ARCNEWS

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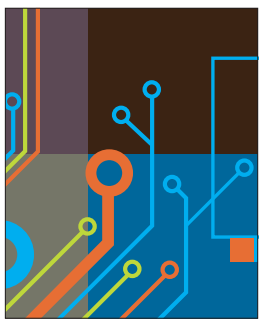
Process Models and Next-Generation Geographic Information Technology

By Paul M. Torrens



Much of the inner workings of geographic information systems is organized around data models: computational structures (rasters and vectors are common variants) that determine how GIS stores, organizes, and displays various types of information for different purposes. Put simply, data models treat the world in terms of objects that represent entities and their related attributes. In GIS, there is usually no dedicated model of the processes that govern dynamics, adaptation, and evolution of a system. For many years, GIS has advanced the potential for unifying representations of entities and processes, and recently, the long-standing promise of consociating the two is beginning to be realized, enabling a burgeoning paradigm shift to a new style of GIS.

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GIS: Designing Our Future

By Jack Dangermond

"Man may perish by his own explosive and insidious inventions. For an adjustment to them he leaves himself precious little time, and progressively less as his technological wizardry runs wild and rushes on. If he is to survive at all, it cannot be through slow adjustment. It will have to be through design more subtly considered and circumspect, through more cautious planning in advance."

With those words in 1954, influential architect Richard Neutra opened his seminal book *Survival through Design*. Neutra was an early environmentalist, taking an approach to architectural design that applied elements of biological and behavioral science—what he called biorealism, or the "inherent

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Deploy Fast, Modern Web Maps

ArcGIS 9.3.1 Unlocks the Potential of GIS

ArcGIS 9.3.1 helps users deploy modern Web maps that are relevant to their entire organization. ArcGIS 9.3.1, which began shipping in April 2009, focuses on improving the performance of dynamic map publishing and increasing the sharing of geographic information.

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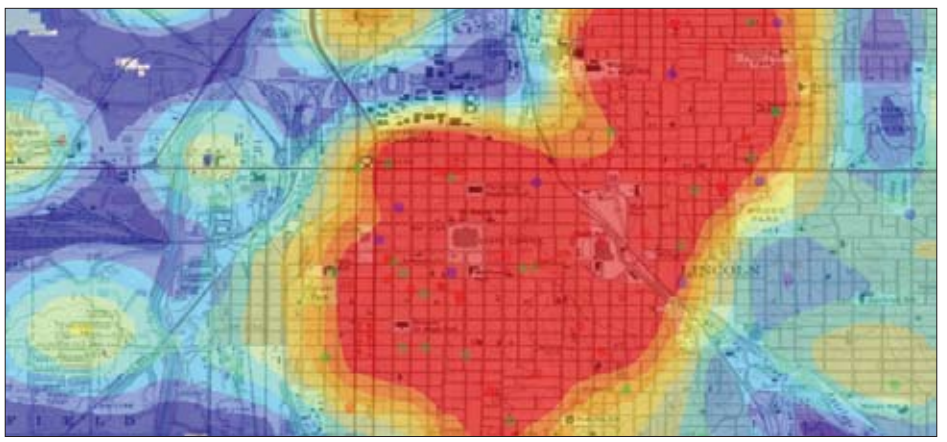

Seamless data integration using Web maps promotes quicker understanding of complex issues, such as in this blending of a cumulative crime density analysis with a basemap service from ArcGIS Online.

Updated Operations Center Helps U.S. DOI See Bigger Picture

Created in 1849, the United States Department of the Interior (DOI) has a different role from that of the interior ministries of other nations, which are usually responsible for functions that, in the United States, are performed by the Department of Homeland Security. Known as "the department of everything else" in its early history because it was tasked with an assortment of unrelated functions, DOI has evolved to become one of the country's principal public conservation agencies responsible for protecting the United States' natural and cultural resources and acting as steward of its trust responsibilities

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Revealing New Trends

ESRI's Updated Demographics

This July 2009 map of unemployment rates illustrates the expected effect of the recession on county-level unemployment rates. The ESRI data team tracks current conditions and models the data to reflect local change. This data is one variable in the annual demographic updates released in April for 2009. Complementing this map are ESRI's labor force forecasts, which accurately model change in labor force participation and employment by industry and occupation to the block group level. *(See "Trends from ESRI's 2009/2014 Updated Demographics" on page 11 and visit* **www.esri.com/demographicdata** *for more information on the data available as well as ESRI's 2009 Update Methodology.)*

Indian Government Selects ESRI's Image Processing Platform

After an extensive competitive analysis, the Indian Space Research Organisation (ISRO) selected ESRI's Image Management software platform to equip its five Regional Remote Sensing Service Centres (RRSSCs) with ArcGIS Server and its

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Oregon Moves Ahead with Enterprise Technology

The State of Oregon recently became the sixth state in the United States to secure an enterprise license agreement (ELA) with ESRI. The agreement provides unlimited access to ESRI ArcGIS software statewide, cuts procurement

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Special in This Issue

ArcGIS 9.3.1 Unlocks the Potential of GIS

Continued from cover

Highlights

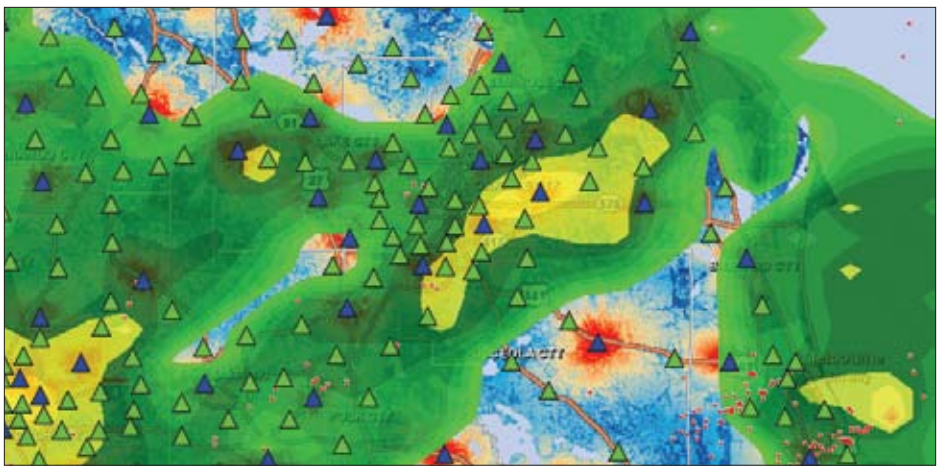
- New optimized map service makes Web mapping significantly faster.
- ArcGIS 9.3.1 includes new tools for tuning map documents.
- ArcGIS Online makes it easier to find and share geographic content.

High-Performance Dynamic Map Publishing

ArcGIS 9.3.1 includes an optimized map service that allows users to produce high-performance dynamic maps. Users will notice improved map quality in optimized map services, including sharper edges to features, clearer labels, and better color transparency.

ArcGIS Desktop users can fine-tune their maps for faster performance using the new Map Service Publishing toolbar. The toolbar allows the map to be analyzed and makes recommendations for tuning. Users can then preview the results and see estimated draw times. They can also directly publish the map from the ArcGIS Desktop ArcMap application to ArcGIS Server.

Optimized map services also improve map caching performance, as faster rendering speeds reduce the time it takes to create map caches for basemaps. Map quality is noticeably improved, and storage is more efficient.



New optimized map service produces maps of superior quality.

These new map services outperform equivalent ArcIMS services and provide significantly better-looking maps, benefiting those who use dynamic Web mapping or combine dynamic and cached maps on the Web.

Better Sharing of Geographic Information

At the 9.3.1 release, ArcGIS Online includes new functionality to allow users to easily share geographic content, such as maps, data, and layers.

With the new ArcGIS Online application, users can type in keywords to search and find content; preview it; and, with a simple click, add it to ArcMap, for example.

To facilitate the sharing of layers in ArcGIS Online, at the 9.3.1 release ArcGIS Desktop users can create layer packages that encapsulate ArcMap cartography and data, including a thumbnail, the extent, and spatial reference, in an easy-to-share package. Layer packages can also be shared via e-mail or DVD or placed on network drives.

Seamless Integration with Microsoft Virtual Earth

ArcGIS Desktop (ArcInfo, ArcEditor, and ArcView), ArcGIS Server, and ArcGIS Explorer users will be able to directly connect to Microsoft Virtual Earth services and quickly start their GIS projects with ready-to-use content.

ArcGIS Desktop users who are current on maintenance have access to a free, limited annual transaction allotment of Virtual Earth services that includes aerial imagery, roads, and hybrid (aerial with labels) imagery. An annual subscription with unlimited transactions is available for purchase as well. ArcGIS Server users have a built-in 90-day free evaluation, after which they can purchase blocks of transactions. ArcGIS Explorer users can access Virtual Earth services and share transactions as part of an existing ArcGIS Desktop license. ArcGIS Explorer users who don't have an existing ArcGIS Desktop license can evaluate Virtual Earth at no cost for 90 days, then purchase an annual unlimited use subscription.

With a familiar look, Virtual Earth imagery appears as just another data layer in GIS. The imagery provides excellent background maps on which users can overlay their operational data. Without needing to spend time creating background maps, users can focus more on their business data.

Developers building Web applications have access to a complete GIS platform that supports geospatial services through ArcGIS Server and ArcGIS Web Mapping APIs, including JavaScript, Flex, and Microsoft Silverlight. This means that clients can access Microsoft Virtual Earth content from any ArcGIS Web application.

ArcGIS API for Microsoft Silverlight

End users of Web maps now have a more intuitive, fast, and modern experience via the ArcGIS APIs. These APIs can be used to build rich user experiences on top of ArcGIS Server services. They are lightweight for quick development and very fast and scalable.

In addition to the ArcGIS APIs for JavaScript and Flex that ESRI recently introduced, users can now leverage the new ArcGIS API for Microsoft Silverlight. This API allows developers to use any .NET Framework-supported language (e.g., C#, Visual Basic) to add GIS capabilities and consume services from ArcGIS Server and Microsoft Virtual Earth in a Silverlight application.

The API takes full advantage of the mapping, geocoding geometry, image, and geoprocessing capabilities of ArcGIS Server. End users can display their data in an interactive map, search for and display GIS data features and attributes, locate addresses, identify features, access raster imagery, and perform complex spatial analysis by simply clicking a button or feature on the map. To download the ArcGIS API for Microsoft Silverlight, visit www.esri.com/silverlight.

Enhanced Support for Java Developers

Java developers who want to extend the ArcGIS framework on the ArcGIS Desktop/ArcGIS Engine (Java SE) and ArcGIS Server (Java EE) platforms will be able to create custom geoprocessing tools, server object extensions (SOEs) for ArcGIS Server, class extensions for custom behavior, custom renderers for customized rendering of data, plug-in data sources, and custom layers.

Eclipse integrated development environment (IDE) support is also provided in the form of wizards to generate boilerplate code based on the developer's specification. This will facilitate quick and easy development of the extensions. ArcGIS 9.3.1 also includes an autodeploy feature that allows Java developers and their end users to automatically deploy their Java extensions.

Easy to Install

Users who have ArcGIS 9.3 installed are able to upgrade to ArcGIS 9.3.1 without having to uninstall ArcGIS 9.3. In addition, ArcGIS 9.3.1 is completely compatible with ArcGIS 9.3 for all aspects of ArcGIS, including geodatabases, maps, and APIs, so users will be able to easily migrate or work in mixed environments of ArcGIS 9.3 and ArcGIS 9.3.1 on different computers within the same organization.

Licensing Changes for ArcGIS Server

With the release of ArcGIS 9.3.1, there are some licensing changes to ArcGIS Server. ArcGIS Server Standard (Workgroup or Enterprise) users can use the editing capabilities of ArcGIS Server. Also, ArcGIS Server Advanced (Workgroup or Enterprise) includes the Spatial, 3D, Network, and Geostatistical extensions for no additional fee. Furthermore, ArcGIS Server Enterprise users can deploy the following components without incurring an additional deployment license fee: Web ADF—SDK or Runtime, Web Service Handlers, and Server Object Manager.

More Information

To learn more about ArcGIS 9.3.1, visit www.esri.com/whatsnew. AN

Please see the
Web Maps poster on pages 24–25.

Featured in This Issue

Regular Features and Departments

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Process Models and Next-Generation Geographic Information Technology

Continued from cover

The next generation of geographic information systems will be driven by process models. These are usually composed of algorithms and heuristics that will act on users' requests for the GIS to perform some service for them, connect to digital networks to contextualize those requests, and interact seamlessly with other databases and processes to achieve users' goals. Alternatively, process models may be used as a synthetic representation of system parts to build artificial phenomena "in silico" that can be subjected to experimentation and what-if scenario building in ways that are not possible "on the ground." Geoprocessing has been featured with increasing priority in GIS for some time, and conventional GIS already relies on geoprocessing for spatial analysis and data manipulation.

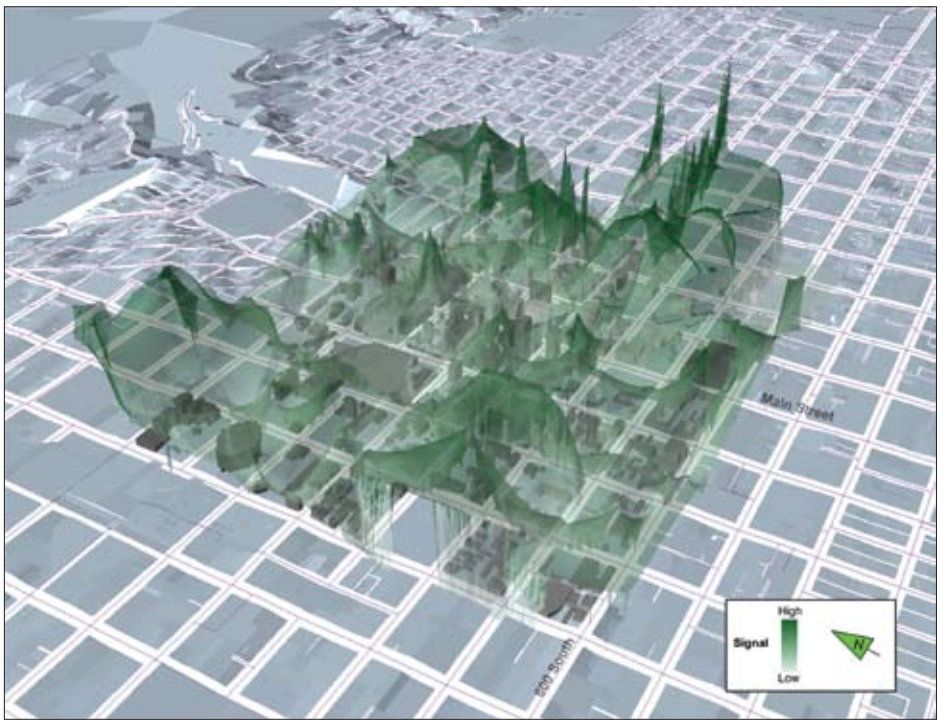
Process models represent an evolution from these existing technologies, catalyzed by artificial intelligence that takes traditional GIS operations into the world of dynamic, proactive computing on a semantic Web of interconnected data and intelligent software agents. Imagine, for example, building a representation of the earth's boundary layer climate in GIS, but also being able to run dynamic weather patterns, storms, and hurricanes over that data, using climate models that sit in a supercomputing center on another continent. This article charts the development of process models in the geographic information sciences and discusses the technologies that have shaped them from the outside in. In addition, it explores their future potential in allying next-generation GIS to the semantic Web, virtual worlds, computer gaming, computational social science, business intelligence, cyberplaces, the emerging "Internet of Things," and newly discovered nanospaces.

Background

Much of the innovation for process models in the geographic sciences has come from within the geographic information technology community. Geoprocessing featured prominently in the early origins of online GIS, where server-based GIS delegated much of the work that a desktop client would perform to the background, hidden from the user. Interest in geoprocessing has resurfaced recently, largely because of increased enthusiasm for online cartography and expanding interest in schemes for appropriating, parsing, and reconstituting diverse data sources from around the Web into novel mashups that lean on application programming interfaces—interfaces to centralized code bases—that have origins in search engine technology.

Concurrently, many scholars in the geographic information science community have been developing innovative methods for fusing representations of space and time in GIS. This has seen the infusion of schemes from time geography into spatial database and data access structures to allow structured queries to be performed on data's temporal, as well as spatial, attributes. Time geography has also been used in geovisualization, as a method for representing temporal attributes of datasets spatially, thereby allowing them to be subjected to standard spatial analysis. Much of this work has been based around a move toward creating cyberinfrastructure for cross-disciplinary research teams, and significant advances have been made in developing technologies to fuse GIS with real-time data from the diverse array of interconnected sensors and broadcast devices that now permeate inventory systems, long-term scientific observatories, transportation infrastructure, and even our personal communication systems. In parallel, work in spatial simulation has edged ever closer toward a tight coupling with GIS, particularly in high-resolution modeling and geocomputation using cellular and agent-based automata as computational vehicles for animating objects through complex adaptive systems. Automata are, essentially, empty data structures capable of processing information and exchanging it with other automata. Simulation builders often turn to GIS routines in search of algorithms for handling the information exchange between automata, and over time, a natural affinity between the two has begun to develop into a mutually influential research field often referred to as geosimulation.

Much of the work in developing process models is finding its way into GIS from outside fields, however, and developments in information technology for the Web—and for handling geographic data on the Web—have been particularly influential. A massive growth in the volume and nature of



The cloud of Wi-Fi signals that envelops central Salt Lake City, Utah, generated by approximately 1,700 access points.

data in which we find our lives and work enveloped has catalyzed a transition from a previous model of the Web to a newer-generation phase. The Web remains fundamentally the same in its architecture, but the number of applications and devices that contribute to it has swelled appreciably, and with this shift, a phase change has taken place, instantiating what is now commonly referred to as Web 2.0. The previous iteration of Web development was centered on static, subscription-based content aggregated by dominant portals such as AltaVista, AOL, Excite, HotBot, Infoseek, Lycos, and Yahoo! By comparison, much of the current generation model for the Web is characterized by user-generated content (blogs, Twitter tweets, photographs, points of interest, even maps) and flexible transfers between diverse data sources. Moreover, these varied data streams interface seamlessly over new interoperable database and browser technologies and are often delivered in custom-controlled formats directly to browsers or handheld devices via channels such as Really Simple Syndication (RSS). This takes place dynamically, updating in near real time as the ecology of the Web ebbs and flows.

