone could see when walking by. I am not talking about unknown places in the woods, only those buildings for which the local authority already has addresses. The x,y coordinates remain an internal, nonpublic resource at the Census Bureau, paid for with public funds, but not available to the public or any other government agency. Does this make sense?

Parcels are in a similar situation, but different because no federal agency has responsibility for maintaining a national parcel dataset. Nearly every domestic agency, save USGS, has the need for parcel data. USDA needs parcel data to manage its crop insurance programs. Our national parks and forests need information on parcels to communicate with neighboring landowners. FEMA needs parcel data for rescue and recovery operations; it wasted millions of dollars following Hurricane Katrina in aid to people who did not own property in the damaged area. The Census Bureau could use parcels on the outer edge of cities to update their governmental unit boundaries. The U.S. Department of Housing and Urban Development (HUD) could use parcel data to monitor urban decay or renaissance. Some would argue that access to good parcel data would have allowed us to foresee the recent mortgage crisis and intervene before things went so horribly wrong.

A 2007 report by the National Academy of Sciences looked at parcel data issues: *National Land Parcel Data: A Vision for the Future*. I was on the committee that drafted that report. We envisioned a Web mapping service that would allow people to see parcel maps, along with a limited set of attributes, for any place in the country without regard to county or state borders. States would play an intermediary role, adding their own landownership data and managing records for those local governments without sufficient internal capacity. This

is technically and economically feasible. Yet the United States cannot do it because we lack the will and a governance structure to develop and manage such a system. The first recommendation of our study was to create a panel to identify a national coordinator to begin working on the governance issue. The Bureau of Land Management (BLM) has responsibility for the cadastre under OMB Circular A-16, so the panel would start by determining whether BLM has enough authority and capacity to do the job. Two years after our report was published, there is still no panel looking at this issue.

States Are Organized

States around the country coordinate GIS activities better than the federal government. They typically have some kind of statewide council. The most effective councils coordinate activities at the state level with a strong hand but work gently with local governments. They include representatives from all stakeholder groups, including federal, state, county, municipal, and tribal governments; private-sector GIS users and providers; the academic sector; nonprofit organizations; utilities; and the general public. They have clear vision, supported by a strategic plan and a business plan.

The Fifty States Initiative was designed by NSGIC and FGDC to help states become effective coordinators. This initiative is intended to connect with the data resources of the 50 states and, through them, to the 3,141 counties, over 18,000 municipalities, and more than 370 tribal governments. To this end, FGDC has funded 46 states in developing strategic and/or business plans to support the NSDI.

NSGIC has developed a scorecard so each state can know how it stands on relevant criteria. The scorecard has nine criteria starting with a full-time coordinator and sustainable funding. More powerful criteria include a clearly defined authority for state-level coordination, the ability to coordinate with local government and other stakeholders, and a formal relationship with the state chief information officer (CIO).

My own state recently created the Minnesota Geographic Information Office (MnGeo). The state had been struggling with fragmented operations, and its NSGIC scorecard showed it. With a grant from FGDC, it hired a private firm to help bring together stakeholders and develop a governance model that would work *(see diagram on page 3)*. The plan called for the new MnGeo with two advisory bodies: one for *state government* coordination and one for *statewide* coordination. The state government advisory council is composed entirely of state agency GIS representatives. The statewide advisory council is composed of representatives of local government, the private sector, tribal government, nonprofit organizations, and academia. The GIO participates on both committees—as the chair of the state government council and as a nonvoting member of the statewide council.

The National Solution

The simple solution is to "get organized," along the lines of what the states are doing. There are no technical problems in developing the NSDI, only organizational ones. Increased governance is necessary to make things work better. I see four parts to this new model: (1) creation of a new federal Geographic Information Office, (2) a radical empowerment of FGDC to coordinate federal GIS activities, (3) the creation of a new body representing nonfederal stakeholders, and (4) development of a congressional oversight committee to watch and guide overall activities.

At the federal level, we need a structure that supports and demands coordination of geospatial data development across federal agencies. This should start with the creation of a new position—a federal GIO. The office should be part of the Office of Management and Budget. OMB develops and executes a government-wide management agenda and assists the president in preparing his budget. It already houses the new federal CIO. This is the ideal place to set federal mandates for agency operations.

One of the first tasks of the new GIO should be to develop an economic argument for the NSDI. NSGIC has estimated the price of the NSDI at nearly $9 billion, with an annualized cost of about $2.5 billion. Is it worth it? If so, where are the highest payoffs? The effort should begin by defining a rigorous methodology that delivers results understandable to both economists and the educated public, including agency heads and members of Congress. The study should cover all levels of government, the private sector, and the public. NSGIC has suggested that the economic study should be delivered within 18 months after the GIO takes office. If the study shows positive benefits, support for the NSDI will logically follow.

FGDC should continue to coordinate activities at the federal level, but with more muscle behind its efforts. Duplicative activities should be identified and corrected. Agencies should be held accountable for fulfilling data assignments. Gaps should be identified, prioritized on economic return, and assigned to agencies. To operate effectively, FGDC probably needs to be moved from its current home in the Department of the Interior to OMB, since that organization has the mandate to review the performance of federal agencies and make budget recommendations affecting them.

Over time, I have written two contradictory articles about what it takes to make a difference in the world of sharing data. In 1995, I wrote about institutional inertia and the need for a body outside the organization, usually the chief executive or legislative body, to set the rules for organizational mandates and individual rewards. Later, in 2005, I recanted, as I recognized the value of "white knights" who are motivated to do what is right regardless of the institutional rules. I think I was right the first time—at least for something as large and complex as the NSDI. Certainly, large federal agencies need that outside oversight.

A National Spatial Data Council (NSDC) is needed to coordinate nonfederal activities. This idea has been around for years. I took this name from a 1998 report of the National Academy of Public Administration, *Geographic Information for the 21st Century*. The NSDC, or whatever we decide to call it, should be composed of stakeholder representatives from state, local, and tribal governments; the private sector; academia; and others. The representation should look much like that of the current National Geospatial Advisory Committee to FGDC, but would have power, grant-making ability, and access to the GIO. The federal government should be represented by FGDC as a nonvoting member.

A new congressional oversight committee could do three things: set the expectations for federal agencies and the new NSDC; monitor performance, asking hard questions; and become the political champion to support the development and maintenance of the NSDI.

As a nation, we have gone nearly two decades with limited progress on the NSDI. Most of that progress has been made through the goodwill and volunteer efforts of altruistic people and organizations. We are in the information age, but we're still building stovepipes. It's time to put some muscle and money behind the NSDI vision.

About the Author

Will Craig is associate director of the Center for Urban & Regional Affairs at the University of Minnesota. He chaired URISA's Research Agenda Group in the mid-1980s, proposing an agenda that had a strong focus on institutional research. He is the president of NSGIC and has been inducted into URISA's GIS Hall of Fame.

More Information

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ESRI Services

VIPER: Virginia Deploys Web-Based Emergency Management System

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Highlights

- VIPER has changed how VDEM provides emergency mitigation and response services.
- ESRI Professional Services configured the Flex Viewer to gather data from VDEM's crisis management system.
- The system was built using ArcGIS Server and ArcGIS Desktop.

People access the system to gain an accurate understanding of events on the ground, deploy the right personnel and equipment, and update data dynamically from the field or command center.

"What we needed was a method to avoid redundant work and to improve our situational awareness," says Bobbie Atristain, chief technology officer, Virginia Department of Emergency Management. "VIPER achieves this. Now we get the right information we need as soon as it's available to make better decisions."

VDEM implemented VIPER after an extensive needs assessment. The agency wanted to overhaul its existing situational awareness system. The goal of the new system was to enhance information sharing, communication, and analysis. It would provide a new level of connectivity and fully integrate multiple systems. The obstacle of wading through numerous information stores, databases, and other technologies would be removed. In addition, preconfigured processes could be put in place so that when an incident occurs, the right datasets and feeds will be activated so that responders can act immediately and monitor events in real time.

Making a Good System Better

The Commonwealth of Virginia has a long track record of successful GIS deployments. VDEM had used GIS for years. After an outbreak of nearly 80 wildfires in Virginia in February 2008, VDEM looked at ways to improve its ability to capture data and view it in real time.

Based on a demonstration provided by ESRI, VDEM contracted with Professional Services consultants in the ESRI Charlotte office to help Atristain extend the capabilities of VIPER. Professional Services staff worked with Atristain to configure ESRI's Flex Viewer, powered by ArcGIS Server, to monitor environmental sensors and gather data from VDEM's crisis management system and other systems, such as the National Weather Service.

The system was built using ArcGIS 9.3, including ArcGIS Server and ArcGIS Desktop software.

"I saw the first version of the Flex API and instantly knew that's what we needed," says Atristain. "I just thought that the Web was a much easier way for us to deploy something, because everyone can get to it—it didn't rely on any software on anyone's machine."

Bolstering the High-Tech Landscape of Emergency Management

VIPER has literally changed how VDEM provides emergency mitigation and response services.

VIPER provides Virginia Emergency Operations Center (VEOC) staff with the ability to visually assess statewide emergency management operations in real time. It also automatically offers instant access to essential information and maps. For example, if a particular highway experiences a severe traffic accident with multiple injuries, VIPER will provide information about nearby hospitals; in the case of a hazardous materials spill, VIPER will offer data about schools and other high-priority evacuation sites. VIPER then performs an analysis of all available information and alerts VEOC staff about potential impacts on critical infrastructure.

This VIPER full-size image shows real-time data from systems such as the National Weather Service and the Virginia Department of Transportation.

VIPER is set up using geoprocessing models to show staff what they want to know as soon as it requires attention—sensors about to reach action stage, at action stage, or above action stage. Then the system immediately pulls in preidentified information from multiple data points. The system alerts staff with what to look for based on a specific type of event, its location, and other factors.

Today, VIPER is available not only to local, state, and federal agencies but also to the public. Anyone can go online using the Web to view the real-time data and point or click their way to information they want. 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.

Since its launch, VIPER has had several successful deployments. During Tropical Storm Hanna, VDEM used the new platform for the first time. The system showed shelter status overlaid with the National Weather Service's feeds. This helped staff prepare in advance for the potential large-scale displacement of people.

During the 2008 presidential election, VDEM staff hosted geoprocessing models authored on its desktops and pushed them into its server environment. The result was a model that queried the statewide hazmat, 5-1-1 transportation and traffic telephone hotline, and Virginia Department of Transportation construction projects against the schools and election polling location layers. During the election, staff working in the VEOC viewed only polling places or schools that fell within a two-mile buffer zone of any obstructions. The benefit was that watch commanders could immediately identify polling places that could have potential complications. They could then contact the staff at highlighted polling locations, such as near a hazardous material spill or large traffic accident, to make sure the polling process was still running smoothly.

"There was a great concern about overcrowding at the polls," says Atristain. "This is why we needed the overall situational awareness for the entire

VIPER was important at the presidential inauguration, January 2009. This is a zoomed image during the whistle stop. Red symbols show incidents, and the squares show the timeline.

state in preparation for the November election. We needed to be able to respond to something, if possible, before it became a serious problem."

In addition, VIPER was used during President Barack Obama's inauguration ceremony, which was the largest in the nation's history. The system helped provide security for the 2.7 million people who attended. VIPER helped track multiple related events across Maryland, the District of Columbia, and Virginia. In the Multi Agency Command Center (MACC), local, state, and federal officials used VIPER to look for any anomaly that could have impacted the inauguration.

"The system is very empowering to the end users and very helpful to the IT staff," emphasizes Atristain. "Since we implemented VIPER, our GIS department has not needed to make maps for operational incidents. Much of the information previously spread out over servers and shapefiles and different types of file formats—information GIS staff would have to work to locate during different exercises or events—is right here, on your Web browser for you."

Indeed, the success of the system is catching the attention of the nation. Several local and state agencies have looked at the VIPER system as a model for something they can quickly build using their existing GIS resources and at a nominal cost. There have been congressional hearings where VIPER has been showcased as a model for a possible nationwide system.

"We're getting an amazing response, especially for all the system can do that's above what you might usually see," says Atristain. "It's exciting."

More Information

For more information, contact Bobbie Atristain, chief technology officer, Virginia Department of Emergency Management (e-mail: Bobbie.Atristain@vdem.virginia.gov). AN

ArcNews *Cover Summer 2009*

Revisiting Map of Unemployed

Correction—The United States unemployment map on page 1 of the Summer 2009 *ArcNews* was incorrectly titled. It should have read, "Percent Unemployed, July 2009." In addition, the text accompanying the map incorrectly identified the date shown by the map as April 2009. It was intended to say "July 2009." ESRI sincerely regrets any confusion or inconvenience these errors may have caused.

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**.

Exclusive *ArcNews* Articles Online

The Fall 2009 issue of *ArcNews* Online (**www.esri.com/arcnews**) presents the following exclusively online articles:

What Is the Geographic Approach?

ESRI president Jack Dangermond often emphasizes the importance of using the geographic approach for problem solving. Read about this methodology's five steps.

Pennsylvania GIS Enables Data Sharing Across County Lines

In Pennsylvania, the state's 67 counties share geographic data for enhanced emergency response and have looked for ways to orchestrate it.

Cyclone Leaves Its Mark on the Map

Cyclone Nargis struck the Myanmar coastline, destroying much of the area's agricultural economy. The Foreign Agriculture Service of the United States Department of Agriculture used remote sensing and GIS to analyze damaged areas and crop production capacity.

City of Dover Provides Enterprise-Wide Geospatial Application Access

The City of Dover, Delaware, recently deployed an enterprise geospatial platform that improves a wide range of city functions by opening up data stores and providing seamless, user-friendly information access.

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

California Selects GIS as One of the Six Key Enterprise IT Strategies

continued from cover

California is indeed a big place, and its state government similarly needs solutions fitting its size and range of issues. In February 2009, State Chief Information Officer (CIO) Teri Takai released the State Information Technology Capital Plan. This plan outlines the solutions the state will invest in over the coming years. The plan aligns these solutions along business-driven priorities, maps them across the state's IT strategic goals, and subsequently identifies opportunities for collaboration.

In the 2009 report, the CIO identified six of these opportunities: geographic information systems, business intelligence, transaction processing, enterprise content management, customer relationship management, and case management. What this effort really identifies is a set of unifying business examples that can be leveraged across agencies for increased economies of scale in technology service delivery. The fact that one of the technologies is GIS points to just how important GIS is as a solution for California needs. We need solutions that can tackle the large policy issues we face in this diverse state, and few technologies get us there—but GIS does.

Of the 39 state departments identifying capital investments in information technology in this plan, 10 of them are projecting investment in GIS technologies. These departments are diverse. California Emergency Management Agency, Department of Forestry and Fire Protection, Department of Public Health, and State Water Resources Control Board are all planning on capital investments in GIS. The capital plan really gives the Office of the State Chief Information Officer the chance to analyze common business needs across departments and look for opportunities to align these investments. For instance, if we see a common thread of data, technology, or human resources need in these investments, we can allow partnerships to grow from these plans whereby infrastructure development or data can be shared. This collaborative approach allows us to save money, be more effective, and give the business units the best value gained.

In October 2008, the California Natural Resources Agency and ESRI developed the Web-based Flex Viewer application to support Golden Guardian. This allows streaming of services and using mobile devices. New and enhanced map services will serve high-resolution urban area imagery.

So where has California succeeded to date in this approach? Two projects in particular are notable. Both housed at the California Natural Resources Agency, the CalAtlas effort and the Common Operating Picture effort have been very successful by identifying common need for collaboration across agencies.

CalAtlas (**www.atlas.ca.gov**) is the California central repository for geospatial data. CalAtlas embodies Web 2.0 technology and provides a framework for GIS data sharing. Users must first register. They then have the ability to catalog data they steward, push data for download at CalAtlas, develop services to be accessed, and publish basic maps. The real success of CalAtlas is that it is open and free to end users, which limits the need for duplicating publication infrastructure about spatial data in the state. Those agencies already with advanced infrastructures can use the services, as well as those with emerging GIS use. CalAtlas now has more than 11,000 registered datasets described and an estimated 200 terabytes of data to download. This data adds to the state's collective knowledge.

The second effort, the Common Operating Picture (COP), was born out of the collaboration required during the response to the 2007 firestorm. During that event, literally thousands of wildland fires were raging in California at one time. Through partnerships with the California Department of Forestry and Fire Protection, the California Emergency Management Agency, the Natural Resources Agency, and ESRI, the idea for the COP was born. The COP is a view of common geospatial data in California to be used for situational awareness. It contains common base, infrastructure, and critical asset type data, which is important for a common understanding of large-event response. Built on ESRI Flex Viewer technology, the COP was tested during the Golden Guardian exercise of fall 2008. Golden Guardian is a test of the emergency response community, in partnership with U.S. Geological Survey (USGS) and others, usually held every other year in California. In 2008, the three-day exercise simulated a 7.8 earthquake along the San Andreas fault running from the Salton Sea to Los Angeles. During this exercise, many Emergency Operations Centers (EOCs) around the state used the COP to view the spatial data. This collaborative approach allows us to assess large problems with an economy of scale that is most effective.

We don't plan on stopping there. The Office of the State Chief Information Officer has just released a comprehensive data strategy for the state. As an offshoot of one of the six strategic concepts (see **www.itsp.ca.gov/Facing_the_Future/Strategic_Concepts/default.asp**), managing data as an asset is essential to more effective and efficient state government. The strategy identifies a common data approach to all data managed in state coffers. The data strategy identifies geographic data as core to nearly every data asset California owns. As such, developing a common, collaborative "data as a service" approach is essential to managing the scale of business and policy issues Californians face. This new strategy will lay the foundation for managing the spatial data component in all data and managing data as a service to benefit the most people. Pilot efforts for the data as a service approach are under way with Minimum Essential Datasets of imagery, roads, and landmarks.

While Californians face significant budget challenges, they also expect the highest degree of innovation from technology solutions. GIS is a core solution that California will continue to build sophisticated business processes around to increase government effectiveness.

About the Author

Michael Byrne, M.A., GISP, is the geospatial information officer for the State of California. He has 18 years of GIS experience in a wide variety of positions in California state government and academia. He has served as a GIS manager for the University of California, Davis's Information Center for the Environment, and as staff to the Secretary for Resources implementing special GIS projects. Byrne is a member of the National Geospatial Advisory Committee and a director for both the National States Geographic Information Council and GreenInfo. He holds a bachelor of science in environmental planning and a master of arts in geography, both from the University of California, Davis.

More Information

For more information, contact Michael Byrne (e-mail: michael.byrne@cio.ca.gov). AN

Gary Moll Wants People and Nature to Work Together

This article is part of an ongoing series honoring individuals who have made a difference in the world by applying a GIS solution to challenges or needs within conservation or their communities. Since these unique individuals have been selected for their innovations or special achievements in a particular field, the series is appropriately named GIS Heroes. ESRI recognizes ecosystem environmentalist Gary Moll as a GIS Hero.

An advocate of using technology to integrate human and natural systems, Gary Moll has been a force in bringing the value of urban ecology to the attention of federal and local leaders and uses GIS to apply solid scientific and engineering data to decision making.

Along his life path as a conservationist, Moll has successfully worked with the Congress of the United States to increase funding for urban forestry and with the U.S. Forest Service (USFS) to expand urban forestry programs to 50 states. His work on the development of the GIS software program CITYgreen helps local governments measure urban forests and harness their benefits.

"The human network needs to be built with the natural system in mind," says Moll. "Urban forests and green infrastructure are part of the city ecosystem. GIS shows the relationships between social systems and ecosystems and offers a means for us to weave the city structure into the natural system." Moll is the senior vice president of the Urban Ecosystem Center at American Forests and is one of the nation's foremost authorities on urban forestry and urban ecosystems.

Community leaders traditionally make their decisions about community structures based on dollar values. Sadly, they almost always overlook the value of the natural system upon which these community structures are built. People need to be made aware that if the natural system remains intact, it can do much of the work a structure does. Moll and his team use GIS to show that the original natural system provides similar ecosystem services to those offered by expensive structures. This has huge financial value. For example, using Landsat imagery and GIS technology, Moll was able to show that the 10 counties of the Atlanta, Georgia, metro area lost $2 billion worth of storm water runoff benefits. The analysis measured the tree loss in the region between the years 1972 and 1986. The team then ran the CITYgreen analysis on both scenarios. The good news was that the area still had about $1 billion of that natural storm water benefit left. When community leaders become aware of these dollar amounts, "environmentalists" suddenly are invited to join the urban development discussion.

In the early 1990s, Moll was introduced to GIS technology while working with USFS on an urban forest research project. The agency was planning to issue two urban forest research proposals, one for tree inventory and one for cost-benefit calculations. Moll suggested these two projects should be one and successfully convinced the agency leaders to combine them before issuing the final proposal. The project introduced urban forestry specialists to GIS and proposed a new way to look at urban forests, not as street trees, but as comprehensive urban forest ecosystems.

The proposal recognizes that urban forests are a mix of street trees, yard trees, park trees, and all the other land cover that makes up a community. The national hydrologist, Don Woodward, who worked for the Natural Resources Conservation Service (NRCS) (formerly known as the Soil Conservation Service), showed Moll's team how to calculate the movement of storm water based on land cover. NRCS developed a runoff "curve number" system after monitoring streamflow for 50 years. This became the basis for the most widely used storm water planning model in the country.

Woodward helped Moll's team add the impact trees had on that curve number. As a result, for the first time, people could calculate the ecosystem services provided by tree cover. The engineering formulas provided by Woodward produced accurate volume measurements for storm water, Moll's team determined dollar values by obtaining the cost of building storm water retention structures from engineering firms, and the Environmental Protection Agency costs were calculated using cubic foot storage metrics.

Ultimately, however, USFS did not adopt the methods developed by Moll's team as a national standard. Then in 1995, Moll and his team developed an ArcView extension using this technique and, in 1996, released the desktop software CITYgreen. This program makes it possible for local communities to calculate the functions of their natural system, attach dollar values to storm water and air quality, and use this information to make better decisions about managing their communities. Along with the advances in ArcGIS software, the CITYgreen extension has since undergone six iterations.

Moll played a central role in the growth and development of the urban forestry movement and was chairman of the National Urban Forest Conference from 1984 until 2001. But his view of urban forests, not as street trees but as an ecological system, led him to organize the first National Urban Ecosystem Conference in 2003 and drop the National Urban Forest Conference altogether. Taking the broader ecological view of the places where people live has led Moll to work with nontraditional partners and rethink traditional approaches.

Along with Michael Gallis, a renowned expert in large-scale metropolitan regional development strategies, Moll and his nontraditional partners proposed the concept of coevolution, which proposes the management of the human network and the natural system in concert and in parallel. This requires a new framework for efficiently guiding economic growth and rebuilding ecosystems. *(See Moll's, Gallis', and Heather Millar's series of three People–Nature articles in* ArcNews*—Winter 2006/2007, Summer 2007, and Fall 2007.)*

Moll says, "An aphorism of coevolution is that the global network is the most useful framework for understanding the pressures on ecosystems and human systems around the country and around the world. Simply put, global networks are patterns of trade, transportation, and information that people use to meet their needs, such as roads, shipping routes, and economic regions."

This network forms a pattern of centers and corridors that reaches around the world like a web. Looking at the world this way makes it possible to break down problems and begin to identify goals and strategies. The idea is to start at the global scale, then come down to areas on a regional scale, putting together the natural and human networks.

This high-resolution leaf-on image of Bellevue, Washington, provides city officials with a detailed analysis of their green infrastructure. Trees (vegetation) and soils provide the basic foundation for the movement of air and water through this landscape.

Recently, Moll and his team, along with Gallis and his associates, and Dr. Michael Flaxman of the Massachusetts Institute of Technology, applied the method to the Piedmont Crescent that lies between Birmingham, Alabama, and southern Virginia, including North Carolina, South Carolina, the Appalachian Mountains, and parts of Tennessee and Kentucky. The task to collect the data and maps about the many different systems was quite involved. Using GIS to analyze data from the Army Corps of Engineers, the Census Bureau, the National Oceanic and Atmospheric Administration, USFS, and USGS, the team found the area to be much different than expected. The southern forest of the Piedmont area is 99 percent gone; the forest of the Great Smoky Mountains is 93 percent gone. The system is in total disarray. These findings have been published in a map book called *Piedmont Crescent*. One of the biggest surprises was that all the thousands of rivers in this Piedmont Crescent area had been altered—every single one. In reality, the area is not a natural system but actually an unnatural one.

The sobering question asks, if expansion of the human network is inevitable, how do we manage its impact? It would help if everyone stopped to take some time to determine ways the human network can move through these places without destroying them. Questions need to be asked: What economic and social patterns are driving the development of a region? Where are the transportation corridors? Where are the economic corridors? What metro areas are nearby? How are they linked? How is expansion and change happening? How do air and water move through these ecosystems?

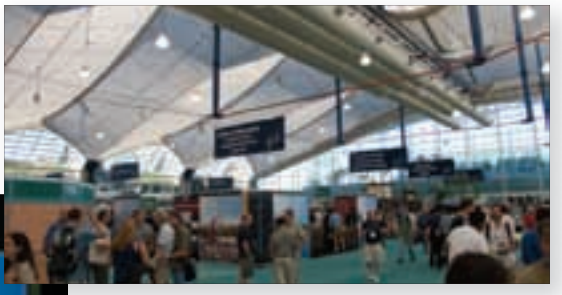
"The solution to building better communities in the future lies in learning how to integrate the natural system with the human network," advises Moll. "The first step is to understand how the natural system functions, and the second is to understand the human network. This must be done at various scales. Once that is done, GIS technology can help people understand how the two will interact so we can develop human networks that are low impact and highly efficient."

More Information

For more information, contact Gary Moll (e-mail: gmoll@amfor.org). Read more about American Forests at **www.americanforest.org**. Download a free PDF version of the booklet *Co-Evolution* at **www.americanforest.org/Co-Evolution**.

29th Annual ESRI International User Conference Helps Professionals Chart the Future with Purposeful Design

Users Learn from Each Other at the 2009 ESRI UC



The 2009 ESRI International User Conference (ESRI UC), held July 13–17 at the San Diego Convention Center in California, marked ESRI's 40th anniversary. GIS has evolved greatly over the last four decades, in part due to the global community that meets annually at the ESRI UC. This year's 12,000 attendees from more than 100 countries are a big portion of what makes ESRI GIS tick—the projects, innovation, collaboration, and ideas that stem from this gathering result in important work being done to better societies and organizations everywhere.

This year's conference started by showing hundreds of user slides demonstrating the value of GIS in a broad range of applications. ESRI president Jack Dangermond urged attendees to keep focusing on and teaching each other, noting that the people there possessed the greatest store of knowledge about geography and how to interpret it and apply it.

Plenary Focuses on Designing the Future

The conference theme, "GIS—Designing Our Future," set the tone for the Plenary Session. "You are an extraordinary group," Dangermond told attendees, emphasizing that the reason for coming together was to celebrate their work as part of a large global network of GIS professionals. Dangermond discussed using GIS to design our future. "Geography is the science of our world," he said. "GIS can be used to integrate this science with the methods of design and planning to create a new profession—GeoDesign. An example of GeoDesign is land-use planning. We have the opportunity to change the direction of a future that is fragmented and depleted toward one that is purposefully designed and that considers all the factors. Future releases of GIS will give us the tools that support both geographic analysis and the creative design process. It will offer the science-based decision-making framework that communities need to chart in the future." ESRI acknowledged the work of people and organizations that have impacted their communities. Cindi Salas accepted the Enterprise Application Award for CenterPoint Energy's extension of GIS into practically every workflow of the utility. The Making a Difference Award went to Dr. K. Kasturirangan, a member of the Indian National Planning Board, who's been influential in spreading remote sensing and GIS across India. Andrew Douglas-Bate accepted the Humanitarian Award for MapAction *(see sidebar below).* The President's Award was given to Maryland governor Martin O'Malley, who implemented GIS-based CityStat and StateStat programs for planning and managing Maryland's health, education, protection, and other government services. Dr. Henk Scholten, president of Geodan in the Netherlands, received the Lifetime Achievement Award, recognizing his dedication to GIS use in education and spatial data infrastructure.

Showcasing the release of ArcGIS 9.3.1, ESRI developers explained how they've focused on platform and making it easier to serve maps with GIS to a widening range of people. The technology offers more quality and scalability and supports rich Internet clients. ArcGIS Online was profiled featuring a new way to share data and maps via layer packages and many new free online content services.

Previewing the coming ArcGIS 9.4 release, ArcGIS presenters showed how the software will become much easier to use and enhance performance, simplify workflows, increase productivity, improve editing, support Web collaboration, and advance cartography.

FedEx gave a demonstration of how it uses ArcGIS to meet urgent shipping needs requiring special handling, from artwork to pharmaceuticals.

The keynote speakers presented ways GIS is impacting environments and societies. Willie Smits, founder of the Borneo Orangutan Survival Foundation, Indonesia, talked about his use of GIS to study deforestation, habitat suitability, and land-cover change.

Hernando de Soto, economist, author, and president of Peru's Institute for Liberty and Democracy, spoke about the power land title documentation gives to the poor. He explained geospatial technology as a catalyst for landownership reform, a concept he believes can help those living in third-world countries overcome poverty. *(See article on page 11.)*

Tim Trainor, U.S. Census Bureau Geography Division chief, spoke about launching the world's largest deployment of mobile GIS. "Geography is core in everything we do," he said. *(See article on page 11.)*

New to the conference, Lightning Talks took place after the plenary; these were five-minute demonstrations of inventive applications based on ESRI Web and mobile technology.

The Map Gallery and new Virtual Map Gallery housed hundreds of maps and presentations. The diverse collections—from housing foreclosures to ocean chlorophyll mapping—put attendees to the test when voting for their favorites in the different contest categories.

Highlights and How-tos

Numerous highlights peppered the conference with intriguing offerings each day. "Father of GIS" Dr. Roger Tomlinson moderated the 19th Annual ESRI Senior Executive Seminar. Among the speakers was California's geographic information officer Michael Byrne, who called GIS the "new whiteboard" for decision makers. During the plenary, the National Geographic Society and ESRI's education team announced the GeoMentor program launch, rallying users in the audience to volunteer to assist educators and students with GIS projects. More than 150 Special Achievement in GIS Award winners were honored in a special ceremony, complete with a cheesecake bar and photo opportunity with Dangermond.

With attendees in search of project guidance, answers to questions, and new goals, the week progressed with hundreds of user presentations, technical and industry sessions, and workshops. Special Interest Group and Regional User Group meetings organized by field, location, or topic facilitated networking. Product demonstrations and one-on-one conversations with ESRI's Professional Services staff took place throughout the ESRI Showcase. Additionally, more than 300 exhibitors were on hand in the Exhibit Pavilion to discuss their solutions and advancements.

The Climate Change GIS Showcase sparked conversations about GIS and climate change issues. Launched last year, the Climate Change Program has continued to grow and offered a variety of discussions on alternative energy sources, forest carbon monitoring, and other conservation topics. Visually stunning Special Displays at the conference, provided by organizations such as the National Geographic Society and the State of Maryland, illustrated how GIS is an essential tool in today's world.

At the Closing Session, ESRI's senior directors answered questions from attendees. One of the questions to Dangermond was, "What's your passion these days? What still drives you?" Dangermond's answer: "ESRI is a team of friends that drive and motivate each other. We all love technology and applications and what they bring. I heard someone say something earlier in the week that was inspiring—'realizing a good idea that really matters.' Now that gets me excited!"

Conference-Goers Get Involved

Each year, ESRI works to make sure there are plenty of ways users can play a part in the knowledge sharing that remains the conference cornerstone. Dangermond accepts plenary image submissions that he can display and discuss during his opening slide show presentation. "It was great seeing my photo in the opening plenary video," said John Urkov, a GIS specialist for the City of Palm Desert, California. "I expect Hollywood to call any day now."

Users can also submit abstracts months in advance to be considered for presentation. These user presentations fit into session tracks that share specific industry or interest best practices, lessons learned, and tips and tricks; topics include everything from agriculture to Web GIS.

More Information

Videos from the Plenary Session, Lightning Talks, and Closing Session are now available at **www.esri.com/uc**. Conversations about the ESRI UC can be followed on Twitter at **www.twitter.com/esriuc**. Next year's conference will return to San Diego July 12–16. The 2010 ESRI Education User Conference, Survey & Engineering GIS Summit, and Homeland Security GIS Summit will again take place concurrently with the ESRI UC. The call for presentations for all these events is now open online.

MapAction Awarded for Applying GIS to Humanitarian Aid

During the User Conference Plenary Session, ESRI president Jack Dangermond presented the Humanitarian Award to MapAction, an organization that helps governments and relief agencies coordinate aid and relieve human suffering. In his speech of thanks, MapAction chairman and volunteer Andrew Douglas-Bate praised ESRI for its help to the charity by providing software and software maintenance. The brainchild of his son Rupert, founder emeritus, MapAction is feisty, driven, and just 13 years old.

MapAction has completed approximately 80 GIS deployments, 16 of which have been in response to catastrophes, such as earthquakes, hurricanes, tsunamis, floods, or volcanic eruptions. The charity also uses GIS to respond to man-made crises, giving aid such as mine clearance or refugee movement. Other missions to help the human condition and design our future include teaching local communities how GIS works and how it can be used both as a first step and as disaster develops.

"We aim to help people to help themselves," said Douglas-Bate. "The power of GIS is step one in that equation. The first few hours after a disaster are crucial to saving lives. The disaster level and comfort of those in need have to be addressed with speed and effectiveness in situations where the whole landscape may have changed. A fog of uncertainty hangs over the scene of catastrophe. This is where GIS, arriving within hours and in the hands of highly trained, highly motivated, well-led MapAction volunteers, transforms humanitarian aid opportunity into delivery success."