Enveloping these developments has been a groundswell in the volume of geographic data fed to the Web. In many ways, Web 2.0 has been built on the back of the GeoWeb that has formed between growing volumes of location-enabled devices and data that either interface with the Web in standardized exchanges (uploading geotagged content to online data warehouses, for example) or rely on the Web for their functionality (as in the case of alternative positioning systems that triangulate their location based on wireless access points). The reduction in the cost of geographic positioning technologies led to the massive infusion of location-aware technology into cameras,

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Process Models and Next-Generation Geographic Information Technology

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phones, running shoes, and cars; atop bicycle handlebars; and in clothing, pets, handheld gaming devices, and asset-tracking devices on the products that we buy in supermarkets. Devices all over the world began to sense and communicate their absolute and relative positions, allowing, first, the devices to be location tagged; second, those tags to become a significant medium for organizing, browsing, searching, and retrieving data; and, third, their relative geography to become the semantic context that ascribes to those objects (and their users) information. Indeed, for many online activities, maps and GIS have become the main portal to the Web.

Semantic intelligence is driving the next evolution of the Web, characterized by the use of process models (usually referred to as software agents or Web services) as artificial intelligence that can reason about the meaning of data that courses through Internet and communication networks. A slew of ontological schemes—methods for classifying data and its relationships—provides the scaffolding that supports semantic reasoning online. Geography and location ontology is an important component of online semantics, allowing processes to not only know where something is in both network space and the tangible geography of the real world but also to reason about where it might have been, where it might go and why, whether that is usual or unusual behavior, what might travel with it, what might be left behind, what activities it might engage in along the way or when it reaches its destination, and what services might be suggested to facilitate these activities. Often, these may be location-based services that make use of the geographic position of a device, its user, or the local network of related devices, or they may make use of the network to deliver "action at a distance" to enrich a user's local experience, by connecting the user to friends across the world, for example.

Process models have also been developed in other information systems. Much of the potential for advancing geographic information technology stems from the ability of GIS to interface with other processes and related informatics through complementary process modeling schemes. The early precursors of this interoperability are already beginning to take shape through the fusion of GIS and building information models (BIMs). BIMs offer the ability of urban GIS to focus attention on a much finer resolution than ever, to the scale of buildings' structural parts and their mechanical systems. GIS allows BIMs to consider the role of the building in a larger urban, social, geological, and ecosystem context. When process models are added to the mix, the complementary functionality expands even farther. Consider, for example, the uses of a GIS that represents the building footprints of an entire city but can also connect to building information models to calculate the energy load of independent structures for hundreds of potential weather scenarios, or BIMs that can interact with an earthquake simulation to test building infrastructural response to subsurface deformation in the bedrock underneath, using cartography to visualize cascading envelopes of projected impact for potential aftershocks.

Virtual Worlds

Many advocates of the semantic Web envision a massive dynamic system of digitally networked objects and people, continuously casting "data shadows" with enough resolution and fidelity to constitute a virtual representation of the tangible world. These virtual worlds are already being built, and many people and companies choose to immerse themselves in online virtual worlds and massively multiplayer online role-playing gaming (MMORPG) environments for socializing, conducting business, organizing remotely, collaborating on research projects, traveling vicariously, and so on.

Here, process models are also driving advances in technology. Process models from computer gaming engines have been ported to virtual worlds, to populate them with automated digital assistants and synthetic people that behave and act realistically and can engage with users in the game world in much the same way that social interactions take place in the real world. Virtual worlds have been coupled with realistic, built and natural environment representations constructed using geometry familiar to GIS. The current generation of process models for MMORPG environments is relatively simple in its treatment of spatial behavior, but rapid advances are being made in infusing them with a range of behavioral geographies and spatial cognitive abilities that will enable more sophisticated spatial reasoning to be included in their routines.

Gaming is just one application of process models in virtual worlds. The actions and interactions of synthetic avatars representing real-world people can be traced with perfect accuracy in virtual worlds because they are digital by their very nature, and often, that data may be associated with the data shadows that users cast from their real-world telecommunications and transactional activities in the tangible world. Virtual worlds are seen by many as *terra novae* for new forms of retailing, marketing, research, and online collaboration in which avatar representations of real people mix with process models that study them, mimic missing components of their synthetic physical or social environments, mine data, perform calculations, and reason about their actions and interactions.

Code Space

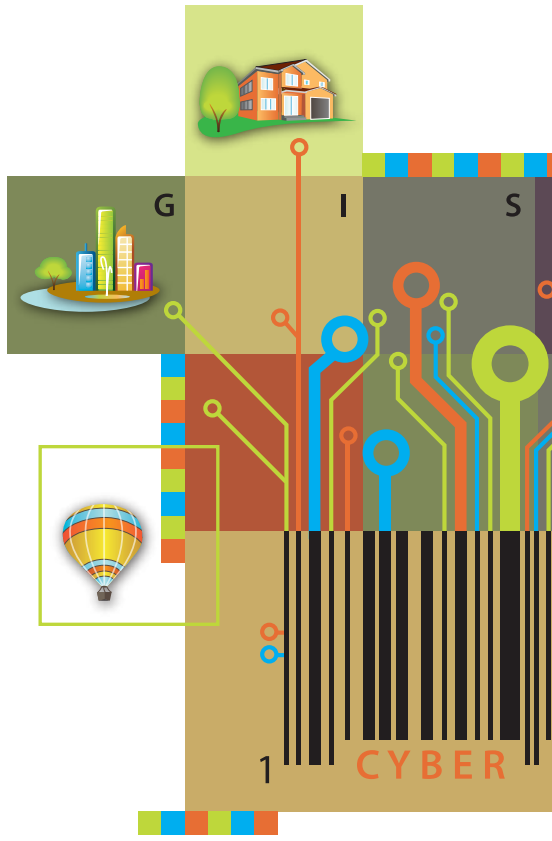
Aspects of the semantic Web may seep into the real world, from cyberspace to "meatspace." In many ways, the distinction between the two has long ago blurred, and for many of us, our lives are already fully immersed in cyberplaces that couple computer bits and tangible bricks, and we find much of our activity steeped in flows of information that react to our actions and often shape what we do. Geographers have begun to document the emergence of what we might term a "code space," a burgeoning software geography that identifies us and authenticates our credentials to access particular spaces at particular times and regulates the sets of permissions that determine what we might do, and with whom, while we are there. Commercial vehicle traffic for interstate commerce, commuter transit systems, and airports are obvious examples of code space in operation in our everyday lives. Mail systems transitioned fully to coded space a long time ago: for parcel delivery services, almost every object and activity can be identified and traced as it progresses through the system, from collection to delivery on our doorstep. Other code spaces are rapidly moving to the foreground: patients, doctors, and supplies are being handled in a similar fashion in hospitals. Goods in supermarkets and shopping malls are interconnected through intricate webs of bar codes, radio-frequency identification (RFID) tags, and inventory management systems that reason about their position in a network of stores and even the supply geography of individual packets on a shelf. Similarly, transactions may be tagged at the point of sale and associated uniquely to customers using loyalty, debit, and credit cards that also link customers to their neighbors at home and similar demographic groupings in other cities, using sophisticated geodemographic analyses. The influence between location-aware technology and sociology is also beginning to reverse. Other code spaces facilitate the emergence of "smart mobs" or "flash mobs," social collectives organized and mediated by Internet and communications technologies: text messaging, instant messaging, and tweeting, for example, for the purposes of political organization; social networking; or, as is often the case, simple fun.

The Internet of Things

In technology circles, objects in a code space are referred to as "spimes," artifacts that are "aware" of their position in space and time and their position relative to other things; spimes also maintain a history of this location data. The term *spime* has arisen in discussions about the emergence of an Internet of Things, a secondary Internet that parallels the World Wide Web of networked computers and human users. The Internet of Things is composed of (often computationally simple) devices that are usually interconnected using wireless communications technologies and may be self-organizing in formation. While limited individually, these mesh networks adopt a collective processing power that is often greater than the sum of its parts when their independent process models are networked as large "swarms" of devices. Moreover, swarm networks tend to be very resilient to disruption, and their collective computational and communication power often grows as new devices are added to the swarm. Networks of early-stage spimes (proto-spimes) of this kind have already been developed using, for example, microelectromechanical systems (MEMS), which may be engineered as tiny devices that are capable of sensing changes in electrical current, light, chemistry, water vapor, and so on, in their immediate surroundings. When networked together in massive volumes, they can be used as large-geography sensor grids for earthquakes, hurricanes, and security, for example. Sensor readings can be conveyed in short hops between devices over large spaces, back to a human observer or information system for analysis. MEMS often contain a conventional operating system and storage medium and can thus also perform limited processing on the data that they collect, deciding, for example, to take a photograph if particular conditions are triggered, and geotagging that photograph with a GPS or based on triangulation with a base station.

Geodemographics and Related Business Intelligence

The science and practice of geodemographics are concerned with analyzing people, groups, and populations based on tightly coupling who they are with where they live. The *who* in this small formula can provide information about potential debtors', customers', or voters' likely economic profile, social status, or potential political affiliation on current issues, for example. The *where* part of the equation is tasked with identifying what part of a city, postal code, or neighborhood those people might reside in, for the purposes of allying them to their neighboring property markets, crime statistics, and retail landscapes, for example. Together, this allows populations and activities to be tagged with particular geodemographic labels or value platforms. These tags are used to guide a host of activities, from drawing polling samples to targeting mass mailing campaigns and siting roadside billboards. The dataware for geo-



demographics traditionally relied on mashing up socioeconomic data collected by census bureaus and other groups with market research and point-of-sale data gathered by businesses or conglomerates. Traditionally, the science has been relatively imprecise and plagued with problems of ecological fallacy in relying on assignment of group-level attributes to individual-level behavior. Because of early reliance on data from census organizations, which aggregate returns to arbitrary geographic zones, the spatial components of geodemographics have also suffered from problems of modifiable areal units (i.e., there are an almost infinite number of ways to delineate a geographic cluster). Data is often collected for single snapshots in time and is subject to serious problems of data decay; households, for example, may frequently move beyond or between lifestyles or trends, without adequate means in the geodemographic classification system to capture that transition longitudinally.

Process models could change geodemographics. When users browse the Web, their transactions and navigation patterns, the links they click, and even the amount of time that their mouse cursor hovers over a particular advertisement can be tracked and geocoded uniquely to their machine. Users' computers can be referenced to an address in the Internet protocol scheme, which can be associated to a tangible place in the real world using reverse geocoding. Along retail high streets and in shopping malls, customers now routinely yield a plethora of personal information in return for consumer loyalty cards, for example, or share their ZIP Codes and phone numbers at the point of sale, in addition to passively sharing their names when using credit or debit cards. By simply associating an e-mail address to this data, it is relatively straightforward, in many cases, to cross-reference one's activity in the tangible world with one's data shadow in cyberspace. Developments in related retail intelligence, business analytics, inferential statistics, and geocomputing have increased the level of sophistication with which data can be processed, analyzed, and mined for information. This allows the rapid assessment of emerging trends and geodemographic categories. Process models are even coded into the software at cash registers in some instances.

Much of this technology is allied to spimes and code spaces. Technologies based around RFID and RFID tagging, initially designed for automated stock taking in warehouses and stores, are now widely embedded in products, cards (and

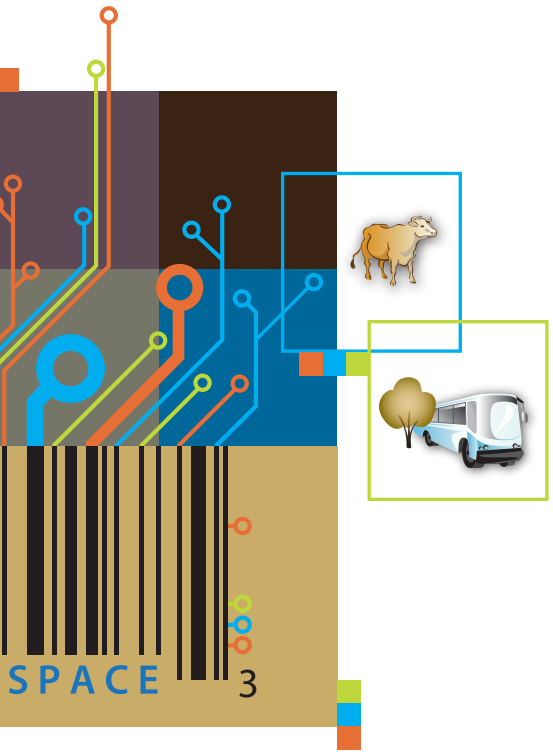


Illustration by Suzanne Davis, ESRI

therefore wallets), and the environment with such pervasiveness that they enable widespread activity and interaction tracking, particularly within a closed environment such as a supermarket. Coupled to something like a customer loyalty card, these systems allow for real-time feeds of who is interacting (or not) with (not just buying, but handling, or even browsing) what products, where, when, with what frequency, and in what sequences. The huge volumes of data generated by such systems provide fertile training grounds for process models.

The increasing fusion of mobile telecommunication technologies with these systems opens up a new environment for coupling process models to mobile geodemographics. This is a novel development for two main reasons. First, it creates new avenues of inquiry and inference about people and transactions on the go (and associated questions and speculations regarding where they may have been, where they might be going, with whom, and to do what). Second, it allows geodemographic analysis to be refined to within-activity resolutions. This has already been put to use in the insurance industry, for example, to initiate pay-as-you-go vehicle coverage models, using GPS devices that report location information to insurance underwriters. Mobile phone providers have also experimented with business models based around location-based services and location-targeted advertising predicated on users' locations within the cell-phone grid, and groups have already begun to experiment with targeting billboard and radio advertising to individual cars based on similar schemes. New GIS schemes based around space-time process models and events are well positioned to interact with these technologies.

Nanosystems

When spimelike devices are built at very small geographies, capable of sensing and even manipulating objects at exceptionally fine scales, they become useful for nanoengineering. In recent years, there has been a massive fueling of interest in nanoscale science and development of motors, actuators, and manipulators at nanoscales. With these developments have come a veritable land grab and gold rush for scientific inquiry at hitherto relatively underexplored scales: within the earth, within the body, within objects, within anything to be found between 1 and 100 nanometers. Geographers missed out on the last bonanza at fine scales and were mostly absent from teams tasked with mapping the genome. The cartography required to visually map the genome is trivial and the processes that govern genomic patterns are completely alien to most geographers' skill sets, so their exclusion from these endeavors is understandable. The science and engineering surrounding nanotechnology differ from this situation, however, in that they are primarily concerned with spatiotemporal patterns and processes and the scaling of systems to new dimensions. These areas of inquiry are part of the geographer's craft and fall firmly within the domain of geographic information technologies. Process models with spatial sensing and semantic intelligence could play a vital role in future nanoscale exploration and engineering.

Computational Social Science

Geographic process models also offer tremendous benefits in supporting research and inquiry in the social sciences, where a new set of methods and models has been emerging under the banner of *computational social science*. Computational social science, in essence, is concerned with the use of computation—not just computers—to facilitate the assessment of ideas and development of theories for social science systems that have proved to be relatively impenetrable to academic inquiry by traditional means. Usually, the social systems are complex and nonlinear and evolve through convoluted feedback mechanisms that render them difficult or impossible to analyze using standard qualitative or quantitative analysis. Computational social scientists have, alternatively, borrowed ideas from computational biology to develop a suite of tools that will allow them to construct synthetic social systems within a computer, in silico, that can be manipulated, adapted, accelerated, or cast on diverging evolutionary paths in ways that would never be possible in the real world.

The success of these computational experiments relies on the ability of computational social science to generate realistic models of social processes, however, and much of the innovation in these fields has been contributed by geographers because of their skills in leveraging space and spatial thinking as a glue to bind diverse cross-disciplinary social science. Much of computational social science research involves simulation-building. To date, the artificial intelligence driving geography in these simulations has been rather simplistic, and development in process models offers a potential detour from this constraint. Moreover, computational social science models are often developed at the resolution of individual people and scaled to treat massive populations of connected "agents," with careful attention paid to the social mechanisms that determine their connections. This often requires that large amounts of data be managed and manipulated across scales, and it is no surprise that most model developers turn to GIS for these tasks. Connections between agent-based models and GIS have been mostly formulated as loose couplings in the past, but recent developments have seen functionality from geographic information science built directly into agent software architectures, with the result that agents begin to resemble geographic processors themselves, with realistic spatial cognition and thinking. These developments are potentially of great value in social science, both in providing new tools for advanced model building and in infusing spatial thinking into social science generally. At the same time, developments in agent-based computing have the potential to feed back into classic GIS as architectures for reasoning about and processing human environment data.

Prologue

This is a wonderful time to be working with or developing geographic information technologies, at the cusp of some very exciting future developments that will bring GIS farther into the mainstream of information technology and will infuse geography and spatial thinking into a host of applications. Of course, some potential sobering futures for these developments should be mentioned. As process models are embedded in larger information, technical, or even sociotechnical systems, issues of accuracy, error, and error propagation in GIS become even more significant. Ethical issues surrounding the use of fine-grained positional data also become more complex when allied with process models that reason about the significance or context of that data. Moreover, the reliability of process models as appropriate representations of phenomena or systems must come under greater scrutiny.

About the Author

Dr. Paul M. Torrens is an associate professor in the School of Geographical Sciences at Arizona State University and director of its Geosimulation Research Laboratory. His work earned him a Faculty Early Career Development Award from the U.S. National Science Foundation in 2007, and he was awarded the Presidential Early Career Award for Scientists and Engineers by President George W. Bush in 2008. The Presidential Early Career Award is the highest honor that the U.S. government bestows on young scientists; Torrens is the first geographer to receive the award.

More Information

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GIS: Designing Our Future

Continued from cover

and inseparable relationship between man and nature." Fifteen years later, in his groundbreaking book *Design with Nature,* landscape architect Ian McHarg advocated a framework for design that helps humans achieve synergy with nature. Design and planning that take into consideration both environmental and social issues help us ensure that our resources are used appropriately and responsibly, to help us move toward a better future for all. McHarg's pioneering work not only had a fundamental influence on the up-and-coming field of environmental planning but simultaneously solidified the core concepts of the young field of GIS as well.

In the 40 years since *Design with Nature* was written, a better world is the common goal all of us—geographers, planners, scientists, and others—have been striving for. Discussing his book during the Keynote Address at the 1997 ESRI International User Conference, McHarg laid out a process by which "environmental data could be incorporated into the planning process." Rejecting the view of a future modeled after some idyllic environmental past, he instead was an early adopter of the view that we should be using our dominance of earth systems to help evolve the natural world and make it better, rather than conquer it. Powerful anthropogenic influence over earth systems represents not just a huge challenge but an equally huge opportunity—not humans versus nature, but humans with nature. "While traditional ecological research selected environments with a minimum human influence, I selected arenas of human dominance," McHarg said. Today more than ever, it is important to recognize the overwhelming impact of humans on the environment, that massive human impacts on the earth are a fact that's not going away, and that we stand at the crossroads. Thus, our challenge is to provide designers, engineers, planners, and others, with a set of tools and a framework for designing and managing the anthropogenic earth.

Design for the Anthropogenic Earth

I've recently become very interested in the relatively new field of earth systems engineering and management (ESEM), which concerns itself with the design, engineering, analysis, and management of complex earth systems. ESEM takes a holistic view of multiple issues affecting our earth—not only taking environmental, social, and other considerations into account up front in the design process but also looking at challenges from an adaptive systems approach, where ongoing analysis feeds back into the continual management of the system.

Braden Allenby, professor of civil and environmental engineering at Arizona State University and one of ESEM's founders, often emphasizes the undeniably dominant role humans have in earth systems. "We live in a world that is fundamentally different from anything that we have known in the past," says Allenby in his paper "The Metaphysics of the Anthropogenic Earth Part I: Integrative Cognitivism," "It is a world dominated by one species, its activities and technologies, its cultures, and the integrated effects of its historical evolution." McHarg was already moving in this direction in the 1960s, and today we understand that it is even more important to emphasize the anthropogenic elements of earth systems. In other words, at this stage of ecological evolution, humans are a significant, if not dominating, component of the natural environment, and all problems need to be addressed and decisions made with anthropogenic elements in the forefront.

Allenby sees reasoned design and management in the age of the anthropogenic earth as our moral imperative, but the biggest obstacle to our success is that we are not set up to work, or even think, in this way. "We lack solid data and analytical frameworks to make assertions about the costs, benefits, and normative assessments of different . . . practices," notes Allenby in "Biomass Management Systems" in *Reconstructing Earth.* And this is why I believe that GIS and the emerging field of GeoDesign are critical to the success of approaches such as ESEM and other logical and rational models for dealing with the environmental and planning problems of ours and future generations.

"We are being propelled into this new century with no plan, no control, no brakes."
– Bill Joy, Cofounder and Chief Scientist, Sun Microsystems

Designing Alternative Futures

The key to developing a true understanding of our complex and dynamic earth is creating a framework to take many different pieces of past and future data from a variety of sources and merge them in a single system. GIS is a sophisticated technological tool already in widespread use by planners, engineers, and scientists to display and analyze all forms of location-referenced data about the health, status, and history of our planet. GIS enables a GeoDesign framework for analyzing and managing anthropogenic earth issues by allowing users to inventory and display large, complex spatial datasets. They can also analyze the potential interplay between various factors, getting us closer to a true understanding of how our dynamic earth systems may change in the coming decades and centuries.

Carl Steinitz, an urban planner at Harvard University, originated many of the early ideas about the application of GIS for landscape analysis and urban planning. Steinitz developed a model of landscape change that enables design of alternative futures. Those alternative designs can then be evaluated in terms of their impact on the natural environment as well as their utility to the human population, and the alternative future that is projected to achieve the best balance can then be selected for implementation. With a debt of gratitude to Steinitz ("A Framework for PLF," *Landscape Future*), the GeoDesign framework also lets us design and test various alternatives, helping us make the most educated and informed decisions about the best possible future.

Is the earth getting hotter or colder? Is the stress human populations are putting on the planet contributing to climate change? What potential factors may significantly impact our ability to thrive and survive in the future? What additional sorts of environmental monitoring can we be doing today to improve decisions in the future? We are only beginning to understand how to approach these questions, let alone come up with scientifically valid answers. Only through careful observation of the data, application of scientific principles, and using GIS and other technologies do we have any hope of truly understanding the stressors and impacts on the incredibly complex systems that comprise our anthropogenic earth. It's also the key to making pragmatic, thoughtful, informed design decisions and proposing alternatives that allow humans and nature to coexist more harmoniously.

Design with Nature

Design with Nature—rarely has a three-word title so eloquently summed up an entire tome. The most important word in that title is not *design,* nor is it *nature.* It's *with.* It sets the stage for design and nature working together in concert to achieve something that is bigger than the sum of the parts, a synergy of design and nature reaching toward the goal of the survival of the human species in particular and the planet in general.

It's not a stretch to say that the development of GIS technology and the entire industry around it was profoundly influenced by the work of McHarg. He popularized the overlay concept and laid the groundwork for what was to become GIS, thus taking a number of budding young landscape architects and geographers and changing their lives forever.

McHarg and I may have disagreed on some things, but we clearly shared the vision of using geographic analysis techniques to design a better world. Although we've made much progress in building the infrastructure to help us accomplish this monumental task, we're still not quite there yet. In fact, 28 years after *Design with Nature* was published, McHarg issued a challenge of sorts to attendees of the 1997 ESRI International User Conference in his Keynote Address:

> "By and large, the ecological planning studies I did in the 1960s and 1970s have not been equaled, far less surpassed. And I think there has got to be a challenge; that is, we've got to be able to learn to do at least as well for regions and for the nation and, indeed, for the global environment as we are doing at the moment."

Like McHarg's *Design with Nature,* ESRI is also celebrating its 40th anniversary this year. It's no coincidence that both the concepts espoused within *Design with Nature* and the GIS work led by ESRI launched almost simultaneously. When McHarg advocated this new methodology of taking geographic considerations into the design process and workflow, I don't know if he could ever have imagined how far we'd come with GIS by 2009. But the hard work we've been doing on developing GIS technology for the last 40 years does not mean we are finished, or even close to being finished. And I feel that all our hard work evolving GIS has led us to this pivotal point. The next logical step in the evolution of this technology is GeoDesign.

The Case for GeoDesign

GeoDesign borrows concepts from landscape architecture, environmental studies, geography, planning, regenerative studies, and integrative studies. Much like GIS and environmental planning before it, GeoDesign takes an interdisciplinary, synergistic approach to solving critical problems and optimizing location, orientation, and features of projects both local and global in scale.

Design is art within the framework of limitations—limitations that arise as a result of function, world view, bias, and other factors, but also limitations that arise as a result of place. Design considering place was at the core of McHarg's beliefs, and it is the basis for our research and development efforts in the emerging field of GeoDesign.

". . . design is always and necessarily an art as well as a problem-solving activity . . ."
—David Pye, *The Nature of Design*

To a certain extent, this is already done today by numerous GIS practitioners in fields like urban and regional planning and environmental management. But GeoDesign makes this easier by making it an integral part of the workflow, both shortening the cycle time of the design process and improving the quality of the results.

Cycle time is shortened because GeoDesign moves analysis to an earlier stage in the design process. Rather than analyzing the potential impacts and effects of a proposed project after the design phase, critical factors are instead taken into consideration up front. The quality of the results improves because the project is designed around, in concert with, and/or to fully leverage certain geographic, environmental, and social features while simultaneously minimizing undesirable impacts to those same features.

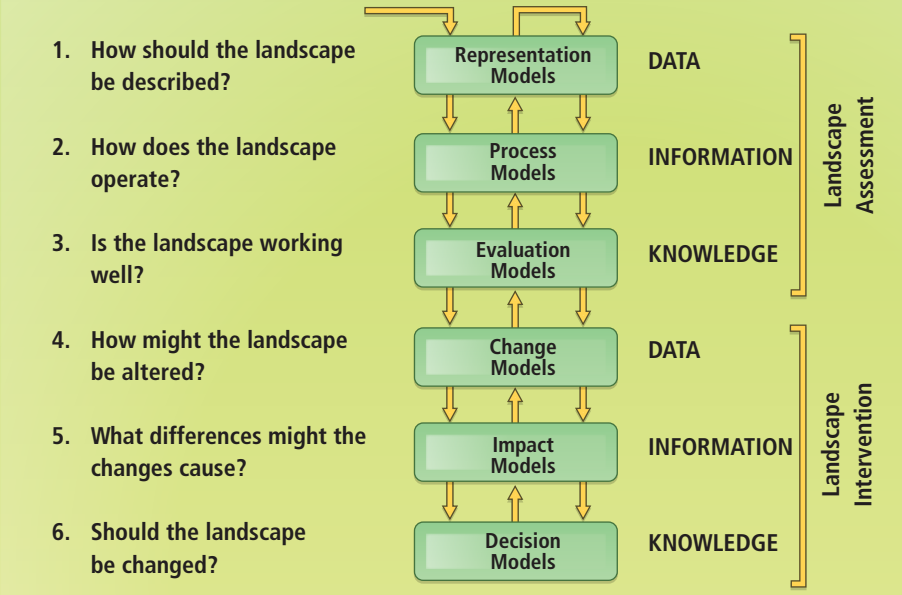
Designing Our Future

"GIS: Designing Our Future" is the theme of the 2009 ESRI International User Conference. When I talk of designing our future, I believe that combining the wealth of data available about our world with sophisticated analysis and management tools is the prescription for understanding and shaping the future of our planet—an anthropogenic future where advances in human society, technology, etc., are designed in close collaboration with nature, resulting in the best of possible future worlds. It's a huge task and a delicate balance, for sure, but with help from GIS and GeoDesign tools, we readily accept that challenge. Because, frankly, we have no other choice.

What Is GeoDesign?

GeoDesign brings geographic analysis into the design process, where initial design sketches are instantly vetted for suitability against a myriad of database layers describing a variety of physical and social factors for the spatial extent of the project. This on-the-fly suitability analysis provides a framework for design, giving land-use planners, engineers, transportation planners, and

The Steinitz Model of Landscape Change



others involved with design, the tools to leverage geographic information within their design workflows. Fully leveraging geography during the design process results in designs that emulate the best features and functions of natural systems, benefiting both humans and nature through a more peaceful and synergistic coexistence.

GeoDesign involves three activity spaces: the work environment (where designers do their work), the design tools (the tools designers use to do their work), and supportive workflows (how designers do their work). Having one of these out of sync can impede the design process.

- **Work Environment—**Today's work environment used by geo-based design professionals involves the field, the desktop, connection to enterprise servers and databases, the use of document management systems, collaborative environments (both inside and outside the enterprise), and interaction with outside agencies and organizations.
- **Design Tools—**Geo-based designers use a variety of tools to assist them as they create their designs. Probably the most frequently used tool, or type of tool, is the drawing tool. The particular type of drawing tool depends on the designer's domain and whether the designer is working in 2D or 3D space.
- **Supportive Workflows—**Most geo-based workflows, at least at a detailed level, are domain specific. Three workflows pertaining to the use of geographic information stand out, however, as being predominantly genetic: one related to land-use change; one related to the design, construction, and management of built facilities; and one related to the use of 2D CAD.

Early Forays in GeoDesign

Although it might be easy to compare the two, GeoDesign should not be confused with computer-aided design (CAD). In fact, the first geographic design system was ArcCAD, ESRI's earliest attempt to build a dedicated GeoDesign tool. Released in the early 1990s, ArcCAD was the first fully functional GIS system within the AutoCAD environment. While traditional CAD is a useful tool in the architectural design of a building, GeoDesign is concerned with designing that same building in and around the environment. ArcCAD was an attempt to integrate geographic data and spatial modeling into the design process. ArcCAD provided powerful mapping, data management, spatial analysis, and display tools that worked directly with AutoCAD's design and drafting tools.

ArcCAD was followed by other ESRI applications (including SDE CAD Client and ArcGIS for AutoCAD) that allowed designers and others within the CAD environment to leverage the full power of GIS functionality and GIS databases. ArcGIS for AutoCAD, a free downloadable tool that offers seamless interoperability between AutoCAD and the ArcGIS platform, is used widely today. ArcGIS for AutoCAD users are provided with quick and easy access, within the AutoCAD environment, to enterprise GIS data published by ArcGIS Server. This tool lets designers include the results of GIS analysis in AutoCAD designs, as well as create, manipulate, and define how CAD data is organized and attributed as GIS content.

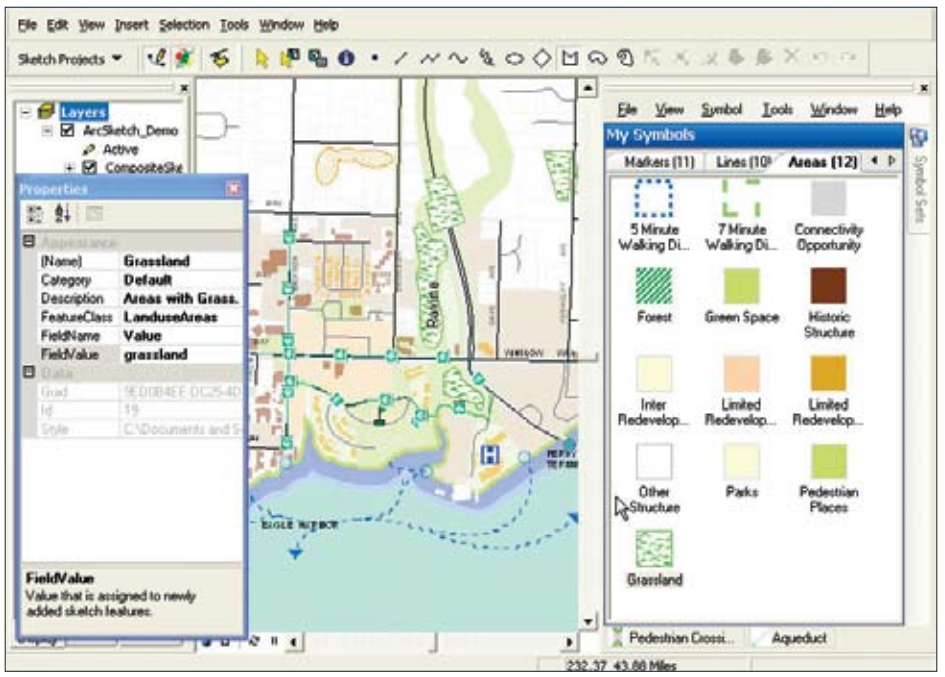
Design Tools in ArcGIS

Design professionals are creative and rely heavily on intuition, a gut feeling that something is right. GIS professionals providing input to a creative process rely heavily on analysis and science. With GeoDesign, GIS becomes a tool for designers; they can move rapidly through an iterative design process while leveraging the full analytical power of the geodatabase. We believe that bringing together the worlds of design and analysis under one common information system framework will have huge implications.

In 2005, Bill Miller, ESRI's engineer/architect, led a small team to develop a free sample ArcGIS extension that was the first step toward true GIS-based GeoDesign tools. Released in 2006, the extension allows you to quickly create features in the ArcGIS Desktop ArcMap application with easy-to-use sketch tools. You simply select a sketch tool and an associated symbol, then draw the feature. This simple design tool automatically manages the drawing environment, allowing you to conceptualize what to draw, as opposed to how to draw it. With ArcSketch, you can sketch a set of alternative land-use concept plans, quickly lay out the spatial components of a disaster response plan, sketch out the location of a highway, or lay out a site master plan.

As a geographic sketching tool that allows users to sketch initial designs on top of GIS-based maps and imagery, ArcSketch was useful to many of our users, but it is only the beginning. Functionality similar to ArcSketch will be further enhanced and integrated into the core software system at the 9.4 release. And subsequent releases of ArcGIS promise even more support for the use of GIS for design.

ArcSketch tool-style editing in ArcGIS 9.4 will make editing simpler, with new streamlined functionality making it easier for you to complete your work.



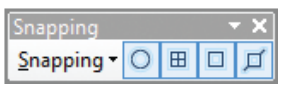
ArcSketch tool-style editing in ArcGIS 9.4 will make editing simpler.

Creating features is accomplished through the use of feature templates. To get started with templates, you just need to start editing, which launches the Create Templates wizard. The wizard will quickly help you build a set of feature templates you can use to create new features. Once you finish, the Create Features window opens with a list of templates.

Feature templates define all the information required to create a new feature: the layer where a feature will be stored, attributes new features will be created with, and the default tool used to create that feature. In the Create Features window, choose the template in which to store the new feature, click a construction tool from the palette at the bottom of the window, and click the map to digitize the shape of the feature. In ArcGIS 9.4, the edit sketch will show a WYSIWYG preview with the symbology used for that template (layer).

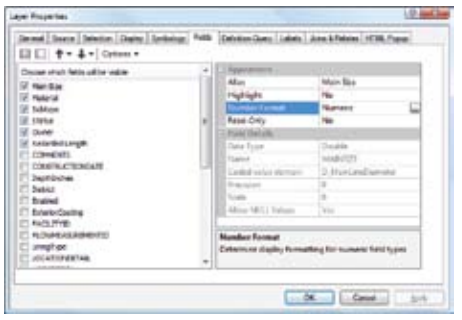
Snapping is now enabled by default and has been broadened from being within an edit session only to being available across ArcMap. To this end, all the settings you need to work with snapping are located on the new Snapping toolbar, including turning on and off snapping types (edge, vertex, endpoint, and so on) and customizing the appearance of the cursor and SnapTips.

The Fields tab on the Layer Properties dialog box has been redesigned for 9.4, making it easier to reorder fields, turn them on or off, sort them, and set other display and formatting properties. These properties will be used throughout ArcMap, including the editor's attributes dialog box, table windows, and the Identify dialog box.



Meeting the Challenge with GeoDesign

Integration of design tools with existing GIS functionality is important, but it's only the first step. Ultimately, our vision is to expand the utility of GIS to the point that it is a foundational design system. As humanity comes to grips with its overwhelming impact on the natural world, we are also gaining a much better appreciation for our inextricable link to nature. And with that, of course, comes an enormous responsibility—a responsibility made all the more gargantuan by the fact that we still have a long way to go toward fully understanding the dynamics of the various systems and developing a robust suite of comprehensive models and other tools to support these activities. As Neutra did with architecture in the 1950s, we need to advance a framework for design and planning that not just incorporates but also embraces technology; science; and, ultimately, nature in a system that helps us design and choose the best alternative futures.