When asked about financial support, Douglas-Bate said, "The MapAction service is free to recipients. While we rely on practical and technical help from organizations like ESRI, we also depend on external funding from many sources. Several types of funding are required such as endowment sums for long-term infrastructure and specific project funding. The more we receive, the better we are able to serve our critical clients. I want to thank many users for their contributions. For example, a schoolteacher from Palm Beach said she would go home after the User Conference and raise hell with the local community to get money for us. We take away from San Diego an exciting GIS message, not only of what is happening today but its potential for the future of our planet."

To make a donation to MapAction, e-mail Douglas-Bate at asdb@btinternet.com or visit **www.mapaction.org**.

Census Is the Largest Peacetime Mobilization in the United States

Bureau Chief Tim Trainor Says Geography Is Core of Census

As a keynote speaker at the ESRI International User Conference this year, Tim Trainor, chief of the Geography Division at the United States Census Bureau, addressed a crowd of thousands at the Plenary Session and delivered a clear message: "Geography is the core of the census."

Trainor focused his talk on activities for the 2010 decennial census, some of which are already under way. Since geography is a key component of census activities, the bureau uses GIS throughout the process, from the first activities of address canvassing to final data delivery.

Initially, the bureau divides the country into almost seven million census blocks with ArcGIS software. Those blocks are then aggregated into approximately 800,000 larger assignment areas for individual enumerators. Data from approximately 8,000 assignment areas is processed each day during address validation activities, which can exceed three million addresses per day.

"The census is the largest peacetime mobilization in the United States," said Trainor. "It's a snapshot of the population. It tells us who we are within our borders, and it tells us where we live. The goal of the census is to count everyone once and only once in the right location."

Using handheld computers, enumerators recently verified each address in the United States, which will supply the mailing list for the census questionnaires to be sent on April 1, 2010. Trainor described it as, "by far, the largest deployment of mobile GIS in the world." One hundred forty thousand temporary workers canvassed 145 million addresses and had 11 weeks to complete the task.

"We're using GIS in the field to make things easier and faster," Trainor explained. He then announced, "Because of this technology, I'm pleased to tell you that on Friday, July 10, at 10:00 in the morning, the last assignment area was checked and verified. That ended our address canvassing field operations seven days ahead of schedule."

After the census is taken next year, the bureau will limit the amount of material it disseminates with paper and will opt instead to deliver the majority electronically. Many users will access the data through American FactFinder, which is being redesigned to take advantage of Web 2.0 technology. Cached maps will load faster, and users will be able to make thematic maps with any data instead of predetermined sets of data.

Census data will support general GIS applications, including planning efforts and determining where to locate schools, hospitals, and other public institutions. Trainor also noted it will help people answer questions about affordable housing, plan roads and bridges, and enhance businesses and other economic infrastructure, as well as develop social programs and improve community projects. Population totals will determine how many seats

each state receives in the House of Representatives, and states will use the information to redraw congressional district boundaries.

"The census," Trainor concluded, "is basic to our democracy." Then he strongly encouraged everyone to fill out their census forms.

More Information

For more information, contact Tim Trainor (e-mail: Timothy.F.Trainor@census.gov).

GIS—The Right Tool to Help Reform Property Rights

Keynote Speaker de Soto Explains the Mystery of Capital

Hernando de Soto is no stranger to traveling from his home in Lima, Peru, to meet with world dignitaries. The Peruvian economist and president of the Institute for Liberty and Democracy (ILD) is known for his work on the informal economy and on the importance of property rights. With ILD, de Soto has worked on the design and implementation of capital formation programs in Africa, Asia, Latin America, the Middle East, and the former Soviet nations. Some 30 heads of state have invited de Soto to carry out these ILD programs in their countries. It was ESRI's honor to have de Soto travel to San Diego, California, as a keynote speaker for ESRI's 2009 International User Conference.

In his Keynote Address, de Soto spoke about the inability of the world's poor to gain formal recognition of their property rights. He believes this factor to be a major stumbling block to alleviating poverty. He suggests that almost everywhere in the world, the poor have one thing in common: the only significant asset they have is the land they occupy.

Very few of these people have ever received any type of legal recognition that the land they occupy is theirs. Without legal documents or records that prove landownership, they cannot do the things that have helped establish the western world's successful market economy, such as borrowing against, selling, and setting up a permanent business on the land that one legally owns.

Though de Soto is not a GIS specialist, he is a proponent of applying the technology to help formalize landownership in poverty-stricken countries. For example, de Soto pointed out that many of his ideas were put into action recently when a project in Ghana began using geospatial technologies to create a land titling process and GIS-based land records system. This implementation significantly reduced the time and cost involved in collecting and documenting property ownership information and increased the number of formalized land rights. It's a GIS-based system such as this that de Soto believes can help streamline and eliminate the red tape in the land titling processes

of many countries, empowering people with secured land rights and a formal place in our world. *(See the four-article series based on de Soto's ideas published in* ArcNews*—Fall 2008, Winter 2008/2009, Spring 2009, and Summer 2009.)*

More Information

For more information about Hernando de Soto and ILD, visit **www.ild.org.pe**.

125 Years of Topographic Mapping

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developments prior to widespread use of GIS.

In the late 19th century, surveyors created topographic maps in the field. They measured a series of points in the field, using tape and compass traverses with elevations determined with an aneroid barometer and used in a process known as field sketching to draw a terrain representation using contours. The introduction of the plane table and alidade, which could measure vertical angles, point positions, and elevations much more rapidly, greatly increased the accuracy of data shown on topographic maps but still required the surveyor to field sketch the contours after control points had been identified. The aid of a visual three-dimensional model in the office to construct the surface representation awaited the development of photogrammetry.

During this time, USGS maps were created at scales of 1:250,000 for 1-degree areas and 1:125,000 for 30-minute areas. The scales were increased with time, and by 1894, most of the maps were created for 15-minute areas and produced at a scale of 1:62,500. Features shown on the maps included civil divisions of state, county, township, and city or village; public works, including railroads, tunnels, wagon roads, trails, bridges, ferries, fords, dams, canals, and acequias; hypsography with contours and floodplain representations; and miscellaneous features of forest, sand, and sand dunes.

The reproduction of maps from the original field sketches used a lithographic printing process based on copper plates. The image of the topographic features was engraved on the copper plates. A three-color process was used with civil divisions and public works in black, hydrography in blue, and hypsography and miscellaneous features in brown.

USGS cartographers commissioned for service in the Army Corps during World War I brought back knowledge of aerial photography. Throughout the 1920s, USGS experimented with photogrammetry, but it was not until the 1930s during the Great Depression, when the Tennessee Valley Authority needed complete topographic maps of the entire Tennessee Valley and was under time constraints for mapping, that USGS established a multiplex mapping office in Chattanooga, Tennessee.

A USGS topographer engraves topographic map information onto a copper plate for map reproduction.

The ability to view a three-dimensional terrain surface by doubly reflecting the overlap area, or stereomodel, of a pair of stereophotos in a multiplex stereoplotter effectively replaced the requirements of field sketching. An operator could fix a vertical floating mark at a preset elevation in the stereomodel and trace contours to represent the terrain. Similarly, tracing a road or other planimetric feature in the stereomodel, but allowing the mark to change elevation along the feature, provided recording of all required planimetric features for the topographic map.

After 1942, USGS used pen-and-ink drawings that were photographed to film separations, eliminating the need for copper plates. After a few years, the pen-and-ink process was replaced by engravers and scribe coat. The scribe coat replaced the film in the pen-and-ink process and could be used directly for photographic reproduction.

The 1:24,000-scale 7.5-minute mapping program resulted from demand for more detail on the topographic maps. With the larger scale, USGS included almost 200 features separated into color groups for the five color plates to be used in the film-based reproduction process. The five plates included cultural features, such as roads shown with casings, buildings, and much of the type used on the map on a black plate; road fills, urban tints, Public Land Survey lines, and other features on a red plate; woodland tint and other vegetation on a green plate; hydrographic features on a blue plate; and contours, depressions, and other hypsographic features on a brown plate. The color separations were composited on a five-color lithographic press.

USGS widely adopted photogrammetry as part of the mapping process after World War II, and USGS employees developed innovations in the production workflow and instrumentation. Russell K. Bean of USGS invented the Ellipsoidal Reflector Projector (ER-55) for which he was awarded a patent in 1956. The ER-55 became a replacement for the multiplex stereoplotter for USGS and was later manufactured and marketed by Bausch & Lomb as the Balplex stereoplotter. Also, during this period, the Kelsh stereoplotter, invented by Harry T. Kelsh of USGS, was widely adopted. A USGS innovation for the Kelsh and other optical projection stereoplotters was stereo image alternation (SIA), which operators often called the "squirrel cage" because of the rotating shutters inside a short metal tube; when viewed with the naked eye, SIA sequentially presented the left photo to the left eye and the right photo to the right eye to form the stereomodel.

Additional innovation and developments provided USGS with solutions for stereoplotting, aerotriangulation, point measurement, and other photogrammetric operations. The Kelsh stereoplotters were used in areas of moderate to high relief, but low-relief areas, such as along the coasts and large parts of the Great Plains, required

A portion of an early USGS topographic map surveyed in 1892, using contours for terrain and the water-lining method of representation for water bodies.

the capabilities of the "heavy" stereoplotters that used projection by mechanical rods. These stereoplotters included the Wild A8 and B8; the Kern PG-2; and others of German, Swiss, and Italian manufacture. The Kelsh and the heavy plotters were used until completion of the 7.5-minute topographic map series in 1991; however, additional innovations led to the concept and technology for producing orthophotos in the 1960s.

The development by USGS of the orthophoto concept and building of a practical orthophotoscope by Bean, with a patent in 1959, led to the production of orthophotoquads—rectified aerial photos. Orthophotos became a standard product of USGS and later served as a base for the 7.5-minute topographic maps.

Many other innovations affected the mapping process, such as the measurement of angles in the field with instruments, including transits and theodolites. Distances were measured with electronic distance measuring units using microwave technology and, later, lasers.

The development of computers may represent the greatest technological innovation to change the mapping process, and USGS employees were quick to embrace this technology. In the 1960s, USGS developed the AutoPlot, a device that used stepping motors to move scribing engravers to create a scribe coat negative of the topographic map neat line (latitude and longitude lines that bound the quadrangles) and horizontal pass points.

After 1970, USGS embarked on three different tracks using digital technology. First, it initiated a massive program to manually digitize existing maps to create a product with an arc/node data model, known as a digital line graph (DLG). During the same time, USGS used advances in photogrammetric technology that generated an orthophotograph to simultaneously produce a digital elevation model (DEM). Both DLGs and DEMs were placed in the public domain.

The second track was the automation of the map production operation. The Digital Cartographic Software System development included retrofitting analog stereoplotters, such as the PG-2, with three-axis digitizers to collect and record the x,y coordinates and attributes of geographic features from the stereomodel to a magnetic tape. The tape later was used to drive a large-format automatic plotter, a Gerber 4477, to engrave the map data onto the scribe coat, or to drive a photohead device to expose a film negative. USGS also developed a cartographic interactive editing capability, referred to as the Graphic Map Production System. The scribe coats or film negatives from the final editing process became the color separations necessary for the five-color press to create the lithographic map.

The final track was the development of a land-cover data-generating program, Land Use Data Analysis. The program also developed software, the Geographic Information Retrieval and Analysis System, to support vector graphics and analysis from an arc/node data model. This data became the first complete land-cover dataset for the conterminous 48 states and, as with the DLG and DEM data, was provided in the public domain.

Throughout this period, USGS scientists were developing innovative computer-based data products and hardware/software systems that were made directly available to the public. A software example that persists today is the General Cartographic Transformation Package, written in the 1970s by Atef Elassal, a USGS employee. The computer code in FORTRAN IV (later converted to C and, in 2009, available in C++) can transform data to any of 21 different map projections. This software was the basis of map projection packages that became part of GIS software, which would have its commercial debut in the 1980s.

About the Authors

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Call for Presentations

2010 ESRI International User Conference

Tell Your GIS Story

Share your experience in GIS and submit an abstract for possible presentation at the ESRI International User Conference, which will return to San Diego, California, **July 12–16, 2010.** Diverse presentation topics attract professionals from around the globe who want to hear how you're using GIS technology.

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Barry Waite
Business Development Manager
City of Carson, California

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www.esri.com/ucpapers.
The deadline for submissions is **November 6, 2009.**

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Map Data Provided by
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All authors submitting an abstract are asked to choose a session track that best fits their presentation.

- Agriculture
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- Cadastral and Land Records
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- Climate Change
- Database Design, Automation, and Management
- Defense and Intelligence
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- Ecology and Conservation
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- Electric Utilities
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- Technology Integration
- Telecommunications and Location-Based Services
- Transportation
- Tribal/Indigenous GIS Programs
- Water Resources
- Water, Wastewater, and Storm Water

GIS, Design, and Evolving Technology

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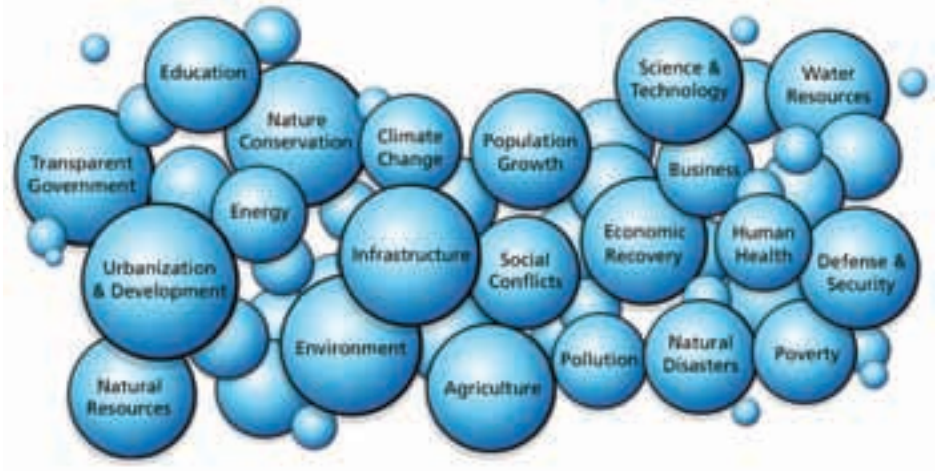
GIS Users Are Making Geographic Information Mission Critical to Society

The purpose of our annual User Conference is to focus on you, the GIS user: to focus on your work, provide you with knowledge and assistance, and help you build relationships with your peers. You are doing very important work in many areas, such as forestry, land-use planning, conservation, national security, and utilities. But at the same time, you are also building the information infrastructure on which will be built the next chapter in the history of the world. You are creating a powerful new kind of information that will lay down the fabric for creating a more sustainable future. The work you do is making a difference. And whether or not you realize it, you are working on virtually all the world's challenges—from economic recovery, government transparency, urbanization and development, and open-space planning to environmental assessment, conservation of nature, climate science, and designing our future.

One of the big challenges facing our society today is the rapid change that humans are making to our global environment. While there are certainly many amazing advances taking place in areas such as technology, health care, and basic scientific understanding, we are also severely affecting our natural environment—the foundational infrastructure for sustainable life.

These changes are largely the result of uncoordinated, unguided human activities. Our landscapes are becoming more fragmented, depleted, polluted, and eroded; in some cases, they're actually disappearing, becoming extinct. This is a tragedy for our future, and it's happening largely because we are not consciously designing our future, and we are not evaluating and accounting for the long-term impacts of our actions on our communities, our environment, our society, our climate—our world.

My message is simple. We need to move from a future that simply happens to one that is purposefully designed with full understanding of the consequences. This will take many participants and more conscious and collective action—action guided by our best vision, science, and intentions. We need to design our future while fully accounting for and being responsible for the consequences of what we do.

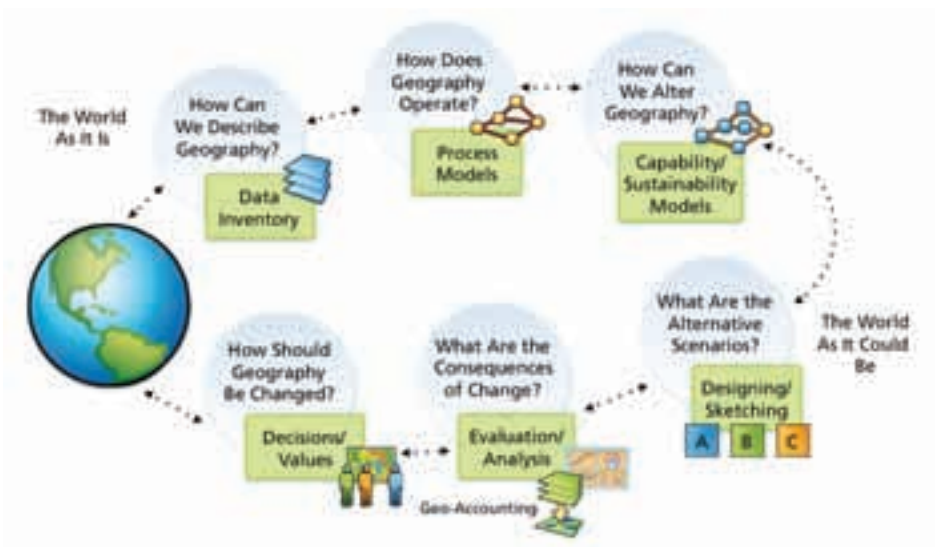


"You are working on all our world's challenges."

GIS: Designing Our Future

This year's conference emphasized the interesting relationship between design and GIS with emphasis on the concept of "GeoDesign."

Today, GIS professionals work with geographic information to manage many aspects of our world. Design is a discipline and process where people deliberately create. Design is about purpose and intentions; it's about seeing in our mind's eye what could be, then creating it. GIS can provide a platform for integrating geographic science with design. I like to refer to this as the field of GeoDesign.



Adapted from the Steinitz model of landscape change, GeoDesign is a rapid and adaptive process for creating a sustainable future.

GeoDesign is a systematic methodology for geographic planning and decision making.

users collectively build and maintain—layers of information, measurements, and analytic models—and plugging it into a new interactive process where one can design alternatives and get geography-based feedback on the consequences of these designs right away. "What if we do this here?" "What is the impact of that alternative versus this alternative?" This iterative design/evaluation process is fundamentally how the human brain works; we try something, evaluate the results, and move on.

Geographic Sketching

Geographic sketching is the central GIS tool for supporting GeoDesign. This new capability allows users to quickly sketch their design ideas on top of suitability maps and get immediate feedback on the performance or impact of the design being proposed. The GIS framework provides instantaneous feedback in the form of maps, charts, and statistics and enables rapid testing of multiple design services.

> "You are creating a powerful new kind of information that will lay down the fabric for creating a more sustainable future."

Dr. Carl Steinitz, professor of landscape architecture at Harvard University, first described how the GeoDesign process worked by posing it in the context of six geographic, or landscape, questions.

The first question is, How can we describe geography? This is done in a GIS by abstracting geography into a series of inventory data layers. The second question is, How does this geography actually operate? Here, GIS is used to combine data with spatial analysis modeling to describe geographic processes. Examples include soil erosion, land-use and vegetation change, hydrology, and traffic flows. Process models predict or describe how various spatial phenomena change with respect to time. The third question is, How can we alter geography considering all the factors? GIS uses suitability and capability modeling to answer this question. Various map factors are overlaid and weighted relative to their merits for a particular use.

These first three questions describe the world as it is; the following questions describe the world as it could be. First, What are the alternative scenarios for designing the future? This involves sketching out the options. Then, How can we quickly evaluate the consequences of those changes? Here, GIS can be used to evaluate the impacts of each alternative. Last, How should geography be changed? This integrates considerations such as policies and values into the decision-making process.

The concept of GeoDesign integrates all six of these steps, providing us with a rapid, adaptive process for creating a more sustainable future.

GeoDesign Will Extend into Every Field

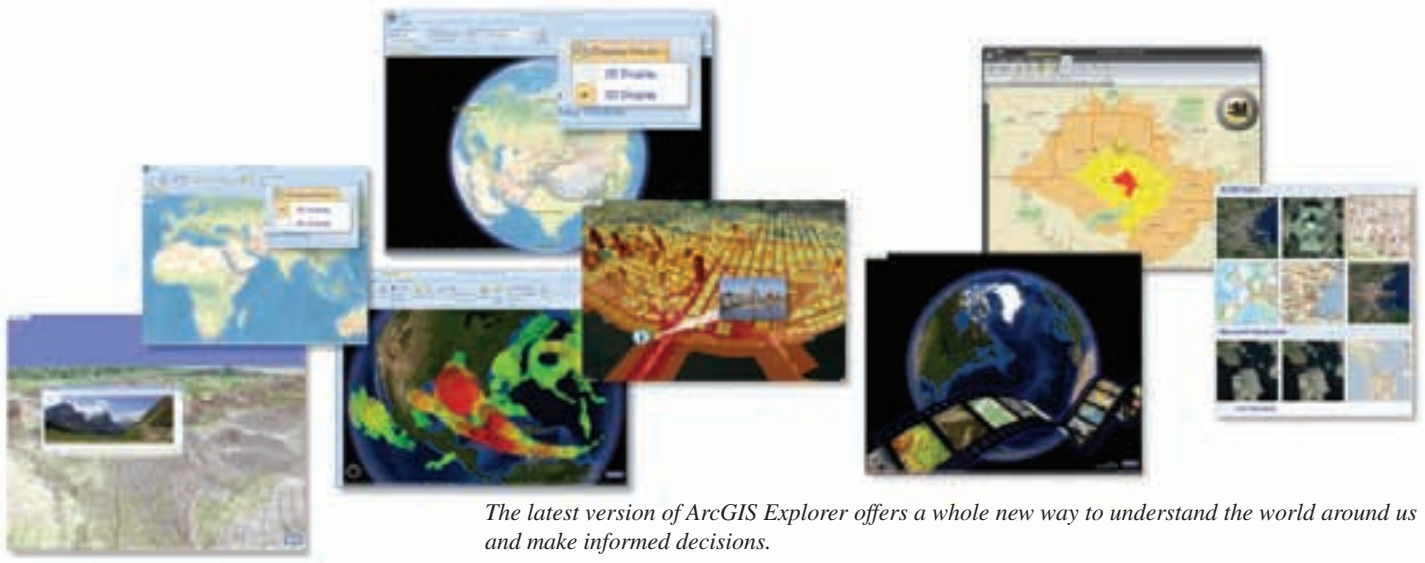
GeoDesign is an evolutionary step in the GIS field. While very exciting for land-use and environmental planning, GeoDesign has broad implications for virtually all professions. This methodology will be applied in many fields—by retailers who want to understand the consequences of opening or closing stores; by engineers who want to locate a road in the right location; and by utilities, farmers, foresters, law enforcement, energy companies, and military organizations, to name just a few. This approach will move GIS beyond simply describing the world as it is toward the idea of creating the future, integrating geographic thinking into all the work we do.

GIS professionals will chart the future using GeoDesign maps. These maps will become a new language for us to communicate and evaluate the future, showing the world as it could be, encapsulating geographic knowledge with purposeful design. This process is about bringing information and science into the way that we make decisions. Our new president is fond of saying he wants to put science in its rightful place. This is where I think its rightful place is—supporting the creation of the future with new kinds of maps that bring it all together.

GeoDesign is an evolutionary step, serving many different types of people and creating many new opportunities for GIS professionals.

The Next Step

Maps and GIS are changing. They're becoming richer, smarter, and more dynamic. They are also becoming more pervasive and being presented using new styles, new patterns, and new techniques. The Web and Web 2.0-style mashups are leading to a new breed of maps and geographic analysis. People are integrating traditional GIS data (services) with new media types, such as social networks and real-time data. This movement will lead to geographic knowledge becoming even more widespread in society. This Web environment offers many opportunities for GIS professionals to be creative with new forms of cartography and spreading geographic knowledge everywhere.



The latest version of ArcGIS Explorer offers a whole new way to understand the world around us and make informed decisions.

Platform Evolution

Today, GIS is being implemented in many different patterns. The desktop pattern is perhaps the most pervasive. Server and enterprise implementations are especially useful in the area of managing organizations, and we see a plethora of new client types, such as rich Internet clients and mobile clients. All these patterns are flourishing and growing, influenced by advances in the technology, faster machines, increased bandwidth, more storage, and the emerging cloud-computing resources that can be leveraged and integrated into applications. Today, all these patterns are also integrated with the Web. The Web is linking us and tying our geographic knowledge creation and services into a larger network or infrastructure.

GIS servers are playing an increasing role in this evolution. They're powering the enterprise and thousands of types of geospatial Web applications—fast maps, the publishing of globes on the Web, and the connecting of mobile workers. They are also supporting mashups and enterprise integration and integrating GIS into other parts of the IT infrastructure. The server is emerging as the foundation for creating spatial data infrastructure with multiple sources of data, services, and applications. The server is also the GIS platform for cloud computing.

The Web as a GIS Platform—Emerging Rapidly

In ESRI's lifetime, we've witnessed the rise of many platforms, including mainframes, minicomputers, workstations, PCs, and client-server computing—lots of waves of change—and every time, we have morphed our technology to take advantage of the latest platform. We're now at the dawn of a new era: the era of Web GIS.

The Web is a strong platform for GIS. Web GIS is about serving, integrating, and distributing geographic knowledge—your work—and making it available everywhere. As GIS professionals, you are building the content that drives the GeoWeb. You're building the data—authoritative data, not just casual data. You're building high-quality maps, visualizations, and spatial analysis models. You have the geographic knowledge, and you have the skills needed to describe it and share it and build rich applications. In this environment, you are beginning to leverage all that content and knowledge for many new kinds of users. Citizens, knowledge workers, field-workers, industry experts, executives—actually, everyone—can now gain access to your geographic knowledge and leverage it in their own domain.

The technologies fueling this growth are the powerful GIS server technology together with easy-to-use client technology. The clients include the new rich Internet applications, geobrowsers (i.e., ArcGIS Explorer), and mobile applications. These, coupled with the growing online content and Web sharing capabilities, are fueling a very rapid deployment.

This is a very exciting time for GIS. From my perspective, it's the most exciting time so far. Web GIS is creating an environment where the applications and the good that GIS can do are about to explode—explode in terms of leveraging our common reservoir of digital geographic knowledge.

ESRI GIS Software

The main focus of ESRI's work is designing software for our users (maps, data, models, visualization). ArcGIS is a complete and integrated system for authoring and serving geographic knowledge.

ArcGIS works on mobile devices, on the desktop, on the Web, in enterprise environments, and across the cloud. Presented here is an overview of recently released and soon-to-be-released additions and enhancements to the ArcGIS platform.

ArcGIS 9.3.1

At 9.3.1, we made a substantial improvement to the ArcGIS platform, focusing on quality, performance, and scalability, and particularly on fast dynamic map display on the Web or in enterprise environments. We also enriched ArcGIS with a number of rich clients. We introduced some new ways to easily share data and expand online content for people to use, and we simplified some licensing. This is a valuable platform for this next generation.

ArcGIS is a complete platform for authoring, serving, and using geographic knowledge everywhere.

Layer Packages

Layer packages are a new way to package your data, map the symbology associated with that data, and share it. Many of you do this now, but layer packages make the process much easier. You can create a layer package and share it on a CD/DVD, put it into a shared file system, e-mail it as an attachment, or upload it to ArcGIS Online.

ArcGIS Online

ArcGIS Online provides a rich library of maps and imagery for the world. This year, ESRI has extended ArcGIS Online with a powerful sharing capability that allows users to find and share maps, layers, and tools on the Web. This capability is in many ways like Flickr (the photo-sharing Web site). The ArcGIS Online sharing site has been designed to allow users to find, upload, and share content either with defined groups (such as their own enterprises) or publicly. The managers of these groups can choose with whom to share their maps and data. They can restrict or allow access at the individual or group level or choose to share their work with anyone.

Next-Generation Geobrowser

The recently released version of ArcGIS Explorer represents the new standard in geobrowser technology. It has incorporated many new features and capabilities, including a more intuitive user experience, integrated 2D and 3D map display, enhanced data support, integration with ArcGIS Online, easy customization, and a software developer kit.

ArcGIS Explorer is a free and exciting desktop client that can be used to view and mash up virtually any geospatial service, as well as integrate local and enterprise GIS datasets.

Application Templates

One of the things we've focused a lot of energy on is making it easier for you to get your work done. We think about this in terms of common applications that all our users employ. We've begun providing a set of desktop and server templates that help you implement ArcGIS. Templates will help you configure and use ArcGIS; they include data models, maps, styles (MXPs), and tools. When you find a template you're interested in, you can watch a video to learn how to use it, view it live on the resource center, or download the contents of the template to configure it in your organization.

You may also want to review the resource center for information on technical topics. When you download a template from the resource center, you'll get a sample geodatabase and map layers. You'll also receive one or more map documents to help you visualize the layers in that geodatabase. We also provide documentation and a getting-started guide to help you configure the template in your organization. Templates are not meant to be

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GIS, Design, and Evolving Technology

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the whole solution, but they are meant to get you started quickly with best practices.

Business Solutions

ESRI's business solutions include a number of different products. ArcLogistics is a fleet management tool to create optimized routes and efficient schedules. The Business Analyst product suite is used in site evaluation and selection, as well as exploring customer opportunities related to specific locations. A new mapping-focused solution called MapIt is a product for simple database mapping. It was jointly developed by ESRI and Microsoft. MapIt allows you to create maps showing information from Microsoft SQL Server and Excel. It includes access to basemaps, geocoding, and routing services from ArcGIS Online and Bing Maps, as well as ESRI Business Analyst Online API drive-time and ring analysis and demographic data services. MapIt integrates with applications such as SharePoint and has a Silverlight viewer. We see MapIt as a way to propagate more mapping and map literacy in the IT environment.

"We need a future that is purposefully designed."

ArcGIS Desktop 9.4

In the second quarter of 2010, ESRI will release ArcGIS 9.4. This product will reflect many user-requested enhancements. We're doing an overhaul of the user experience of desktop. We're also doing a lot of work in the areas of editing, geoprocessing, spatial analysis, and publishing and sharing maps to the server. A major focus is reducing the number of clicks and the number of concepts you need to understand to get your work done.

ArcGIS is going to become a lot easier and more productive to use at 9.4. New tools and features are being added in this release, including fast map display; time visualization; integrated search; improved organization of default menus; the integration of the catalog inside ArcMap; a dynamic table of contents; better maps, reports, and tables; and direct access from the desktop to spatial type data in RDBMSs, enabling advanced SQL functionality. ArcGIS 9.4 will also support license checkout, so you can check out a license for a while, put it back in, and share it with somebody else.

ArcGIS Innovation

There are a number of themes in ArcGIS 9.4. Usability and productivity are certainly two of them, but they also include data management, making GIS more mobile, spatial analysis supporting science, cartography, best practices, sharing, and much more. The focus of this release is to make you more productive and improve some underlying things like quality and performance.

Improved Editing

At 9.4, editing gets a whole lot easier, both for traditional GIS users (compilation and editing) and in the design-based (GeoDesign) sketching workflow. ArcGIS 9.4 uses a simple graphical approach to creating features. To create features, you just pick a symbol from the list and start drawing on the map. It's really that simple. ArcGIS 9.4 also uses a simple snapping environment that is always available, is fast and responsive, and provides graphic feedback so that you always know exactly what you're snapping to. We're also working on improving selection and how the editor works with layers.

Advanced Mapping

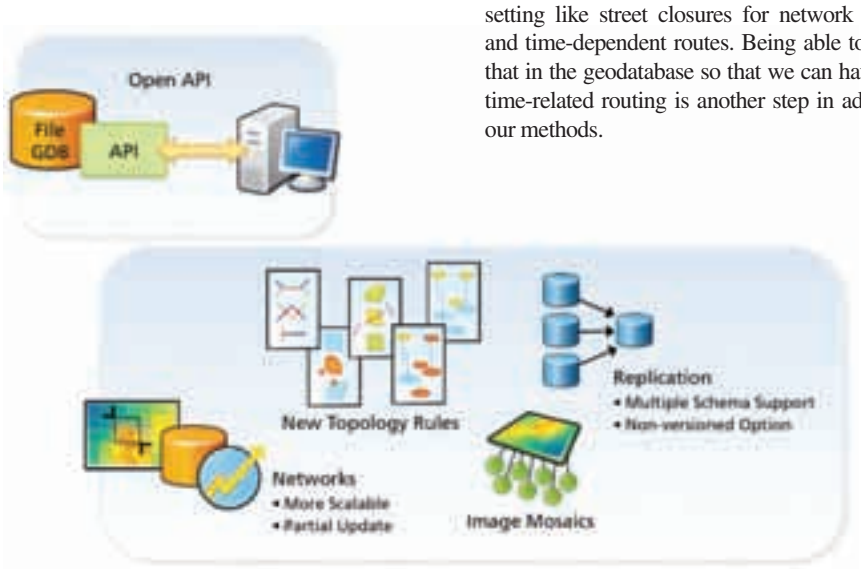
ArcGIS 9.4 fundamentally advances map visualization and cartography. It introduces new methods for creating maps at different scales by simplifying features. The ability to automate common workflows is one of the key underlying features of 9.4. Map automation allows updating symbology and changing data sources for maps and layers using scripting (Python). The creation of multipage map books with dynamic elements can now be automated with Python.