Imagine if your initial design concept, scribbled on the back of a cocktail napkin, has the full power of GIS behind it: the sketch goes into the database, becoming a layer that can be compared to all the other layers in the database. The experience ESRI has gained while developing CAD integration tools, ArcSketch, and the new tools in ArcGIS 9.4 has led to an appreciation of the power that could be derived by associating drawing tools, symbology, data models, and process models into one integrated framework for doing GeoDesign. Having "back of the napkin" design sketches available for immediate analysis and feedback is one of ESRI's primary areas of research and development over the coming years, and our users will see the results of these efforts in upcoming releases.

And the need for such tools has never been greater. We live in an ever more complex world, where our impact on the natural environment is massive and can no longer be ignored. People are starting to recognize the importance Neutra placed on the inseparable relationship between humans and nature and to realize McHarg's vision of design with nature, and they want to act.

"There is now a growing interest in combining design functionality with the broader geographical context that geospatial tools offer in order to engage more deeply in land-use planning," notes Matt Ball, editor at *VI Magazine.* A GeoDesign framework will provide a robust set of tools for design professionals and finally meet the challenge of Ian McHarg, letting us truly design with nature.

More Information

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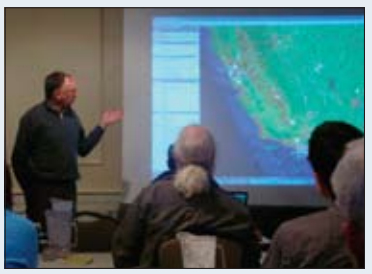
Spatial Concepts in GIS and Design

To what extent are the fundamental spatial concepts that lie behind GIS relevant in design? To what extent can the fundamental spatial concepts of design be addressed with GIS? Is it possible to devise a curriculum to develop spatial thinking in both GIS and design?


NCGIA meeting (Photo from the NCGIA Web site: Jake Sopher).

To begin developing answers to such questions, a specialist meeting on spatial concepts in GIS and design was held December 15–16, 2008, in Santa Barbara, California. The purpose of the meeting was to discuss the potential for integrating design more fully into GIS, as well as the development of curriculum in spatial thinking. This was one of an ongoing series of such specialist meetings organized by the National Center for Geographic Information and Analysis (NCGIA) at the University of California, Santa Barbara, over the past two decades. The meetings combine a small number of context-setting presentations with ample time for discussion in plenary sessions, small groups, and informal social gatherings.

The meeting was cosponsored by NCGIA and ESRI and was attended by Tom Fisher, Michael Goodchild, Fritz Steiner, Carl Steinitz, Ron Stoltz, Jack Dangermond, and a number of other representatives from education and industry interested in the emerging field of GeoDesign.

More Information

A full participant list, as well as position papers and presentations, can be viewed at ncgia.ucsb.edu/projects/scdg/participants-scdg.php.

Maryland's Programs Improve Life and Environment

Governor Martin O'Malley Leads with GIS

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 Governor Martin O'Malley as a GIS hero.

Maryland Governor Martin O'Malley.

Governor Martin O'Malley of Maryland believes that geography matters to the people he serves. For him, it is critical to the relationships that sustain us and vital to making government work for the people.

"When you show people how you are using GIS, they inevitably ask this question, 'Can you show me my house?'" says O'Malley. "People want to know that they matter to their government and that their government is relevant to them. They want to understand the forces at work around them."

He continues, "This question speaks to the innate human need to understand the relationship of oneself to others and to the world we live in. With GIS, we develop a deeper understanding of our actions across time and space. With that knowledge, we can progress in a way that strengthens our relationships with one another and with the earth."

Service Oriented

O'Malley's career has always been focused on service. After graduating from the University of Maryland School of Law in 1988, he began his career as an assistant state attorney for the City of Baltimore. Three years later, he was elected to serve on the Baltimore City Council. And then he was elected to govern the city from 1999 to 2007.

During his first of two terms as mayor, O'Malley learned of COMSTAT, the successful GIS-based program the New York City Police Department (NYPD) was using to revolutionize crime fighting. He began to consider applying the same method of performance accountability to improve life in Baltimore.

"The NYPD was using GIS to map crimes, deploy more cops to those areas, and maintain close follow-up on hot spots to drive crime down," explains O'Malley. "We began to realize that if [the NYPD] could use mapping technology to improve law enforcement, it could also be used to improve other government activities, everything from removing dead trees to repairing traffic lights and collecting garbage."

At the time, the City of Baltimore was facing high rates of violent crime, absenteeism and overtime, slow response time to citizen complaints, and illegal dumping, to name just a few of the problems. Seeking change, in 2001 the governor implemented CitiStat, a performance-based management process that holds government agencies accountable. GIS is at its heart.

Each week, O'Malley and top cabinet members would meet with representatives from a city agency to analyze data, field research, and resident feedback. The GIS-based analysis provided a framework for discussion and a way to see patterns, problems, and ways forward.

"We started using GIS to map every conceivable service, problem, and opportunity so we could measure outcomes and performance every day," says O'Malley. "Then we were able to adeptly deploy resources and make real progress."

The results of the CitiStat program are remarkable. During O'Malley's tenure, for example, violent crime dropped 40 percent, the number of children with lead poisoning fell 65 percent, and the cleaning and boarding of vacant houses moved from response times of 319 days for cleaning and 152 days for boarding to 5 days for each.

"Governor O'Malley pushes GIS initiatives forward because they give him the information he and his staff need to quickly and comprehensively understand issues and examine program effectiveness," says Kenny Miller, Maryland's geographic information officer. "By displaying program information on a map, a clear picture emerges showing the best ways to target resources, track performance, and reach out to the public."

Though O'Malley has moved on to govern the state, CitiStat remains a vital program in the mayor's office, and the same model is now used in cities across the United States, such as Springfield, Massachusetts, and Buffalo, New York.

Broadening Vision

When O'Malley became governor of Maryland in 2007, he brought the CitiStat ideals with him and developed StateStat, which expands the CitiStat model to a state scale and even includes stimulus spending statistics. Currently, the following agencies participate in the process: the Maryland State Police and the Departments of Agriculture; Business and Economic Development; Environment; General Services; Health and Mental Hygiene; Housing and Community Development; Human Resources; Juvenile Services; Labor, Licensing, and Regulation; Natural Resources; Planning; Public Safety and Correctional Services; and Transportation.

"There is great power in merging mapping, human effort, and imaginative public policy," states O'Malley. "Government has traditionally been very good at measuring input, and not as good at measuring output. This is where GIS comes in to propel progress. Just as it is impossible to steer a ship without a compass or controls, it is impossible to drive government forward without measuring outputs and outcomes. It is only with that information that we know where challenges and opportunities lie. With GIS, we can all see exactly where and how progress is being made or where it is stalling."

With BayStat and GreenPrint, which measure Chesapeake Bay restoration projects and land conservation, respectively, the governor has expanded his performance measurement programs in Maryland. They measure the health of the environment in Maryland, help the government make decisions about the best ways to implement effective conservation strategies and preserve green spaces for future generations, and provide effective communication with stakeholders and the public.

"Sustainability is a defining issue of our times," O'Malley notes. "In Maryland, we must focus on improving the condition of the Chesapeake Bay, which has been polluted for generations. We are tackling this issue with the same approach we took with CitiStat and StateStat—using geography and performance measurement to improve the bay's health each year."

GreenPrint supports BayStat efforts, and the GIS-based GreenPrint Web mapping application serves as the framework for discussion in the combined BayStat/GreenPrint meetings. GreenPrint data is also accessible via MD iMap, Maryland's launched portal into the state's enterprise GIS.

MD iMap (**mdimap.com/imap**), which includes seamless, geocoded centerlines and six-inch imagery for the entire state, provides an overarching look into Maryland state government performance. It gives citizens, government staff, and other stakeholders access to a variety of information, such as designated open spaces, protected targeted ecological areas, and the progress of highway beautification projects.

"Governor O'Malley's administration has made what was once impossible become reality in Maryland—bringing together state and local government to form a uniform GIS foundation across the entire state of Maryland," says Marshall L. Stevenson III, enterprise GIS and public safety manager, Frederick County, Maryland. "This was first seen with the statewide road centerline and geocoding service project and is now moving forward with the soon-to-be-created statewide vector cadastral layer, with data provided by local jurisdictions."

More Information

For more information, contact Lindsay Major, governor's office, State of Maryland (tel.: 443-336-1483, e-mail: lmajor@gov.state.md.us).

NATIONAL GEOGRAPHIC™

"Geo Learning"

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

Get Involved with Geo-Education Reform

We've got a problem in our country. The rate of geographic literacy—meaning the number of people who can synthesize geographic information from a variety of sources and draw a sound conclusion—is abysmally low. On the other hand, *ArcNews* goes to almost a million individuals who earn their living by doing that kind of geographic reasoning every day.

So, what we have is an enormous geographic literacy gap. We have a solid core of geographic experts, including the readers of *ArcNews,* but once we get outside that group, there is a dramatic drop-off in the level of geographic understanding and skills. As the companies and agencies that are struggling to fill openings for GIS professionals can attest, we can certainly use more geographic experts in our country. However, from a societal perspective, I believe the gap in expertise between experts and the rest of the population is a much bigger problem.

For our society to function effectively in the modern world, we need the vast majority of our population to be either *geographically competent* or *geographically proficient.* These are terms I use to describe nonexpert levels of geographic literacy. *Geographically competent* describes individuals who are prepared for everyday geographic reasoning, such as choosing where to live or evaluating a ballot initiative that would affect land use. In a well-functioning school system, most students would achieve geographic competence by the end of middle school.

Geographically proficient describes college readiness in geographic skills and understanding. A geographically fluent individual is prepared for college-level coursework in subjects that require geographic skills and understanding, such as international relations or environmental science. At the National Geographic Society, we have set the goal of achieving a 50 percent rate of geographic fluency among 18-year-olds by 2025.

While there are no statistics on the distribution among different levels of geographic literacy in the United States, there is pretty good evidence that a majority of Americans are not geographically competent. Our goal is to flip this distribution over the next couple of decades. Furthermore, our goal is to have the geographically proficient population be the largest, followed by the geographically competent and geographically expert populations.

One reason that increasing the rate of geographic literacy is more important than increasing the number of geographic experts is that the public is the audience for the work of geographic experts at the end of the day. We can no longer afford for corporate executives, policy makers, politicians, and even the general public to be uneducated about geographic planning and decision making. If they are, then the work of geographic experts is largely wasted. Of course, the other reason is that if we increase the supply of individuals at the other levels of geographic literacy, then the pool for geographic experts gets larger.

If we are serious about reducing this geoliteracy gap, then the question we have to ask ourselves is, Where is the solution to this geoliteracy gap going to come from? It is not going to be solved by the majority. The majority are not even in a position to understand what they are missing. The solution is going to come from the people who can see the price that our society is paying on a daily basis for the lack of geographic literacy among its citizens. It is going to come from the relatively small minority of geographically literate individuals, especially the geographic experts.

So, what actions can individual GIS professionals and other applied geographers take to help move along the incipient campaign to boost geographic literacy?

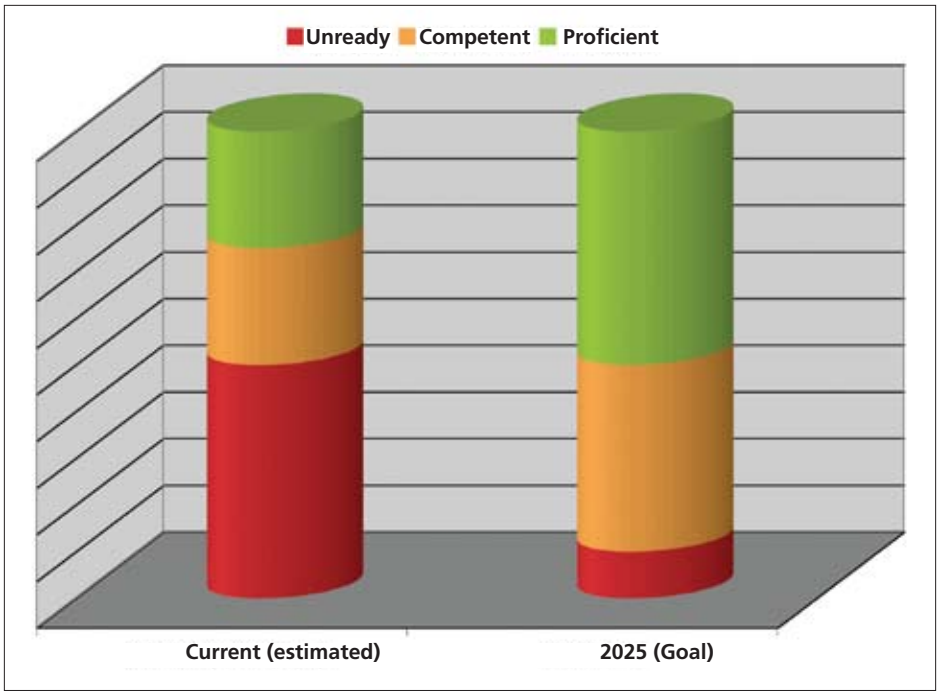
The first action is personal. It is important that we start building public awareness of why geographic literacy is so important and what a good geographic education would teach our children. Those of us who "do geography" on a daily basis need to start talking to the people in our families and communities about what we do, so they start to understand that geographic literacy is not about knowing where things are but about knowing how to plan and make decisions.

By talking to our family and friends about the kind of geographic problem solving we do, we can start to help them see what their children are missing in their educations. It is possible to talk to people about the kinds of work that GIS professionals do without using terms like symbology, constraint satisfaction, buffer, and model. It can be good practice for us and eye opening for them.

The second action is political. At both the state and federal levels, it is important that people who understand the importance of geographic literacy advocate for improved geographic education in our schools. As a result of hard work by a large number of "geoevangelists," all 50 states, the District of Columbia, and Puerto Rico have social studies, science, and technology standards that call for geographic literacy. However, these state standards are revised every few years, and if we don't stay vigilant, they can be changed. If you are interested in finding out about the current policy situation in your state, you can contact your state geographic alliance (find yours at **www.ngsednet.org/communities**).

At the federal level, there is legislation pending in Congress right now to establish a fund for the improvement of geography teaching. Geography is the only subject listed in No Child Left Behind as a core academic subject that has no federal funding program. The bill in Congress, called the Teaching Geography is Fundamental Act, has strong bipartisan support, but it will not pass unless legislators know that there are constituents who care. All it takes is a few minutes to make a phone call or write a letter, and it can make a huge difference. National Geographic has information about the bill and how to contact your legislators at **www.nationalgeographic.com/foundation/policy_initiative.html**.

The third action is educational. There are valuable roles for geography professionals to play in their local educational system. Many GIS professionals teach at community colleges and in professional seminars. This is very important for filling the pipeline for geographic experts, but there are things we can do in the K–12 system that will start to boost the numbers of geographically competent and proficient individuals. However, finding and developing opportunities to work in schools can be tricky. So, National Geographic and ESRI are teaming up on a GeoMentoring program to pair geography professionals with K–12 teachers to bring their expertise into the classroom.



A rough estimate of the distribution of geographic literacy among 18-year olds in the U.S. today (left) and the distribution that National Geographic is committed to achieving by 2025 (right).

At the ESRI International User Conference this summer, we will be introducing this new program that will provide geography professionals with guidelines for working with schools and materials for activities they can do with teachers in their local schools. These activities will range from "pre-GIS" activities using paper maps, crayons, and cutouts for lower grades and schools with limited technology access to real GIS activities using ESRI software in schools.

The fourth action is financial. In most of the scientific disciplines, a substantial stream of funding for educational improvement comes from scientists and the companies that employ them. Over time, the cause of geographic literacy is going to require that same level of support. In a future column, I will describe some giving opportunities for individuals and organizations to support the improvement of geographic education at local, state, and national levels.

In closing, I have two points to make. One is that the problem is urgent. The second is that the solution we are seeking will, at best, come slowly and only through serious and prolonged effort. There are things that we, as geographic experts, can and should do today, and I encourage you to begin right away. I must also caution you, though, that improving education is more about tortoises than it is about hares. So, if you do talk to a neighbor, call your senator, or become a GeoMentor, don't do it as a quick fix. Be prepared to stick with it for a while. If we all do, we will be able to make a change.

More Information

For more information, contact Daniel C. Edelson, vice president for education, National Geographic Society (e-mail: dedelson@ngs.org).

ArcPad 8 Now Available—Enhances User Experience and Improves Customization

Helps Field Staff Manage Critical Information More Efficiently

Highlights

- ArcPad has a new user interface with modern icons, toolbars, and menus.
- Update and synchronize ArcPad field edits directly with ArcGIS Server.
- ArcPad customization tools and first year of maintenance are now included.

ArcPad 8, ESRI's field mapping and data collection software designed for use with ArcGIS Desktop and a variety of mobile devices, is now available. This major release includes new usability and performance enhancements to increase field productivity and help users manage their GIS projects more efficiently.

Integration with ArcGIS Server

The new no cost ArcGIS Server ArcPad extension allows users to publish their ArcPad projects directly to ArcGIS Server. Mobile devices that connect to the Internet (by cradle, USB, Wi-Fi, or phone connection) can now synchronize ArcPad field edits with the enterprise geodatabase via ArcGIS Server.

Enhanced User Experience

Modern icons, menus, and toolbars in the new ArcPad use less screen real estate than previous versions. Toolbars can now be docked, minimized, and maximized. Also, a new desktop tool called the ArcPad Toolbar Manager lets users either modify the out-of-the-box toolbars or create their own. The previous ArcPad Startup dialog box has been replaced with the Open Map dialog box, which can be used to browse ArcPad maps by list or thumbnail.

ArcPad Studio Now Included

ArcPad Studio, the development framework to customize ArcPad, now comes with every ArcPad 8 license. ArcPad 8 is a maintenance-based product, and the first year of ArcPad maintenance is included. Customers may subscribe to annual maintenance to get software updates and technical support. Technical support will be provided to customers who are current on maintenance.

Improved GPS

The GPS user interface has a refresh in ArcPad 8. The position dialog box is now replaced by the new GPS status bar, a translucent toolbar that appears at the bottom of the map screen. It shows much of the same detail from the previous position dialog box, but now has visual color cues to indicate the quality of the GPS fix. In addition, more detailed GPS position information can be displayed on the full-screen multitab GPS dialog box.

Improved StreetMap Capabilities

The StreetMap extension included with ArcPad 8 now provides an easier method to find addresses and locations using the new lookup index. The extension is based on ESRI StreetMap Premium data derived from the Tele Atlas dataset and now includes data for Europe in addition to North America. The extension is included at no extra cost and supports the Smart Data Compression format and enables display, address geocoding, reverse geocoding, and routing capabilities.

Enhanced ArcPad Data Manager Extension

The ArcPad Data Manager extension now gives users more options when preparing data for ArcPad. Users can configure an ArcPad project for repeated use with geoprocessing tools or author an ArcPad project for publication to ArcGIS Server. Additional geoprocessing tools have also been added to ArcPad Tools in ArcToolbox, which supports using ArcPad projects for geoprocessing and deploying to mobile devices.

"From very basic to more advanced, sophisticated applications, ArcPad 8 helps users get up and running quickly," says Jian Lange, ESRI product manager for ArcPad. "The customization framework now included with this release provides additional capabilities to complete mobile GIS tasks and projects effectively."

More Information

For more information on ArcPad or to evaluate ArcPad 8 at no cost, visit **www.esri.com/arcpad**.

With ArcPad 8, users can now synchronize field edits directly with the enterprise geodatabase via ArcGIS Server. Inset: Identify target areas for inspections and GIS data collection.

ArcPad Eases Address Canvassing in 2010 U.S. Census

The 2010 U.S. Census is less than one year away, and preparations are in full swing. In April of this year, the Census Bureau launched the address canvassing operation, where approximately 140,000 census workers verified the nation's residential addresses and captured GPS locations for each of these addresses using a PDA equipped with ArcPad software. The address canvassing operation helps ensure that everyone residing in the United States receives a 2010 Census questionnaire and helps simplify future census enumeration operations by providing a specific coordinate, or "map spot," of each household in case a revisit is necessary. The result will be the most comprehensive U.S. address list.

According to Timothy Trainor, U.S. Census Bureau's Geography Division chief, "The goal of address canvassing is to go out and check the address list that we have and GPS capture each of the individual housing unit locations." The results of this effort will be used for the distribution of 2010 Census questionnaires to U.S. households. However, the U.S. Census Bureau expects that 35 percent of all households will not return their census questionnaires on time, and follow-up will be necessary. Says Trainor, "We not only use the address information [captured in address canvassing] for mailing questionnaires, but we also use the coordinates to help untangle some of those difficult-to-observe or difficult-to-read situations. Now the enumerator can actually go to the right unit based on a precise set of coordinates and record the information directly into a handheld computer. We believe that having a mobile infrastructure in place will head off many of the problems with census nonresponse."

ArcPad is also helping the U.S. Census Bureau reduce costs and produce fewer paper forms. "We produced a lot of paper in the last census," says Trainor. "And it wasn't just the use of the paper; it was all the things that go with the paper. We had to procure it, store it, and ship it. It was just all over the place. One of the goals of the 2010 Census is to simplify operations, and we're currently achieving that with the mobile data collection system."

The U.S. Census Bureau is not a new user of ArcPad software. Andrea Johnson, the Census Bureau's Geographic Products Branch chief, says that the Census Bureau has been using ArcPad since 2002 in various iterations in many of its census tests. "When we were planning for the 2010 Census operations, we knew that the enumerator would need an integrated tool that could facilitate many tasks," says Johnson. "The combination of mobile hardware and ESRI software was the most interoperable and flexible solution for our address canvassing operation."

More Information

For more information, contact Andrea Grace Johnson, Geographic Products Branch chief, U.S. Census Bureau (e-mail: andrea.grace.johnson@census.gov).

Bring the Best of the Web to Market Analysis and Site Evaluation

ArcGIS Business Analyst Online

Today's economy and competitive pressures are forcing organizations to respond to new challenges faster and more decisively than ever. Opportunities arise quickly and are lost if companies cannot respond. Successful organizations understand the need to react within narrow time windows and armed with accurate information.

ESRI's ArcGIS Business Analyst Online helps improve performance to overcome daily business challenges. The next-generation release of ESRI's popular hosted GIS for customer segmentation, market analytics, and site evaluation, ArcGIS Business Analyst Online, powered by ArcGIS Business Analyst Server, provides a rich and intuitive Web 2.0 experience to users as they analyze and explore a vast collection of economic, social, and geodemographic data.

ArcGIS Business Analyst Online Delivers Expert Analysis to the Novice

Business problems can be tackled by anyone using the guided workflows that are part of the user experience, or subscribers can take their own approach to analysis and exploration by using any combination of analysis tools and data query reports.

All ArcGIS Business Analyst software application products share a common architecture and are built using reusable components. Any data, model, or analysis created on the desktop, server, or Web can be shared, mashed up, and integrated with any of the other applications, including ArcGIS and other enterprise business tools.

ArcGIS Business Analyst Online supports the sophisticated needs of line-of-business managers and analysts yet is intuitive enough for boardroom executives and casual workers to perform detailed analysis without any prior training.

For small businesses, retailers, real estate professionals, health care practitioners, franchisors, and many other business segments, ArcGIS Business Analyst Online helps subscribers validate a business concept, understand market conditions, or investigate a hunch.

For example, a marketing specialist can view a specific neighborhood and be able to literally overlay hundreds of data variables that influence consumer buying habits and preferences. On-demand access to more than 50 reports, 1,600 data variables, thematic maps, and time-saving "quick comparison" features allow users to explore a geographic region easily.

ArcGIS Business Analyst Online is reaching into many market sectors and industries that have not had access to easy GIS functionality before.

Retailers can explore markets through more innovative criteria to predict the success of sales promotions or assess the impact of competitors' activities on the customer base. For economic developers, the system helps fine-tune and consolidate the processes of attracting inward investment to cities and counties by providing information that reflects local taste and mar-

Trends from ESRI's 2009/2014 Updated Demographics

The U.S. Population Is Aging, Changing, and Struggling

Highlights

- The 2009/2014 demographic updates and projections were produced with proven methodologies.
- ESRI's 2009 Updated Demographics reveal some of the key changes that affect us all.
- Updated Demographics can be delivered in a wide range of geographies, formats, and variables.

Recently updated by ESRI's data development team, the 2009/2014 demographic updates and projections were produced with proven methodologies to provide the highest possible level of accuracy.

In the past year, changes in the nation's economy have become extremely personal. The failure of the subprime mortgage market in 2007 extended its devastating impact in 2008, shaking the very foundations of the U.S. economy and touching every household in the country. Nearly everyone in the United States has been directly affected or knows someone who has been impacted by life-changing events such as job loss, home foreclosure, reduced retirement savings, and lower home values. As *ArcNews* goes to press, the economy remains in recession. ESRI's 2009 Updated Demographics reveal some of the key changes.

Housing Market

The continuing slump in the housing market is now being affected by the economic downturn. Foreclosures rose 81 percent in 2008, with sharp increases since January 2009. Part of this foreclosure increase may be attributed to mortgage holders' inability to make payments because of job losses. The 2009 median home value is $162,000, 11.3 percent lower than the 2008 figure. The decline in the 2008–2009 median home value has affected more than two-thirds of U.S. counties. Vacant housing units increased by more than 8 percent; the U.S. vacancy rate is now 11.2 percent. The 2009 homeownership rate of 66.2 percent is now slightly less than the rate in 2000.

Economic Trends

According to the National Bureau of Economic Research, the economy has been in recession since December 2007. The committee determined that the decline in economic activity in 2008 met the standard for a recession. Without seasonal adjustments, the unemployment rate rose to 10.6 percent. In the past year, 5.6 million jobs were lost. The economy continues to slow because of job losses, the drop in housing prices, lack of consumer confidence, and the credit crunch.

Income

Median household income did not grow in 2008. The U.S. median household income figure stands at $54,700. Thirty-seven percent of U.S. counties are experiencing declines in median household income. This decline will directly affect local consumer buying power, resulting in lower sales tax revenues for area governments. Median net worth declined by 7.6 percent to less than $98,000.

Population

In most markets, population growth and change slowed pervasively due to decreased in- and out-migration flows. The job market has not yet offered significant employment opportunities for movement, as the sluggish housing market has prevented people from moving to more productive regions. The fastest-growing areas from 2000 to 2009 are counties that are adjacent to large metropolitan areas:

- Flagler County, Florida
- Kendall County, Illinois (Chicago metro area)
- Rockwall County, Texas (Dallas-Fort Worth metro area)
- Pinal County, Arizona (Phoenix metro area)

Fastest-growing ZIP Codes are

- 89084 (North Las Vegas, Nevada)
- 89086 (North Las Vegas, Nevada)
- 89138 (Las Vegas, Nevada)
- 80238 (Denver, Colorado)

Whether we like it or not, we're all aging. The U.S. median age in 2009 is 36.9 years, an increase of 1.5 years since 2000.

Population Diversity

The "face" of America continues to change as more people arrive in the United States to seek the American Dream, or are born to those of various races and ethnicities. The most diverse states are California, New Mexico, and Texas, due in large part to the growth of the Hispanic population. The 2009 Hispanic population is 48.7 million or 15.7 percent of the U.S. population. From 2000 to 2009, this population segment has grown more than 3.5 percent annually.

The Asian population in 2009 is 13.9 million or 4.5 percent of the U.S. population. Since 2000, this population has grown at a rate of 3.4 percent annually.

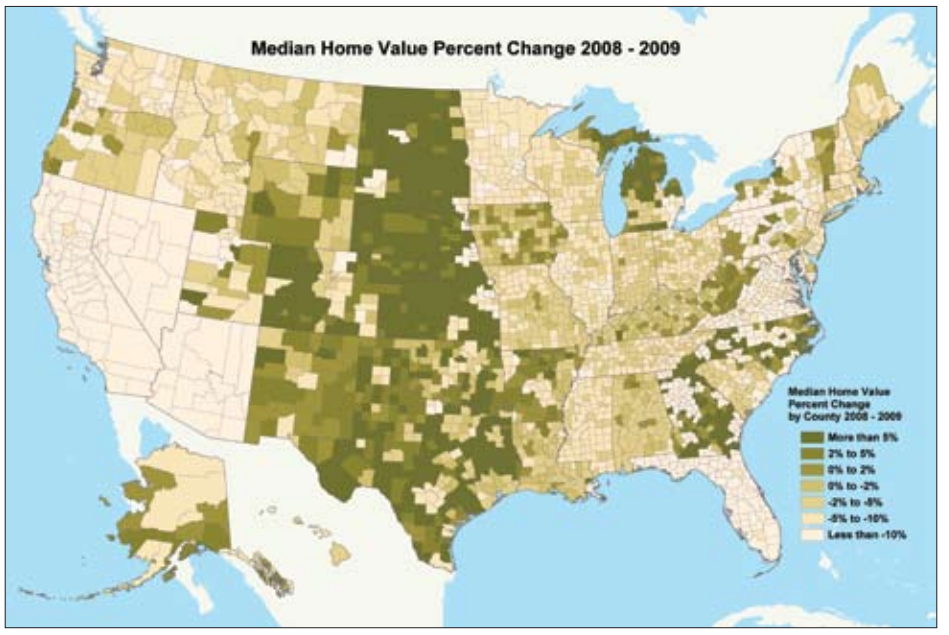
The multiracial population is now 9.1 million, approximately 3 percent of the total U.S. population. The annual growth of this population segment is 3.2 percent.

ESRI's 2009/2014 Updated Demographics

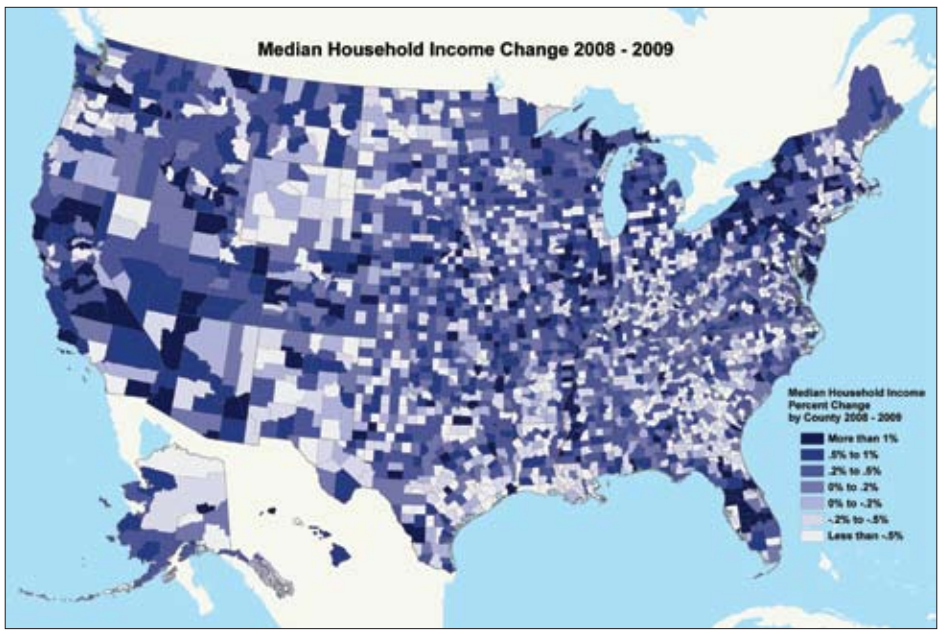
Delivered in a wide range of geographies, formats, and variables, ESRI's Updated Demographics will also be available in ArcGIS Business Analyst Online, ArcGIS Business Analyst (desktop), ArcGIS Business Analyst Server, ArcGIS Online, and Address Coder and as ad hoc data.

More Information

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



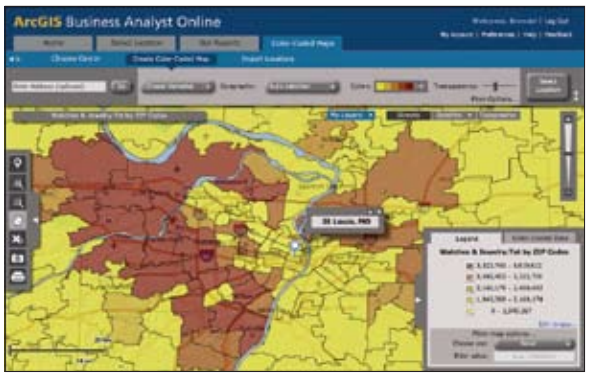
2008–2009 change in median home value in the United States by county.



Change in median household income in 2008–2009 for the United States by county.

ket opportunity right down to the block group level.

Banks and financial institutions are using the application to better understand local markets and the needs of their customers. U.S. government funding under the Troubled Asset Relief Program (TARP) has driven many to perform detailed neighborhood analysis around their branches so they can determine which locations are the most viable and where there should be consolidation.



Color-coded maps show intensity of a wide variety of data variables, allowing market exploration in a geographic context.

New Tools Ensure Accuracy and Ease of Use

This release of ArcGIS Business Analyst Online is a leap forward in interacting with the types of geodemographic data that users in any organization need. Enhanced site comparison tools and new reports allow users to quickly gain knowledge of how their markets are performing now and assess future potential. In addition to the inclusion of 2009 demographic data updates and 2014 projections, the application includes new ways to visualize data and download it in a digestible format. Comparing a region or particular set of sites to identify both strong and weak performers can be done with a few mouse clicks, while benchmarking performance against key criteria is easy with workflow and export wizards. Improved support for data interchange with desktop applications, such as Microsoft Office and other common enterprise systems, is also included. ESRI has tapped into its wealth of cartographic and charting experience, and ArcGIS Business Analyst Online contains simple menus and control wizards to automatically guide users to their most popular reports and help navigate the first-time user through the analysis process or automate benchmarking conditions through which to compare a firm's real estate portfolio.

Choose Level of Service

Thousands of companies and individuals have already integrated ArcGIS Business Analyst into their decision-making processes, making it an important business resource. The application is available in different subscription levels, from onetime-only reports purchased using a credit card to premium subscription packages and specialized development services. Want to try it out? More than 100 variables are available free for guest users at **bao.esri.com**. For more information on what's new in ArcGIS Business Analyst Online, visit **www.esri.com/whatsnewinbao**.

For Additional Information About ESRI Products

Please call ESRI at 1-800-447-9778.

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www.esri.com/distributors

ArcGIS Server Geoportal Extension Manages Geospatial Resources Enterprise-wide

Organizations Benefit Through Improved Efficiency and Effectiveness

Highlights

- The ArcGIS Server Geoportal extension provides powerful, intuitive tools and features to develop GIS portals.
- Organizations can manage and publish the metadata for their geospatial resources.
- The extension's out-of-the-box portal application includes a fully functional metadata catalog.

With the release of ArcGIS 9.3.1, the GIS Portal Toolkit becomes the ArcGIS Server Geoportal extension. In addition to fully integrating into ArcGIS Server, the Geoportal extension includes several enhancements:

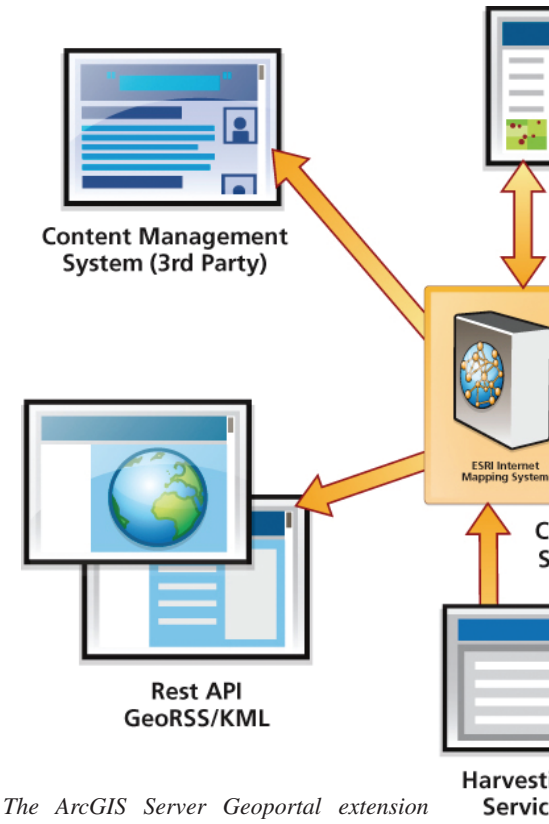
• It includes the North American Profile and Infrastructure for Spatial Information in Europe (INSPIRE) metadata standards. These standards are required for an organization to participate in the North American and European National Spatial Data Infrastructure (NSDI) networks.
• It includes enhanced security with record-level metadata access control. Based on single or multiple Lightweight Directory Access Protocol (LDAP), this enhancement gives access to metadata resources only to people and business units that need it.
• It can now make direct searches for all registered Catalog Service for the Web (CSW) repositories. Users can now search other portals from within a single GIS portal.
• It now uses the ArcGIS API for JavaScript to preview map services and feeds. Users can preview services, including ArcIMS and KML services, without loading a browser plug-in or launching a desktop GIS application.