Spatial Analysis

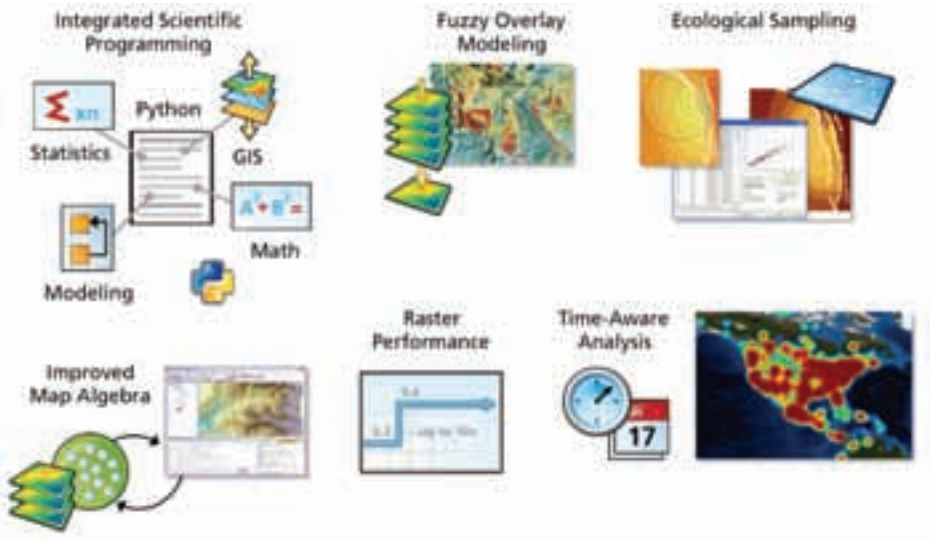
Spatial analysis is the heart of GIS, and a huge step forward is happening at ArcGIS 9.4. We are fully integrating Python inside ArcGIS. Python is rapidly becoming the accepted standard for scientific programming, and its integration will bring a lot of advances in geographic science. We are also adding fuzzy overlay modeling, improved math/algebra integration, and radically improved raster performance for analytic operations. We're integrating time through the whole stack, at the user interface and into analytics, and we're introducing an ecological sampling tool that brings a lot of geostatistics into play.

Network Optimization and Analysis

Another significant spatial analysis enhancement is network modeling. At 9.4, we are adding location-allocation modeling, which helps locate optimal places for things like fire stations, retail stores, and banks. We're also adding gravity modeling, the ability to do dynamic barrier setting like street closures for network routing, and time-dependent routes. Being able to embed that in the geodatabase so that we can have more time-related routing is another step in advancing our methods.



ArcGIS 9.4 enhances the geodatabase, improving data access and interoperability and strengthening data integrity and workflow.



ArcGIS 9.4 advances geographic science, extending our quantitative methods.

A Complete 3D GIS

We've been working for years on making ArcGIS fully 3D, and 9.4 makes ArcGIS a complete 3D GIS, creating a more powerful visualization environment for things like virtual cities. It supports a complete 3D vector data model, opens up a lot of the analytic operators, supports 3D and terrain editing, and allows the integration of real-time video. There's also a huge increase in performance in visual display.

ArcGIS Server 9.4

At ArcGIS Server 9.4, we're introducing new Web clients, a new editing service, enhanced mapping, optimized image service, time integration, SharePoint integration, and much more. We're also adding the ability to zip, clip, and ship your data cells. We will provide an open API to the file geodatabase. The 9.4 release will also strengthen data integrity and a lot of the workflows associated with geodata management by adding new topological rules and better support for very large networks; enabling the partial update of very large networks without having to rebuild the entire logical network; and providing a new geodatabase image type called Mosaics that allows users to access image data in its native format, dynamically build on-the-fly mosaics, and offer fast performance.

Collaborative Data Collection

Web editing in 9.4 will support the notion of collaborative data collection. It allows many people to share and build a common understanding, designing together for a particular geography without being in the same room at the same time.

A Strong Platform for Imagery

In the last two years, ESRI has taken a major strategic direction to improve and integrate imagery directly into the core ArcGIS platform. ArcGIS is a very strong platform for imagery today, and 9.4 will dramatically improve display speed, integrate on-the-fly image analysis on the desktop, and support massive scalability through the introduction of Mosaics. (*See "Imagery: A Core Component of GIS" by Lawrie Jordan, page 17.*)

Mobile GIS

Blackberries, iPhones, and other mobile devices are exploding in popularity, and ArcGIS is poised to support this explosion. Mobility isn't just about one niche—mobile GIS will connect everybody. This includes GIS professionals; field-workers, who might just do some GIS data collection and analysis; knowledge workers, who might embed a very simple task associated with geography or geographic information; and finally even executives, who might want to get a real-time view of exactly what's going on. With the mobile capabilities of ArcGIS 9.4, anyone can access your services.

Supporting Our Users

ESRI is more than simply software—it's an organization that's designed to support you, our users. Our other goals also continue to be the same: advancing GIS and geographic science, spatially integrated thinking, and supporting our employees in their growth and their own professional development. This year, ESRI is 40 years old. It's important to know that we are unchanged in our fundamental purpose, which is serving you.

These are difficult times for many organizations, but I want to assure you that ESRI is secure, financially sound, and growing as an organization, thanks to you and many of our other relationships.

Content is a key component of ArcGIS, which includes easy access to ready-to-use maps and imagery.

Professional Services

ESRI is dedicated to helping customers be successful, to realize the full potential of the software. ESRI's Professional Services' mission is to support customers and business partners around the world in the effective use and application of ESRI software products, as well as to use the lessons learned from projects to influence software development. Today, the division comprises some 600 domain specialists and GIS/IT professionals, located in more than a dozen cities in the United States and several overseas. The division's activities range from providing focused and advanced support under extended support programs to carrying out large database and system development projects. In many cases, projects involve the implementation of ArcGIS software in mission-critical enterprise environments. ESRI teams with its more than 2,200 business partners to further expand its consulting capacity and capabilities to ensure that customers are fully supported.

User Communities

When we talk about designing powerful and effective GIS systems, this is largely about you—the GIS professional and your work. ESRI is not the expert here; you are. ESRI provides software tools, training, support, best practices, data, services, and other components to support you in building, maintaining, and growing your GIS systems. But we have always felt that one of our biggest, most important contributions to your success is building and supporting communities.

How you design your systems, maps, databases, and the governance systems that make these things work—this is some of the most valuable geographic knowledge of all. Your investment can be summarized and shared with other GIS users as best practices, streamlining the development of their systems. There are many opportunities for you to learn from the best practices of other users—that is the basis of ESRI's community building. Our international and regional user conferences, user group meetings, online sharing opportunities, publications, and more, have proved highly successful at connecting you to other users, and our commitment to these valuable forums remains steadfast. AN

ArcGIS 9.4 improves the editing experience, supporting both GIS- and design-based workflows.

Nine Innovations in ArcGIS 9.4

At this year's ESRI International User Conference, ESRI staff presented its top nine favorite innovations in ArcGIS 9.4:

9. **User Interface.** ArcGIS 9.4 features a new user experience. The upgraded look includes dockable windows that can automatically hide. Also, a new catalog window is embedded in ArcMap. These and other underlying framework changes will greatly improve your productivity.
8. **Attribute Tables.** At 9.4, attribute tables are now displayed in a dockable window. You'll see a new toolbar across the top, giving you easier access to the tools you need. And you can open multiple tables using the tabbed interface at the bottom.
7. **Search.** A new search capability complements the Add Data dialog box. The new search tool allows you to type in search criteria and, with subsecond response time, locate the data you're interested in. You can use special keywords like points, lines, polygons, or layer to further refine your search.
6. **Reporting.** ArcGIS 9.4 includes a new reporting capability. A series of predefined templates makes it easier to make nice, formatted reports. Once you've created a report, you can save the report so that you can later re-execute it with a different selected set.
5. **Geoprocessing Tools.** With ArcGIS 9.4, the customization capability will be enhanced so you have access to all the analysis tools. You can drag and drop the Buffer tool or a geoprocessing model onto a toolbar. There's also a new geoprocessing option that allows you to enable background processing.
4. **Table of Contents Views.** The table of contents now supports multiple views. The Group By Visibility view organizes layers in your map into visible, scale range, or not visible groups, making it easier to work with complex maps with a lot of layers. It's a nice innovation to complement the traditional table of contents.
3. **Symbol Search.** To change symbols, you no longer have to browse through 20,000 different symbols looking for the right one. You can simply do a search. It is far more efficient to search for symbols than browsing through the multitude that are included with ArcGIS.
2. **Temporal Mapping.** ArcGIS 9.4 is becoming time aware, making it easier to make temporal maps with ArcGIS. There's a new Time tab in the layer properties, as well as a new clock tool that allows you to set the display's date and time.
1. **Fast Basemaps.** In releases prior to 9.4, when ArcMap updates the display, it redraws each layer sequentially. A new basemap layer in 9.4 enables continuous, fast redraw.

Imagery: A Core Component of GIS

By Lawrie Jordan, ESRI Director of Imagery Solutions

Several years ago, ESRI launched a major program to enhance our support for use, exploitation, and analysis of imagery across our product line. This began with the introduction of Image Server, a product that allowed our users to manage and disseminate vast quantities of imagery quickly and easily. This technology has continued to mature, and last year, it became an extension to ArcGIS Server. At the same time, image services, which optimize the delivery of imagery over the Web, were built into the core ArcGIS Server product.

At ArcGIS 9.4, we are continuing to integrate image services and at the same time improve the performance and capabilities of all our products with regard to imagery. Our desktop product will include basic image analysis with focused imagery tools and fast image display capabilities. This will allow intuitive and high-performance capabilities for navigating imagery integrated with map displays inside ArcMap. We are improving our image data modeling, management, and visualization and adding dynamic analytic tools. We have done this in a way that supports the typical workflows associated with geospatial imagery.

With the additional imagery capabilities in ArcGIS 9.4, ESRI is making imagery a fundamental component of ArcGIS. ESRI's strategy for providing you with increased imagery support includes highly scalable image data management, new desktop image display and analysis tools, and the ability to leverage the strengths of key technology partners.

Highly Scalable Image Data Management

At 9.4, we've created a new type of raster catalog called Mosaics. Mosaics live in the geodatabase for working with large image catalogs. Mosaics allow you to keep your imagery in its native format and dynamically access your original source imagery with on-the-fly orthorectification, mosaicking, and pan sharpening. This dynamic approach to image data management, which underpins our entire image strategy, creates a foundation on which you can build a highly scalable solution and which greatly reduces the latency, or the time required between initial imagery acquisition and its operational use.

Half-meter resolution image showing the new Library of Alexandria, Egypt, which opened in 2002 (collected by the GeoEye-1 satellite on May 30, 2009).

New Desktop Image Display and Analysis Tools

At 9.4, ArcGIS Desktop becomes an image analyst workstation and includes a powerful new image display capability featuring real-time roam, zoom, and rotation across imagery of virtually any size, any resolution, and any location. The 9.4 release also includes a new image analysis window, which contains a number of new image enhancement and analysis tools that you've asked us for. These tools are all easy to use, they're all in one place, and they operate in real time. You can perform image processing tasks, such as vegetation analysis, with a single click of a button.

The Ability to Leverage the Strengths of Key Technology Partners

We are also working to further extend the ArcGIS desktop, geodatabase, and server platforms with technology from our imagery partners. We are very fortunate to have a large number of technology partners in the imagery world. Working with them allows you to unlock the powerful information contained in your imagery. One such partner is ITT Visual Information Solutions, with its ENVI software suite. ENVI combines the latest spectral image processing and image analysis technology with an intuitive, user-friendly interface. The new ENVI EX product—unveiled at the 2009 ESRI International User Conference and tightly integrated with ArcGIS—delivers the accurate, scientifically proven processes that ENVI is known for in revolutionary step-by-step workflows that quickly and easily guide GIS users through advanced image processing tasks.

Highly scalable image data management, desktop image analysis tools, and close ties with key partners will provide you with a complete platform that brings imagery full circle as a core component of ArcGIS.

Geoservices Create a Framework for Collaboration, Understanding, and Open Government

GIS Professionals Lead the GeoWeb Revolution

The adage "The Web changes everything" can be applied to many things, and GIS is no exception. Over the last several years, many people have made predictions about Web mapping somehow making professional GIS less relevant. But we at ESRI see something very different. We see the geospatially enabled Web—the GeoWeb—driving change that is beneficial for both users and creators of geospatial information.

Geographic knowledge created in GIS environments is increasingly being made available to Web users, and consumer and commercial awareness of geospatial capabilities has grown tremendously. The geospatial industry has never before had this much attention focused on it. This is leading to open, more transparent access to geographic knowledge and increasing the value of you, the GIS professionals responsible for creating the majority of the world's geographic knowledge.

What Is Geographic Knowledge?

Geographic knowledge is an assemblage of data describing spatial phenomena; data models that structure the data; models and analytic tools that show predictions or suitability; cartographic expression; geospatial workflows; and metadata, which describes the first five components and is key to sharing, discovery, and access.

The current state of geographic knowledge has changed how we abstract our world and how we reason. People are thinking more about relationships between things and interconnections. The good work of Google, Microsoft, and others, in creating a more spatially aware society has consequences beyond simply looking at maps. The GeoWeb is a revolution in spatially integrated thinking.

Geographic knowledge can be created by specialists from many fields, across government, academia, and business, often brought together by GIS professionals who focus on broad issues such as integration and access. Having the technical skills needed to perform geocentric operations that support mission-critical applications leads to a better understanding of complex issues and more holistic decision making.

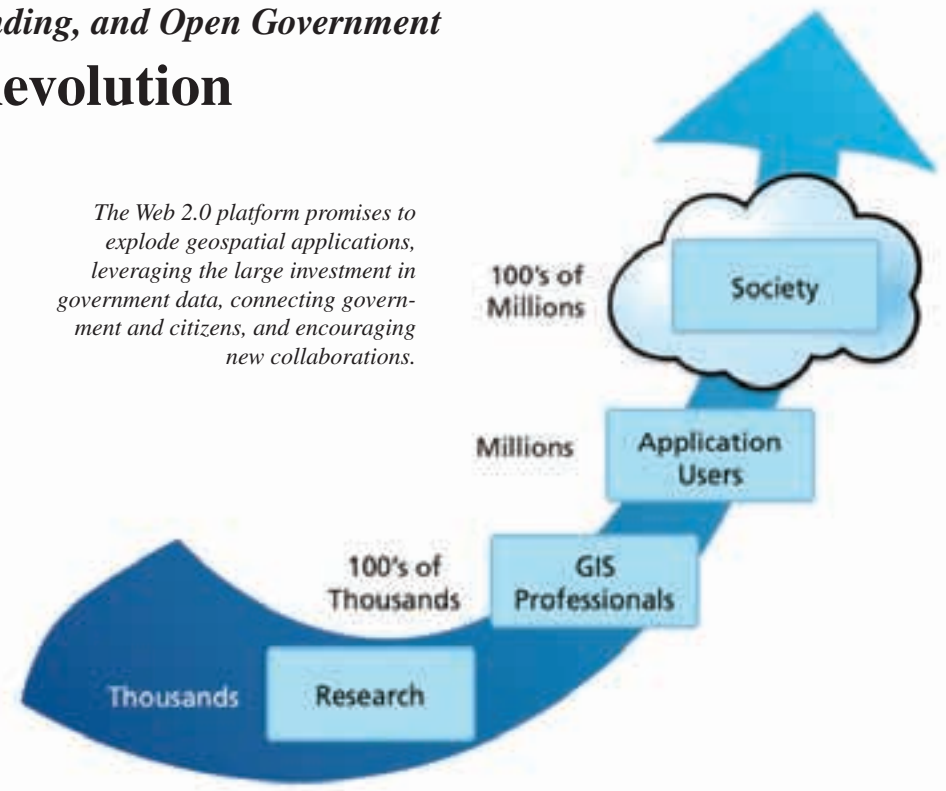
Sharing geographic knowledge in the GeoWeb environment is also changing how we organize and communicate between different agencies and organizations. And this is just the beginning. The GeoWeb revolution will go far beyond simple visualization and mapping, embracing all types of knowledge and ultimately becoming a societal infrastructure for human behavior and human action.

The Next Wave

From the beginning, GIS has been focused on capturing, creating, applying, and sharing geographic knowledge, regardless of the platform. From mainframes to minicomputers, UNIX workstations to desktop PCs, and mobile devices to massive servers, GIS is a pervasive technology that adapts well to and even thrives on the next platform. And today, the Web is the next platform.

But in some ways the migration to the GeoWeb is different from platform migrations we've experienced in the past. Opening large GIS databases for much wider access is something that we at ESRI have been striving to achieve for many years. And now this dream is finally being realized on the GeoWeb.

Users of GIS technology in government and elsewhere have made enormous contributions to the GeoWeb in terms of basemaps, thematic datasets, and more. What really drives GIS users is integration of this geographic knowledge into human action. Using geographic knowledge impacts business and government and helps create a more sustainable world, and its pervasive use enables unprecedented levels of transparency and decision making. This is the real impact of the GeoWeb.



The Web 2.0 platform promises to explode geospatial applications, leveraging the large investment in government data, connecting government and citizens, and encouraging new collaborations.

From Data Sharing to Geoservices

Today, geographic knowledge is a valuable commodity, especially in government. Geographic knowledge is used successfully in a multitude of applications and provides a critical infrastructure to improve planning, management, and decision making. Data sharing has been key to this success—many government agencies consider sharing to be a key component of their mission, and data clearinghouses have greatly improved access—but these efforts have not resulted in a true geospatial framework.

To realize such a framework, we need to move beyond sharing of GIS databases and into an era of shared geoservices. GIS professionals in government will play a large role in creating these shared services, and GIS professionals everywhere will leverage these geoservices to open up access to geographic knowledge to large numbers of new users through new types of applications, providing authoritative data, high-quality maps, visualizations, spatial analysis, and models to new audiences.

The GeoWeb makes geographic knowledge more accessible to people who are not trained in geography or GIS, but who still have much to benefit. In this next wave, GIS professionals will increasingly be called on to create this geographic knowledge and set the context for its use. We already see this happening today.

Sharing Geographic Knowledge

The fundamental difference between the Web platform and the other platforms that GIS has historically embraced is that the Web is transforming access to the global geographic knowledge base, taking what were dispersed bits of knowledge and making them more available, usable, and collaborative. And the GIS user community is leading this movement by transforming its datasets into services so those published services can be mashed up with other Web services and made available for new audiences.

Sharing of geographic knowledge on the GeoWeb is enabled by a new breed of geoservers. These servers are easy to use, standards based, collaborative, and key to leveraging the billions of dollars already invested by the GIS community in developing basemaps, thematic datasets, and other geographic knowledge.

One particularly interesting aspect of sharing geographic knowledge on the GeoWeb involves user-generated content (UGC)/volunteered geographic information (VGI). There can be major

January 6–8, 2010

Inaugural GeoDesign Summit to Gather Geospatial Thinkers

- Can we prototype the redesign of our cities as if we were playing video games?
- What if spatial analysis could inform your back-of-the-envelope sketches?
- How do we visualize a million people changing a design simultaneously over the Web?

Join us at the first GeoDesign Summit, a gathering of geospatial thinkers engaged in the transformation of technology, engineering, and planning in a rapidly changing world. The summit will introduce the first generation of GeoDesign concepts, tools, and technologies, drawing from a multitude of interdisciplinary experiences from around the world. Share insights with an internationally known group of innovators, including keynote speakers, with a wealth of experience, opinions, and ideas. Take part in Idea Labs, workshops for geodesign brain-storming, and cross-disciplinary hands-on learning.

The GeoDesign Summit will be held January 6–8, 2010, at ESRI's Redlands, California, headquarters campus.

More Information

For more information, visit **www.esri.com/geodesign**.

The Web is a strong platform for GIS, distributing geographic knowledge everywhere and leveraging this content to serve the needs of multiple users.

differences between the authoritative content developed in a professional GIS workflow and the casual content volunteered by people on the GeoWeb. Both types of information can be valuable, but we need to remember that certain types of decisions need to be made from verified, authoritative content to ensure reliability and accuracy of the decision.

GIS Professionals Are More Relevant Than Ever

Geography and GIS bring together information from many different fields and sciences—physical, social, cultural, and design—and integrate the resulting geographic knowledge across disciplines through mapping and modeling of spatial relationships and patterns. Geographers and GIS professionals then apply this knowledge across government and industry. GIS is an integrative platform that brings information together and facilitates coordination and cooperation across organizations and disciplines. The result is a new approach to problem solving: The Geographic Approach.

The Geographic Approach can be characterized as quantitative, systematic, analytic, and representative of integrated thinking. GIS professionals provide the skills and understanding to apply this approach in ways that are responsive to the needs of their organizations. Demand for these talents is increasing rapidly because most people trained in domain-specific disciplines do not have the same level of exposure to multidisciplinary problem solving and integrative thinking as geography and GIS professionals.

Today's GeoWeb environment gives GIS professionals many opportunities to share their geographic knowledge. The Web is helping expand the relevance of GIS and make it more pervasive, and GIS professionals are the people already creating and managing this infrastructure. This offers many new opportunities and challenges—building new partnerships, learning how to collaborate, sharing information, etc. In this sense, GIS is just beginning.

GIS Technology Is Evolving

The popularity of Web-based mapping has increased the awareness and value of what GIS professionals do. This, together with the advances in ESRI's Web mapping technology, makes the GeoWeb a window into the wide-ranging collection of geographic knowledge authored by the GIS community.

The GeoWeb is also changing user expectations. The definition of a good map has evolved, from paper-based and digital maps to intuitive and interactive maps served on the Web. With traditional GIS maps, the emphasis has been on the information and analysis behind the map. Now with the GeoWeb, the map itself is increasingly the focus of attention; it is a rich, stand-alone information product that must be designed carefully for end users.

Even within complex government organizations with vast collections of geographic knowledge, only a limited number of these information products are needed. These organizations have standard cartographic symbols and layouts that are used to support various workflows. It can also be said that whole classes of organizations (cities, for example) share the similar workflows with respect to their need for standard map products. This has led to an effort to design and share a series of common templates for mapping with desktop GIS and the GeoWeb. (See **resources.esri.com/maptemplates**.)

The Technology Exists to Do This Now

ESRI has been aggressively designing products to effectively leverage the Web 2.0 environment. The centerpiece of this effort is ArcGIS Server, the first full Web 2.0 GIS platform. ArcGIS Server supports fast, high-quality mapping; globe services; and powerful geoprocessing services. ArcGIS Server also provides easy-to-use, consumer-style mapping with a variety of REST-based Web APIs (Flex, JavaScript, and Microsoft Silverlight) as well as capabilities that promote sharing of geographic knowledge and collaboration between and among users. ArcGIS services can also be easily mashed up with other Web services to support development of cutting-edge applications.

Other technologies in ESRI's Web 2.0 strategy include ArcGIS Explorer, a powerful, free GIS viewer, and ArcGIS Online, which provides content and sharing capabilities for GIS users to leverage.

Success Is Growing

Many successful GeoWeb applications have already been deployed, and many more are emerging. The applications are richer, more dynamic, and more collaborative. We are seeing new styles, patterns, and techniques emerging, helping to disseminate geographic knowledge and the concepts of geography to ever-widening groups of users. The GeoWeb promises to explode geospatial applications and the usefulness of geographic knowledge. Leveraging the large investments already made by government and others, serving geographic knowledge will better connect government and citizens, encourage more collaboration, and ultimately realize a more open form of government.

We believe the evolution of the GeoWeb is just beginning, and it is becoming a strong multiparticipant framework. But with all this emphasis on geoservers and the GeoWeb, desktop GIS will continue to grow as the solution for most spatial analysis projects and the fundamental authoring platform for creating the majority of the geographic knowledge consumed on the GeoWeb.

Conclusion

The Web environment is a fantastic visualization and content-delivery platform for information about the world we live in. As people become more familiar with visualization tools and their voracious appetite for geographic knowledge increases, they are beginning to ask more intelligent questions about the world, and the work being done by GIS professionals in creating geographic knowledge has never been more important or appreciated.

The GeoWeb revolution will have lasting repercussions well beyond the GeoWeb itself. As geographic knowledge becomes embedded in every device and changes our way of thinking, it presents an opportunity for GIS professionals to expand geospatial literacy toward sophisticated analysis and spatial decision making.

Free Annual Maps and Globes Optimized for ArcGIS Server

Jump-start Your Web Maps

For years, ESRI has been helping ArcGIS Desktop users get started with their GIS projects by providing them with ESRI Data & Maps preconfigured map data updated annually and delivered on a set of DVDs. Composed of many types of map data at various scales, ESRI Data & Maps is ideal for many types of GIS projects. To help ArcGIS Server users quickly jump-start their projects, ESRI now offers free map data optimized specifically for ArcGIS Server. ESRI Data & Maps for ArcGIS Server is now available to every ArcGIS Server user upon request and will be included in the box with the ArcGIS Server 9.4 release.

ESRI Data & Maps for ArcGIS Server provides preconfigured 2D map and 3D globe cache services and map data, such as satellite imagery, street maps, land cover, and shaded relief, down to about 1:1,000,000 scale. These basemaps and reference layers work with any ArcGIS Server client application, such as ArcGIS Desktop and ArcGIS Explorer, or can be used to build custom applications using ArcGIS Server APIs, such as Microsoft Silverlight, JavaScript, Flex, .NET, or Java.

Users can create 2D and 3D digital worlds by combining the map services with local data and services from ArcGIS Server and ArcIMS; Open Geospatial Consortium, Inc., Web Map Services; and KML services. A multiscale world street map down to highway-level detail, along with multiresolution imagery; the Natural Earth physical map; and a worldwide shaded relief map provide fast, high-quality basemaps. Transportation, boundaries and places, and elevation reference layers are also included to augment the basemaps with detailed reference information. In addition, the basemaps can be supplemented with users' own data for a specific local area of interest.

Delivered on DVD and hosted by users on their own secure GIS servers, ESRI Data & Maps for ArcGIS Server ensures that map services are quickly available to all users on a network. The optimized set of data can be used as a global basemap framework for deploying GIS applications to users both inside and outside an organization.

ESRI Data & Maps for ArcGIS Server works with ArcGIS Server 9.2 Service Pack 2 or higher for both the .NET and Java platforms.

More Information

To learn more and to request a free copy of ESRI Data & Maps for ArcGIS Server, visit **www.esri.com/dataandmapsserver**.

ArcGIS Server projects are easily enhanced with prerendered satellite imagery for the world. Inset: Jump-start routing projects with a multiscale world street map optimized for ArcGIS Server.

Now Includes Geocoding, Routing, and Expanded Map Options

ArcGIS Data Appliance Provides Ready-to-Use Map and Task Services

The latest release of ArcGIS Data Appliance, a preconfigured network storage device loaded with terabytes of ready-to-use data, offers geocoding and routing functionality along with expanded imagery and street data. ArcGIS Data Appliance delivers maps and tasks optimized for ArcGIS Server, allowing users to publish map services quickly and securely.

ArcGIS Data Appliance users can now securely access geocoding and routing functionality for the United States, Canada, and Europe. The geocoding options enable users to find and display addresses on a map through single address, reverse, or batch geocoding. The routing options allow users to generate routes between two or more points and display the routes on maps along with the associated driving directions. Both the geocoding and routing services use the most recent commercial street data from Tele Atlas to provide the highest geocoding match rates and generate the most efficient routes and driving directions.

The precached and prerendered basemap data offerings for ArcGIS Data Appliance have been expanded with the following new options: World Imagery, World IKONOS Cities Imagery, and European Street Map. Users can now access detailed satellite imagery for the world, including 15-meter resolution for the entire world and a 1–2-meter resolution imagery mosaic for the contiguous United States. Also, 1-meter resolution imagery for more than 700 major metropolitan areas around the world is available. The street data now includes a multiscale street map for Europe with highways, major roads, minor roads, railways, water features, administrative boundaries, cities, and landmarks overlaid on shaded relief imagery for added context.

ArcGIS Data Appliance provides rich, detailed data—including imagery, street maps, topographic maps, shaded relief, elevation data, and reference layers—that fits easily into an existing IT infrastructure to enhance ArcGIS Server applications and services. The ready-to-use content is optimized for high performance with ArcGIS Server, enabling users to publish large sets of varied data quickly and easily. With the addition of geocoding and routing options, ArcGIS Data Appliance now allows organizations to host many of the same maps and tasks available through ArcGIS Online *(see the ArcGIS Online article at the bottom of page 22)* on their own secure servers behind their firewalls.

Users can also combine their own map data with that included in ArcGIS Data Appliance by purchasing additional storage capacity. Their data can be hosted in cache format and published as services, which can be combined in an ArcGIS application with services published using the data shipped with ArcGIS Data Appliance.

A complete server bundle is available for organizations that do not have ArcGIS Server. ArcGIS Data Appliance (Server Bundle) includes applicable ArcGIS Server software, choice of data collections and task services, and hardware.

More Information

To learn more about ArcGIS Data Appliance, visit **www.esri.com/dataappliance**.

IKONOS World Cities Imagery, Sydney, Australia (source: GeoEye).

New geocoding and routing options, along with new data, such as European Street Map, allow ArcGIS Data Appliance users to quickly and securely access the critical services they need for their ArcGIS projects.

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Free Web Mapping APIs

continued from cover

Highlights

- ESRI releases ArcGIS Web Mapping APIs free for noncommercial use.
- Web Mapping APIs enable organizations to build and deploy GIS applications.
- Live samples, recorded training seminars, and other resources make API use easy.

ArcGIS Web Mapping APIs help organizations deliver rich maps and GIS capabilities that are comparable with desktop mapping applications, but with all the benefits of the Web. The APIs provide the tools to generate fast, cross-browser and cross-platform dynamic maps. End users can interact not only with the map itself but also with its attributes and features. Web Mapping APIs offer developers several platforms for creating Internet and desktop applications, including Microsoft Silverlight, Adobe Flex, and JavaScript. With Web Mapping APIs, users can add mapping and GIS to their environment.

Going Beyond Simple Map Display

Often, GIS Web applications need to include geospatial functionality that goes beyond simple map display and interaction. Web Mapping APIs can easily accommodate the need for added functionality. For example, a parcel viewer application could use a draw toolbar to capture what a user draws on the map to allow more interaction and analysis. Or, an appliance repair company could use a geoprocessing task to generate drive-time polygons to estimate the total length of service calls, then use a routing task to calculate the routes and directions before dispatching a vehicle. With Web Mapping APIs, developers can include a variety of tasks in their applications, including query, identify, find, address locator, routing, geometry, and geoprocessing. Web Mapping APIs also provide components that support multiple map projections, as well as both dynamic and cached (tiled) map services.

Resources Available

Web Mapping APIs are free and can be used by anyone who is interested in adding fast, modern Web mapping applications to their environment. Additionally, to save time and resources while learning how to use these APIs, ESRI offers the following:

- **Live samples—**Developers can simply copy and paste the source code from various samples from the Web Mapping APIs Resource Center.
- **Recorded training seminars—**Anyone interested in using the APIs can listen to demonstrations and view code samples from ESRI experts on how to use the APIs.
- **ArcGIS Online—**With a single URL, developers can leverage maps and tasks published and hosted by ESRI.
- **User community—**Download and share code samples through code galleries and exchange ideas with users on discussion forums.
- **Sample viewer applications—**Users can quickly deploy these sample viewers with a simple modification to the application's configuration file, and developers can use the source code to extend the application.

More Information

For details about the licensing of Web Mapping APIs, reference the table to the right or contact your local ESRI regional office, reseller, or distributor. To use Web Mapping APIs for free, visit **www.esri.com/mappingapis**. AN

Please see "ArcGIS Is Bringing Mapping to Everyone" poster on pages 24–25.

ArcGIS Web Mapping APIs for Flex, JavaScript, or Silverlight	Annual License Fee for ArcGIS Web Mapping APIs	Description
Noncommercial Use		
ArcGIS Web Mapping API is used in any application that does not generate revenue.	$0	No annual license fee
Commercial Use		
Hosted Web Site		
ArcGIS Web Mapping application is used on a Web site that generates revenue.	$0 For ArcGIS Server users when used in conjunction with their ArcGIS Server services	Annual license subscription fee per domain
	$4,000 For ArcGIS Server users when not used in conjunction with their ArcGIS Server services	
	$4,000 For those not using ArcGIS Server	
Web Mapping Application Deployment		
ArcGIS Web Mapping application is embedded in a product sold to other customers.	$0 For ArcGIS Server users when used in conjunction with their ArcGIS Server services	Annual royalty per domain deployment. *Domain* is defined as a single domain in which software is deployed, for example, esri.com.
	$4,000 For ArcGIS Server users when not used in conjunction with their ArcGIS Server services	
	$4,000 For those not using ArcGIS Server	
Desktop Application Deployment		
ArcGIS Web Mapping desktop application is sold as a product to other customers.	$0 For ArcGIS Server users when used in conjunction with their ArcGIS Server services	Annual royalty per organization deployment. *Organization* is defined as a specific geographic location where software is being deployed, for example, ESRI, 380 New York Street, Redlands, California.
	$4,000 For ArcGIS Server users when not used in conjunction with their ArcGIS Server services	
	$4,000 For those not using ArcGIS Server	

Free Tools and Interactive Resources Promote More Effective Collaboration and Information Sharing

ArcGIS users now have an easy way to access and share maps, layers, services, and tools for their GIS work. Through ArcGIS Online, users can connect to basemap and task services, create Web maps without any programming through the built-in Web map application, and upload and share their own maps with other users. ArcGIS Online provides an online platform where users can leverage free cloud-based content for their GIS work and share and collaborate with others who have a common interest.

Add high-quality imagery basemaps to your GIS projects at no cost (source: World IKONOS Cities, GeoEye).

To quickly create attractive maps and high-performance Web mapping applications, ArcGIS Desktop (including ArcGIS Explorer) users, as well as ArcGIS Server and ArcGIS Web mapping API users, can connect to ArcGIS Online map and task services. These ready-to-use, precached maps and advanced GIS tasks are hosted and maintained by ESRI and require no additional investment in infrastructure or technology. ArcGIS Online map services include high-quality imagery, street, shaded relief, and topographic basemaps. ArcGIS Online map services are available as standard or premium services. Standard map services can be used at no cost for internal and external noncommercial use. To use ArcGIS Online standard map services in a commercial environment, or to use ArcGIS Online premium map services, requires an annual subscription fee.