Benefits of a GIS Portal

Recent years have witnessed the rapid advance and expanding use of automated mapping, GIS, and spatial data communication technologies. Such progress—along with the associated growth in geospatial data collection activity by organizations and governments throughout the world—has helped create a global reservoir of electronically enabled geospatial information that has a real potential for improving decision making and operations at all levels of endeavor in all types of organizations.

For this potential to be fully realized, geospatial information resources must be positioned both institutionally and technologically for discovery, exchange, and use.

A spatial data infrastructure (SDI) has evolved as a conceptual framework to enable geospatial information sharing at a significant scale. The ArcGIS Server Geoportal extension provides a technical mechanism—a GIS portal or geoportal—for posting, discovering, and exchanging existing geospatial resources in support of both broadly based SDIs and more narrowly framed local and organization-specific data-sharing communities. Geoportals reduce the time users spend finding relevant geospatial resources that meet their needs and help ensure that they only use approved, high-quality datasets.



The ArcGIS Server Geoportal extension provides all the components that users need to create their own GIS portals.

Capabilities of the ArcGIS Server Geoportal Extension

The ArcGIS Server Geoportal extension gives organizations the capability to organize and publish the location and descriptions of their geospatial resources and gives users the ability to discover and connect to these resources. Metadata is the information that describes the content, quality, condition, origin, and other characteristics of a resource. Metadata for geospatial resources typically documents how, when, where, and by whom the data was collected; the availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability compared to established standards.

The ArcGIS Server Geoportal extension collects and publishes metadata in a central catalog that allows users to search and access the associated resources. It does not create or duplicate geospatial resources but allows organizations to leverage existing resources regardless of their location, format, or structure. It encourages collaboration and cooperation among multiple departments and organizations by facilitating sharing of geospatial resources regardless of GIS platform. It also gives organizations an enterprise-level awareness of disparate geospatial resources and activities.

The ArcGIS Server Geoportal extension addresses the needs of four very different constituencies:

• Resource users who use geoportals to discover and gain access to datasets, analyses, tools, and Web services for use in their own projects. They need an easy-to-use, intuitive interface for finding, previewing, and using the resources and trust that they are using the most current, best quality, resource available. This discovery process needs to be integrated as much as possible in the users' workflows. Their interest is in the content available in a geoportal, not in the geoportal itself.
• Resource publishers who use GIS portals to publish and share the resources they have authored. The goal of the ArcGIS Server Geoportal extension is to minimize the overhead of publishing and maintaining their resources' descriptions.
• Developers who create applications that consume one or more services available through a geoportal. They need a comprehensive services platform with a variety of application programming interfaces that allow them to quickly and easily create custom applications.
• Administrators who are responsible for maintaining the quality, currentness, and availability of the geoportals and resources. They need a complete system for evaluating new record descriptions, implementing access control to resources, and integrating geoportals into existing enterprise IT infrastructures.

The ArcGIS Server Geoportal extension provides powerful, intuitive tools and features to make it easy for everyone to develop, administer, and use GIS portals.

Developing GIS Portals

To help portal developers get a GIS portal up and running quickly, the ArcGIS Server Geoportal extension includes an out-of-the-box portal application. This application gives users a fully functional metadata catalog to search and publish resources and uses the ArcGIS API for JavaScript to preview resources. The out-of-the-box application is simple to customize, with documentation included that demonstrates how to modify every component of the application.

The extension also includes a REST API that portal developers can use to integrate GIS portals into their external Web applications. The REST API supports GeoRSS, KML, and HTML outputs, which allows developers to include dynamic portal feeds in other applications. For example, a GeoRSS feed could be used to notify portal users, in real time, about updates to the GIS portal.

Administering GIS Portals

The ArcGIS Server Geoportal extension integrates well with enterprise architectures because it is built on service-oriented architecture (SOA) principles, supporting existing IT, Web, and geospatial interoperability standards, including industry specifications of the Open Geospatial Consortium, Inc. (OGC).

The ArcGIS Server Geoportal extension includes enhanced security features. It supports user authentication with an external authentication service through the LDAP. This protocol is available on most user directories, including, but not limited to, Microsoft Active Directory, Sun Open Directory Server, Oracle CoreID, and IBM Lotus Domino. Sensitive data can remain behind the firewall, and access can be restricted to authorized employees and business units.

Global Doorway to Understanding the Earth
GEOSS GEO Portal

ESRI Services

In 2003, the European Commission, along with 76 other international governments, formed the Group on Earth Observations (GEO) to strengthen global cooperation in developing earth observation systems. GEO is a voluntary coalition of governments that serves as a task force for developing new earth observation projects and coordinating strategies and investments to increase global awareness.

The GEOSS GEO Portal makes Earth Observation data available to scientists around the globe.

To achieve its task, GEO began constructing a Global Earth Observation System of Systems (GEOSS) in 2005. Based on a 10-year implementation plan that will be finalized in 2015, GEOSS will yield a broad range of "societal benefit areas" that address many major challenges facing our world. Among these societal benefits, which require precise geospatial awareness to address, are reducing deaths and loss of property from natural and human-caused disasters, understanding and improving environmental factors harmful to human health and biodiversity, and improving the management of energy resources. Of the many goals for GEOSS, one is to eliminate key obstacles to data access. GEO recognizes the need for full and open exchange of observations, guaranteed data access and usability, and a solid regulatory framework for earth observations.

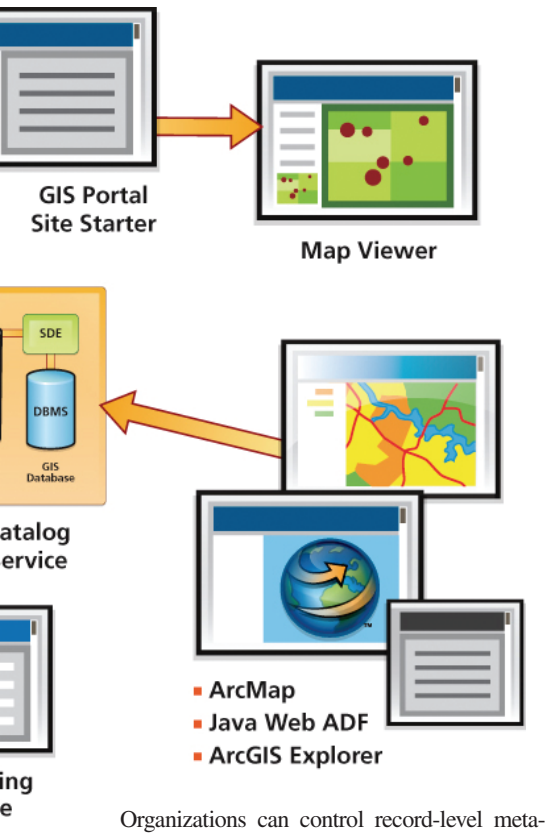
Soon after GEOSS was proposed, GEO contracted with ESRI Professional Services to build the GEOSS GEO Portal using ESRI's ArcGIS Server Geoportal extension (formerly the GIS Portal Toolkit). The GEOSS GEO Portal offers a single Internet access point for data, imagery, and analytic software packages relevant to all parts of the globe. It connects users to existing databases and portals and provides reliable, up-to-date, and user-friendly information, vital for the work of decision makers, planners, and emergency managers. The ArcGIS Server Geoportal extension is a standards-based platform for building geospatial portals, spatial data infrastructures, and metadata catalogs. It gives GEO partners the capability to organize and publish the locations of geospatial datasets, applications, and Web resources while providing users with the ability to discover those resources and facilitating access to them *(see main article above)*.

Conclusion

Today, the GEOSS GEO Portal provides scientists with easy access to a wealth of earth observation data and Web mapping services. It is a global doorway to increasing our understanding of the earth and helping participants move from principles to action.

More Information

To learn more about GEO, visit www.earthobservations.org. To use the GEO Portal, visit geoss.esri.com/geoportal.



Organizations can control record-level metadata access through the use of three types of access control policies. The Unrestricted policy allows all users to access all approved resource descriptions. The Public-Protected policy allows all users to access public documents and only allows members of one specific group to see the protected documents. Finally, the Restricted policy allows all users to access the unrestricted documents, but only specified groups have access to restricted documents. During the aftermath of Hurricane Katrina, particular datasets were made available to first responders for a brief period of time without making these datasets publicly available.

The ArcGIS Server Geoportal extension also includes a harvesting tool that allows portal administrators to add and update large volumes of geospatial resources to the metadata catalog. The harvesting tool automatically retrieves and updates metadata from existing catalogs and databases, then registers them with the metadata catalog.

Publishing and Sharing

The ArcGIS Server Geoportal extension supports many different metadata profiles and standards. In addition to a custom metadata service based on ArcGIS Server technology, the extension supports Dublin Core, Federal Geographic Data Committee (FGDC), and International Organization for Standardization (ISO) metadata standards. Organizations or SDI initiatives typically create profiles of these standards to capture specific or additional information in resource descriptions that are deemed relevant for the particular SDI initiative. To support two globally relevant SDI initiatives, the ArcGIS Server Geoportal extension includes support for the North American Profile and INSPIRE profile of the ISO metadata standards.

The browser-based Web application allows resource publishers to register their resources with a GIS portal and either create the metadata directly or upload existing metadata. The Web application also provides tools for managing published resources. Additionally, resources can be published directly to a GIS portal from ArcCatalog by using the publishing client.

Discovering and Using GIS Resources

The browser-based Web application created by the portal developers and managed by the portal administrators provides an intuitive experience for resource users to find, preview, and access geospatial resources. Additionally, they can search and access resources directly from ArcGIS Desktop and ArcGIS Explorer with the freely available CSW clients, which integrate seamlessly with these desktop GIS programs.

Additionally, to save time and IT resources, users do not have to access or download an entire resource to use it in their projects. By using the clip-zip-ship task, users can draw a polygon around their desired location, select the layers they wish to receive from that location, and choose an output format and projection. The GIS portal, using the ArcGIS Server Data Interoperability extension, runs a geoprocessing task that extracts the required information from the resource and sends the user an e-mail with the location of the extracted data.

Conclusion

Organizations use the ArcGIS Server Geoportal extension to improve knowledge sharing, reduce duplication of effort, direct people toward the best available data, and improve the overall quality of geospatial data and information. With the ArcGIS Server Geoportal extension, organizations improve the efficiency and effectiveness of geospatial activities within their enterprise and with other organizations.

More Information

To learn more about the ArcGIS Server Geoportal extension, visit www.esri.com/gisportal.

ArcGIS Server OGC News Update

The following is an ArcGIS Server news update on Open Geospatial Consortium, Inc. (OGC)-supported standards and how they can be used:

The ArcGIS Server implementation of the OGC Web Map Service (WMS) standard includes support for the use of Styled Layer Descriptors (SLD). The implementation of the SLD specification allows a publisher to advertise multiple user-selectable styles when generating a map. Users can also create their own styles in an SLD document and task the ArcGIS Server WMS to generate an image based on a user-defined style. The SLD implementation allows greater client-side control of symbology.

Another new feature is the Transactional Web Feature Service (WFS-T), which enables any GIS client that supports WFS-T to carry out transactions against geodatabases using the WFS-T service published by ArcGIS Server. Publishers can also create Web applications that leverage the WFS-T specification, allowing multiple browser-based clients editing access to the ESRI geodatabase.

Both the SLD and the Web Feature Server (WFS) implementation of ArcGIS Server can leverage the OGC Filter Encoding (FE) specification. The ArcGIS Server implementation of FE allows SLD-based WMS workflows to apply spatial and attribute filter logic to selectively style relevant features. In the context of ArcGIS software's WFS implementation, FE-based spatial and attribute filters can be used within the queries to request a subset of features from the data store.

ArcGIS Server can publish any raster dataset as OGC WMS, WCS, or KML. Web Coverage Service (WCS) is a data service that enables multispectral pixel values from a raster dataset to be returned to Web applications. The ArcGIS WCS implementation returns data in a multitude of formats—GeoTIFF, NITF, HDF, JPEG, JPEG 2000, and PNG. Applications that can connect to WCS services (including ArcGIS and geoprocessing tools) can then perform analysis on the pixel values.

ArcGIS Server allows users to share maps and data as OGC KML. Map and image services expose a KML network link using the REST pattern. ArcGIS Server map services can also return the results of geoprocessing, geocoding, and query operations as KML. Some of the ESRI-supported OGC specifications include WMS, WFS, WCS, KML, CSW, SLD, and FE. A complete list is available on the www.esri.com/standards Web site.

More Information

For more information and new podcasts, visit www.esri.com/standards.

ArcGIS Web Mapping APIs

Create Fast, Modern Web Applications

A simple way to create cross browser and cross platform Web mapping applications is available via the ArcGIS Web Mapping APIs. These application programming interfaces (APIs) for JavaScript, Flex, and Microsoft Silverlight can be purchased separately from any other ArcGIS software. A low-cost annual subscription allows users to access the ArcGIS API for JavaScript, Flex, or Microsoft Silverlight and deploy it. The subscription also includes access to ArcGIS Online standard, no-cost services. The APIs include support for dynamic and cached map services, common GIS tasks, and drawing graphics and adding pop-up windows.

More Information

For more information, visit www.esri.com/mappingapis.

ArcGIS Explorer 900 Makes It Even Easier to Deliver GIS to Everyone

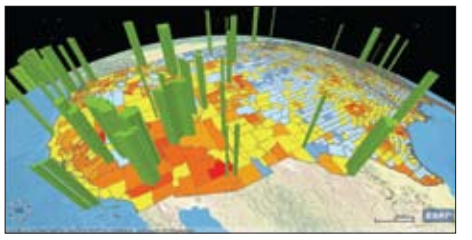
ArcGIS Explorer 900 offers an enhanced user experience and expands how the software can be used to deliver geographic information to a broad audience.

ArcGIS Explorer offers an easy way to view, present, and share GIS data. It connects directly to a variety of ready-to-use ArcGIS Online basemaps and layers and enables users to connect to their own map services or add local data. It can also be extended with a user's own tools to deliver geoprocessing and other capabilities to people who do not necessarily know anything about GIS. It is ideal for delivering GIS to everyone, not just GIS professionals.

ArcGIS Explorer includes intuitive, high-performance visualization and presentation tools that let users make information visually compelling. It is engineered to work directly with maps and layers authored using ArcGIS Desktop and published via ArcGIS Server, or shared as layer packages, and makes integration of other data easy.

New features in ArcGIS Explorer 900 include

- *Easier to use, intuitive user experience*—A new ribbon-based user experience guides users to the appropriate tools, making ArcGIS Explorer more intuitive to use.
- *Integrated 2D/3D display*—With a single click, users can switch their display mode.
- *Geographic presentation*—Users can create dynamic presentations that integrate GIS and other content, including titles, pop-ups, documents, photos, and videos. ArcGIS Explorer 900 also offers a full-screen display.
- *ArcGIS sharing*—It is now even easier to leverage data from ArcGIS Online, including data published by ESRI and other GIS users.
- *Enhanced data support*—ArcGIS Explorer 900 supports the new ArcGIS 9.3.1 layer packages, which encapsulate ArcGIS Desktop cartography, along with data. ArcGIS Explorer 900 also supports layer files and offers improved support for KML/KMZ. In addition, users can change their basemaps on the fly while maintaining their operational layers.



ArcGIS Explorer 900 includes intuitive, high-performance visualization and presentation tools that let users make information visually compelling.

- *Multiple languages*—The ArcGIS Explorer help tool, resource center, and user interface can be used in a variety of languages.

ArcGIS Explorer also includes a software development kit available for free download, which provides a powerful object model and lets developers create new tools and add-ins.

More Information

For more information and to download ArcGIS Explorer 900, visit www.esri.com/arcgisexplorer.

Discover and Share Geographic Information

Join the ArcGIS Online Community

With the ArcGIS 9.3.1 release, ArcGIS Online now includes a Web application that serves as a central online repository for users to easily share and find GIS data, maps, layers, services, and tools. ArcGIS users can now easily upload and share their geographic information and find content published by other users as well as content published by ESRI.

Joining ArcGIS Online

ArcGIS users can join the ArcGIS Online community by using their existing ESRI Global Account login or creating a new Global Account. ArcGIS Online membership is free and allows users to control access to items they want to share. It allows users to create groups and grant access to others who want to join their group. ArcGIS Online can also be accessed anonymously without creating an account, although registering with an account gives users access to more functionality, such as creating and joining groups and uploading items.

Groups are a great way to collaborate with other ArcGIS users who share a common interest in a particular topic, for example, sustainable development or wildfire mitigation. Users can join groups they are interested in by entering keywords into the search dialog box. Once a group has been joined, members can easily view and access content published by other group members and share their own content with the group.

Adding and Sharing Content

Content that can be uploaded and shared in ArcGIS Online includes maps created with ArcGIS Desktop, for instance, ArcMap documents (.mxd) and ArcGlobe documents (.3dd); layer files (.lyr) and ArcGIS Server map, globe, and image services; and tools such as ArcGIS Server geoprocessing and location services. Uploaded content can be tagged with keywords.

Search for content by keyword and view the results, which include file type, a description, and file opening instructions.

To simplify the sharing of layers, ESRI has introduced layer packages (.lpk) with the ArcGIS 9.3.1 release. ArcGIS Desktop users can automatically create layer packages, which are ZIP files that contain intrinsic properties such as item type, thumbnail, extent, and spatial reference. After saving a layer package locally, users can then upload it to ArcGIS Online and share it. Once the layer package is uploaded, users can add more information, such as tags, that makes the layer package easier to find. Layer packages can also be shared via e-mail or as a file over the network.

Users can also share Web maps created with the ArcGIS Online map viewer application. Users can combine their own shared GIS services with services shared by others to create a Web map that includes multiple map services "mashed up" onto any of the basemaps published by ESRI, choosing from imagery, streets, topography, or shaded relief. All of this is accomplished with no programming.

More Information

To join ArcGIS Online today, visit **www.arcgisonline.com**.

New and Updated Content in ArcGIS Online 9.3.1

The latest ArcGIS Online changes and updates include a new imagery service based on Landsat imagery and a reduction in price for the USA Prime Imagery map service from $500 to $200 for an annual subscription. ArcGIS Web mapping APIs for JavaScript, Flex, and Microsoft Silverlight are also now available to assist users in rapid Web application development.