Bing Maps Integrated with ArcGIS

Bing Maps, available through ArcGIS Online, are seamlessly integrated with ArcGIS. ArcGIS Desktop users current on maintenance have free access during their maintenance year. ArcGIS Explorer users who have an ArcGIS Desktop license on the same machine can share Bing Maps access. ArcGIS Server and ArcGIS Web mapping API users can evaluate Bing Maps for 90 days at no cost. Access also includes Bing Maps geocoding. After the evaluation period, an annual, transaction-based subscription can be purchased.

ArcGIS Online task services include world geocoding and routing, as well as drive-time and demographic analysis. Again, these services, with the exception of drive-time and demographic analysis, are available at no cost for internal and external noncommercial use but require an annual subscription fee if they are added to applications used for commercial purposes.

Additional content that is freely available can be found through ArcGIS Online Sharing, a Web-based repository that includes content such as maps, layers, layer packages, and services uploaded and shared by ESRI, ArcGIS users, and other authoritative data providers.

More Information

For more details about ArcGIS Online and how to access content, visit **www.esri.com/agol**.

Locate, Segment, and Target Mailings to Raise Response Rates

Address Coder Reveals Valuable Marketing Information in Address Lists

How can marketers learn more about the people behind the addresses in their mailing lists? Address Coder, ESRI's affordable stand-alone U.S. geocoding and data-appending software, appends latitude-longitude coordinates, Federal Information Processing Standards (FIPS) codes, ESRI's Updated Demographics, and Tapestry Segmentation data to United States address records. To obtain higher response rates, marketers can use this information to craft specific messaging and promotions that will appeal to similar households in the mailing list.

Offered in two configurations, Address Coder matches addresses by the fallback locator concept. For example, if an address cannot be matched at a specific level, such as by street, the geocoder "falls back" to the next level. Address Coder includes four address match ranges, from the Street Ranges Locator to the City/State Locator level. Address Coder Premium begins five-level matches at the "rooftop" level, followed by the same four match levels that are included in Address Coder. The database maps street addresses to a physical location so that each address is a fixed point, not an interpolation from an address range.

New features of Address Coder include the ability to append the name of the closest store from a list to each customer record. This is how profitable sales territories can be created that match customer lists with stores to conduct special promotions tailored to customers' shopping needs and behavior. This feature helps marketers target customers who are located within a desirable distance, thereby increasing the likelihood that they will respond to the promotion. Another feature enables users to append the distance from a point; for example, insurance companies can measure the distance from disaster sites to determine percentages of risk for area locations. Public safety agencies can use this information to define where to place services before, during, and after an evacuation.

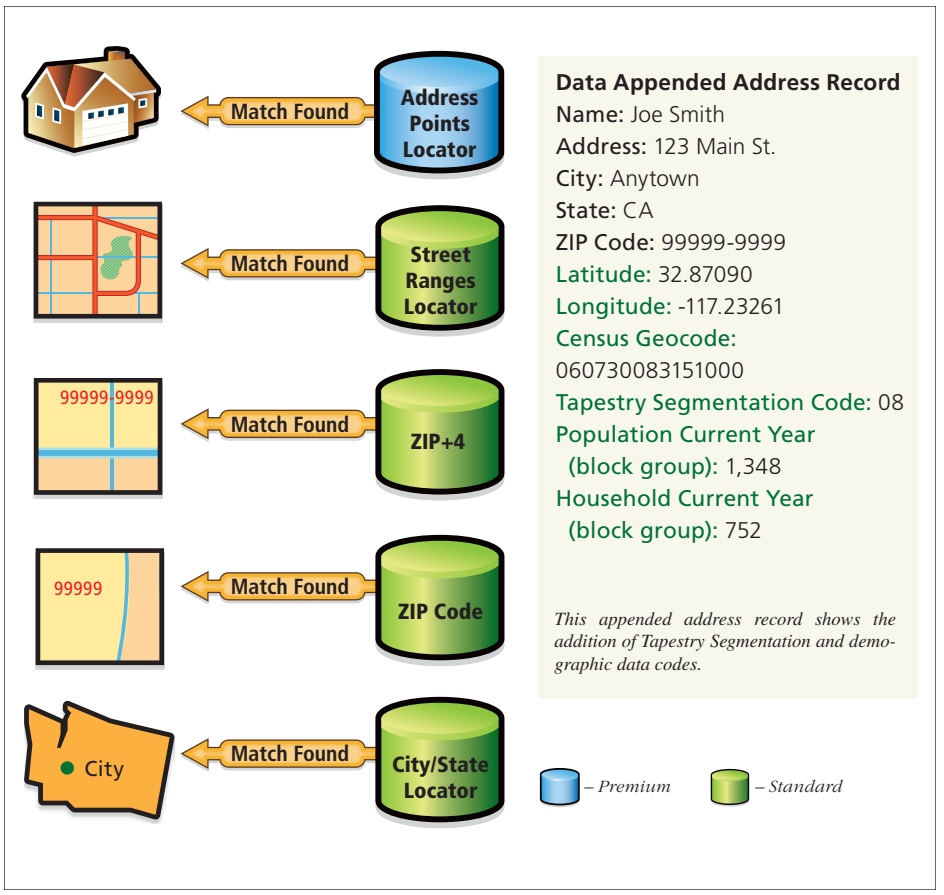
Data updates include ESRI's 2009 Updated Demographics and Tapestry Segmentation data. The geocoding reference data includes Tele Atlas Address Points and streets data and is current as of February 2009. The Tele Atlas Address Points database now includes more than 51 million reference U.S. address points.

With minimal training, users can quickly and easily geocode address lists by a single record or in batch mode for marketing, direct mail, and notification campaigns. Marketers in all industries can raise response rates by targeting only the most profitable audience, avoiding areas with low potential, then segmenting mailing lists and devising separate messages based on demographics, lifestyle information, physical locations, and spending habits. Address Coder is available for the United States, by six-state regions, or by individual state.

Built with ArcGIS Engine and ESRI's geocoding locator technology, Address Coder provides a proven address matching concept that is already part of ArcGIS.

More Information

To learn more about Address Coder, visit **www.esri.com/coder**.



Address Coder uses the fallback locator method to match address records. The graphic shows the levels of geography available for address matches, along with the detail that geocoding provides to a standard address record.

ESRI's 2009 Sourcebook Products Provide Exact Data

Perform Accurate Research

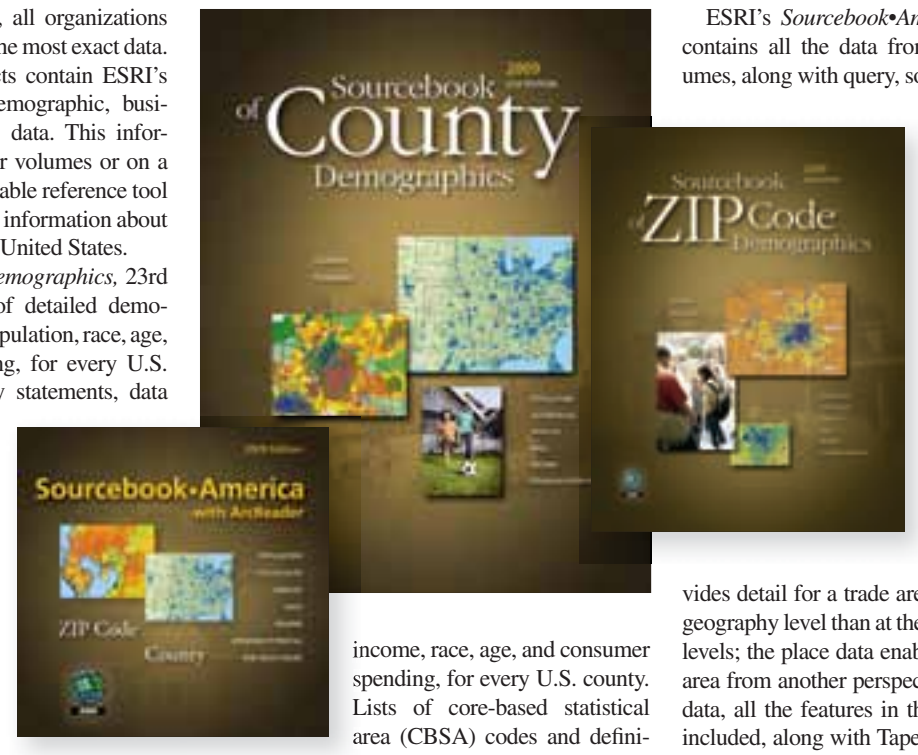
To perform accurate research, all organizations need quick and easy access to the most exact data. The 2009 Sourcebook products contain ESRI's newly released 2009/2014 demographic, business, and consumer spending data. This information, packaged in soft-cover volumes or on a convenient CD-ROM, is a valuable reference tool for anyone who needs accurate information about any ZIP Code or county in the United States.

Sourcebook of ZIP Code Demographics, 23rd Edition, contains categories of detailed demographic information, such as population, race, age, housing, income, and spending, for every U.S. ZIP Code. Data methodology statements, data variable definitions, Tapestry Segmentation descriptions, and cross-referenced lists are also included. Other content consists of

- 2009 demographic data estimates and 2014 forecasts
- All residential and nonresidential U.S. ZIP Codes
- Business summary data about local firms and the total number of employees
- Consumer spending indexes for more than 20 categories of products and services
- Dominant lifestyle segment in each ZIP Code classified by Tapestry Segmentation

Sourcebook of County Demographics, 21st Edition, contains more than 80 updated data variables, such as population, households, families, income, race, age, and consumer spending, for every U.S. county. Lists of core-based statistical area (CBSA) codes and definitions, designated market area (DMA) codes and definitions, methodology statements, and definitions of data variables are included, along with maps of each state marked with county and CBSA boundaries. Other content consists of

- 2009 demographic data estimates and 2014 forecasts
- Consumer spending indexes for 20 categories of products and services
- Total businesses and total employment information for each county's dominant industry



ESRI's *Sourcebook•America with ArcReader* contains all the data from both soft-cover volumes, along with query, sort, and report software, on a single CD-ROM. ESRI's ArcReader map display software enables users to easily view, explore, display, and produce presentation-quality maps that illustrate the demographic data.

For users needing more refined research and analysis, ESRI's *Sourcebook•America with ArcReader* is also available with tract/place data. The census tract data provides detail for a trade area at a smaller standard geography level than at the U.S., state, and county levels; the place data enables analysts to view an area from another perspective. In addition to this data, all the features in the standard version are included, along with Tapestry Segmentation data for every U.S. census tract.

Data from the Sourcebook products can be used to

- Determine whether current government services are meeting a population's needs.
- Explore new markets and business opportunities.
- Forecast demand for products and services in existing markets.
- Evaluate store performance.
- Profile customers or constituents.
- Analyze sales by territory.

More Information

For more information about ESRI's 2009 Sourcebook products, visit **www.esri.com/sourcebooks**.

ArcGIS Is Bringing Mappin

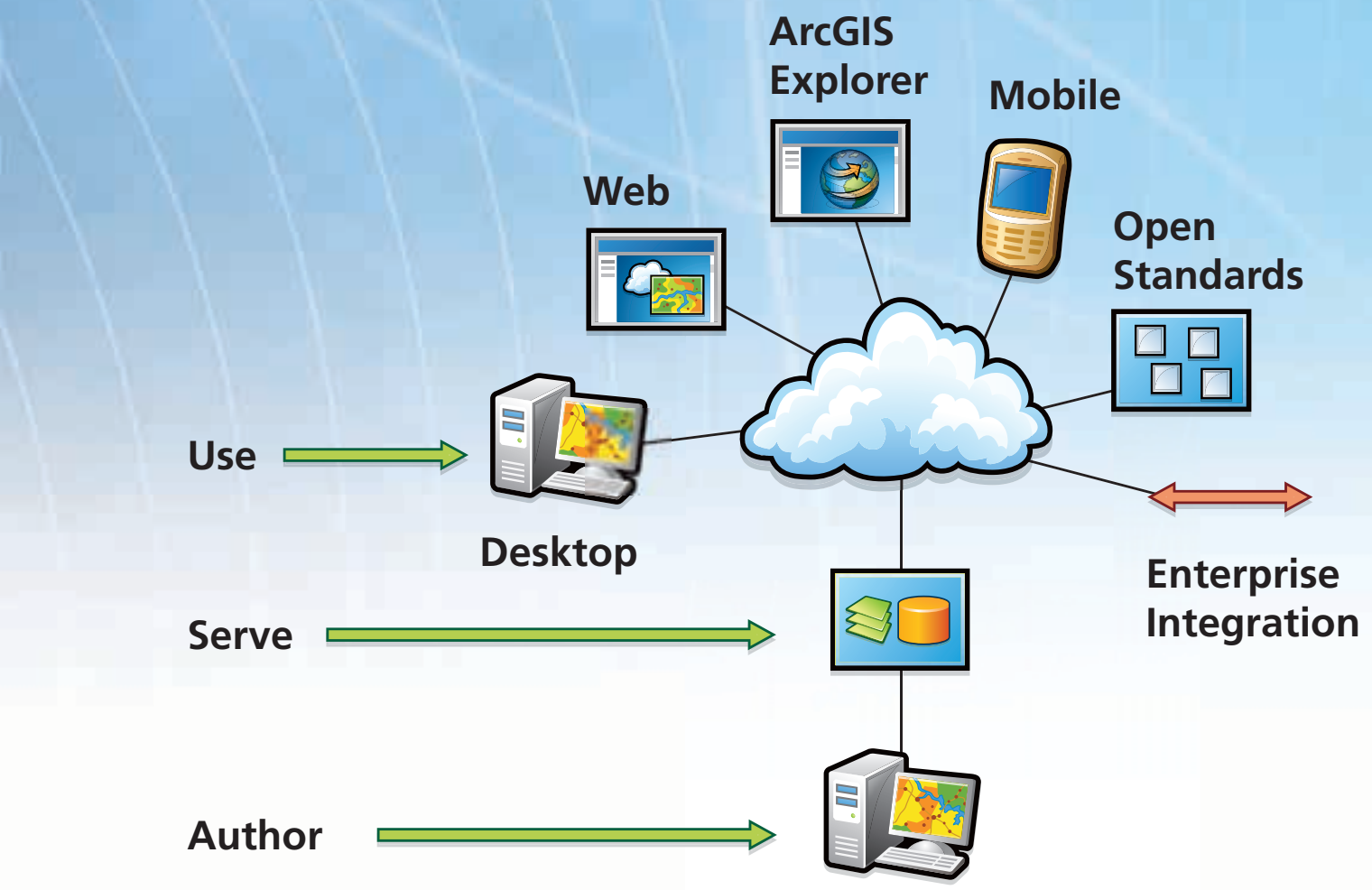
Maps and GIS are changing—they are becoming richer and more pervasive. ArcGIS® Server technology is making GIS dramatically easier and extending the reach of geography to everyone.

The server platform opens GIS to a broad audience by making it easy to share maps and GIS services. New client technology makes it easy for end users to access and use these services in virtually any application.

GIS professionals are combining GIS services with new media, real-time data, mashups, user-generated content, and social network data to create Web 2.0 geospatial knowledge online.

ESRI is leading the world with foundation technology, online map services, and professional services to help our users expand their services to students, citizens, mobile workers, industry specialists, knowledge workers, and executives—everyone.

Deploy intuitive applications to mobi



ArcGIS Explorer provides an easy way to e geographic information.

Visit **www.esri.com/mapping** to learn more.

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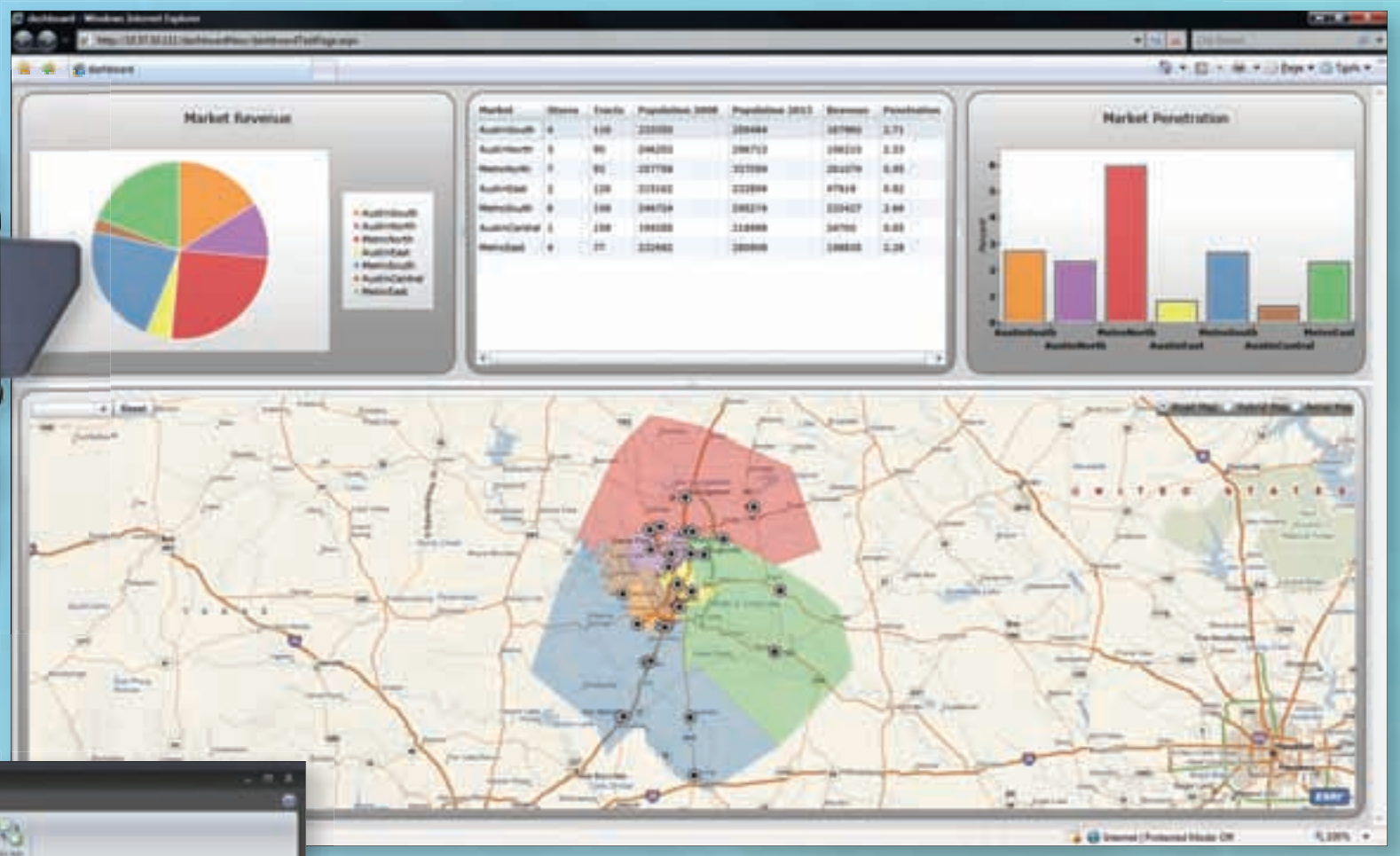
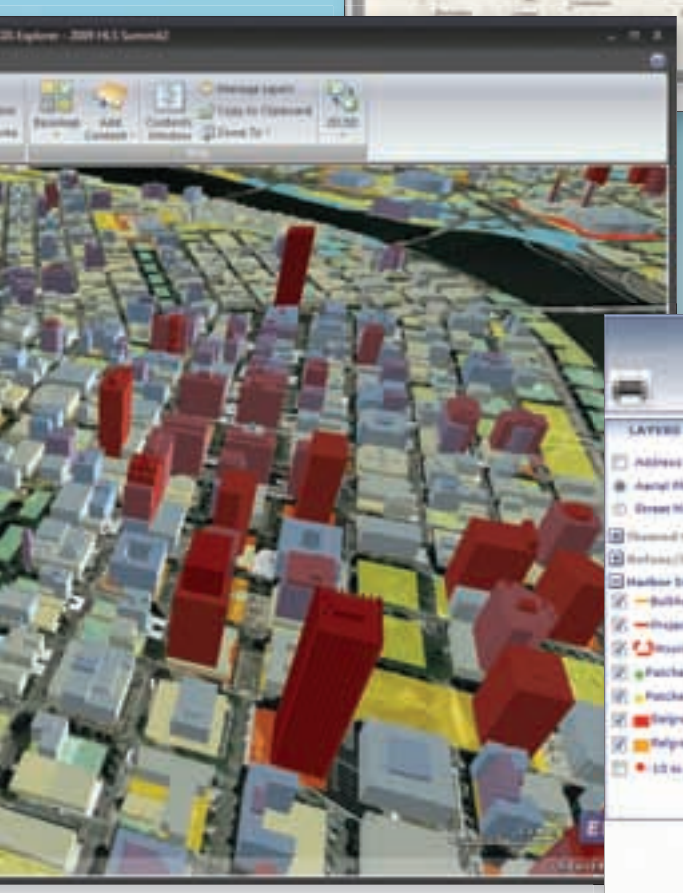
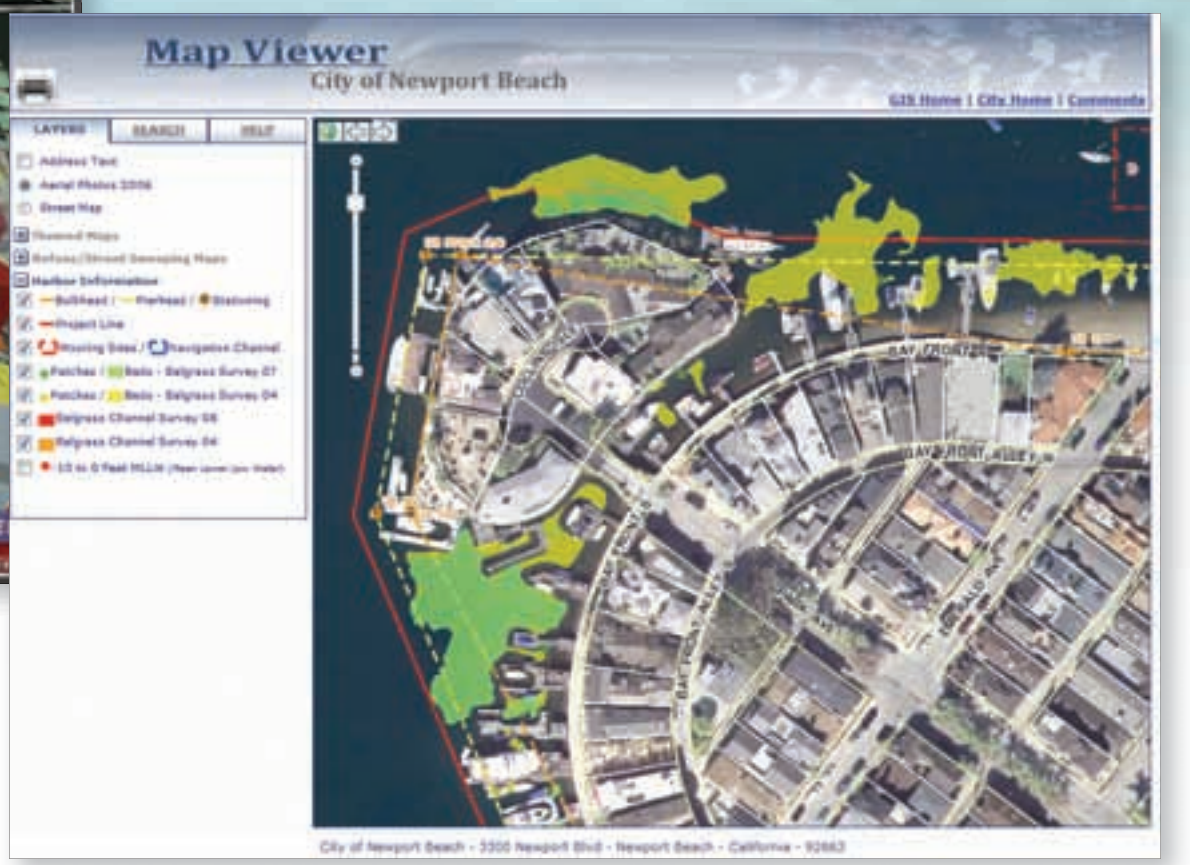


Gain insight into your business operations with MapIt™.



explore, visualize, share, and present



The City of Newport Beach, California, uses the ArcGIS API for JavaScript to give the public easy access to city services information.

ESRI

Building an Oasis in the Desert

GIS Helps Ensure that Masdar City Meets Its Carbon-Neutral, Zero-Waste Goals

Highlights

- Every facet of designing and building the city will be analyzed with ArcGIS.
- Asset management using ArcGIS means all systems can be visualized, maintained, and tracked efficiently.
- An enterprise geodatabase will be used throughout the city's life cycle.

Many of us are interested in decreasing our carbon footprint, whether one individual, one family, or one organization at a time. Imagine living in an entire city specifically designed to meet the ambitious goals of zero waste; sustainable living; and, ultimately, carbon neutrality. This is the vision of Masdar City, which is being designed and constructed in Abu Dhabi, the capital of the United Arab Emirates (UAE), by Masdar, Abu Dhabi's multifaceted initiative advancing the development, commercialization, and deployment of renewable and alternative energy technologies and solutions. *Masdar,* which means "the source" in Arabic, integrates the full technology life cycle—from research to commercial deployment. The Masdar company aims to create renewable energy solutions.

Masdar City is a prime example of how GIS can be used to design our future. This shimmering oasis of 6 square kilometers, located 30 kilometers from Abu Dhabi city, is committed to sustainable living. To reach its carbon-neutral ambitions, Masdar City will use only renewable energy sources. A photovoltaic power plant will generate most of the electricity, while the city's cooling will be provided via concentrated solar power. The zero-waste targets of Masdar City will be achieved through a combination of recycling, reuse, and some breakthrough waste-to-energy technologies. Landscaping within the city and crops grown outside will be irrigated with gray water and treated wastewater produced by the city's water treatment plant.

Through this innovative design, residents in Masdar City will consume far less energy. Peak demand at Masdar City is currently predicted to be only 200 megawatts instead of the 800 megawatts normally required by a conventional city of the same size and climate zone. Desalinated water consumption will drop from 20,000 cubic meters per day to only 8,000. And Masdar City will eliminate the need for millions of square meters of landfill.

The first residents of Masdar City will be the students and faculty of the Masdar Institute of Science and Technology (MI). MI is a graduate-level university specializing in alternative energy and environmental technologies and is a collaboration between Masdar and the Massachusetts Institute of Technology. MI will ensure a ready supply of highly skilled graduates to meet the growing demand within the clean technology and sustainable energy sectors.

Shifting from Oil to Renewable Energy

UAE is a federation of seven emirates, or federal states, located in the southeast Arabian Peninsula. Abu Dhabi, the capital of UAE, has a rapidly growing economy, due largely to the emirate's vast oil reserves: Abu Dhabi is estimated to hold approximately 9 percent of the world's crude oil reserves.

Despite its vast hydrocarbon resources, Abu Dhabi has adopted a progressive approach to its economic growth. The emirate is committed to diversifying its economy away from oil, ensuring the long-term development and prosperity of the country. As a worldwide leader in the energy markets, the emirate believes it is well placed to invest its knowledge and financial resources in the world's future energy markets—renewable energy. So in April 2006, the Abu Dhabi government established Masdar. Through its portfolio of projects that includes carbon monetization, clean technology investments, and renewable utilities projects—both in Abu Dhabi and abroad—the company is contributing to the global effort of mitigating climate change. In this way, Masdar plays a key role in the development of Abu Dhabi's renewable energy sector, driving continual innovation and commercialization of clean and sustainable energy technologies.

Masdar's progress since its development has been significant. The company has established partnerships and large-scale renewable energy programs around the world. And as a further sign of Abu Dhabi's advancement in the alternative energy space, UAE was recently successful in its bid to host the headquarters of the International Renewable Energy Association, against strong European competition, in Masdar City.

CH2M HILL, an ESRI Business Partner and a leader in full-service engineering and consulting based in Colorado, was chosen as a leading partner for the Masdar City design/build project. CH2M HILL had used ESRI technology on many projects in the past and knew ArcGIS was the solution necessary to manage and analyze information throughout the city's life cycle.

Lean, Green City Planning

"GIS is imperative in managing the overall spatial information necessary for designing, building, and operating Masdar City," says Derek Gliddon, GIS manager, Property Development Unit, Masdar.

For the city to meet its challenging goals, CH2M HILL carefully considered the geography of the area: sun angles, wind patterns, street widths, and building density and height. The orientation of buildings on a diagonal grid to provide maximum natural shading was modeled in ArcGIS. To understand all the variables and communicate effectively during the project, the company used a geodatabase that enforces use of a single, shared coordinate system across the project. A common basemap was created to support planning, design, and construction of the city, with the foresight that the city would also be maintained and operated using the same data.

"Building a city like this has never been done before. And GIS is proving to be an absolutely critical tool," says Shannon McElvaney, information solutions consultant, CH2M HILL.

Data layers contained in the geodatabase include information such as transportation, vegetation, drainage, structures, boundaries, elevation, biodiversity, buildings, and utilities, as well as terrain elevation, bathymetric data, and remotely sensed imagery. Information from tabular databases is incorporated into the map layers, as well as GPS coordinates and georeferenced photographs. All the construction-related information, including cost, schedule, and carbon tracking data, is tied together by location, making it more accurate and efficient to use.

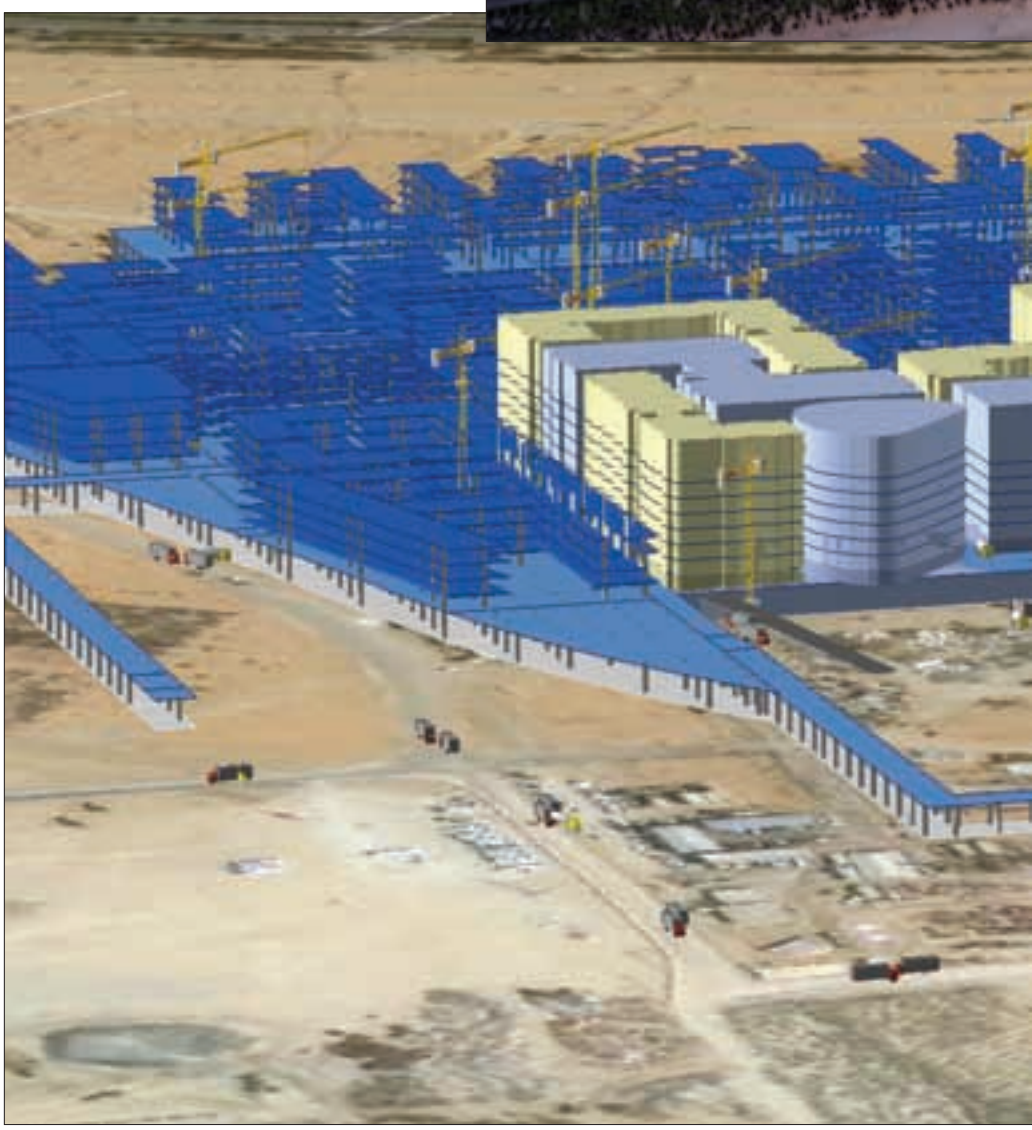
The resulting information is available company-wide. ArcGIS Server was recently deployed and will enable the more than 100 organizations involved in developing Masdar City to access maps, data, and analytic services, thus reducing problems of multiple data versions in circulation. A sophisticated Web browser-based virtual city visualization and navigation tool uses master plan data from the geodatabase and links to the program scheduling software. This tool is used to visualize the construction of the city over time. Construction managers can navigate anywhere in the city; "play" the project timeline; and identify spatiotemporal clashes, accessibility problems, and other logistical issues. On a fast-paced, high-density development, these issues are very important. Information can be searched using spatial criteria and viewed on easily readable thematic maps. Using GIS to visualize the massive amounts of data makes communicating about the project easier.

Optimized Facility Placement

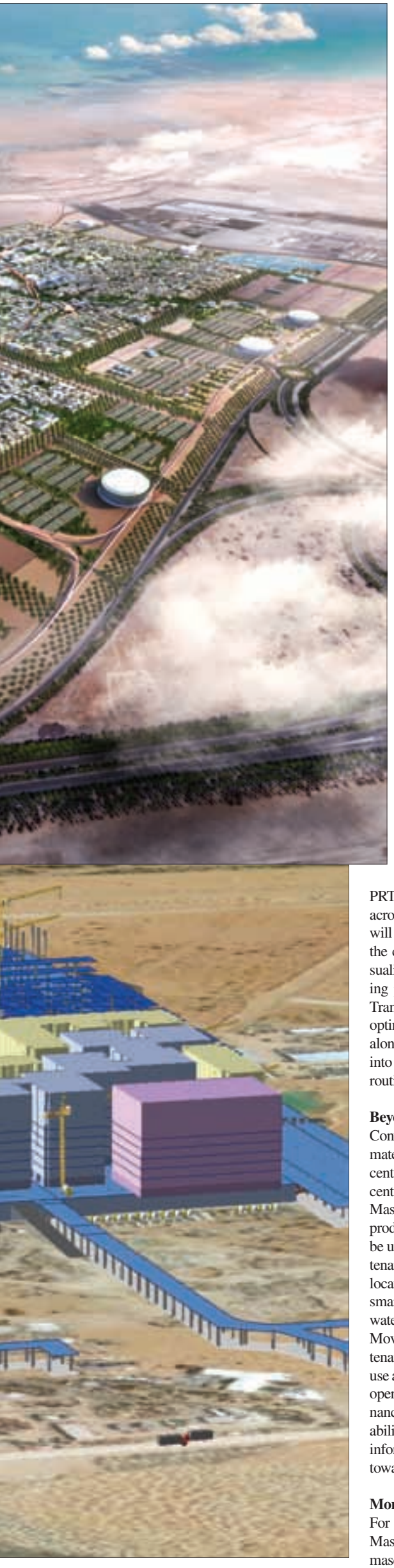
ArcGIS introduced the spatial analysis and modeling necessary for the most efficient placement of facilities at the city. Water and sewage treatment plants, recycling centers, a solar farm, geothermal wells, and plantations of various tree species were placed using traditional planning principles modeled with ArcGIS. Questions—Is there enough physical space available? How much are the buildings shading each other? How much space is needed between a facility and the residents?—are modeled and the best answer chosen through GIS.

McElvaney cites a problem that was quickly resolved when line work from one building was off by 30 centimeters from the previous line work. Having access to all the data and visualizing it with GIS allowed catching the mistake: "A mistake like that could be very time and cost intensive

This artist's conception shows an aerial view of Masdar City as it will look when completed.



Staff members at the City of Masdar use GIS to model building information throughout the life cycle of the project.



to fix during the construction stage. GIS is extremely helpful in preventing that kind of thing from happening."

From Models to Real Life

GIS has ensured that the carbon-neutral status of the city translates from a concept to design. CH2M HILL used ArcGIS to even choose where to place construction materials during the building phase. Alternative scenarios for where to place building materials could be modeled so that, in the end, the company could choose the most efficient location for reducing transportation-related carbon emissions.

GIS was able to model water and power usage over a period of 10 years, plotting monthly resource demand across the city like a geographic histogram. The variables appear as different heights, allowing planners to see any issues rapidly. "This exercise immediately revealed a couple of problems with the logic that had not been easy to spot in a massive spreadsheet format," says McElvaney.

Changes happening during construction were tracked and recorded to monitor the effect on carbon neutrality. Masdar City has a team that keeps track of all fuel and material use and reuse during building. This team is also responsible for logging any environmental infractions. Team members found that using a GPS-enabled camera to take photos and transfer them to the GIS to document the location of an infraction allowed them to see what happened where and whether there were underlying trends, all of which contribute to managing the sustainability of the build.

Innovative Transportation

Masdar City will utilize breakthrough transportation technologies that revolutionize and redefine urban transport. A Personal Rapid Transit (PRT) system running on solar-charged batteries will transport residents around the city. There will be 3,000 PRT vehicles, generating 130,000 trips each day across 85 stations. A Freight Rapid Transit system will make up to 5,000 trips per day to transport the city's goods. ArcGIS was instrumental in visualizing all routes for the PRT network and testing predicted walk times between PRT stations. Transportation planners also used ArcGIS to find optimal locations for perimeter parking garages, along with effective road and rail transport routes into the city. Real estate plots were valued using routing GIS.

Beyond Construction

Conventional cities of similar size create approximately 1.1 million tons of CO_2 per year—80 percent from buildings and energy creation, 13 percent from waste, and 7 percent from transportation. Masdar City expects to eliminate the emissions by producing zero carbons. ArcGIS will continue to be used and integrated with a computerized maintenance management system that will include the location of all infrastructure assets; gas pipes; smart grid infrastructure; clean, gray, and black water networks; and the transportation network. Moving forward, GIS will make facilities maintenance easier and enable the tracking of resource use and reuse and the overall carbon balance of the operational city. GIS will be used in city governance, where it will form part of the city's sustainability performance feedback service, which will inform residents about their personal contribution toward overall city performance.

More Information

For more information, contact Derek Gliddon, Masdar's GIS manager (e-mail: dgliddon@masdar.ae), or Shannon McElvaney, CH2M HILL (e-mail: Shannon.McElvaney@gmail.com, tel.: 791-238-9263).

Renewable Energy—No Longer the Impossible Dream!

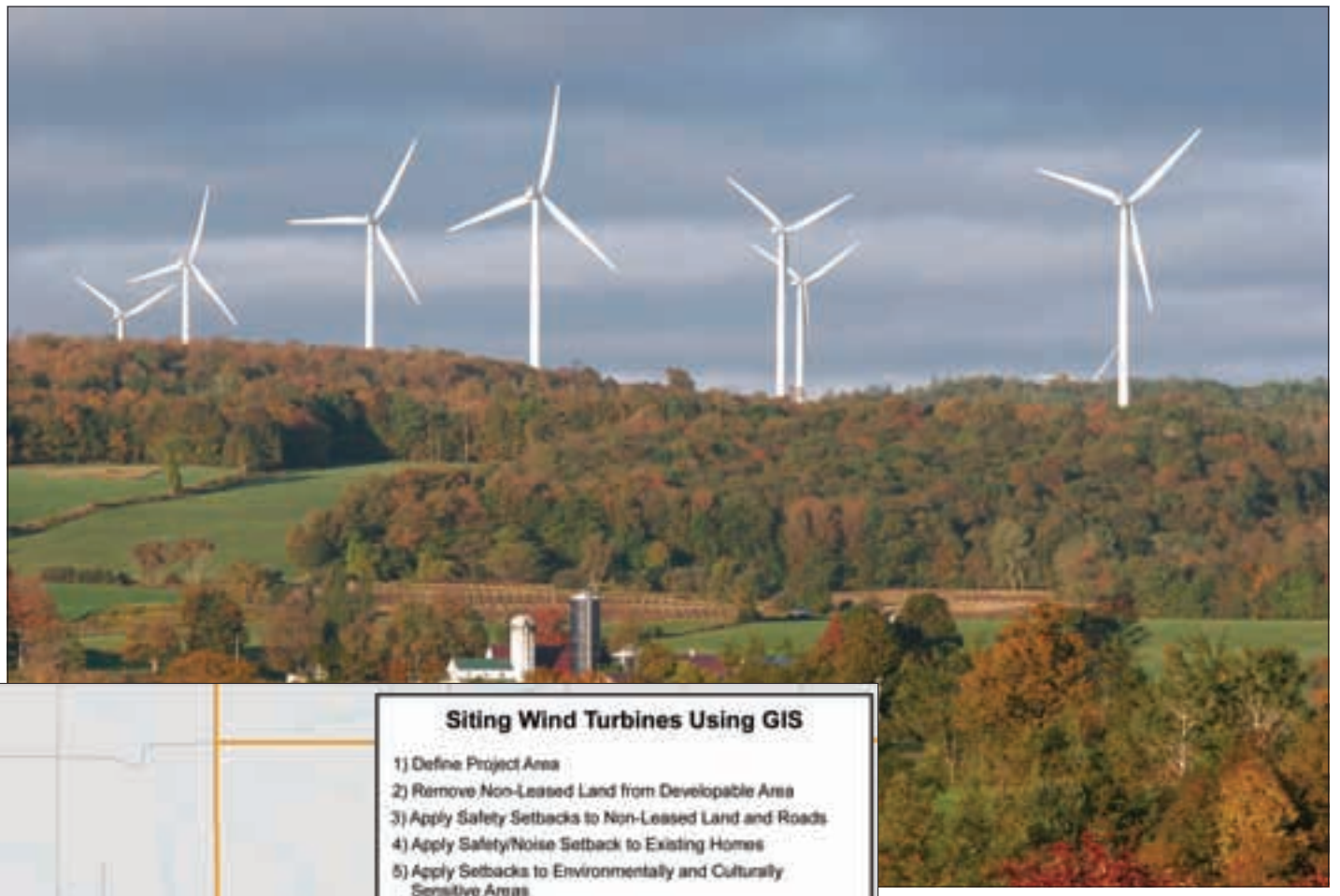
GIS and the Science Behind Tapping Wind Power Offer Insight on the Resource's Feasibility

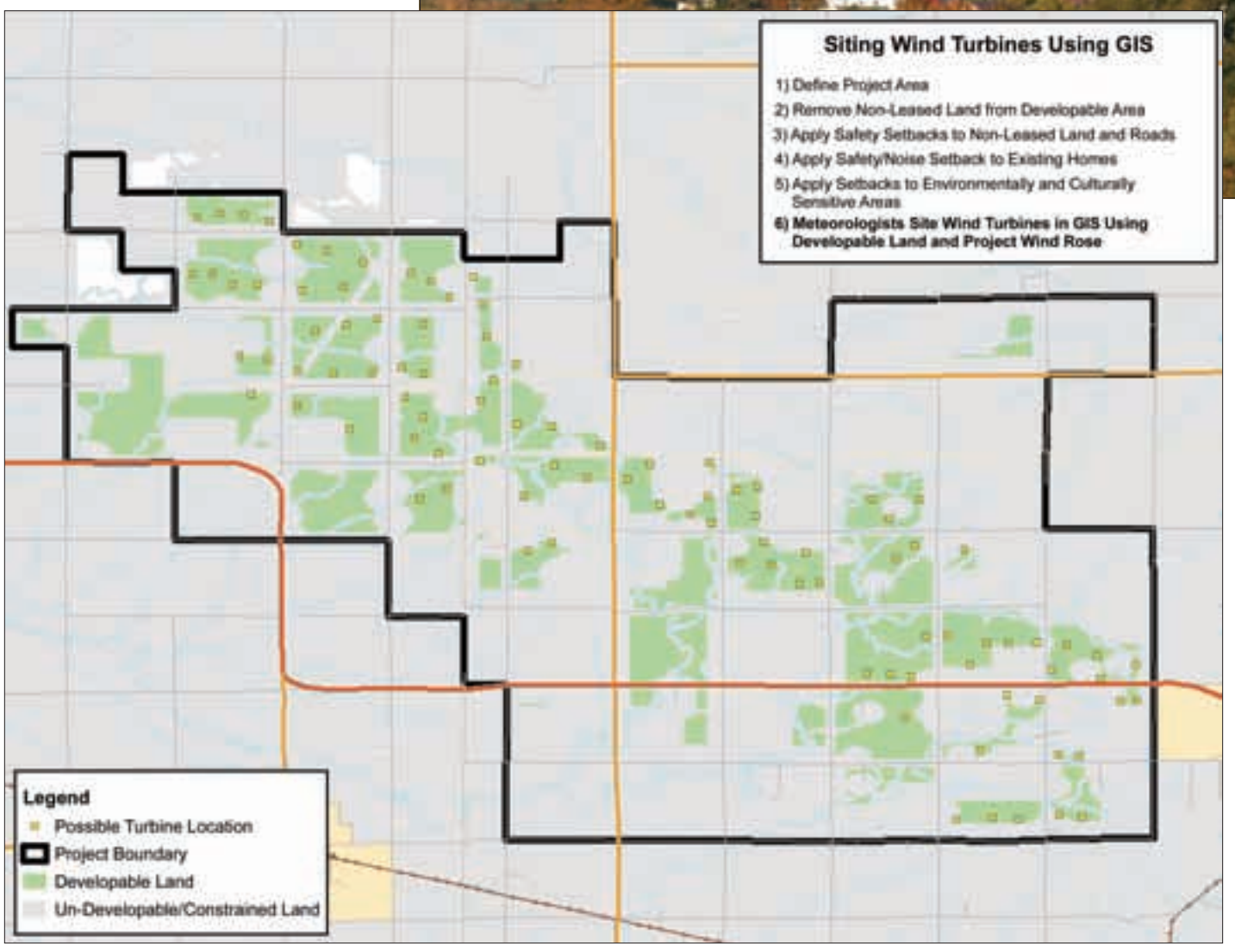
Highlights

- ArcGIS improves the quality and accessibility of data to maximize the efficiency of decision making.
- Nearly all the wind power facility layouts can be done with GIS.
- Locating the right site can be done quickly and accurately with publicly available data and GIS technology.

Just then they came in sight of thirty or forty windmills that rise from that plain. And no sooner did Don Quixote see them that he said to his squire, "Fortune is guiding our affairs better than we ourselves could have wished. Do you see over yonder, friend Sancho, thirty or forty hulking giants? I intend to do battle with them . . . With their spoils we shall begin to be rich . . ."

When Miguel de Cervantes wrote of the impetuous and noble hero Don Quixote 400 years ago, he could not have imagined that one day environmental scientists and energy analysts would "dream the impossible dream" of stocking the electric grid with the power of the wind. Nor could he have envisioned the hulking giants that now line many a horizon, the 400-foot-tall wind turbines each wielding three 130-foot steel blades and weighing 8.5 tons. When he talked of tilting at windmills, the Spanish literary master would not have guessed that public utilities, private companies, and investors would someday look to the wind to "beat the unbeatable foes" of waning fossil fuel supply and deleterious carbon emissions.





This example of siting wind turbines with GIS shows six layers of data.

The Maple Ridge Wind Farm is a 321-megawatt project spanning the New York towns of Martinsburg, Lowville, Watson, and Harrisburg, about 75 miles northeast of Syracuse. The project produces enough electricity to power up to 160,000 average New York homes. Maple Ridge has increased the amount of wind power in New York by 600 percent. New York is a state with a 25 percent Renewable Portfolio Standard, designed to be in full effect by 2013.

Wind energy now accounts for 1 percent of the United States' power supply, and forecasts from the U.S. Department of Energy say that figure could reach 20 percent by 2030. While wind farms crop up across the country's windiest terrain, critics point to the need for new transmission lines and the variability of the wind. Many citizens support the idea as long as it's "not in my backyard."

Despite criticism, wind power is touted as one of the cleanest, most reliable renewable resources dreamed up so far. But is harnessing wind power on a wide scale as quixotic as dreaming the impossible dream?

In 2008, the United States surpassed Germany as the world's biggest generator by volume of wind energy. The amount of wind power the United States generates has doubled in the last two years, according to the American Wind Energy Association (AWEA), a trade group for wind power developers and equipment manufacturers. An investigation into the solid science of wind power facility development clarifies the potential and reliability of this blustery resource.

Twenty-eight U.S. states have set renewable energy mandates and are determined to woo wind developers. A Nebraska utility brochure boasts, "Nebraska has wind. In fact, the state ranks sixth in America for wind development." An energy company in Minnesota is announcing plans to buy an interstate transmission line and develop wind energy to replace coal-generated electricity. One county in Montana is distributing a wind map book compilation of all necessary data to entice investors.

Harnessing the Wind

Wind turbines convert the kinetic energy in moving air into rotational energy, which in turn is converted to electricity. Humans have used wind power for centuries to move boats, grind grain, and pump water. Timeless and simple as it may seem, development of a wind power facility is much more complex than staking a pinwheel in the breeze.

Iberdrola Renewables is the largest developer

of wind power in the world. It has a flurry of wind power projects in the works as utilities aim to reduce dependence on nonrenewable energy. Modeling the feasibility of these projects requires studying location, wind speed, environmental concerns, and other variables.

There was a time not long ago when the company's development teams of meteorologists, engineers, environmental permitting staff, and land agents only had paper maps to work from. These paper maps didn't show property ownership, wetlands, county- or state-required safety setbacks, rights-of-way, or environmental and cultural resource sites.

Knowing that there had to be a better way, Iberdrola investigated available technologies that would help it organize and analyze complex data and decided that GIS from ESRI, which was a familiar platform for engineers in the electric and gas industry, would dramatically improve the quality and accessibility of its data and maximize the efficiency of decision making. ArcGIS Desktop and ArcGIS Server became fundamental to the business model of the company.

Smart Layers for Smart Maps

The life of a wind farm project starts with a look at potential plots of land. Most developers require land within a prescribed distance of a transmission line to tie in power to the grid. If the wind is strong and steady, developers may decide to build their own transmission line. By loading utility data into the GIS, researchers can quickly see existing transmission routes and estimate the benefits of accessing existing electric lines.

Another important consideration for developers is landownership. State and county land-use data in the GIS identifies areas under development restrictions from the Bureau of Land Management and those requiring right-of-way grants. If land is privately owned, developers will have to obtain consent from individual landowners.

A layer of constraints is added, marking areas that are environmentally protected for migratory flight paths or other animal activity. Other site restrictions are military bases and airports where developers must consider radar interference and Federal Aviation Administration regulations.

Wind data is equally crucial to researchers, who add a resource layer to ArcGIS detailing wind speed and reliability. Meteorological data is continuously collected during a one- to five-year period using tower-based anemometers and vanes mounted at several height levels up to 60 meters aboveground. Wind power can be classified into wind power density classes ranging from one (poor) to seven (excellent). For example, a wind power class of four has an average wind speed of 15.7 to 16.8 mph at a height of 50 meters aboveground. In addition to site research, meteorologists use wind data stored in ArcGIS Server to help design the layout of a wind farm by identifying wind direction, strength, and location.

Site Scouting Field Trip

"Almost all the wind power facility layouts can be done in the GIS, with maybe one or two visits to the field," says Tyler Hoffbuhr, GIS analyst and manager with Iberdrola Renewables. "Now we can stock the GIS with U.S. Geological Survey maps, property lines, aerial photography, and detailed topography data to see how the buildable area matches up with the wind data."

When development teams visit a proposed location, they collect site-based data to compare with digital information and maps within the GIS. Using a mobile device equipped with GPS and GIS, the team is able to update data from the site and make any necessary adjustments to the facility layout.

"GIS enables us to reach our goal of finding the best wind areas while causing as little impact as possible to wildlife and the environment," says Hoffbuhr. "Locating the right site can be done quickly and accurately with publicly available data and GIS technology."

In total, wind power facility development is about a four-year process that involves the site research and data collection, as well as procurement of government permits, landowner permission, funding, and the physical resources. When the plans are ready, developers hand over the project to the construction team.

"Once all the initial research is done, construction of the wind power complex happens quickly, sometimes in four to six months," says Laurie Jodziewicz, manager of siting policy, AWEA. "Projects under construction right now will be online and delivering energy within a year or less."

Once a wind farm is up and running, operators continue to use GIS to help gather inspection and operational data. Since wind energy is variable, utility companies have to figure out what to do when the wind does not blow. With ArcGIS technology, operators can model and predict how well the wind will perform in the next few hours or days and accurately match energy production with demand.

But Will It Work?

Healthy government incentives are driving much of the wind power development in the country. A report led by the Department of Energy's National Renewable Technology Laboratory in Golden, Colorado, reiterated predictions that wind energy will claim a 20 percent share of electricity production in the next 10 years. The report called the forecast "ambitious," but "feasible."

The energy industry is already on board with more than 9,000 new wind farms under construction in the United States and nearly 20,000 existing.

"With sophisticated site development technology and incredible wind resources, wind energy is becoming increasingly valuable," said ESRI's utility industry expert Bill Meehan. "We are now seeing utilities integrate wind power into the electric system to supplement fossil fuels. Wind is a cost-effective, nonpolluting energy source that will continue to be one answer to international energy concerns."

More Information

For more information, please visit **www.iberdrolarenewables.us**.

The Elk River Wind Project is a 150-megawatt wind energy project located in Butler County, Kansas.

Mapping the Solar Potential of Rooftops

Germany's SUN-AREA Research Project Uses GIS

Highlights

- Using ArcGIS Desktop tools, researchers identified all necessary rooftop data.
- ArcGIS Desktop ModelBuilder was used to determine the solar potential of all roof areas.
- The ModelBuilder application gave the team an intuitive interface.

SUN-AREA researchers used ArcGIS Desktop applications to calculate the possible solar yield per building for the city of Osnabrück.

The solar age has dawned in Germany. About 20 percent of the country's rooftops are suitable for solar power production, according to recent results from the SUN-AREA Research Project. The project aims to determine how solar energy resources can be optimized by placing photovoltaic panels on rooftops around the country.

The SUN-AREA project is sponsored by the University of Osnabrück and the TOPSCAN topographical information company. It is led by geomatics engineer Martina Klärle and researchers Dorothea Ludwig and Sandra Lanig.

Preliminary findings of the SUN-AREA project estimate that, at full potential, solar power could meet the entire energy needs of homes throughout Germany. The team began its work with an examination of the northern German city of Osnabrück.

"We have proven that 70 percent of the city's total demand for electricity can be covered using only the roofs that are already present in Osnabrück," Klärle says. "In other words, if all the roofs that are especially suitable were now fitted with photovoltaic devices, we could meet 70 percent of the electricity needs of all of Osnabrück."

Germany is very well suited to generate electricity using photovoltaic systems. The majority of the population is not concentrated in urban centers, but spread out over rural areas. That means more space per person, and more roof area.

"My vision is to use all suitable roof surfaces to make solar electricity," Klärle says.

Now Klärle is trying to turn the SUN-AREA vision into reality. She gave city officials a solar power potential map of Osnabrück with an exact catalog of all suitable rooftops. The data has been made public and has already received positive response. The city is stepping up efforts to equip public buildings with solar collectors. Osnabrück has doubled its solar energy installations in the past year alone.

"We're at the point where we can't afford to get our electricity from coal-fired power plants, and we don't want to get it from nuclear power plants," she says. "I just won't accept that we have all this potential on our roofs, and we don't use it."

The SUN-AREA Method

SUN-AREA researchers set out to develop solar power potential maps of each roof area, each city, and each county or district in Germany.

The team started by gathering data, then devised a digital analysis method for identifying high-potential areas. Rooftop data was collected with aerial laser scanners. Klärle spent time flying through the skies over Germany, seeing to the effectiveness of the scanning technology.

Using ArcGIS Desktop tools, including ArcGIS Spatial Analyst, the researchers identified all necessary rooftop data, such as outer form, inclination, orientation, and clouding. The team used an algorithm sequence, created with the ArcGIS Desktop ModelBuilder application, to determine the solar potential of all roof areas. Important data included the angle and alignment of the roof, the sun's path across the sky, shadows cast by a chimney or another rooftop over the course of the day, and the seasonal change in hours of sunlight. The SUN-AREA project also calculated solar suitability, potential power output, CO_2 reduction, and investment volume for each subarea of a roof.

The ModelBuilder application gave the team an intuitive interface to implement necessary data and tools to model solar power. The system detects optimal locations for producing solar power based on laser scanner data and plain view data.

The results from the Osnabrück pilot region are available to the public via an interactive online map created with ESRI's Web GIS technology (**www.osnabrueck.de/sun-area**).

More Information

For more information, contact Dorothea Ludwig, researcher, SUN-AREA Nord, Fachhochschule Osnabrück (e-mail: d.ludwig@fh-osnabrueck.de), or visit **www.osnabrueck.de/sun-area**.

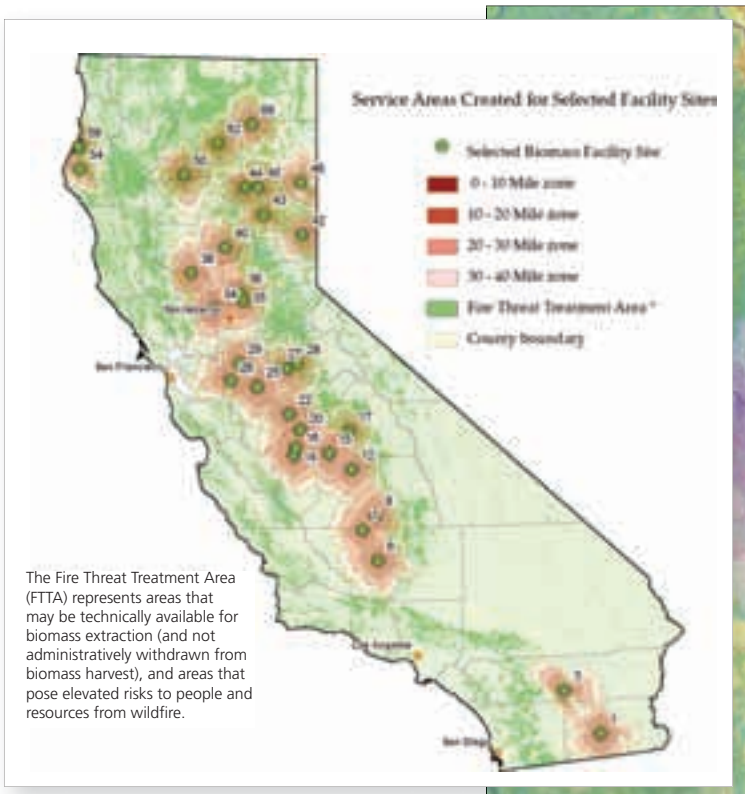
Assessing Economic Biomass Resources in California with GIS

California has a large and diverse biomass resource base that could potentially provide the state with renewable energy, according to research from the California Biomass Collaborative. Feedstock for biomass energy production in California comes from forestry and forest products; agriculture; and urban sources, such as municipal wastes. Biomass may also emerge in the form of new crops as the state moves to reduce consumption of fossil fuels and petrochemical feedstock and use more sustainable and renewable resources for energy and products.

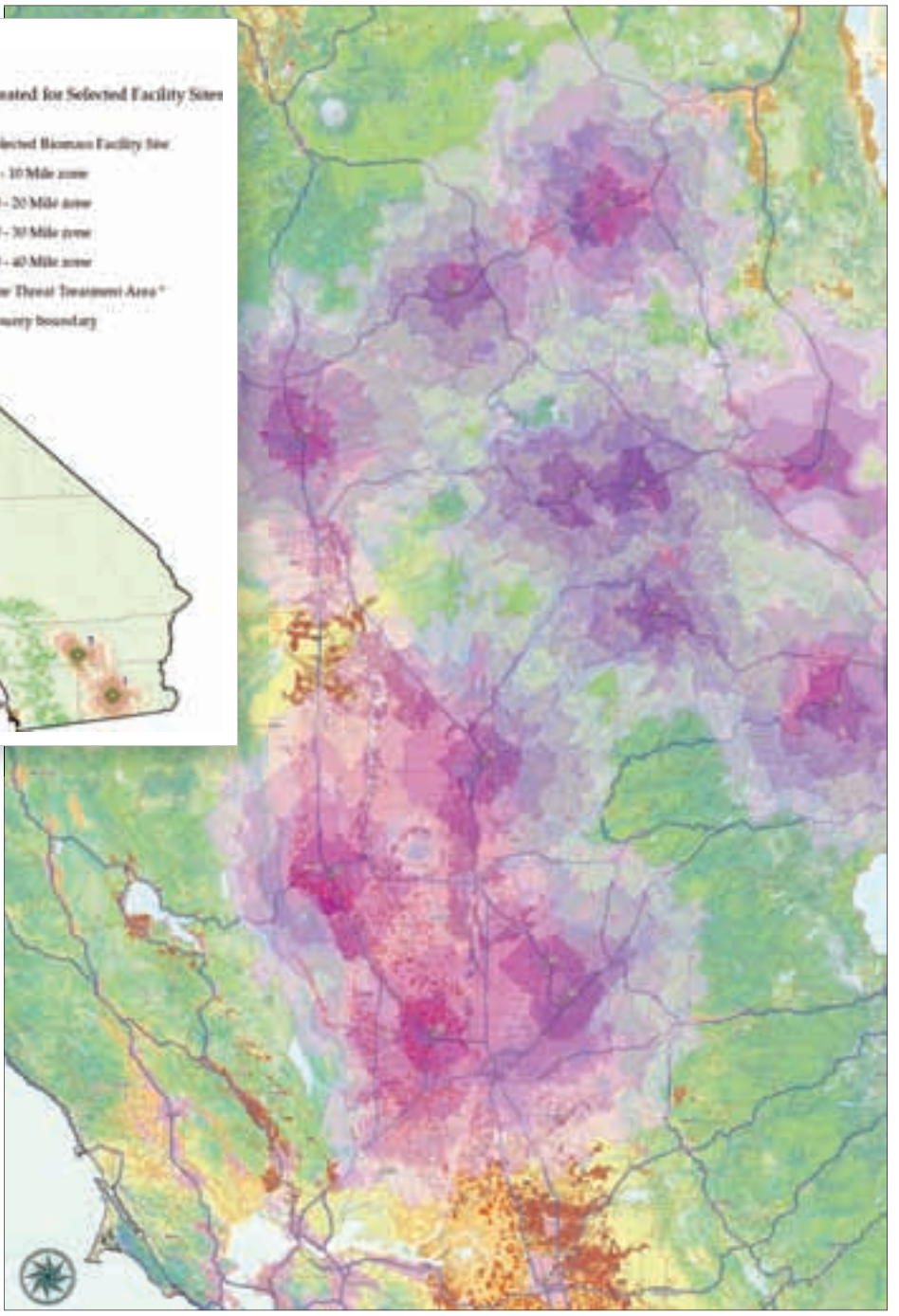
In a recent report, the California Energy Commission asserted that dedicated biomass crops for energy, fuels, chemicals, and other bioproducts may develop given sufficient market incentives or in association with new agronomic practices.

The California Biomass Collaborative used ArcGIS Desktop software to examine the economic feasibility of biomass supply for different types of manufacturing facilities of future bioenergy, biofuel, and bio-based products. The collaborative is made up of researchers from the California Energy Commission and the University of California (UC), Davis. The data used for the study was provided by the California Biomass Collaborative, California Department of Forestry and Fire Protection, California Department of Water Resources, California Energy Commission, UC Davis, and ESRI and included previously assessed data about gross and technically feasible feedstock supplies.

Using the ArcGIS Network Analyst extension, researchers identified feedstock supply zones within fixed distances of each facility site. The actual distance along the road network was determined, as contrasted with simpler analyses employing a fixed radius and tortuosity factor. Researchers accumulated area in acres for each resource polygon to yield the total area within the supply region based on transportation distance. By adding cost information per road and feedstock type, the team was able to determine total delivered feedstock cost.



The Fire Threat Treatment Area (FTTA) represents areas that may be technically available for biomass extraction (and not administratively withdrawn from biomass harvest), and areas that pose elevated risks to people and resources from wildfire.



This project examines the economically feasible biomass supply for different types of future bioenergy, biofuel, and bio-based product manufacturing facilities sited across the landscape. This assessment extends that work by identifying supply curves (cost of supply by quantity delivered) (courtesy of California Biomass Collaborative).

The team identified supply curves—the cost of supply by quantity delivered—and added cost information by road class and feedstock type. The resulting data allows optimization of facility scale or size by satisfying different requirements such as the minimization of delivery cost and the maximization of facility profit.

Facility size optimization was evaluated by combining feedstock delivered costs with economies of scale for capital and operating costs. Using the ArcGIS Spatial Analyst extension, the team was able to provide future developers with a map of supply overlap to assess potential competition for feedstock among facilities.

The GIS work of the California Biomass Collaborative may support statewide efforts to attract developers and include biomass as a viable renewable resource to meet state energy demands.

More Information

For more information, contact Lian Duan, GIS mapping/GIS specialist, California Department of Forestry and Fire Protection (e-mail: lian.duan@fire.ca.gov).

GIS to Meet Renewable Energy Goals

Throughout the developed world, there is ongoing interest in renewable energy as a replacement for traditional fossil fuel. Wind farms are cropping up around the world, and the sunniest spots are slated for solar power potential, while additional significant strides are being made to expand geothermal, tidal, biomass, and other types of generation. Motives for renewable energy development vary from place to place, but the recurring theme is a reduction in greenhouse gas emissions—a smaller carbon footprint. All agree on the need to tread more lightly, and with GIS technology, the path to renewable energy is becoming clearer.

The identification of areas technically suitable for renewable generation involves the collection of existing information, such as historical wind speed and direction, terrain and slope information, and solar radiation. Data must be analyzed for currency, accuracy, and completeness. Further data collection may be required.