ArcGIS 9.3.1 users now have the ability to easily access Microsoft Virtual Earth services. ArcGIS Desktop users who are current on maintenance have free access to Virtual Earth during their maintenance year with a large allotment of transactions per year. Users can also purchase an annual subscription with unlimited transactions. ArcGIS Server users have access to a built-in 90-day evaluation of Virtual Earth, after which they can purchase annual subscriptions with blocks of 100,000 transactions. ArcGIS Explorer users who have an existing ArcGIS Desktop license can share the free transactions allotted to the ArcGIS Desktop license. ArcGIS Explorer users who do not have an existing ArcGIS Desktop license can evaluate Virtual Earth for 90 days, then purchase an annual subscription with unlimited transactions. Virtual Earth services include imagery, streets, and imagery with street labeling (hybrid). ArcGIS Server and ArcGIS Web mapping APIs include access to Virtual Earth geocoding.

ArcGIS Online now also provides World Geocoding, World Routing, and World Drive Time services. World Geocoding is a set of standard, no-cost services that provide address, reverse, and limited batch geocoding for North America (United States and Canada) and Europe, and world place-finding capabilities. Users who need to batch geocode, that is, save geocodes for more than 1,000 addresses per year, or who would like to use this service for commercial purposes, can purchase annual subscriptions that include blocks of 25,000 batch geocodes.

World Routing supports point-to-point and optimized routing for North America and Europe. This standard, no-cost service includes 5,000 routes per year. A fee-based service with no limitations that can be used for commercial purposes is also available. World Drive Time is available as a premium, fee-based service and calculates drive-time polygons using an input location and drive-time values.

More Information

For more details about ArcGIS Online, visit **www.esri.com/arcgisonline**.

Discovering Gems of Wildlife Viewing

New Jersey Audubon Society Uses GIS to Create Trail Maps

Highlights

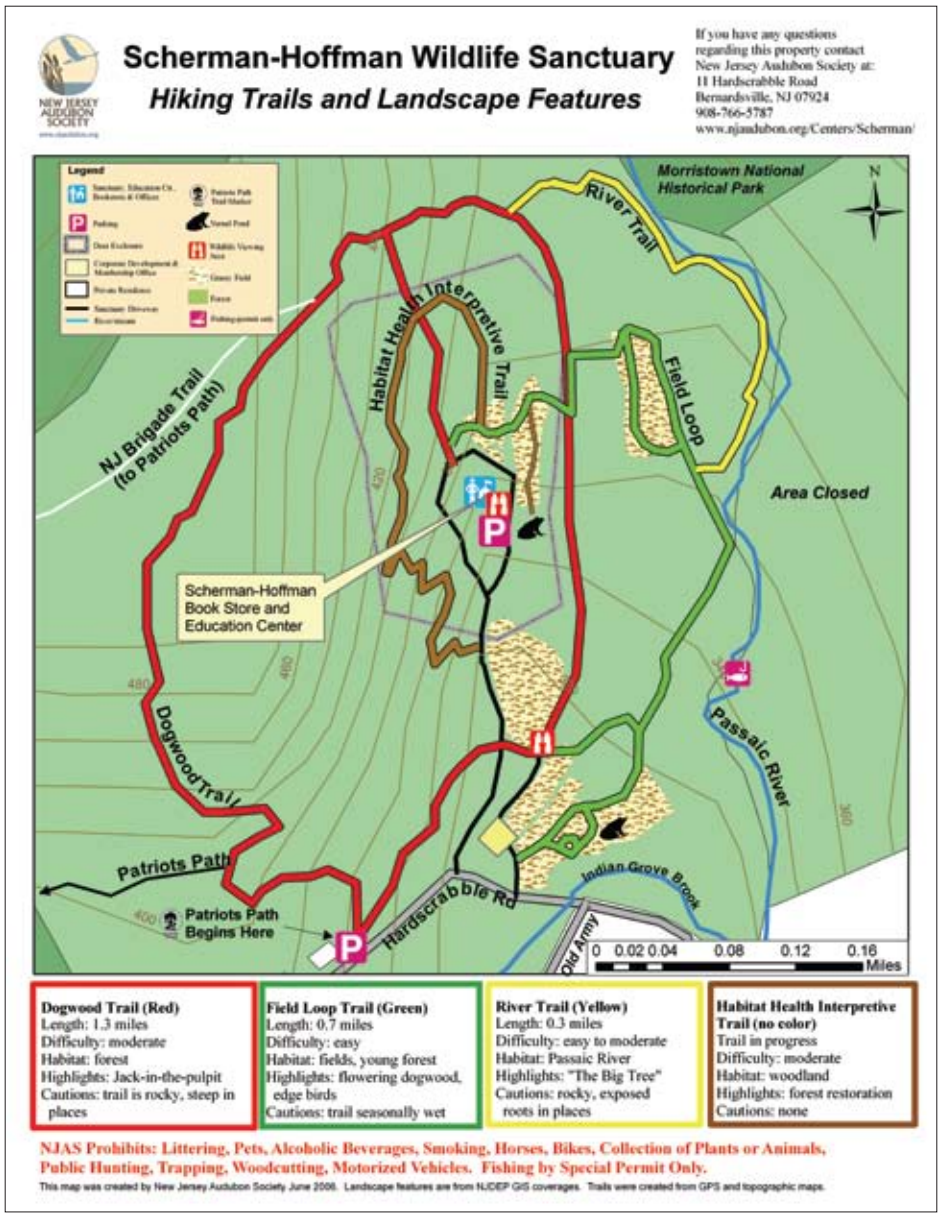
- NJAS used ArcPad on a Pocket PC with a handheld GPS unit to collect trail information.
- With ArcGIS Desktop, the staff easily provides trail updates and changes in land use or features.
- The ArcGIS Desktop editing feature allowed NJAS to smooth trail lines and add attribute table information.

New Jersey Audubon Society (NJAS), a nonprofit environmental organization, is dedicated to fostering an environmental awareness and a conservation ethic among New Jersey's citizens. With 36 wildlife sanctuaries, many of them right in people's own "backyards," these mostly undiscovered gems offer a number of wildlife viewing experiences for New Jersey residents. So what is the best way to get people out and to try nature? Provide accurate maps to help make the experience enjoyable. Maps that identify trail length, highlights, and cautions remove fear of the unknown and encourage a little exploration. In addition, by mapping the sanctuaries, NJAS is able to highlight places to see rare wildlife and habitats, as well as identify areas that should be closed due to the presence of threatened or endangered species. While NJAS's nine staffed sanctuaries have been successful in getting people out on the trail, the unstaffed properties remain open but largely unused. NJAS's task? To bring these ecological gems to the attention of New Jersey residents and encourage passive recreation.

It rapidly became apparent that simply publicizing the sanctuaries was not enough. These sites have hiking trails that meander through grassland, forest, and wetland habitat. Many sites have trails in rugged terrain, while other locations offer a simple, relaxing walk suitable for small children. A few of the sanctuaries had hand-drawn maps, but these were dated and generally lacked sufficient detail in terms of demonstrating unique habitat features as well as trail length and the ruggedness of the terrain. The system was clearly in need of an overhaul. The solution was to create computer-generated maps that not only show hiking trails but also offer relevant feature information about each sanctuary.

NJAS had experience with ArcView and found that ESRI's upgrade to ArcGIS Desktop provided even better mapping capability to help it achieve its goal. The staff was also able to use ArcGIS Desktop to incorporate New Jersey State Department of Environmental Protection shapefiles, specifically elevation, land-cover types, streams, political boundaries, roads, and sensitive wildlife habitat layers. Parcel boundaries were either generated using tax maps or uploaded from municipal GIS sites.

To acquire trail and specific feature information not available as a GIS data layer, NJAS used ArcPad on a Pocket PC with a handheld GPS unit



This trail map was created for the Scherman-Hoffman Wildlife Sanctuary. As many New Jersey Audubon Society (NJAS) sanctuaries are adjacent to state or national parks, connector trails are included so that visitors may easily expand their hikes. This map highlights vernal pools and similar landscape features to enhance nature walks.

connection for satellite reception. Staff members walked each property with hiking trails or where trails were being developed while recording trail information in ArcPad. They collected site-specific data, such as parking, sanctuary nature center (where appropriate), overlooks, vernal pools, pollinator meadows, trail benches, and unique historical features. Using ArcPad and being on-site also gave staff the ability to map potential hazards, such as surface mines, using this accurately pinpointed information to reflect areas as closed or show caution.

Back at the office, staff uploaded all the data into ArcGIS Desktop, and some amount of postprocessing was required. The editing feature allowed NJAS to smooth trail lines and add attribute table information, such as trail name, length, and description. To complete the map, NJAS included some additional data layers, such as elevation and parcels. Some additional postprocessing using New Jersey aerial imagery allowed staff to be more specific about certain landscape features (e.g., the presence of a small meadow in a forest) and, where applicable, other data layers, such as adjacent open space or state and federal parks. Once all data layers were set, staff members measured all trails for approximate trail length. Before the map layout was designed, they clipped the data layers so that only features within and immediately around the sanctuary boundary would be displayed. Then they manipulated the information for quick and easy visual interpretation.

To get the average person out on the trail, it is important to create a map with sufficient content that is easy to read. To complete the final map picture, each sanctuary trail was identified with a brief description that included length, degree of difficulty, highlights, and cautions. For consistency, most NJAS trail maps shared the same basic format and layout, with variations reflective of special features of a particular property.

NJAS's mapping effort has allowed it to promote its 15 hikeable sanctuaries, covering more than 55 miles of trails, full of excellent opportunities for watching and learning about wildlife and wildlife habitats. Visitors now have all the necessary details to plan their trip, from estimating hiking time to the most appropriate footwear and the specifics on terrain—all this offering a good start to getting out and trying nature. These maps have been incorporated into a booklet that briefly describes the history of each sanctuary, its flora and fauna, stewardship activities, and directions. Because NJAS used ArcGIS Desktop in the generation of its trail maps, its staff can easily provide trail updates or modify changes in land use or features. The most current maps are available for download from the NJAS Web site (**www.njaudubon.org**). Best of all, NJAS now has a collection of trail maps that looks professional, providing easy-to-interpret information that will encourage more passive recreation.

More Information

For more information, contact Gylla MacGregor, conservation ecologist, New Jersey Audubon Society (tel.: 908-837-9571, e-mail: gylla.macgregor@njaudubon.org, Web: **www.njaudubon.org**).

Recreation Information Portal Promotes Active Living with GIS

Carver County, Minnesota, Encourages Exploration

Highlights

- The team built the TRIP platform using the ArcGIS API for JavaScript.
- The portal includes a Web mapping framework compatible with Carver County's ESRI-based enterprise GIS.
- The portal presents data in a concise, cartographically appealing manner for people with little or no GIS experience.

Carver County, Minnesota, is located just southwest of the Twin Cities of Minneapolis and St. Paul. Home to more than 86,000 people, Carver County is the state's fourth fastest growing county. Recently, Carver County embarked on an initiative to further develop its Active Community Planning program by creating an information portal for the discovery and exploration of active living opportunities within the county.

Through collaborative efforts and data sharing between multiple county divisions and various city planners, Carver County gathered information to create a county-specific gateway to activities and opportunities associated with active living. The gateway, a Web site appropriately named GoCarverGo (www.gocarvergo.com), was launched August 1, 2008.

To help set the GoCarverGo initiative in motion and encourage citizens to access the county's dynamic trail and park information, Carver County established the Trail and Recreation Information Portal (TRIP). TRIP, an interactive Web mapping application, enables citizens of Carver County to locate parks and trails utilizing an interactive GIS.

"This project serves as a great example of collaboration between a number of local government organizations," says Peter Henschel, GIS supervisor with Carver County. "It would not have been possible without other organizations providing information on trails, parks, and photo points to create an accurate countywide GIS."

To assist in the design and development of TRIP, Carver County enlisted the services of Houston Engineering, Inc. (HEI), and ESRI Business Partner GeoDecisions. Carver County selected HEI and GeoDecisions based on the team's project management approach. HEI and GeoDecisions proposed a six-phase technical approach, including requirements, design, application development, testing, deployment, and maintenance, with the last phase being the responsibility of Carver County. For officials at Carver County, this was very appealing because it gave the county control of future releases and modifications.

Prior to application development, key project stakeholders from Carver County and the HEI and GeoDecisions team attended a joint application design (JAD) session to discuss the goals of TRIP, as well as desired functionality and software requirements. One of the primary goals of the portal identified during the JAD session was to develop a simple yet effective mapping application. Because the majority of the portal's targeted audience has little or no GIS experience, the design had to minimize the number of tools and "clutter," as well as present the data in a concise and cartographically appealing manner.

Another goal of the portal was to develop a Web mapping framework that would be compatible with Carver County's ESRI-based enterprise GIS. The framework also needed to provide for future Web mapping needs. To meet this goal, ESRI ArcGIS Server technology was selected as the development platform. Following system design, the HEI and GeoDecisions team recommended TRIP be built using the ArcGIS API for JavaScript.

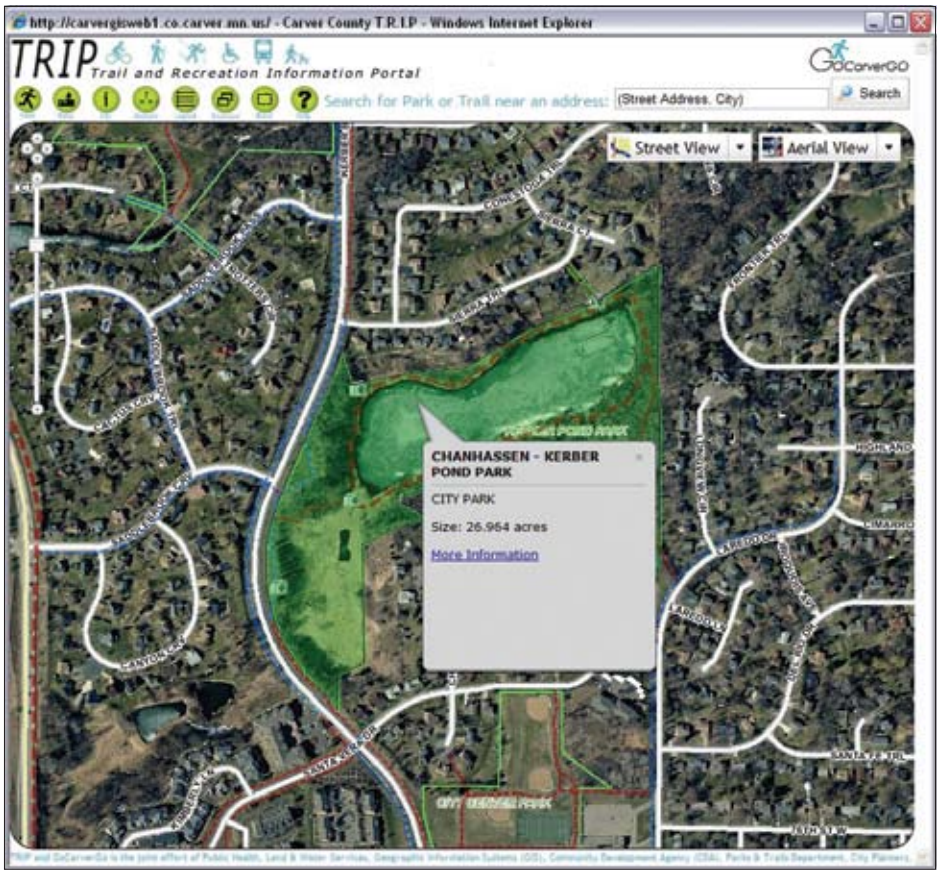
The API was selected because of its ability to satisfy both of Carver County's goals of implementing a user-friendly interface and compatibility with its existing enterprise GIS. To better display important GIS-related information, the ArcGIS API for JavaScript helps meet additional goals, including increased performance as a result of reduced server-side computation, enhanced map visualization and efficiency, and the utilization of map cache services. The ArcGIS API for JavaScript also provides a framework that is cross-browser compatible and easy for administrators at Carver County to customize with future enhancements.

"Carver County has been very pleased with the performance of the portal, as well as its easy-to-use tools developed using the API for JavaScript," says Henschel. Now, with only a few clicks, a variety of trail and recreational alternatives can be identified through a number of search options in the application.

TRIP can be accessed at gis.co.carver.mn.us/TRIP/launch.htm. The portal provides a variety of Web-based mapping functionality, including

- Aerial view
- Hillshaded topographic background
- Hyperlinked MapTips
- Ability to search for recreational opportunities based on address and a specified distance
- Ability to zoom to a specific park or trail
- Ability to transfer latitude and longitude coordinates to Microsoft Virtual Earth's Bird's Eye Application or WalkScore.com

GoCarverGo has received acclaim from various stakeholders throughout the southwestern Twin Cities metropolitan area. According to Henschel: "We have received very positive feedback from our community partners who assisted with data collection. There is already talk of making enhancements to the application and adding more recreational features maintained within our GIS database, thereby giving users more opportunities to become active in their communities."



ArcGIS Server technology allows users to view photo points of trails and parks throughout the county.

More Information

For more information, contact Peter Henschel, GIS supervisor, Carver County (e-mail: phenschel@co.carver.mn.us); Brian Jensen, project manager, GeoDecisions (e-mail: bjensen@geodecisions.com); or Brian Fischer, project manager, Houston Engineering (e-mail: bfischer@houstoneng.com).

Students Scale New Heights with GIS

Young Explorers Study an Unmapped Region of the Himalayas

Highlights

- GIS was used to enter distribution data in the field.
- The mountaineering and trekking guide of Ladakh contains maps generated by ArcGIS.
- Students used ArcGIS to identify and analyze the distribution of plant species in the Thanglasgo Valley.

Thirty-eight British students have named mountains for a new mountaineering and trekking guide for the remote and semidesert Ladakh region of the Himalayas. Ladakh is regarded as the "land of high passes." It is a region in the Indian state of Jammu and Kashmir between the Kunlun mountain range in the north and the main Great Himalayas to the south.

Computer-based mapping of this remote region using GIS in the field underpinned the core purpose of a challenging monthlong research expedition organized by the British Schools Exploring Society (BSES) in July–August 2008 for British students aged 16–20. Maps of the Ladakh region had previously been unavailable.

BSES is a nonprofit United Kingdom-based charity, established at the Royal Geographical Society in London, which has been providing opportunities since 1932 for young people to take part in adventurous expeditions that involve environmental science research in wilderness areas.