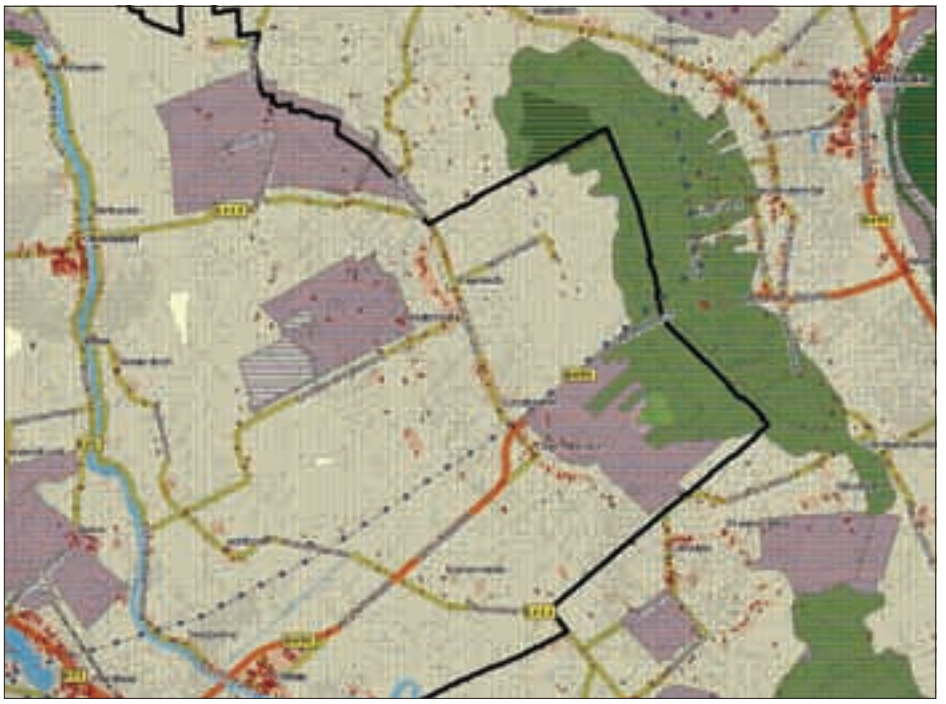
Once base data is available, specific generation requirements can be modeled and applied against that base data. With wind generation, wind speed and duration must be sufficient for turbines to work properly. Similarly, for concentrated solar, sun intensity and the number of sunny days dictate the suitability of an area. Applying the technical models against the base data will classify sites that are technically suitable.

As with analysis for technical suitability, a similar analysis is conducted using data that identifies lands of limited or highly undesirable usability. Typically these are lands of cultural importance, such as historical Native American tribal lands, national parks, or other areas of scenic beauty. The area may be a protected animal habitat or migration zone. The result of this analysis indicates geographic areas that represent few or no barriers to renewable generation development.

Merging the datasets from the first two types of analysis will demonstrate where generation facilities could be constructed with confidence that the site is technically appropriate and where there would be no social objections to their presence.

The last step is to consider the proximity to a transmission grid to deliver power into the grid. It would be unusual to find that no transmission lines are required; the goal is to find sites that minimize this construction requirement.

Utilities, governments, and organizations around the world are using ArcGIS technology for renewable energy development. The following examples describe some of these organizations and highlight some of their methods and successes.



vento ludens: Protected areas and minimum distances combine in one map to display suitable areas in white.

vento ludens—Searching for Suitable Sites

The name of German-based renewable energy developer and investor vento ludens GmbH and Co. KG is Latin for "he who plays with the wind." But, vento ludens does much more than play. The company is actively pursuing suitable sites for the production of clean, renewable energy in Germany, Switzerland, Scotland, and the United States.

"The procedure for finding sites for wind farms and solar power plants is basically the same; the only difference is the data used," says Simone Blaga, project manager, vento ludens. "The perfect site for a renewable energy installation needs to fulfill certain conditions. Information, such as land survey data, is evaluated by specific ArcGIS Desktop applications in order to make a site evaluation."

Once an area is determined to have sufficient renewable resources, engineers at vento ludens must determine the most suitable precise location for a production facility. Regional guidelines, for example, prohibit placement of wind turbines in protected wildlife areas. It is also important to maintain prescribed distances from streets and other transportation routes.

With shapefiles of such criteria, vento ludens is able to rule out restricted land by creating buffer zones on its maps using ArcGIS Desktop. Each shapefile is added as a separate layer. All layers of excluded land are then positioned on top of each other to reveal all off-limits terrain. Engineers then activate the layers that show renewable resource potential, such as high wind speed. When the usable land coincides with resource potential, the area is considered a viable site.

Engineers then use ArcGIS 3D Analyst and the extension's ArcScene application to create a 3D model for visibility analysis. The visibility of new sites should be as unobtrusive as possible and with minimal impact on the landscape. A digital terrain model includes the x- and y-coordinates, as well as all geodetic points. For the public, authorities, and landowners involved in a project, this analysis can be very helpful because it reveals how the installation will look and how it will be integrated into the surrounding area.

"GIS makes the site evaluation process a lot easier and helps us continue building new wind farms and solar power plants," says Blaga. "In doing so, we are making a contribution to ensuring a naturally sound and secure worldwide energy supply."

For more information, contact Simone Blaga, project manager, vento ludens GmbH and Co. KG (e-mail: simone.blaga@ventoludens.de).

Solar Boston—
Determining Resource Potential

Through a program known as Solar Boston, the Massachusetts city is using Web GIS technology to map current solar installations and allow Bostonians to analyze their rooftop solar energy potential. Solar Boston's Web application helps the people of Boston easily start learning about the feasibility of solar projects.

To promote the use of solar energy to investors, the Boston Redevelopment Authority (BRA) needed a system to showcase research and analysis in a user-friendly format. GIS was the obvious tool to achieve this end because it started with a visual reference—a map of the entire city showing the buildings that had solar installation potential.

"We needed a baseline, because you can't really get anywhere if you don't know where you are," says Wilson Rickerson, Solar Boston coordinator. "Without GIS, we'd have no concept of the size of the city's solar industry, how fast it had grown, and what potential it had."

GIS analysts at BRA started on the project by using ArcGIS Desktop software's ArcGIS Spatial Analyst extension to calculate the solar radiation available on building rooftops. To do this, they built a digital elevation model (DEM) of the city.

Users can browse active solar installations throughout Boston.

"We took the bare earth DEM and 'burned' into that the building heights using attributes available in the building footprints, which resulted in a three-dimensional surface model of the city," says Greg Knight, senior GIS applications developer with BRA. "We proceeded with this prepared surface and utilized the solar radiation tools available in the GIS to calculate what the solar radiation availability would be for each rooftop."

The solar radiation tools allowed analysts to model incoming solar radiation and take into account numerous factors, including variation in elevation, orientation (slope and aspect), the shadows cast by topographic features, and changes with time of day or year. After completing the analysis in ArcGIS Desktop, the solar radiation map was published, along with a basemap, other layers of interest (e.g., historic and local electric utility districts), an address locator, and geoprocessing tools, to ArcGIS Server for use by the Solar Boston Web application.

Wrapping the analytics in an easy-to-use Web GIS application was the next step. GIS developers at BRA saw great potential in ESRI's new ArcGIS API for Flex, which is a client-side technology rendered by Flash Player 9 or Adobe AIR. Flex gives developers the capability to combine GIS-based Web services from ArcGIS Server with other Web content and display it in a fast, visually rich mapping application that can be deployed over the Web or to the desktop. It was the ideal medium to show investors the logistics of solar energy investment.

For more information, contact Greg Knight, senior GIS applications developer, Boston Redevelopment Authority (e-mail: gregory.knight.bra@cityofboston.gov). See Solar Boston's Web GIS in action at **gis.cityofboston.gov/solarboston**.

Kyushu University—
Airf ow Analysis for Wind Power

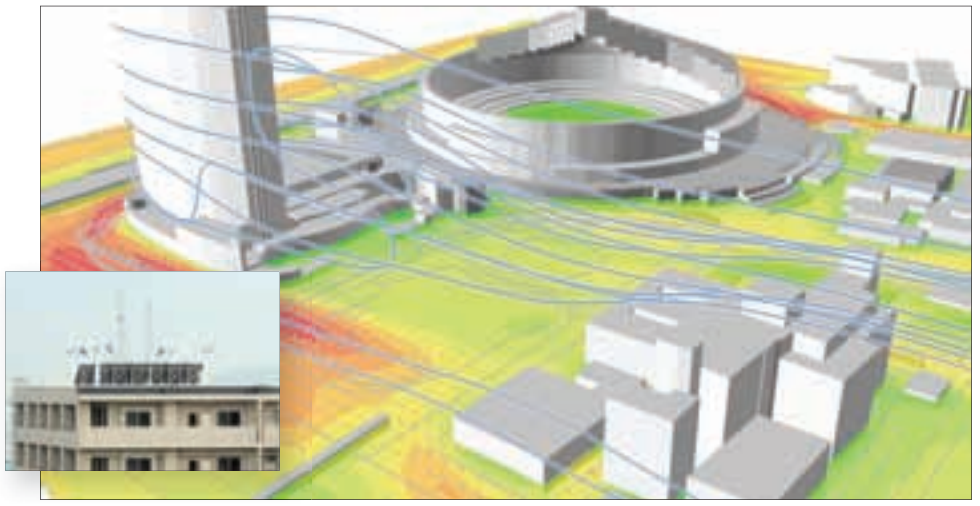
To harness the power of the wind, one must first study the wind's movement. Takanori Uchida, a professor at the Kyushu University Research Institute for Applied Mechanics in Japan, understands this notion. Uchida works with computational fluid dynamics (CFD) technology and GIS to study and predict wind flow.

Wind flow through an urban landscape can help determine the potential for rooftop windmills. An energy engineer can assess not only the best roof but the best location on the roof to place wind generators, as well as predict what the energy output of the generator might be, given certain conditions.

Energy companies can apply CFD to siting transmission assets or assessing how wind will flow around certain complex shapes, such as various types of power generators. Users may choose to determine a landscape's active wind corridors and combine other information, such as environmental considerations and land titles, to assess the value of a wind farm site.

Uchida and his team have developed a new ArcGIS Desktop extension, Airflow Analyst for ArcGIS, that makes it easier for people to process wind energy data in a GIS environment, turning wind assessment into more practical applications. The extension can model data; perform complex calculations; and generate visualizations in 2D, 3D, animated, and temporal representations. With this extension, researchers can more easily perform risk management wind analysis, such as forecasting diffusion of smoke, noxious gases, and other toxic pollutants.

For more information, contact Environmental GIS Laboratory Co. Ltd (e-mail: araya@engisinc.com) or Takanori Uchida (e-mail: takanori@riam.kyushu-u.ac.jp).



Kyushu University: A model of a baseball stadium in Japan, showing the airflow around the stadium. This was created with ArcView, ArcGIS 3D Analyst, and Airflow Analyst.

BirkNielsen: The visibility of proposed wind turbines is displayed. From the white areas, you will not be able to see the wind turbines.

Cascade County—
Attracting Renewable Investors

In the U.S. state of Montana, along the eastern slope of the Rocky Mountains, sits Cascade County, a region known for its powerful Chinook winds. Cascade County Commissioner Peggy Beltrone, who also serves on the U.S. Department of Energy's Wind Powering America steering committee, is leading a wind marketing program for the county that is receiving attention around the globe.

"The way to differentiate the wind that crosses through your county and the next county is to draw attention to it and make it easier for developers to explore your wind resource and see its value," Beltrone says.

Cascade County is using GIS to help wind power developers research available parcels. In addition to attention from regional developers, interest has come from businesspeople as far away as Japan and Ireland.

"We have a lot of people coming into our office looking for data on wind," says Tom Mital, GIS manager for Cascade County. To better serve these interested parties, Mital used ArcGIS Desktop software to create a wind map book that combines wind, transmission, parcel, and road data. The wind speed estimates for an elevation of 50 meters above the ground were produced by TrueWind Solutions using its Mesomap system and historical weather data. The data was then validated with surface data from the National Renewable Energy Laboratory and wind energy meteorological consultants.

A PDF version of the map book is available on the GIS Department Web page of the county Web site at **www.co.cascade.mt.us**. On that Web page, there are also links to a wind power map and wind speed map that visitors can download in PDF format. If someone would like more detail about a specific area, Mital will create a custom map.

"The advantage of using GIS in the marketing of your wind is that it gives developers a lot of information that they need to decide whether or not placing a wind turbine in this area is going to work for their power needs and their budgets," Beltrone says. "One executive told me that the information we provided saved his staff months of work since we did all the work for them. If he can take a look at our resources without having to invest time and money into preliminary research, it's a big draw."

For more information, contact commissioner Peggy Beltrone (e-mail: pbeltrone@co.cascade.mt.us, Web: **www.cascadecountywind.com**).

BirkNielsen Sweco Architects—
Environmental Impact Assessment

Dotting the landscape with wind turbines can adversely affect the environment and cause the community to take umbrage. To ward off such risks, developers enlist the help of people such as Christian Achermann, an urban designer from BirkNielsen Sweco Architects A/S in Denmark, to create an environmental impact assessment (EIA).

"An environmental impact assessment," Achermann says, "should identify, describe, and assess the direct and indirect effect on humans, fauna, flora, soil, water, air, climate, landscape, material assets, cultural heritage, and the interaction between those elements."

For projects with large wind turbines, Achermann says it is especially important to investigate the visual and landscape impact. A visual analysis addresses issues surrounding wind turbine design, size, style, and patterns from a landscape architecture perspective.

For example, when a private builder wants to install wind turbines at a specific site, local politicians and community members need more information to handle the request. They need to know which transportation routes will be traveled by trucks accessing the site, how the site will be restored when or if the turbines are no longer useful, and what changes the area will undergo on account of the wind power facility. An EIA gives them something concrete to discuss.

"If you do not have a fairly accurate picture of how it will look, it becomes pure guesswork," Achermann says. "We use GIS to translate guesswork into something quite specific, and on this basis we can make an assessment as landscape architects."

Achermann and his team use ArcGIS software to create thematic maps with up to 30 layers of relevant data. The maps are shared with interested parties online. The use of GIS-based maps allows politicians and the community at large to understand and visualize the ramifications of a nearby wind facility.

For more information, contact Christian Achermann, urban designer, BirkNielsen Sweco Architects A/S (e-mail: christian.achermann@birknielsen.dk).

U.S. National Renewable Energy Laboratory—
Economic and Government Considerations

The U.S. National Renewable Energy Laboratory (NREL) recently took on the task of updating wind resource maps to educate government decision makers and developers interested in regional renewable energy.

Using ArcGIS Desktop software, the NREL team is able to determine the most favorable locations for wind farms based on the cost of transmission, locations of load centers and wind resources, and the layout of the electric grid. GIS-based modeling enables analysis of terrain, which significantly impacts the quality of wind at a particular site.

The NREL team also examines economic development potential based on strong manufacturing centers and filters the data to exclude sites such as national parks and wilderness areas.

For utility developers, NREL creates forecasting models. Maps include details such as voltage of transmission lines and classes of wind speed and wind power. Forecasts include projected wind capacity by state in 2030 and the expansion of transmission lines that would be required.

For more information, contact Marguerite Kelly, senior project manager, NREL (e-mail: marguerite.kelly@nrel.gov).

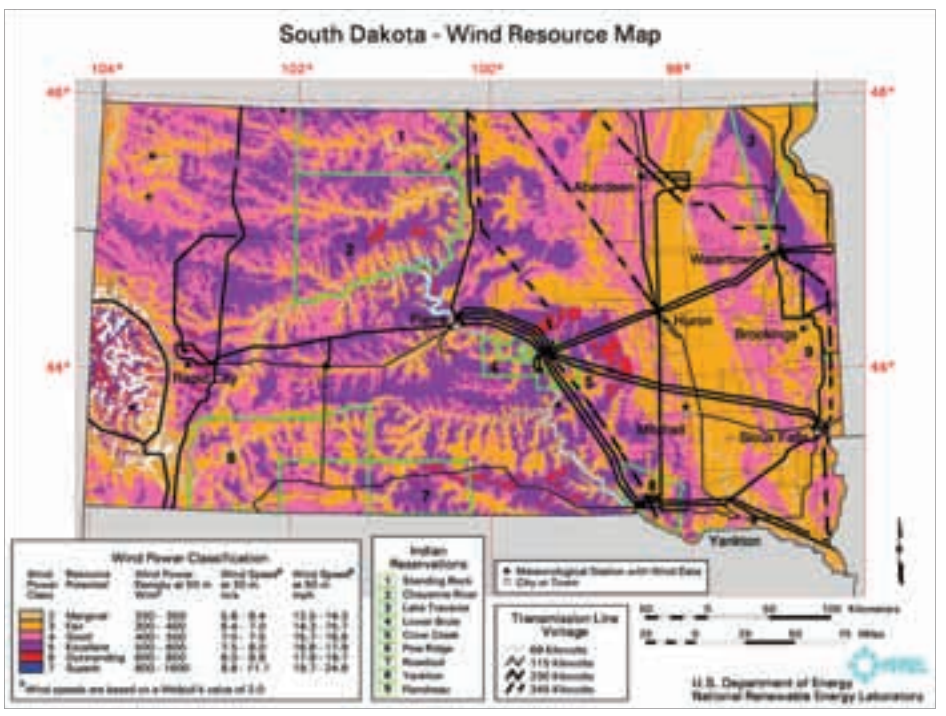
Renewable Generation Location Summary

As shown in the above examples, the identification of a renewable generation location consists of several common steps: Locate geographic areas that are suitable from a purely technical consideration. Name any factors that would prohibit construction, such as environmentally or culturally sensitive lands. Take into account proximity to the transmission grid to avoid the need for new lines. To make these processes most efficient, GIS can collect and view each group of data for consideration.

More Information

For more information, visit **www.esri.com/electric**.

Horseshoe Bend Wind Farm in Cascade County, Montana (source: John Godwin).



NREL: South Dakota's wind resource map depicts an outstanding resource. Transmission lines with voltages can also be seen on this map.

Creating an Enterprise Decision Support System

Korea Land Corporation Consolidates and Streamlines Operations with ArcGIS Server

Highlights

- Enterprise system manages more than 125 layers of geographic data.
- More than 400 employees can use the system via the Web.
- Processing time has been significantly reduced.

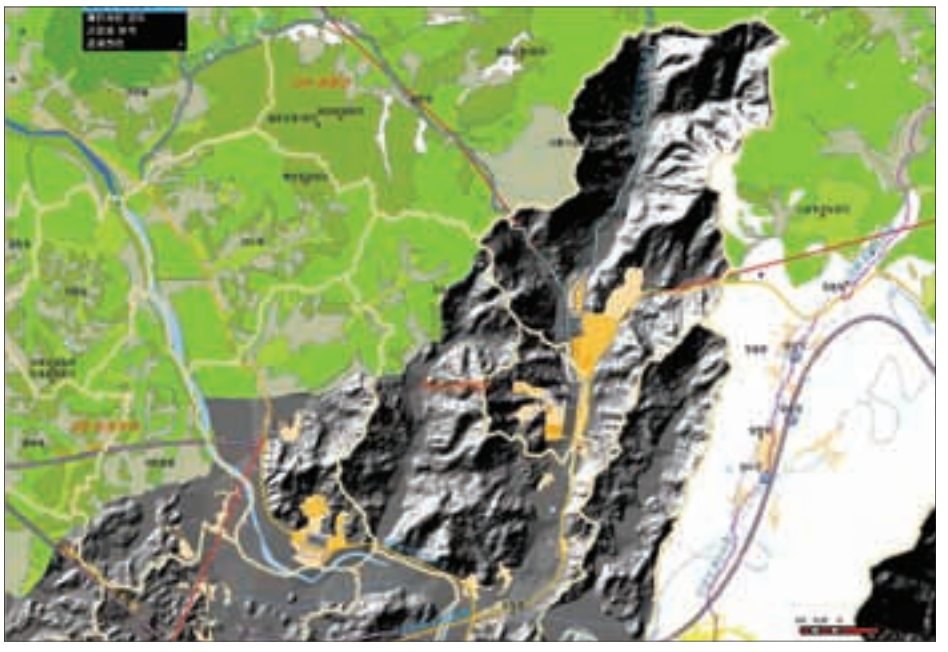
Situated on the Korean Peninsula, the Republic of Korea supports a population of more than 48 million people. This small, densely populated nation continues to expand economically and today stands as the world's eleventh largest trading nation, led by its shipbuilding industry and the manufacture of electronics, semiconductors, and automobiles.

In 1975, the government formed Korea Land Corporation (KLC) to acquire, manage, and develop land for the government and residents in the country. KLC implemented a GIS in 1990 to support its land management efforts and began collecting and indexing digital geographic information, including cadastral, terrain, and environmental datasets. The collected datasets subsequently evolved into KLC's spatial data warehouse (SDW), which reduced redundancy and brought to the agency an integrated platform that increased access to the latest available data. In addition, SDW's common spatial data model and metadata development have improved the quality of the data and helped establish an information-based workflow. SDW stores more than a terabyte of data and includes the Korea land information system, land suitability assessment, urban planning information system, urban planning statistics system, and other datasets used by KLC. The SDW developed by KLC and those databases created and maintained by the Seoul metropolitan government, Daejeon City, and other agencies are part of South Korea's national spatial data infrastructure.

Following an extensive period of competitive analysis, KLC selected ArcGIS Server software to be the heart of the enterprise decision support system that it launched in 2006—the Spatial Information Knowledge System (SPINKS). This allowed KLC to maximize its use of Web GIS capabilities. Oracle 10*g* R2 is used as the relational database management system. SPINKS was primarily implemented to support sustainable development and balanced land management throughout the country, such as land planning, the management of land reserves, the analysis of its land compensation program, and the development of new residential and commercial districts. It enables staff members throughout KLC to access spatial data, use the powerful geoprocessing tools available in ArcGIS Server for analysis, and help develop and support KLC's land-use policies.

SPINKS manages more than 125 layers of geographic data found in KLC's spatial data warehouse. The data is provided via the Web to more than 400 employees located throughout the country. Access to the data and related applications is determined by the nature of an employee's work. Some use the system to simply view data, while others perform complex analyses. The powerful, easy-to-use applications were built using Microsoft's .NET platform and the C++ programming language to make the system readily accessible to all users. This has lowered the learning curve and training costs and helped increase the efficiency of the people using the system.

The targeted area filtered through the previous analysis is visualized by each land use with the chart.



A target area is visualized with a map that excludes excess elevation and slope data.

South Koreans are city dwellers; more than 50 percent of the country's residents live in Seoul, the nation's capital, and its surrounding suburbs. Because of the continuing need to review urban housing initiatives, KLC began the implementation of SPINKS in this region. Today, it is used throughout the entire country.

A key function of SPINKS is the evaluation of land for potential housing projects. The process also includes land acquisition and the determination of compensation to be made to landowners for purchasing their land. Forty staff members use the system to analyze potential sites for land acquisition. After selecting a land area from the administration data, which includes city, county, and district boundaries, a digital elevation model (DEM) is included to determine whether the specified area is suitable for development. Areas meeting the geographic requirements, such as slope specifications, are then saved in the SPINKS system for further processing. Thematic geographic layers (including protected habitats, rivers and streams, roadway networks, local utilities, hazardous materials, and regulations) are overlaid with the specified area to further determine whether it is suitable for development. The results of the analysis are then published, and staff members can download them for additional processing.

The steps involved in compensating landowners for these acquisitions include performing basic research planning; publishing land-use maps; extracting the asset designation numbers and verifying their correspondence with land records; writing papers, including official land details; issuing official papers to proceed; separating project areas; surveying the land; surveying for obstacles; and conducting compensation examination. Prior to the implementation of the ArcGIS Server software-based SPINKS, this extensive procedure took more than three months. Today, the entire process takes less than a week.

More Information

For more information, contact Jung-ho Jang, ESRI Korea, Inc. (e-mail: jhjang@esrikr.com).

ZapMap Streamlines Zoning and Permits Map Application

Lake County, Florida, Creates Customer Service-Oriented Analytic Tool with GIS

Highlights

- With ArcView-based ZapMap, planners can search for a property and see all the previous activity associated with it.
- All property questions, and more, can now be answered right from the desktop.
- County staff increasingly ask for access to the application.

Lake County is located at the center of peninsular Florida. For most of its history, it was a rural county of clean lakes and orange groves, and agriculture was the mainstay of the economy. In the 1980s, it was considered a rural getaway from the adjacent fast-growing Orange County (home of Walt Disney World) and was in the precomputer age when maps were paper and zoning clearances were filled out by hand.

The county suffered a major blow to its citrus crops in the 1980s when two freezes killed off many of the groves. During the development boom of the 1990s and 2000s, development soared as grove owners turned their unprofitable agricultural lands into highly profitable housing developments. But it came so quickly that county planners were nearly overwhelmed with development requests. Processing times of days became weeks, then months, as the volume of requests climbed annually. Decisions over whether to permit were based on paper maps that were literally falling apart, and files to be researched had to first be retrieved from several off-site storage facilities. Something had to be done to modernize the way Lake County did business.

Leadership came from the top, when the director of the Growth Management Department decided that the solution could be the implementation of a GIS. Following a period of software solution evaluations, an interactive mapping application proposed utilizing ArcView, which would bring all the necessary spatial and tabular data for planning and decision making together. It would contain a basemap of existing layers, such as topography, floodplain, and parcels, and most importantly, it would contain a new layer identifying properties that have development approval.

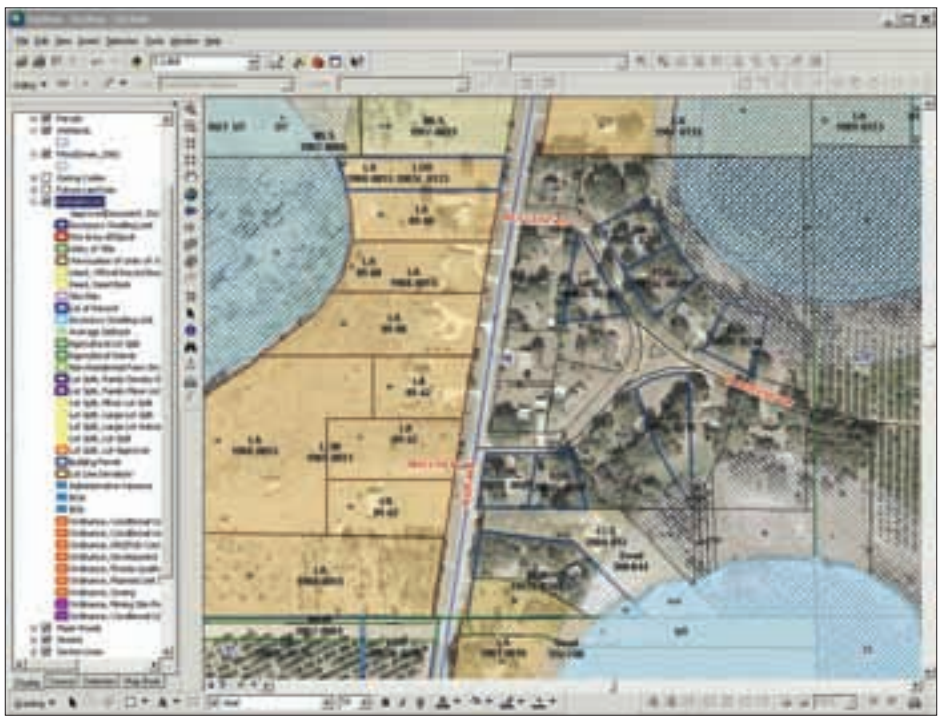
Lake County had the need to analyze and spatially record a number of development requirements, such as lot splits, zoning changes, site plans, unity of titles, and variances. These were the types of documents that needed to be made digital and visible on a map for both spatial and visual analysis. The county decided to identify each of the properties defined by these documents and, using ArcView, map them into a personal geodatabase that could then be displayed on the interactive basemap.

The first step was to gather all the documents together. This was an organizational challenge of heroic proportions. Archives and storage facilities had to be searched. But the location of these documents was only half the battle and was hindered by the condition of the documents. Many were decades old and handwritten or carbon copied, and the ink was fading. The GIS implementation team had to carefully examine each document that was to be mapped to input all the data accurately.

Once the data sources were identified, a personal geodatabase was designed and built in ArcGIS Desktop (ArcCatalog), later to be transferred to a multieditor geodatabase environment.

Domains were assigned for several of the document types since they had various subtypes (e.g., lot splits could be family lot splits, minor lot splits, etc.). Two part-time and two full-time GIS staff were assigned to this project, and each was given a copy of the personal geodatabase.

The GIS team then began the mapping process. Over the next 18 months, the team analyzed each document, geocoding the location based on the legal description of the properties approved for development. The team employed several different methods in locating the properties, including searching the parcel layer, reading and plotting the legal description, and address matching. Then the team members copied and pasted the parcel into the document feature class, used various sketching techniques, or sometimes even used the coordinate geometry (COGO) Traverse tool. Each record was attributed with data taken from the document, and documents that had been recorded by the County Clerk's Office had the URL of their scanned image pasted into a hyperlink field to give instant access to the image of the document. More than 30,000 documents were input in this manner. As each team member finished with a document type, features were copied into a master geodatabase that collected all the data into one place.



An example of the ZapMap application. The table of contents shows all the subtype documents that were mapped. They were then overlaid on the parcel basemap and current aerial photography to provide a clear picture of the existing land use in order to determine future allowable development.

This was the birth of Lake County's Zoning and Permits Map Application, or ZapMap. The necessary layers were added to an ArcGIS Desktop (ArcMap) map document, symbolized, and labeled. Planners now had the ability to search for a property and see all the previous activity associated with that property to determine the zoning or whether it had been split from a larger parent parcel, had a variance, or had any wetlands or floodplains. All these questions, and more, could now be answered right from the desktop.

Once the map document (MXD file) was created, the GIS implementation team started with a small group to test-drive the application. As was expected, when more staff saw ZapMap in action, they wanted access to it. ZapMap was then remodeled as a single geodatabase feature class. All the individual document-type layers were combined into one feature class called BuildableLots, and each document type became a subtype within the feature class. The individual domains were then associated with a specific subtype.

Staff now use ZapMap to determine if a property can be developed or if further permitting needs to be granted. It has become a powerful analytic tool to the decision makers of Lake County.

More Information

For more information, contact Sue Carroll, GISP, Office of Information Technology, Lake County, Florida (e-mail: scarroll@lakecountyfl.gov).

Remote Communities Prevail with GIS

Small Island SDI Is a Huge Success

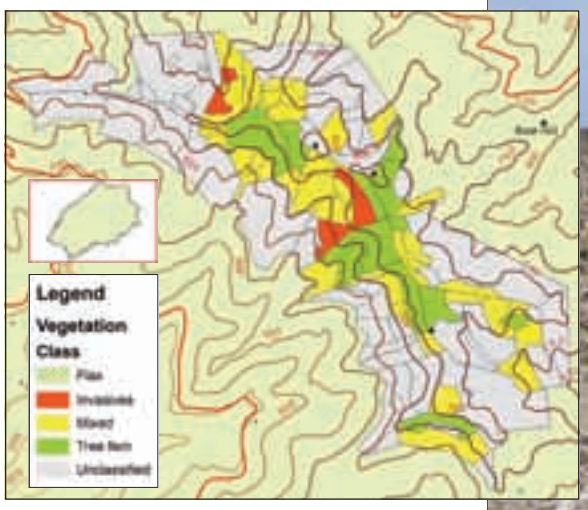
Highlights

- GIS managers feel a sense of community even on small islands in the middle of the ocean.
- The islands use ArcGIS as the backbone for spatial data sharing.
- Benefits are derived from land being carefully mapped and documented with GIS.

GIS for spatial data infrastructure (SDI) is used throughout the world to instill cooperation and collaboration in sharing spatial data to better address social, economic, and environmental issues. It seems logical that large countries like the United States have invested in SDI, such as the Geospatial One-Stop, and national unions, such as the European Union, have come together to share data and resources via the Infrastructure for Spatial Information in Europe (INSPIRE). Does SDI make sense for smaller countries and communities? Arguably, even smaller nations benefit from land being carefully mapped, public works and utilities documented, environments and biodiversity protected, and resources assessed and strategic planning completed.

Thanks to special funding through the joint United Kingdom Foreign Office/Department for International Development Environment Programme, a group of UK overseas territories and the member states of the Organization of Eastern Caribbean States are able to rely on GIS for SDI, using the solution for data quality and control, information sharing, and delivering finished products for use between governmental agencies and private organizations. Calling themselves "tiny SDI," these small islands use ArcGIS as the backbone for spatial data sharing.

Most islands were using ESRI GIS software products in some form or fashion before SDI was implemented. As Alan Mills, principal with Alan Mills Consulting, Ltd., and one of the thinkers behind using SDI to help manage smaller islands, explains it, "We realized there was synergy in sharing the same add-on applications developed with GIS across the islands. Along with the backup support from other islands doing the same functions, the GIS managers on these remote places would feel a sense of community and have a place to go when they needed help. This is important when you live on a small island in the middle of the ocean three days' boat ride from the nearest airport, and you have to be the expert in GPS, databases, cartography, digitizing, and changing the ink in the plotter. Many of these projects produce baby steps in making SDI, but these smaller islands should not be excluded from making best use of GIS for their own special purposes."

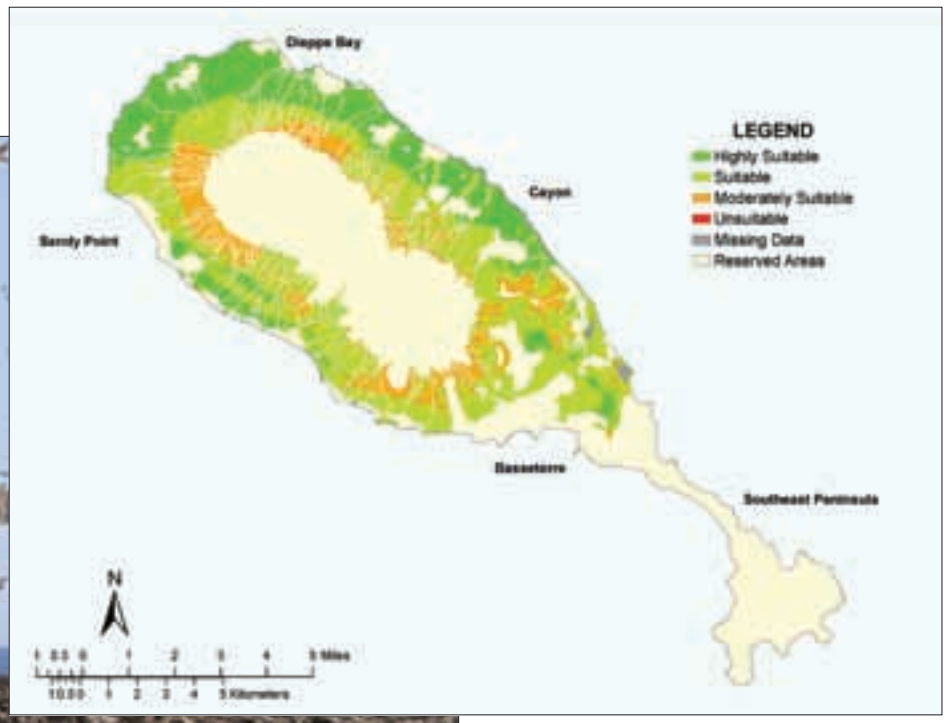


This map shows endemic tree ferns, trees, and threatening weeds on St. Helen's Diana's Peak (as of 2007).

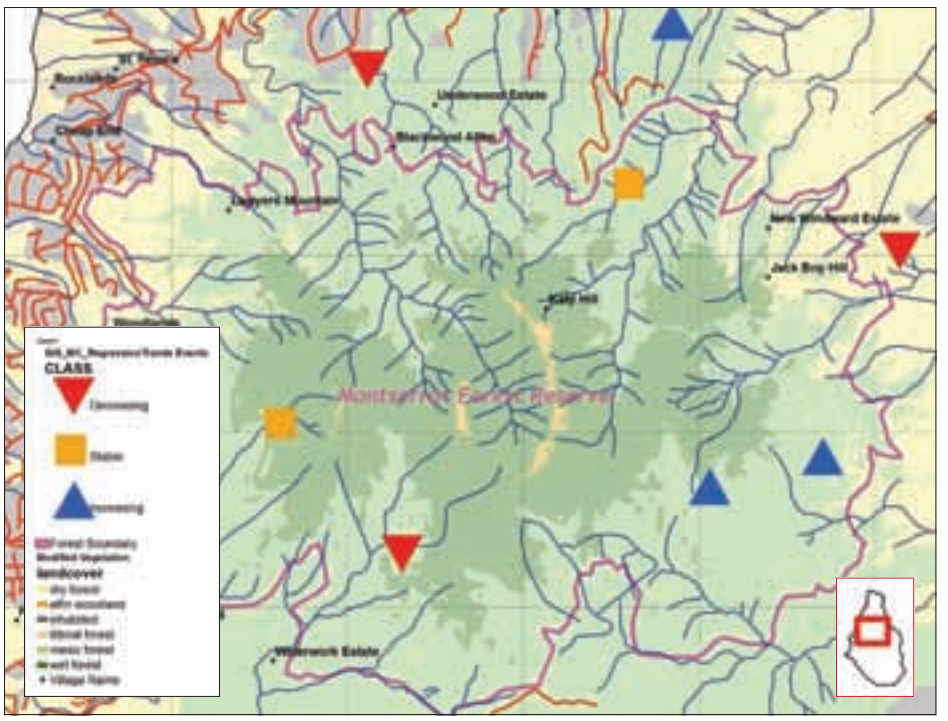
A few thousand of the half million wide-awake (sooty) terns on Ascension Island (photo credit: Alan Mills).

Ascension Island Discovers Data Sharing

One island that has many unique needs housed in a small space is UK overseas territory Ascension Island, situated in the sea halfway between Africa and Brazil. Only 34 square miles in area (approximately 88 square kilometers), the island is inhabited by about 1,000 people. Because the island is a relatively recent volcanic emergence close to the Mid-Atlantic Ridge, there is little natural vegetation except for a few species of ferns and spurge, a plant that exudes a bitter milky juice. The island



St. Kitts' land suitability map for vegetables.



A map defining trends of the mountain chicken habitat of Montserrat.

became a refuge for a wide variety of marine species and is the second largest Atlantic nesting site for green turtles.

Humans discovered the island in the 1500s, and since that time, the island's ecology has changed significantly: invasive plant species have run rampant over parts of the island and rats and cats have decimated the bird populations. Bird and turtle populations have oceanwide impact on biodiversity, and the Conservation Department established by the small Ascension Island government is mandated to protect and enhance the crucial nesting sites, as well as conserve the local plants, crabs, and invertebrates.

Since 2005, GIS has been used to synthesize disparate databases and datasets and create new maps and images for environmental management. GIS also assists with other applications, including the Environmental Health Department's rat control mapping, and documenting of an eclectic set of historical sites, such as the guns of the sunken HMS *Hood,* Dampier's Drip (the original freshwater source for the island), and concrete water catchments in the mountainside that collect scarce cloud water for the island's predesalination plant.

Using ArcView, a component of ArcGIS Desktop, the system works well. Says Dr. Edsel Daniel, professor, Vanderbilt University in Nashville, Tennessee, a codeveloper of the SDIs for Ascension and St. Helena, and a colleague of Mills, "The software is easy enough to be handled by nonexperts. We are able to use a flexible framework that accepts new monitoring data and can integrate datasets from a wide variety of sources and types."

ArcView integrates all the data necessary for the government to make informed planning decisions to balance environmental, amenity, and infrastructural priorities. Clear protocols and procedures have been determined to pass data from the field to the end user.

"The key to this system to function in such a small area so economically with great benefit is the fact that data gathered for one purpose can be shared in many applications," asserts Mills.

St. Helena Finds Cooperation Is the Key

St. Helena, about 750 miles (1,207 kilometers) southeast of Ascension, cannot be reached by air. Instead, a visitor must take the RMS *St. Helena,* which plows between Cape Town, South Africa; St. Helena; and Ascension each month. Approximately 3,500 hardy settlers live on the island, many above the precipitous cliffs or in a narrow canyon where the well-preserved Georgian capital of Jamestown nestles, near landscapes of rocky desert, rolling pastures, and eucalyptus and pine plantations. Near the coast, humpback whale mothers and calves shelter themselves, and thousands of seabirds cling to cliff edges and stacks.

At first, GIS was used to determine the best locations to place freshwater boreholes. In 2004, other projects began, the largest being building the island's cadastre. The St. Helena Agriculture and Natural Resources Department (ANRD), along with the St. Helena National Trust, implemented ArcView and a Microsoft Access database to monitor clearance of invasive flax and other plants and manage the growth of endemic cabbage trees and tree ferns. Len Coleman, GIS manager, St. Helena, says, "The emergence of a map showing the recolonization of endemics over a 10-year period gave other departments the idea to link their monitoring data with the mapping being accomplished."

A single system was then designed to minimize duplication of effort and share the burden of data collection and management. The St. Helena Legal, Lands, and Planning Department was keen on expanding its new cadastral GIS and database, and working with ANRD meant environmental concerns were known by the planning unit for both strategic plans and the development control process. Sharing resources also makes it easier for training sessions to be organized and held for occasional users of GIS. Data is not duplicated, and there is better quality control and attribution when it is used for multiple applications. Visiting scientists and consultants can search the data catalog and have a recognizable way of contributing information back to the system in a structured manner once their project is completed.

GIS Keeps People and Mountain Chickens Safe on Montserrat

In the eastern Caribbean Sea, Montserrat is another UK overseas territory, approximately 12 miles (20 kilometers) west of Antigua. After a volcanic eruption in 1997, the population dwindled from 11,000 to 3,500 and is now settled in only one-third of the island. These few people on the island are in need of GIS to assist them in mapping safe zones and planning for permanent homes and services away from the dangerous area around the volcano. GIS is also used to map endangered species in the Center Hills area, including the curiously named mountain chicken, a frog that is a local delicacy and has been unfortunately decimated by a fungal disease. Work by the Department of Environment in Montserrat—supported by the likes of the Durrell Wildlife Conservation Trust; the UK Royal Society for the Protection of Birds; and the Royal Botanical Gardens, Kew—is helping protect endangered species like the mountain chicken.

Led by GIS manager Lavern Rogers-Ryan, who works in the Montserrat Physical Planning Department, the GIS team uses ArcGIS to cover the requests of clients on the island, including updating the land cadastre and mapping for natural disasters and environmental protection. Comments Rogers-Ryan, "Assisting the Department of Environment in mapping its data opened our eyes to the spatial comparisons across the island."

Mills assisted in developing a database and training field staff in how to make simple maps. Rogers-Ryan emphasizes, "This assistance helped me better structure my data to provide wider services to several government departments without being overwhelmed by the work."

GIS Used to Evaluate Land Resources for St. Kitts in a Postsugar Era

St. Kitts (also called St. Christopher) is part of an independent, twin-island federal state with the island of Nevis. Both islands have a total population of 39,000 and achieved their independence in 1983 when the British made them the smallest independent state in the Western Hemisphere. St. Kitts has a land area of 65 square miles (168 square kilometers) with extremely fertile soils used primarily for sugar production for the past 350 years.

Fluctuating commodity prices and reduced European Union trade preferences have made the island's reliance on single-crop agriculture an economic vulnerability. To address such vulnerabilities, in 2005 the government of St. Kitts and Nevis (GoSKN) made the decision to close the sugar industry and vigorously pursue its economic diversification by placing emphasis on more viable alternatives, such as tourism and nonsugar agriculture, including field crops and livestock. One of the major challenges of this effort is adopting careful planning to ensure that the island's land resources previously utilized by the sugar cane crops are optimized for the long-term economic, social, and environmental sustainability of the country.

After the closing of the sugar industry, the GoSKN Physical Planning Department (PPD) and Department of Agriculture spearheaded the planning for the agricultural transition. A land resource analysis study was conducted using ArcGIS (ArcView) to identify the most suitable lands for six nonsugar agricultural activities: vegetable crops (e.g., tomatoes, peppers), pineapples, fruit tree crops (e.g., sugar apples, guava), field crops (e.g., cassava, sweet potato), livestock production, and pasture/grass (e.g., guinea grass for feeding livestock). "While specific areas have been quantified based on suitability," says Daniel (former PPD staff member and lead researcher on the study), "an added benefit of this study was the ability to identify, compare, and quantify areas for uses beyond agriculture. We were able to evaluate future land use, such as housing for tourism, industrial, and residential, along with suitable lands for nonsugar agricultural activities. Using GIS, we were able to see the bigger picture of how to develop areas for the benefit of the community."

Mapping Resources on Rodrigues Island to Sustain Human Activity

Rodrigues is a partly autonomous island found approximately 400 miles (650 kilometers) east of its sister island, Mauritius. Third largest of the Mascarene Islands, Rodrigues has 40,000 people who live off reef and subsistence farming and has few support services and only a fledgling tourism industry.

Shoals Rodrigues, a nongovernmental organization working closely with the island's government, the Regional Assembly, conducts marine research, education, and training about the extensive reef area, which extends over twice the size of the land itself. One major activity is assessing the extent and health of the marine resources, including the corals, sea grasses, and mangroves. With the support of the Universities of Newcastle and Bangor in the United Kingdom, Shoals Rodrigues created a map of the basic reef structure using supervised classification of Landsat Enhanced Thematic Mapper data, with an eye to using QuickBird satellite imagery and ArcView in the near future for the more detailed map of the resources, as well as in educational work and governmental planning.

More Information

For more information, contact Alan Mills, Alan Mills Consulting, Ltd. (tel.: 44-1622-813214, e-mail: alanpmillsuk@yahoo.co.uk), or Edsel Daniel, Vanderbilt University (tel.: 615-322-3459, edsel.b.daniel@vanderbilt.edu).

International Users Focus on Today's Challenges

Professionals Find GIS Solutions for Real-World Problems

"It's of utmost importance to bridge the gap between countries and continents," says ESRI president Jack Dangermond. "The end result: what stems from our events abroad reaches far and wide and makes great strides in designing our future for the better. It's important for our users to realize that and be part of it." Year-round, ESRI distributors work to put on international GIS user conferences, providing convenient gatherings throughout the world for professionals to join forces in creating a stronger, more sustainable future.

ESRI Latin America User Conference Puts Geography in Action

The 2009 Latin America User Conference (LAUC) is being held October 7–9 in Bogota, Colombia, at the Cosmos 100 Hotel. As the leading event for GIS users throughout Latin America, it brings participants together from across the continent and beyond, including GIS practitioners, managers, educators, developers, and business owners. Attendees are able to create networks of contacts to help in their GIS work—from ESRI staff and business partners to industry leaders and peers—as well as receive guidance on how to launch and grow successful GIS projects.

The Plenary Session kicks off the conference with examples of how GIS is being used to make a difference in the world. Dangermond is scheduled to give the Keynote Address and, along with other presenters, discuss trends, strategies, and the most significant efforts ESRI is making to enhance GIS and benefit users. The LAUC agenda is geared to provide as many ESRI resources as possible, including plenty of technical topics, real-world examples, and insightful presentations provided by the user community. The Map Gallery further illustrates how the power of place is being utilized throughout Latin America. More information about the conference is available at **www.procalculoprosis.com/lauc09**.

ESRI European User Conference Focuses on Geographic Awareness

The 2009 European User Conference (EUC) is dedicated to users throughout Europe and is being held October 14–16 at the Vilnius Congress Concert Hall and Reval Hotel Lietuva in Vilnius, Lithuania, the European Capital of Culture 2009; this honor gives the city a chance to showcase its cultural life and development. The conference theme "GIS: Geographic Awareness" sets the tone for the event's preconference seminars, paper sessions, technical workshops, and other activities that discuss how to best apply geography and technology for measurable results in any market. Attendees are able to increase their GIS skill sets; access helpful tools; and delve into special topics, from saving money and IT integration to best practices in mapping, cadastre, natural resources, urban development, telecommunications, and more.

During the Plenary Session, Dangermond talks about the future of ESRI GIS. Additionally, ESRI staff members who create the ArcGIS software suite give updates on the most recent capabilities and techniques. Participants are offered a range of sessions and workshops. There is also a Gala Dinner at Belemontes, an old country estate situated on the Vilnia River. More information is available at **www.esri.com/euc**.

ESRI Middle East and North Africa User Conference Offers Key Resources

The 2009 Middle East and North Africa User Conference (MEAUC), which will be held November 10–12 in Manama, Bahrain, at the Diplomat Radisson SAS Hotel, is designed to be a valuable resource for users in the Middle East and North Africa. Professionals in any industry and at any level of experience with GIS technology will be able to explore project issues and discover how to achieve more GIS-driven results in their organizations and societies. Attendees will hear from Dangermond; learn about the latest real-world GIS applications that solve unique problems and address recent trends; gain time-saving tips and tricks that further GIS investments; and be able to build relationships with other users, as well as ESRI staff and business partners.

From executives and managers to GIS and IT end users, participants will be able to strengthen their GIS knowledge and skills. Important resources, such as technical workshops led by ESRI product managers and paper sessions on successful GIS applications, will provide many ways to get cost-saving ideas or solutions to technical questions. Visitors can meet one on one with ESRI staff, hear from industry leaders on how to best leverage GIS in today's changing world, and connect with their peers on how to use GIS best practices to address changes in different markets. More information and online registration are available at **www.esri.com/meauc**.

ESRI Asia Pacific User Conference Aims to Extend Location Intelligence

The 2010 Asia Pacific User Conference (APUC), combined with ESRI Australia Pty. Ltd.'s 2010 client conference (OZRI), will take place March 3–5 in Queensland's Gold Coast, Australia, at the Conrad Jupiters hotel. The new combination will provide a larger forum for users to cover a lot of ground in their understanding and skill building as well as collaborate with their peers. "GIS: Extending the Reach" is the conference theme, recognizing that GIS has evolved from being seen as a tool to simply pair location and information to being acknowledged as a serious business system that delivers real benefits. The program will delve into three streams focused on how location intelligence solutions are making it easier to widen and deepen the reach of GIS, whether it is across the globe, throughout a business or department, or in projects of any size.

With delegates expected from many countries throughout the Asia-Pacific region, this event offers a valuable venue for professionals to share how their organization or community is applying GIS. Users are invited to tell their GIS story at the conference, communicating how they have pushed boundaries to extend the power of geospatial intelligence and helping numerous others learn from real-world GIS experiences. Presentation abstracts may be submitted at **www.esriaustralia.com.au/esri**.

More Information

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

NATIONAL GEOGRAPHIC™

"Geo Learning"

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

Making a Difference in Geo-Literacy

Psychologists who study mood have found that your sense of control over external events plays a big role in determining your mood. I believe this explains why so few people choose to get involved in education.

In a set of classic psychological studies, researchers observed that feeling unable to control events is associated with a depressed mood. How does this apply to education? When most of us look at the shortcomings of our educational system, we feel little power to influence events. We do not feel that we can make a difference. That's depressing, so we tend to turn away and devote our energies to something where we can feel what psychologists call internal locus of control.

It doesn't have to be that way. There are many things that we can do to improve education, particularly if we focus on the areas where we can make a difference.

For the GIS community, the place where we can make a difference is in the area that I call geo-literacy, the slice across the science and social studies curriculum that depends critically on geographic analysis. Together with ESRI and other organizations, National Geographic is creating opportunities for geographic professionals to make a difference in education and experience an internal locus of control.

At the 2009 ESRI International User Conference in San Diego, California, Jack Dangermond, president of ESRI, introduced the new GeoMentor program (**geomentor.org**). This program helps GIS professionals find a classroom where they can make a difference in geo-literacy. It operates as a Web-based matchmaking service between GIS professionals and teachers. It also provides a structure to help two professionals who work in very different spheres collaborate successfully.

The idea behind the GeoMentor program is to eliminate the obstacles to volunteering in a school that undermine an internal locus of control. Without the GeoMentor program, a well-meaning GIS professional would likely become mired in thoughts like, I don't know how to find a school to work with. Would a teacher want my help? What could I even do?

The response to the GeoMentor program at the User Conference was overwhelming. More than 850 attendees came by to talk to the National Geographic Education staff at the booth in the Map Gallery. More than 200 attended one of our workshops on how to be a GeoMentor.

If you think you might be interested in working with a K–12 teacher to bring more geo-literacy learning into his or her classroom, you should visit the GeoMentor Web site. There you will find instructions on how to find and work with a teacher in your area (or elsewhere, if you and the teacher are comfortable with online collaboration). You will also find specific ideas for how you can work together, ranging from helping the teacher obtain resources for geo-literacy instruction to coming to the classroom to help teachers implement lessons that involve mapping or GIS.

Everything that a GIS professional and teacher need to establish a successful geomentoring relationship is available on the GeoMentor site.

Volunteering in schools is not for everyone, though. So we've created another way for GIS professionals to make a difference in education with an even lower barrier to participation.

The National Geographic Society recently created the Fund for Geo-Literacy to enable concerned individuals to contribute money to our efforts to improve geo-literacy education. The fund supports the GeoMentor program and other geo-literacy programs for teachers and students.

If you are not able to volunteer your time right now (or even if you are), you can make a difference in geo-literacy education with a contribution to the Fund for Geo-Literacy. Contributions are used to create and distribute free classroom materials and to support professional development programs for teachers.

A gift of $25 is enough to cover the cost of providing teacher guides and maps to five teachers participating in the GeoMentor program. A gift of $100 can cover the cost of one day for a teacher from anywhere in the country to participate in a five-day workshop at National Geographic headquarters in Washington, D.C.

Our goal in establishing the fund is to give people who understand the importance of geo-literacy an opportunity to include support for geo-literacy in their annual charitable giving. These donations are important. As the National Geographic Society is a nonprofit organization, external grants and gifts are necessary to support our geo-literacy reform initiatives.

Between these options for volunteering and giving, National Geographic and ESRI are trying to increase opportunities for the community of GIS professionals to develop an internal locus of control when it comes to education. We want you to experience the feeling of having an impact. Working in our favor is the fact that locus of control is subject to positive feedback. A positive experience increases one's sense of control, which, in turn, motivates more effort. So, whether volunteering or donating is the appropriate place to start for you, I urge you to choose one. You can make a difference.

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**.

From the Department of Geography, University of Tennessee

Free Extended Time-Geographic Framework Extension for ArcGIS 9.3

The Department of Geography at the University of Tennessee is releasing the free Extended Time-Geographic Framework Tools extension for ArcGIS 9.3. This extension is part of the department's research, Towards a GIS-Based Analytical Time-Geographic Framework for Physical and Virtual Activities, which is funded by a U.S. National Science Foundation (NSF) grant.

With this extension, users can visualize tracking data at the individual level (e.g., GPS or cell phone tracking data; activity/travel diary data; and other survey data of individual locations over time, such as migration history data) in a space-time GIS environment. In addition to the space-time GIS visualization tools included in this extension, the department has developed exploratory spatiotemporal analysis functions based on an extended framework of Hägerstrand's time geography for studying individual activities in both physical and virtual spaces.

To Download and for More Information

To download this free extension and for more information about this NSF project, visit the department's Web site at **web.utk.edu/~sshaw/NSF-Project-Website/default.htm**. Comments and suggestions are welcome and should be sent to Dr. Shih-Lung Shaw, professor and head, Department of Geography, the University of Tennessee (e-mail: sshaw@utk.edu).

Community Speaks Up at Spatial Roundtable

The Spatial Roundtable Web site invites you to join the conversation of GIS thought leaders as they address topics requested by the geospatial community. Read what others are saying, respond to the questions, and suggest future topics. ESRI will regularly add new topics to the Web site and make previous topics available for you to read. Pull up a chair to Spatial Roundtable at **www.spatialroundtable.com**.

"Crossing Borders"

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

Jane Goodall to Receive Atlas Award at AAG Meeting

I am pleased to announce that Dr. Jane Goodall, DBE, has been named the first recipient of the AAG's prestigious Atlas Award. Goodall will receive the award in person and will deliver a presentation for the media and to the expected 7,000 attendees of the AAG Annual Meeting on April 16, 2010, in Washington, D.C.

The Atlas Award of the AAG is designed to recognize and celebrate the outstanding accomplishments that advance world understanding in exceptional ways. The image of Atlas bearing the weight of the world on his shoulders is a powerful metaphor for this award program, as our nominees are those who have taken the weight of the world on their shoulders and moved it forward, whether in science, politics, scholarship, the arts, or in world affairs. In addition to a substantial cash prize, an Atlas statuette is presented to awardees, which serves as a compelling keepsake for them and an inspiring symbol for the award program itself. The Atlas statue also conveys the international nature of this award clearly and graphically.

Goodall truly embodies the ideals and goals of the AAG Atlas Award, and we are delighted that she will inaugurate this new award from the Association of American Geographers. Goodall began her landmark research on chimpanzees at Gombe Stream in Tanzania in 1960, under the mentorship of anthropologist and paleontologist Dr. Louis Leakey. Her work at Gombe Stream became the foundation for most subsequent primate research and led to redefined concepts about the relationship between humans and animals.

Goodall received her Ph.D. from Cambridge University in 1965 and became the scientific director of the Gombe Stream Research Center in 1967. In 1977, she established the Jane Goodall Institute (JGI), which continues the Gombe research and is a global leader in the effort to protect chimpanzees and their habitats. JGI is widely recognized for establishing innovative, community-centered conservation and development programs in Africa and the Roots & Shoots global environmental and humanitarian youth program, which has almost 100,000 members in nearly 100 countries.

Goodall's many honors include the Medal of Tanzania, Japan's Kyoto Prize, Spain's Prince of Asturias Award for Technical and Scientific Research, the Benjamin Franklin Medal in Life Science, and the Gandhi/King Award for Nonviolence. In April 2002, Secretary-General Kofi Annan appointed Goodall to serve as a United Nations Messenger of Peace, and she was reappointed in June 2007 by Secretary-General Ban Ki-moon. In 2006, Goodall received the French Legion of Honor, as well as the UNESCO Gold Medal.

Goodall's many publications include two overviews of her work at Gombe—*In the Shadow of Man* and *Through a Window*—as well as the best-selling autobiography *Reason for Hope.* Her book *The Chimpanzees of Gombe: Patterns of Behavior* is recognized as the definitive work on chimpanzees. She has been the subject of numerous television documentaries and films, including, recently, *Almost Human.*

Goodall's receipt of the AAG Atlas Award in 2010 will also coincide with the 50th anniversary of her initial work in Africa at Gombe Stream, where she carried out her seminal research with chimpanzee communities. The Jane Goodall Institute today continues to support the research station there and works to protect and sustain the Greater Gombe Ecosystem (GGE), which is considered a natural treasure. Its chimpanzees are subjects of global importance and national pride. Within GGE is Lake Tanganyika, which boasts nearly 300 unique fish species. However, many plant and animal species within the ecosystem are increasingly endangered.

The unique Greater Gombe Ecosystem also has Tanzania's highest human population growth rate. As people utilize more of the forest resources, damage to watersheds and widespread erosion have occurred. Fuel wood for cooking has become scarce, forcing women to walk miles daily to reach ever-diminishing woodlands. GGE's five chimp populations also have suffered as they become increasingly isolated from each other inside fragmented habitats.

The Jane Goodall Institute has initiated 18 "holistic" strategies designed to restore and improve the ecosystem for the benefit of chimpanzees, as well as the surrounding human communities. Many of these strategies depend on GIS, high-resolution imagery, and geographic analysis to monitor ongoing habitat fragmentation and to help develop holistic approaches to meet the needs of both the humans and chimpanzees who rely on the ecosystem for their subsistence. As a result of recent meetings, both the AAG and ESRI have begun working together with the Jane Goodall Institute on these efforts, which offers an intriguing ongoing dimension to the AAG's Atlas Award program, as well as continuation of ESRI's long and significant support.

The creation of the new AAG Atlas Award was made possible by generous contributions from many people, including significant founding gifts by geographers Harm de Blij and Tom Baerwald, both of whom provided not only substantial donations toward the funding of the award but also thoughtful insight regarding the launch of the new award. Of course, an endeavor of this magnitude can only be successful with the support of the larger GIS community. To that end, the AAG welcomes matching donations that will help increase and sustain both the award funding and its international visibility. For more information on the Atlas Award or the Jane Goodall Institute and how you can help, please visit **www.aag.org** or **www.janegoodall.org**.

I also would like to invite you to join Goodall and the AAG in Washington, D.C., on April 16, 2010, to celebrate her extraordinary accomplishment of the past half century and to discuss with her and with GIS experts and geographers from around the world our plans for a sustainable future for our planet.

Doug Richardson, drichardson@aag.org

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

Mecklenburg County, North Carolina, GIS

The Integrated Land Office

By Todd Wilson, GIS Technology Solutions Manager, Mecklenburg County, North Carolina

In Mecklenburg County, North Carolina, GIS stands for Geospatial Information Services, with an emphasis on *services*. Mecklenburg County GIS has long provided its citizens and business consumers with a rich amount of land development datasets and property record information in the form of electronic maps and reports via the Internet to meet their various business needs.

Comprising most of the area and population of Mecklenburg County, the county seat of Charlotte is the second largest banking center in the United States. The county and its "Queen City," as Charlotte is called, collaborate to provide police, fire, emergency medical, and utilities services to residents as well.

Electronic tax maps, owner information, and tax values, along with real property sales analysis tools, fuel the intelligent decision making that supports Mecklenburg County's impressive growth. As Mecklenburg County's footprint increases with respect to land, residential, and commercial development, so does the workload of the Mecklenburg County GIS Land Records Office. Mecklenburg County's population grew by 19 percent from 2000 to 2006, per U.S. Census Bureau figures. According to Garrett Alexander, the county's director of property assessment, "We're about 350,000 parcels large, handling about 40,000 sales annually, as well as handling probably 50,000 or so building permits. Not all are direct new construction. If you build a 40-story high-rise, it generates a lot of permits."

To address the demanding requirements of land records and addressing management, Mecklenburg County GIS continues to leverage and expand on its ESRI technology, including ArcGIS Desktop, ArcGIS Server, ArcIMS, and the geodatabase. Because roughly 80 percent of the services that Mecklenburg County provides touch on a geographic location, this technology forms the integration backbone for enterprise-wide information sharing.

GIS Consolidation Creates Improved Efficiencies

Back in 2005, the county's GIS program was reviewed by an executive task force made up of selected executive county management and various county department directors and managers. At that time, GIS services were decentralized, performed within two different county departments (Information Services & Technology and the Land Use and Environmental Services Agency—Property Assessment and Land Records Management), and located in three separate work areas and buildings. After a program review, a recommendation was made from the county executive task force and given to the county's senior management team to centralize GIS services and position them within a self-directed service group to better serve all county departments, as well as the citizens of Mecklenburg County. The recommendation was approved.

It was this consolidation that improved GIS business efficiencies. It also brought together two disparate but complementary GIS workgroups (property mapping and address management), once located in two separate buildings, under one roof and in one work area. Later, the GIS Technology Solutions Group (formerly under the Information Services & Technology Department) was relocated into the same work area with the rest of the GIS Service Group. Today, GIS database management, property mapping, address management, and GIS application development and support are centralized in a way that provides a better service-oriented GIS program.

New GIS Technology, New Processes

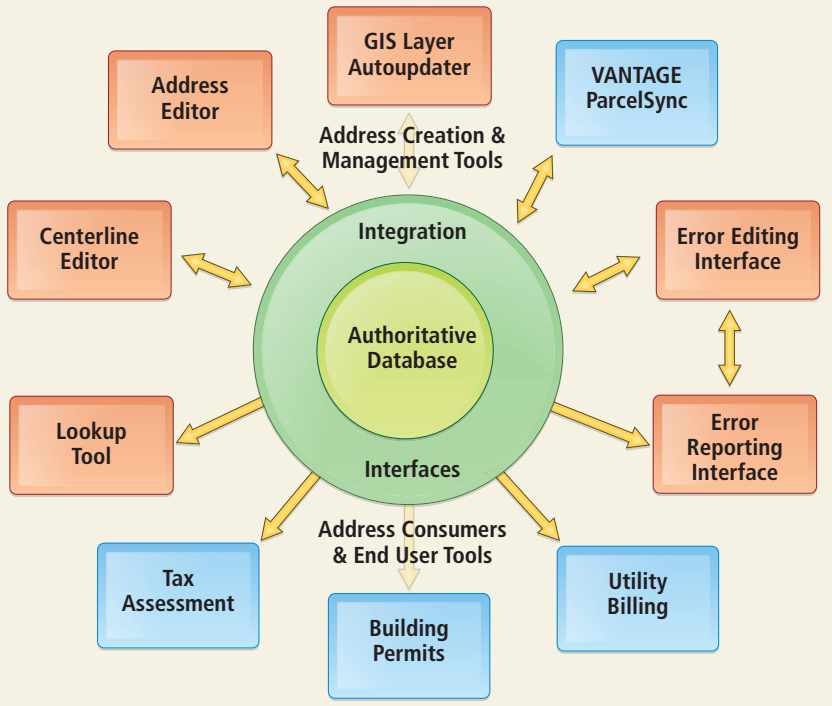
As new GIS technologies have become more readily available, they have been aggressively looked at by the GIS Service Group. The GIS Service Group's land records team generates much of the core data that powers the group's system. Everything else—data distribution, custom mapping, application development—pulls from the team's data. Upstream from the GIS Land Records Office is the Register of Deeds Office; downstream is the Tax Assessor's Office. GIS Land Records uses two software tools that significantly streamline the flow of information—ParcelSync and AddressOne from Farragut Systems, an ESRI Business Partner in Lafayette, Colorado.

ParcelSync, Mecklenburg County's new parcel editing system, allows an editor to simultaneously edit both GIS parcels and computer-aided mass appraisal (CAMA) data and to update the two databases in tandem. In addition to integration with CAMA systems, it may be integrated with records management systems to provide property mapping staff with access to source documents and to leverage document metadata to populate CAMA system attributes. Mecklenburg County is also integrating its parcel editing system that manages land records within the county's Register of Deeds Office.

As stated by Kurt Olmsted, the county's GIS director, "Data that comes from the Register of Deeds system will be inherited directly into the Attributor form and pushed on to the CAMA system, so we don't have to rekey the data."

The new addressing management tools of AddressOne meld mapping technology and database technology in a single application, allowing users to track and manage addresses enterprise-wide. It provides an ArcGIS Desktop extension that allows the creation and management of the relationship of addresses to geography.

The Land Records and Addressing division of the GIS group previously existed as two separate departments that handled addressing, centerline maintenance, and parcel mapping. When asked whether it was worthwhile to bring the groups together, GIS Land Records manager Rhonda Buckner says, "It was a challenge. There was a lot of redundancy in data maintenance. And there still is. That's what this technology is helping us with. But having all the functions together in the same group means



ArcGIS editor tools for addressing and centerline management are shown in red boxes. End-user consumer systems of the addressing database are shown in blue boxes.

there's a lot more synchronization. We're able to get all the pieces of the data done in a timelier, more efficient manner, because we're just sitting across the way from someone who's maintaining another piece of the puzzle. If there are questions—if something doesn't look right or isn't matching up—it's as simple as getting up and walking 10 feet to the neighbor's cubicle and saying, 'Look at this with me,' and getting it fixed right." This streamlining disperses the data to the appropriate points in various systems. This eliminates redundant data entry and increases the accuracy and consistency of address data enterprise-wide.

The county's addressing staff is now able to effectively create new and maintain street centerline line segments, including address ranges and address points, within one ArcGIS Desktop editing interface. An addressing database browser is also available to consumers. Built on top of ArcIMS, this interface gives addressing staff and exclusive external consumers the means to query, attach mailing addresses to physical addresses, and validate physical addresses stored within the addressing database.

Enterprise Addressing Technology Framework and Data Model

Mecklenburg County's GIS Land Records has for a long time maintained an enterprise master address database used by many county and city consumers through different external systems ranging from permitting systems and customer service systems to utility billing systems. Any system referencing an address back to a particular service is an ideal candidate for use of a master address database.

Mecklenburg County's investment in enterprise addressing takes address management to another level by providing extended addressing services and enhanced information to its consumers. A new Addressing Authoritative Database is the core piece of the framework. The Addressing Data Model comprises physical addresses within Mecklenburg County. The data model also provides mailing addresses (in state and out of state) to be linked to physical addresses. Addressing data is stored in both United States Postal Service (USPS)-accepted formats and municipality-specific formats to retain existing legacy system addressing support at the local city/county jurisdiction levels.

The system also provides a common set of Web service interfaces that can be utilized by any application or system requiring real-time access to an enterprise addressing database to draw from for external data population and validation. As an additional plug-in, real-time Coding Accuracy Support System (CASS) certification Web services with USPS current addresses are also available and can be used to validate against both physical and mailing addresses entered into the Addressing Authoritative Database. Address management and consumer tools comprise the outermost perimeter of the Addressing Authoritative Database, providing interactive tools for both editors and consumers of the database.

About the Author

Todd Wilson, GISP, has 12 years of GIS software experience in application development and database management and 5 years of managing a GIS Application Development Group. He has presented at both local and national conferences, such as national URISA and the ESRI International User Conference.

More Information

For more information, contact Rhonda Buckner, GIS Land Records and Addressing Office manager (e-mail: Rhonda.Buckner@MecklenburgCountync.gov), or Todd Wilson, GIS Technology Solutions manager (e-mail: Todd.Wilson@MecklenburgCountync.gov). For information about ParcelSync and AddressOne from Farragut Systems, visit **www.farragut.com**.

ESRI Business Partner Offerings for State and Local Government

ESRI maintains relationships with more than 2,000 business partners that provide focused solutions and assistance to our customers. These partners include value-added resellers, developers, consultants, data providers, hardware providers, and instructors that have extensive experience providing GIS support across several industries. Our partners offer solutions and services that range from custom ArcGIS applications to complete system implementations. For a complete list and description of our partners and their offerings, visit the ESRI Web site at **www.esri.com/partners**.

The Sidwell Company
www.SidwellCo.com
Parcel Builder 3.4
Parcel Builder increases the efficiency of creating and maintaining cadastral maps within a geodatabase and includes modules for managing parcel numbers and addresses, tracking parcel genealogy, and integrating with tax and computer-assisted mass appraisal applications. Parcel Builder adds more than 40 editing tools to the ArcMap interface and includes a robust workflow manager and tax map printing application. These tools can be used with your geodatabase data model or with Sidwell Company's tagged cadastral data model.

EnerGov Solutions LLC
www.energov.com
EnerGov Land Management Suite
EnerGov Land Management Suite is an enterprise land management and permitting package for managing regulatory workflows and land-use management requirements specific to government agencies. Users can consume data from ArcGIS Server directly within the Land Management Suite, allowing them to leverage their GIS business process rules during the permitting and licensing process. This real-time integration allows users to improve cross-departmental efficiency and accuracy while reducing turnaround time for regulatory approvals.

New ESRI Press Book

Strategies Offered for Landownership and Sustainable Development

Peruvian economist Hernando de Soto stated in his Keynote Address at the 2009 ESRI International User Conference that 4.5 billion people do not have recorded property rights, and as a consequence, they cannot get credit, they can't build capital, and they aren't able to participate in a market economy. Land administration systems (LAS) are designed to address this issue by providing a basic infrastructure for implementing land-related policies and land management strategies.

Land Administration for Sustainable Development, by Ian Williamson, Stig Enemark, Jude Wallace, and Abbas Rajabifard, a new book by ESRI Press, offers practical information about how to design, build, and manage LAS in support of better land management and sustainable development. This book also describes emerging tools for LAS design and provides a toolbox of best practices tailored for specific country needs.

Senior government officials and academics, as well as land administrators and others working in land-related professional fields, will find *Land Administration for Sustainable Development* useful to study and address problems of economic development, environmental and resource management, poverty alleviation, social equity, and indigenous rights management. The concepts outlined in this book will also help decision makers in making LAS choices and improvements.

Says de Soto, "If you don't have the deed, then you don't have the record . . . That's what you call dead capital. The solution to poverty to a great extent is in making this dead capital live capital." Formal land administration is fundamental to creating live capital. When communities are empowered with the knowledge and the tools to develop effective landownership policies, their residents can get credit, build capital, and truly engage in a market economy.

More Information
Land Administration for Sustainable Development, ISBN: 9781589480414, 540 pp., $49.95. To learn more about this book or to place an order, visit **www.esri.com/esripress**.

OGC Recognizes ESRI's Commitment to Standards and Interoperability

The power of the Web to reach anywhere in the world for content rests on standard protocols that enable diverse computer technologies to form a single community. Because of this, ESRI has a long-standing commitment to standards and interoperability in the geospatial realm. ESRI has maintained a leadership role as a member of the Open Geospatial Consortium, Inc. (OGC), Board of Directors and the Planning and Technical committees and has been a participant in numerous test processes, pilot projects, and specification products published by OGC.

ESRI's commitment to standards and interoperability was recognized at the June meeting of OGC in Cambridge, Massachusetts. There, David Danko, ESRI's manager of GIS standards, received OGC's 11th annual Kenneth D. Gardels Award. The Gardels Award is given to individuals who have advanced OGC's vision of complete integration of geospatial information and services into the world's information systems.

Danko helped draft the OGC abstract specification for metadata that played a key role in developing and maintaining a working relationship between OGC and the International Organization for Standardization (ISO)/TC 211. Since 1996, he has made important contributions in numerous other key technical committee activities, including the Documentation Subcommittee; the OGC Review Board; and the Mass Market, Defense and Intelligence, and Catalog working groups.

More Information

For more information on standards and interoperability, visit **www.opengeospatial.org**.

Free ESRI Publications

ESRI provides numerous periodicals, which can be subscribed to free of charge by simply going to **www.esri.com/subscribe** on the Web. Here are some examples.

Energy Currents

Energy Currents is a quarterly printed newsletter focusing on GIS in the gas and electric community. It offers practical and technical advice for those interested in energy and ESRI.

HealthyGIS

HealthyGIS is a newsletter printed quarterly for the health and human services GIS user. The publication features articles describing the function of GIS in public health, workforce development, and health education. Those interested will find techniques for implementing ESRI software into their health care work environment.

ArcWatch

ArcWatch is an e-newsletter published monthly for anyone interested in what's new with ESRI, its software, and GIS mapping solutions.

Government Matters

Government Matters is a quarterly printed newsletter for those interested in state and local government and its relationship with GIS. It addresses possibilities for more efficient community management using GIS.

Webinars, Workshops, and Publications

URISA Has Educational Resources for GIS Professionals

In addition to URISA's many conferences throughout the year, the association also offers a number of other resources to support its members and the GIS community.

URISA offers a webinar at least once per month with topics ranging from Addressing Standards to Public Participation GIS to Measuring the Benefits of GIS.

Many organizations have discovered that it is more economical to bring URISA Certified Workshops to their staff than sending their staff to conferences where the workshops are being presented. For the price of two conference registration fees, an organization can license a URISA workshop taught by a certified instructor. Entire departments can take advantage of URISA's peer-reviewed, full-day courses without spending valuable time away from the office.

There is still time to register for URISA's Leadership Academy (ULA) being presented in Seattle, Washington, December 7–11, 2009. ULA is five days of targeted GIS leadership training, taught by GIS leaders. There have been nearly 140 graduates of the program so far. Plan to add your name to the list this December!

The GIS Management Handbook

Another valuable resource that is proving to be popular among GIS professionals is *The GIS Management Handbook,* offered in association with Kessey Dewitt Publications. The handbook covers the concepts, practices, and tools for planning, implementing, and managing geographic information system projects and programs. It is a comprehensive guide and reference for new and seasoned GIS managers, GIS staff, IT management, researchers, students, and companies providing products and services to the GIS community. The handbook was authored by Peter Croswell, an internationally recognized GIS practitioner, manager, and consultant. Reviews include the following:

- "*The GIS Management Handbook* is the first book I have read that comprehensively covers all the tools GIS managers need to have in their toolbox. Beginners and seasoned GIS managers alike can learn something from this book."—Stuart Davis, assistant chief operating officer for the State of Ohio Office of Information Technology and past president of the National States Geographic Information Council

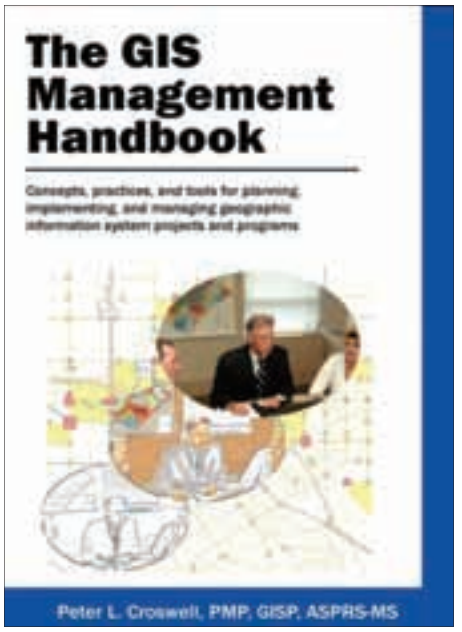
- "This book fills a void and is long overdue."—Jury Konga, manager of GIS Services, Town of Richmond Hill, Ontario, Canada

To Order

To order online and access details about book content, visit **www.urisa.org/gisbookorder**. $110, 330 pp. (ISBN13: 978-0-9824093-0-5)

More Information

For more information about all URISA resources, visit **www.urisa.org**.



CALL FOR PAPERS

The Association of American Geographers invites you to present your research and share your knowledge in Washington, DC, during the next annual meeting April 14-18, 2010.

Register for the meeting and submit your abstract at www.aag.org

Another outstanding program is already being planned to include the latest in GIS, mapping, geomatics, and remote sensing, along with many field trips, workshops, and opportunities for social interaction with colleagues and friends from around the world.

Conference Highlights

- Presentations by leading scholars and researchers from more than 60 countries
- An international networking reception
- Exhibitions showcasing recent scholarly publications, advanced geographic technologies, and expanding employment opportunities
- Numerous field trips to explore the rich cultural and physical geography of Washington and the surrounding region

We look forward to seeing you in Washington!

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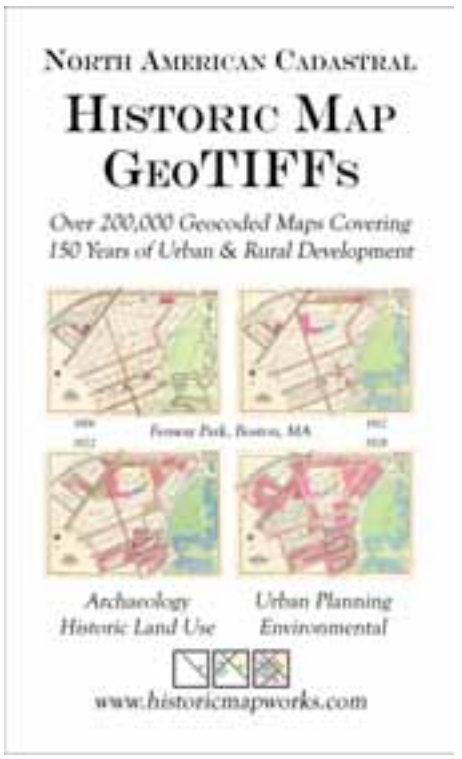
Capitol Dome (Jake McGuire), Chinatown/Metro (Destination DC), Capitol Hill Rowhouses (Destination DC).



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Many of the user success stories in *ArcNews* are written by our Users and Business Partners. We look forward to receiving yours.

If you would like your article to be considered for publication, please follow the article submission guidelines at

www.esri.com/news/arcnews/submission.html

Celebrate GIS Day November 18, 2009

GIS Day is just a few weeks away, but there's still time to join this worldwide activity. Thousands of events will take place November 18 as GIS professionals, educators, and students share their knowledge to inform others about the many benefits of GIS and how it is used in our everyday lives.

GIS Day events are held in just about every corner of the world, but another unique factor is the variety of events that are held. No event is too big or too small. To give you a little inspiration for planning your own event, here are two GIS Day celebrations that have already taken place.

North Central Texas GIS Day—Collaboration Key to Successful Large-Scale Event

As the saying goes, there is strength in numbers. Four organizations pooled their resources to hold a GIS Day event that reached more than 1,000 participants of all ages. Hosted by the Geospatial Information & Technology Association, North Central Texas Council of Governments, South Central Arc User Group, and University of North Texas, the purpose of the event was to render a greater awareness of what GIS means to local citizens, municipal leaders, and business and academic communities. A variety of activities helped inspire participation, including a GIS job fair, a Geography Wheel of Knowledge game, and a student poster competition. In addition, several Dallas-Fort Worth metroplex GIS firms demonstrated their use of GIS, and a map gallery showcased more than 50 maps from local users. "The event clearly demonstrated how multiple and diverse agencies can host a successful GIS Day for a group of participants with different interests," states Robert Wachal, GIS administrator for the City of Highland Village.

National College Iulia Hasdeu students, left to right: Ana Angel, Adrian Danciu, Stefan Stoiciu, Adrian Marton, Elena Mocean, Edward Comanici, Nicoleta Chiorean, Carmen Almasan, Florenta Bratu, Emilia Ion.

National College Iulia Hasdeu, Bucharest, Romania—Showing That Geography Matters to Society

Under the guidance of Professor Elena Mocean and aided by ArcGIS Desktop, a group of K–12 students was introduced to the many ways that GIS technology is used to analyze conditions and improve society. The GIS Day activities focused on three issues impacted by a growing population: wind power, potential earthquake damage, and traffic congestion.

One student wanted to answer a simple question: What is the wind power potential in Romania? The students used a published map that illustrated the number of hours per year in which wind speeds were above 4 meters per second (the minimum usable speed value). They then digitized the map and combined it with a map of restricted areas (buffers of different values for cities, airports, inhabited areas, national roads, railroads, electric grids, and flooded areas). Using these datasets, it was easy for students to calculate available wind power.

Another student wanted to analyze the impact a major earthquake would have on Bucharest. Using a dataset of earthquakes that took place in 2000 and data provided by the National Institute of Research and Development for Earth Physics in Bucharest, the students identified the cities that could be damaged by an earthquake. Another student studied the impact on buildings in Bucharest if an earthquake of magnitude 6 or higher on the Richter scale were to occur. They found that 122 buildings housing more than 2,000 residents would have a significant chance of structural failure. Mocean took the students' findings a step further and used GIS to make an interactive map of all the seismically challenged buildings and the shortest route to the closest hospital or school that could be used as temporary housing for the survivors.

Traffic congestion is a major issue in Bucharest, the capital and largest city of Romania. Using some of the ArcGIS Desktop applications, students created routes designed to go around the city's most crowded areas. The map was digitized and the street network created, streets were adequately marked, then the route was created using the ArcGIS Network Analyst toolset.

Resources Abound

Need more inspiration and ideas? Visit **www.gisday.com** to read other success stories, download activities and free materials, register your event, or ask us a question. No matter what the scale of your GIS Day event, it is just as important as any other and will make an impact.

Join the GIS Day Discussion

There are several ways to connect with others who are hosting GIS Day events this 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**).

New Training Offerings from ESRI

Cost-Effective Training Options for Organizations with Limited Travel Budgets

Staying close to home but still need to learn how to use ESRI software more effectively? Consider these training options to keep your GIS skills up-to-date:

- Instructor-Led Client-Site Training and Client Coaching
- Instructor-Led Remote Classroom Training
- Instructor-Led Virtual Classroom Training
- Virtual Campus Web-Based Training and Free Web Training Seminars
- Instructional Series Podcasts
- ESRI Press Books

Learn more about these options at **www.esri.com/taketraining**.

ArcGIS Data Interoperability

The courses below introduce the ArcGIS Data Interoperability extension, which helps GIS and CAD professionals efficiently access, use, and share spatial datasets, regardless of format, structure, data model, and complexity.

ArcGIS Data Interoperability Basics—Learn the fundamental concepts of data interoperability and the ArcGIS Data Interoperability extension. *Virtual Campus Web Course (Free)*

Introduction to ArcGIS Data Interoperability Spatial ETL Tools—Receive an introduction to the spatial extraction, transformation, and loading (ETL) tools for data translation and schema mapping. *Virtual Campus Web Course*

Data Transformation with ArcGIS Data Interoperability Spatial ETL Tools—Review the spatial ETL tools and discover how to use transformers inside these tools. *Virtual Campus Web Course*

Advanced Format Translations with ArcGIS Data Interoperability Spatial ETL Tools—Find out how to choose settings and parameters to control data translations. *Virtual Campus Web Course*

Multiple Dataset Translations Using ArcGIS Data Interoperability—Discover how to select multiple datasets and set up translations with multiple formats. *Virtual Campus Web Course*

Custom ArcGIS Data Interoperability Tools and Spatial ETL Best Practices—Explore best practices for spatial extraction, transformation, and loading, as well as how to create and use custom formats and transformers. *Virtual Campus Web Course*

Desktop GIS

Performing Analysis with ArcGIS Desktop—Learn a proven process for planning an analysis project and techniques for solving a variety of spatial problems. *Instructor-Led Course*

Creating and Publishing Maps with ArcGIS—Apply a standard cartographic process to ensure your maps are easy to interpret and properly designed for their audience and delivery medium. *Instructor-Led Course*

Server GIS

Authoring and Serving ArcGIS Mobile Projects—Learn a recommended workflow for successfully creating and deploying an out-of-the-box ArcGIS Mobile project. *Instructor-Led Course*

Building Web Maps Using the ArcGIS API for JavaScript—Find out how to create Web maps that are attractive, fast, and easy to use by their intended audience. *Instructor-Led Course*

Introduction to ESRI MapIt—Discover how to visualize and increase the value of your enterprise data for decision making and planning. *Virtual Campus Web Training Seminar (Free)*

Getting Started with Map Templates—Learn the process of working with map templates to help you make professional-quality maps for print, the Web, and mobile applications. *Virtual Campus Web Training Seminar (Free)*

Implementing ArcGIS Server Geoportal Extension—Learn how to use this solution (formerly GIS Portal Toolkit) to implement local, regional, national, and global spatial data infrastructure portals. *Instructor-Led Course Offered by ESRI Professional Services*

For More Information

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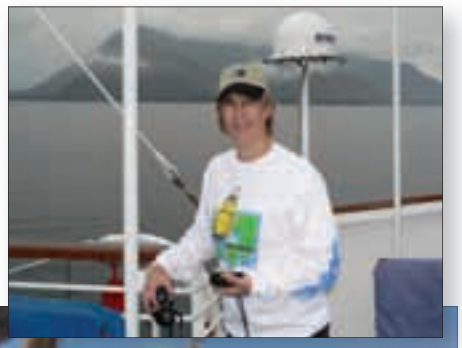
California and the Equator! Don't You Just Love ESRI T-Shirts?

Zahid S. Chaudhry of the West Virginia Department of Environmental Protection stopped at Joshua Tree National Park, California, during his trip to Palm Springs for the 2009 ESRI Developer Summit. He also visited the San Andreas Fault and wore his ESRI T-shirt!

Lynn Carlson, GISP, GIS manager at Brown University in Providence, Rhode Island, is wearing her Northeast Arc Users Group T-shirt while crossing the equator aboard the National Geographic *Polaris,* off the northwest coast of Isla Isabela, Galapagos, Ecuador.

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**.

Lynn Carlson



Zahid S. Chaudhry

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**.

U.S. DOT ARRA Dynamic Web Mapping Site
arra-gis.dot.gov
This site is designed to provide the general public and media with information pertaining to the obligation of U.S. Department of Transportation's (DOT) American Recovery and Reinvestment Act of 2009 (ARRA) funds.

St. George City Maps
maps.sgcity.org/sgcitymaps
The SGCityMaps application allows users to quickly access property locations, recreational features, public services, zoning, and other information of interest to learn more about the city of St. George, Utah, and what it has to offer.

Swain County Property Information
maps.roktech.net/swain
This application allows citizens of Swain County, North Carolina, to easily locate and get more information about their properties. It was built by ESRI Business Partner ROK Technologies with ArcGIS Server 9.3.1 and ColdFusion and utilizes optimized map services.

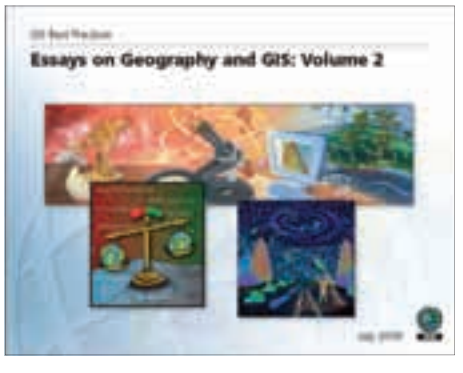
Auckland Region Viewer
maps.auckland.govt.nz/AucklandRegionViewer
This viewer delivers regional information about land values and rates, as well as live feeds, such as maritime events.

Free E-book Now Available

Essays by Well-Known Academics, Thought Leaders

Essays on Geography and GIS: Volume 2, is a new collection of essays written by many of the top academics in the fields of geography and GIS technology. Previously published individually in *ArcNews* magazine, these essays provide insight into the power of spatial thinking. *Essays on Geography and GIS:* Volume 2, is available for download at no cost. This volume is the follow-up to the popular *Essays on Geography and GIS,* which has been downloaded by more than 30,000 people since September 2008.

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. Visit the GIS Best Practices Web site at **www.esri.com/bestpractices** to explore the list of offerings and download your copy free of charge.



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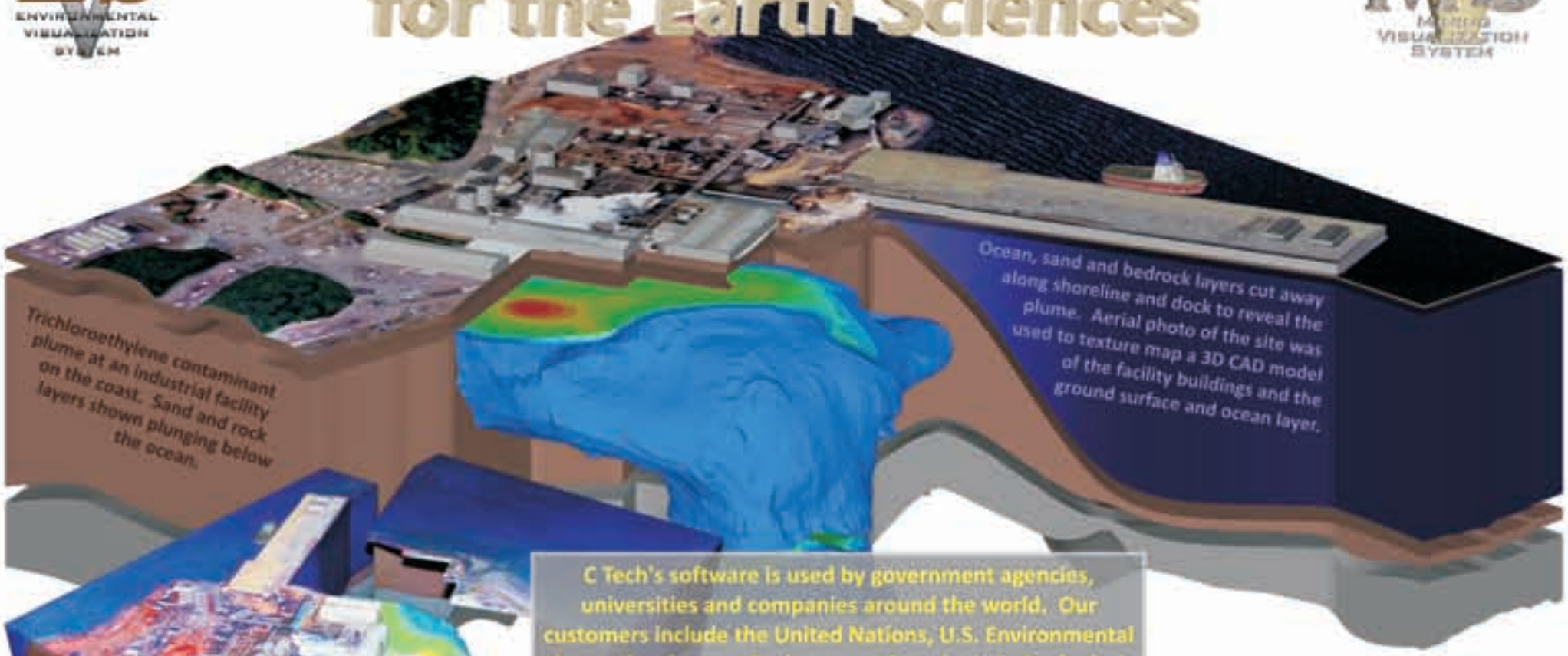

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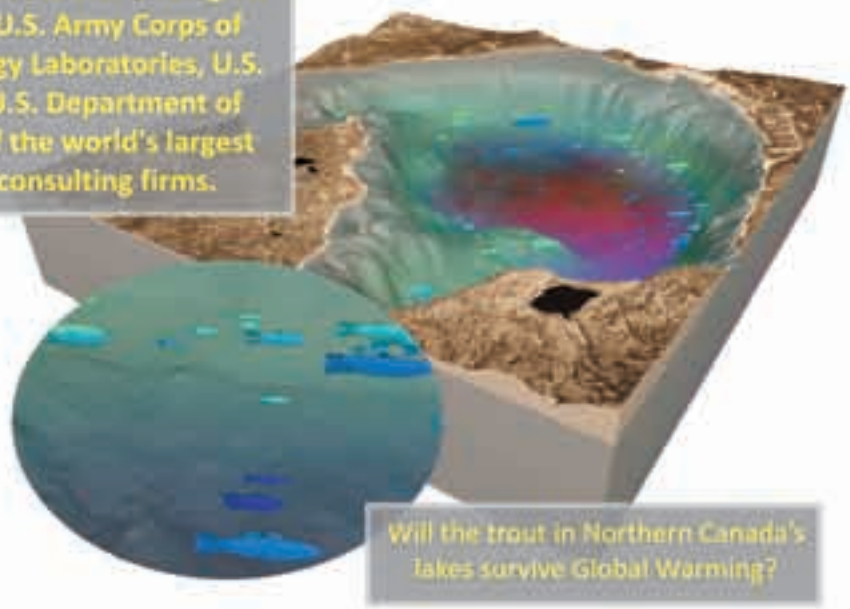
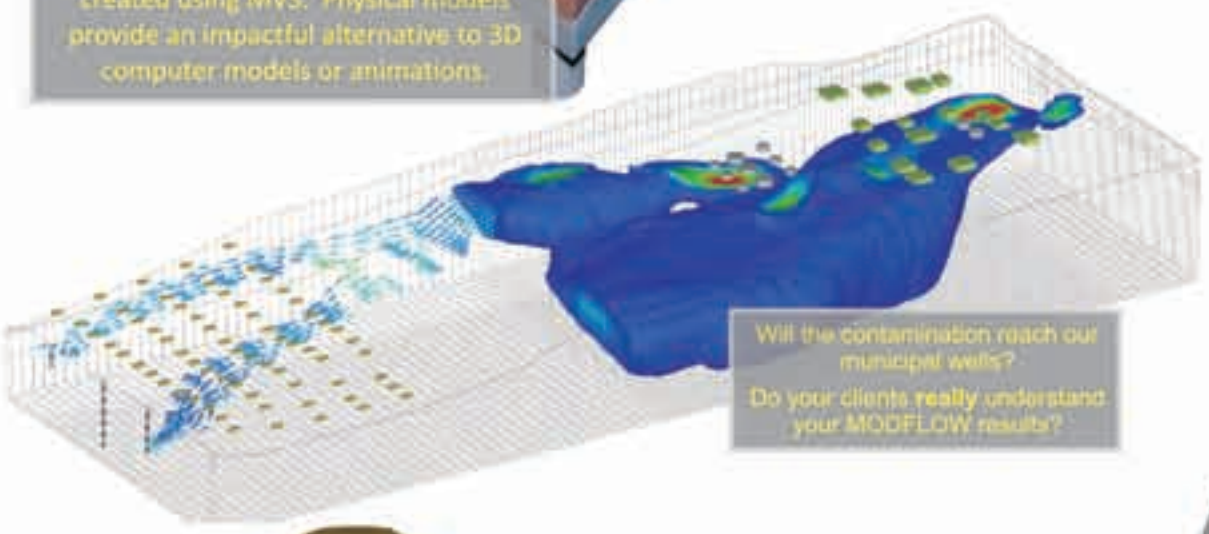
This photo shows a **physical** model created using MVS. Physical models provide an impactful alternative to 3D computer models or animations.

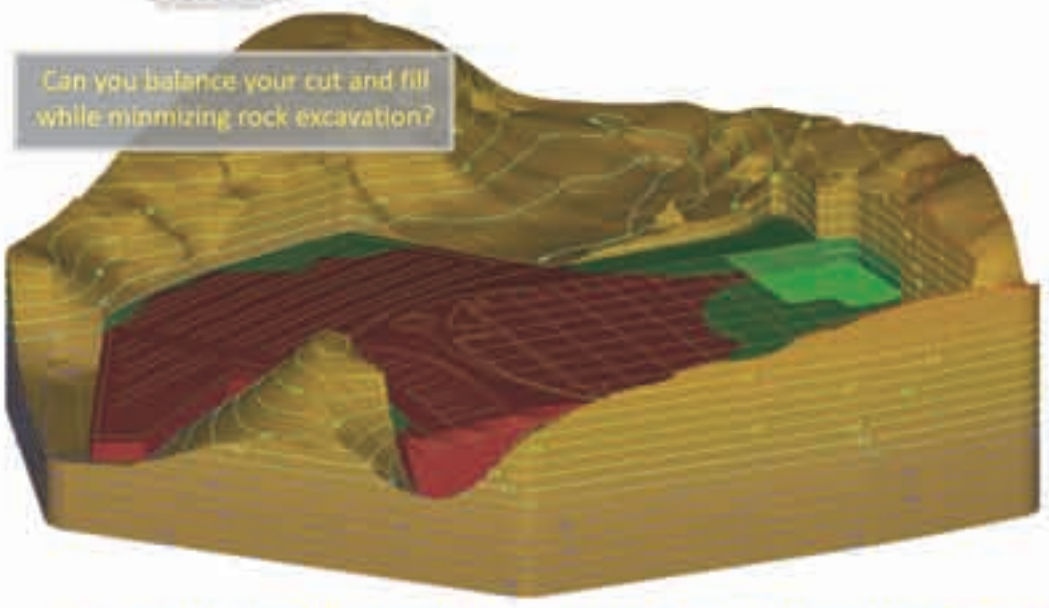


Will the trout in Northern Canada's lakes survive Global Warming?

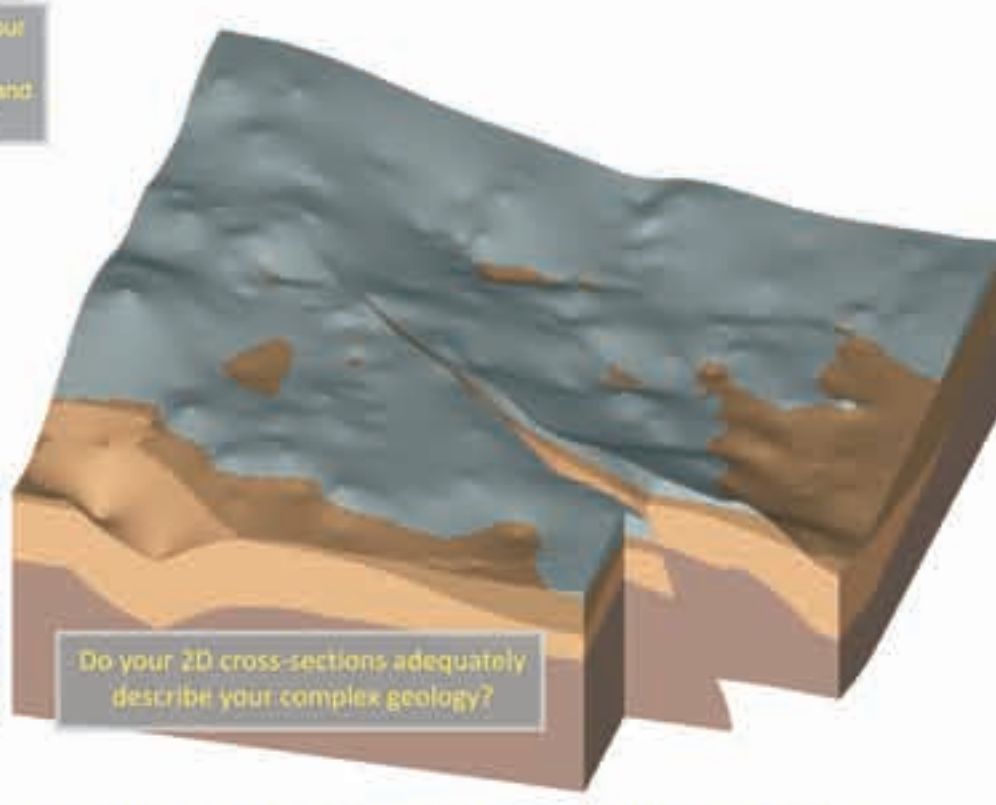


Will the contamination reach our municipal wells?

Do your clients **really** understand your MODFLOW results?



Can you balance your cut and fill while minimizing rock excavation?



Do your 2D cross-sections adequately describe your complex geology?

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