Aims of the Ladakh Expedition

Creating and interpreting mapping and geospatial data supported the expedition's two aims—scientific outputs and adventure activities. The Young Explorers (YEs) were able to combine the excitement of climbing in an unmapped region of Ladakh while researching their environment and analyzing findings on digital maps in GIS. The Hundar peak, for example, has no previously recorded ascents and was summited by the BSES team in August 2008.

The students ran ArcGIS Desktop software on laptops provided by ESRI (UK) Ltd., ESRI's distributor in the UK, to log and analyze geographic data.

Matt Bridgestock, BSES Ladakh expedition leader, says, "The main Thanglasgo Valley in Ladakh has become well known to hikers, but the area beyond it had been uncharted territory until the students used GIS. One of the peaks in the northern valley and two in the southern valley had never been ascended before the group arrived. The students were able to plot mountains on maps and name them. Everyone had a fantastic time on what was a dream expedition."

The resultant mountaineering and trekking guide of Ladakh is available as a PDF on the BSES Web site (www.bses.org.uk), containing maps generated by ArcGIS.

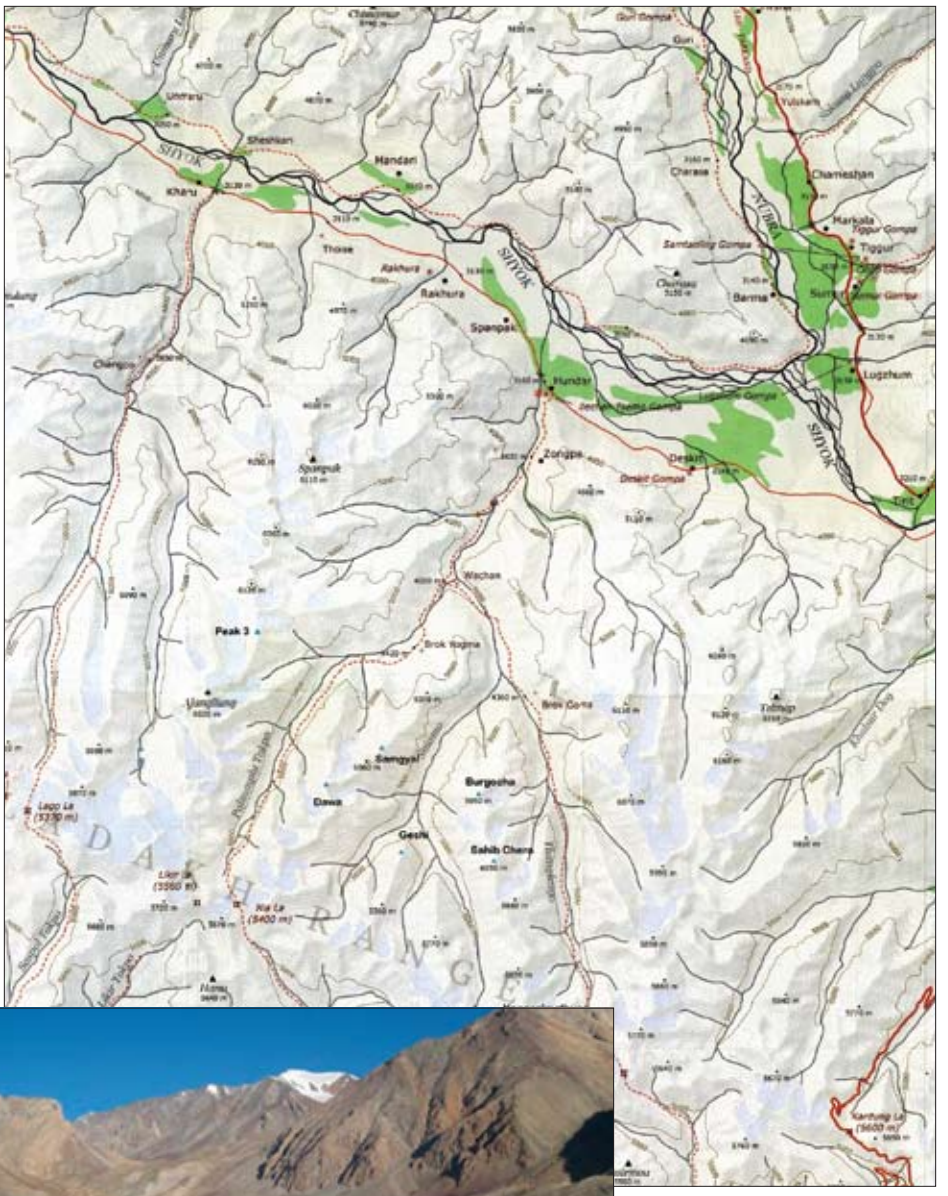
Botanical Projects

As part of the expedition, the students also engaged in science and botanical projects using ArcGIS to identify and analyze the distribution of plant species in the Thanglasgo Valley and side valleys. No one has ever recorded plant species in these valleys, so the YEs initiated a species list for the region and sampled the vegetation at 200-meter intervals between 4,200 meters and 5,200 meters (approximately 14,000–17,000 feet).

GIS was used to enter distribution data in the field and will be built on to show graphs of plant distribution. This will provide a baseline measure for recording the response of these species to climate change. As global temperatures increase, it has been predicted that plant species in mountainous areas will shift their altitudinal ranges upward.

More Information

For more information, contact Charlie Masding, BSES Expeditions, Royal Geographical Society (e-mail: charlie@bses.org.uk, tel.: 020-7591-3141), or Ruth Adams, ESRI (UK) Ltd. (e-mail: radams@esriuk.com).



Left: The Young Explorers' Palzampiu Valley base camp. Above: The region had been uncharted territory until the students used GIS.

One Hundred Ways for Fending Off Hurricane Impacts

U.S. Army Corps of Engineers Uses GIS for Complete Analysis of Category 5 Hurricane Protection

Highlights

- ArcGIS enables planners to see the problem and forecast what-if scenarios.
- GIS helps planners understand the challenges and solutions of the Louisiana coastline.
- GIS reveals how a degraded habitat loses its ability to absorb storm impact.

The onslaught of storms and surge that beleaguer Louisiana's gulf shore is not a momentary battle. Hurricanes will continue to blow throughout the next millennia, but iron-willed Louisianans have no intention of giving up. Not now—not ever. Since technology is yet unable to halt a hurricane, the best strategy is defense. How does a civilization save lives and buttress its cities against an unrelenting assault of natural disaster?

Research scientists, engineers, and planners have collaborated to produce more than 100 alternatives for shoring up the state's coast with options that span from 100- to 1,000-year risk reduction. Led by the U.S. Army Corps of Engineers New Orleans District, these professionals are using technology and science to assess the alternatives for coping with the threat of weather, sea, and river to fortify towns and restore natural habitat.

This effort is titled the Louisiana Coastal Protection and Restoration (LACPR) Project, which the U.S. Army Corps of Engineers initiated in response to congressional and executive directives to conduct a complete analysis for Category 5 hurricane protection. The goal is to save lives, property, the environment, and cultural heritage. Corps of Engineers scientists determined potential surge and wave elevations for both frequent and infrequent events based on critical factors, such as wind speed relationships, central pressure, forward speed, and landfalling location.

The technology to support the methodology of this effort needed to be open and easily integrated to ensure a consistent systems approach to modeling storm events, data sharing, alternatives analysis, and lessons learned. For example, project data and modeling are being shared with the Mississippi Coastal Improvements Program and are also tied to the State of Louisiana's master plan for coastal restoration and hurricane protection.

An essential tool planners are using is ArcGIS software that enables them to see the problem and forecast what-if scenarios based on weather severity, changes in population growth, engineering of levees and other infrastructure, effects on environmental habitats, and more. The Army Corps of Engineers has long used ESRI software and has a geospatial facility within its Engineer Research and Development Center located in Vicksburg, Mississippi.

At the center, GIS specialists work with research scientists to create databases, develop map layers, assess data relationships, and design predictive modeling methods. Data from contributing agencies' databases and remote data, such as lidar, are input into GIS, which completes calculations and creates data visualizations on an intelligent map. Data can also be run in models. For example, the team used GIS to visualize the Advanced Circulation Model for coastal circulation and storm surge that outputs maps for analyzing hurricane surge and flooding events. Data from various sources, such as the National Hurricane Center, was downloaded to the model. Then the team used GIS to generate situation maps. Output reflected a variety of factors used to predict how often and how severely the region could expect to be inundated during future hurricanes.

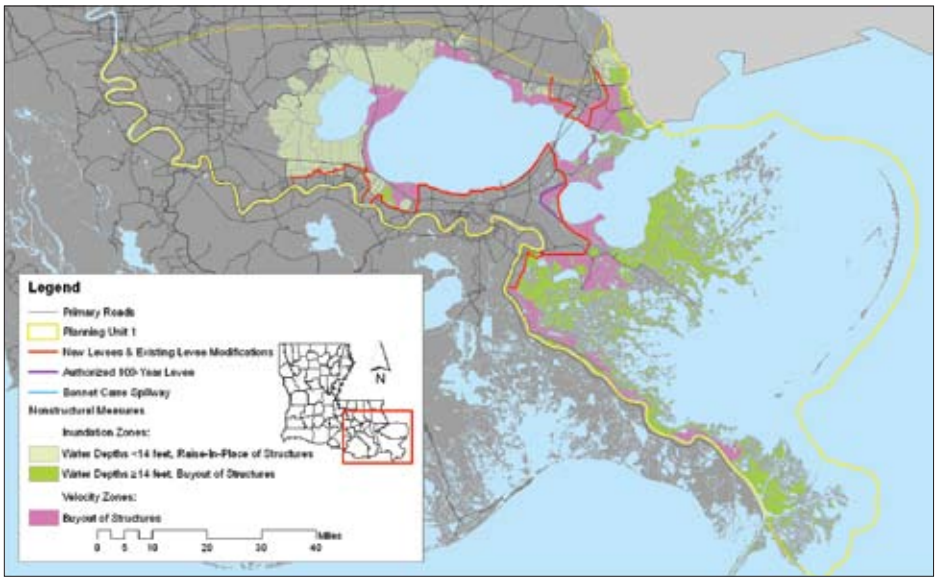
The report's hurricane catastrophe defense options have been categorized into three groups. The first is a set of nonstructural alternatives that either relocates people out of harm's way or elevates structures above the floodplain. It involves raising houses; buying out an area; restricting human habitation; and restoring the area to its natural condition, such as reclaiming a neighborhood developed on marshland and returning it to its natural state.

The second is a set of structural alternatives that includes enhancing the existing levees by adding height to them; building new levees, floodwalls, pumps, gates, and weirs; and assessing the value of the floodgate system.

The third is a set of coastal restoration alternatives that targets coastal features as a first line of defense against hurricane surge and waves. GIS reveals how a degraded habitat loses its ability to absorb storm impact. Coastal restoration options that sustain the estuarine environment include development of additional marshland, diversion of rivers, and restoration of shorelines.

Planners are using GIS to model how these options could affect the landscape. Every one of the more than 100 alternatives in the report includes a map representation. GIS models both elevation and water surge levels to predict and demonstrate outcomes.

A draft of the LACPR technical report has been submitted to the National Academy of Sciences for peer review and professional feedback. The Corps of Engineers will soon revise and submit the report to Congress for consideration, planning, and response. The final report will offer Congress an array of alternatives for evaluation and comparison.



This New Orleans' comprehensive map of alternative options shows floodplain water depths (green areas), suggested buyout structures (purple areas), the existing levees (purple line), and the new levee (red line). It comprises data from a variety of sources and is shared with stakeholders. Congress considers these maps for planning storm surge defense.

More Information

For more information, contact Clint Padgett, chief, Spatial Data Branch, U.S. Army Corps of Engineers, Mobile District (e-mail: clint.padgett@us.army.mil, tel.: 251-694-3721), or visit **spatialdata.sam.usace.army.mil**. The complete LACPR Plan Formulation Atlas and Draft Technical Report are available online at **www.lacpr.usace.army.mil**.

City of Davenport Uses 3D Visualization to Prepare for Flooding

By Dave Cox and Kevin James, City of Davenport, Iowa

The city of Davenport, Iowa, has a long history of flooding. In the last 33 years, there have been eight major Mississippi River floods that have affected the city. In the early 1980s, Davenport decided to use passive flood protection instead of building permanent flood walls or levees to protect the downtown area. This passive protection plan consists of temporary earthen levees, sandbag walls, pumps, and a series of gates to close storm sewer pipes. To efficiently and effectively complete these tasks before floodwater reaches downtown, the city has developed a detailed flood plan consisting of written procedures and maps for various flood levels.

During the winter of 2007–2008, large amounts of snowfall threatened the city with potential flooding in the spring. This risk prompted the public works director to ask GIS personnel to create a demonstration of Davenport's current flood plan for the city council. GIS staff reviewed the maps in the plan and decided that they could use ArcGIS to create a 3D model that would be a more effective way to convey the different aspects of the plan. They used the ArcGIS 3D Analyst extension's ArcScene application to create a 3D model that showed which parts of the city would be inundated at various flood stages. This model made it possible for city staff and council to visualize data about how floodwater could affect specific parts of the city at any flood stage.

Prior to GIS, Davenport's flood models took a long time to complete. Staff would print contour maps, then draw red lines on these maps to show where the predicted floodwater levels would reach. Multiple calculations were made to account for the slope of the Mississippi River. Now, GIS provides analysts with the tools to build a 3D model based on information the city already had, such as two-foot contour data, building footprints, storm utility data, street centerlines, and aerial photography.

Using 3D modeling adds dimensional visualization of a predicted flood level's relationship to buildings.

Adding GIS to the workflow for modeling Mississippi River flooding supports a logical progression and produces insightful results. The first step is to create two surface triangulated irregular networks (TINs) using the 3D tool in ArcGIS Spatial Analyst. One TIN represents the actual ground level. It is created using the city's existing two-foot contour data. Another TIN represents the river rise, calculated using river slope data from previous floods, which was collected by Davenport's engineering/survey division. In the second step, the river TIN's elevation is set to flood stage zero as a starting point for modeling. In the third step, using ArcScene, analysts offset the base height of the river TIN to various flood stages, then display areas of the city where flooding would or would not occur. The fourth step is to verify the GIS model's accuracy by comparing its outcomes with paper maps and written documentation from previous years. In the fifth step, analysts add the locations of levees, pumps, and gates to the model, so areas that would be protected by this infrastructure are shown in the visualization.

Assessing Tornado Damage

City of Fenton, Michigan, Uses GIS for Situational Awareness

Highlights

- All data was maintained within ESRI personal geodatabases.
- ArcView was used for tracking structure damage and monitoring the extent of power outages.
- With ArcView and ArcEditor, the city and Red Cross met the emergency funding deadline.

The City of Fenton is a relatively small Midwest community located in the northwest corner of southeast Michigan. The city got its name in 1837, as the story goes, from the winner of a card game between William Fenton and Robert Leroy. The city was named after Fenton, and the main thoroughfare was named after Leroy. One hundred and seventy years later, on August 25, 2007, the City of Fenton experienced its largest emergency response situation in its recorded history. On that day, the region experienced severe weather that produced strong winds and several tornados. An EF2 tornado, with wind speeds of more than 100 miles per hour, touched down in the city. In a matter of minutes, more than 200 properties were damaged, including hundreds of trees that were uprooted or splintered, and a population of more than 12,000 was largely without power.

At the time of the emergency, the City of Fenton had been using GIS software since 2003. In addition, the idea of using GIS for damage assessment was not new to the city, as staff members had previously participated in damage assessment training and had an emergency response plan in place. With the help of its GIS consultant, the city had been exploring hypothetical tornado-path scenarios for developing first-response methodologies that would allow identification of residents that would need immediate response in case of an emergency. When just such an emergency became reality, GIS became the central feature used in coordination, management, mapping, and final damage assessment reporting.

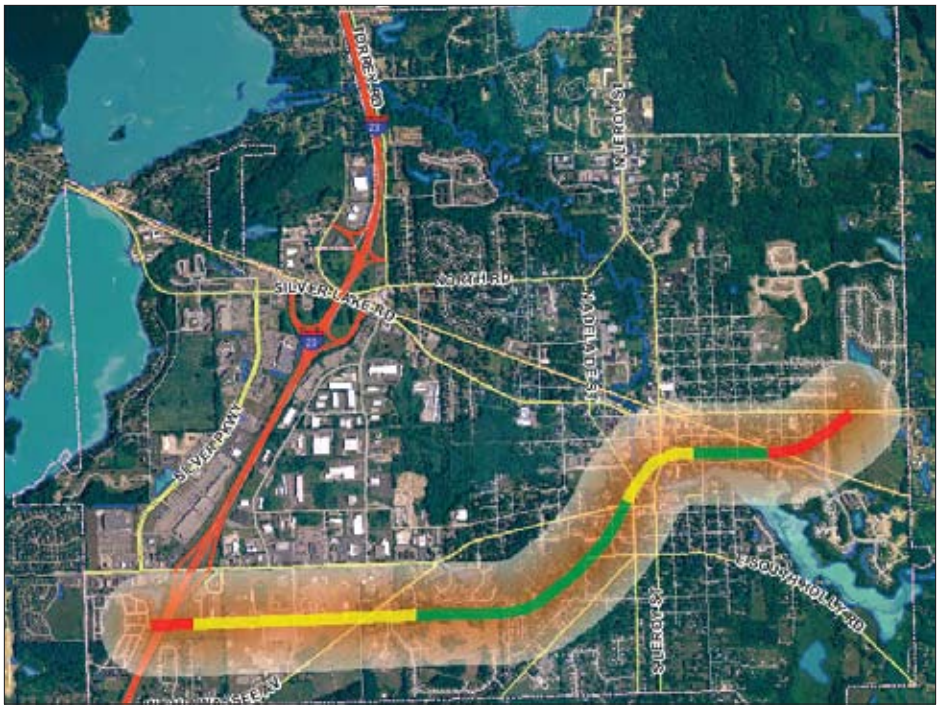
Damage assessment was fully under way the day following the tornado. The objectives were, first, to ensure the safety of the residents and, second, meet the state-mandated deadline for submitting reports to receive emergency management funding (48 hours after the event). While damage assessment was spearheaded by the city, the American Red Cross provided a significant supporting role. Also, as a member of the emergency response team, the city's longtime GIS consultant, North Arrow Technologies, Inc. (a local ESRI Business Partner), was tasked with assisting the Assessing Department with a GIS-based damage assessment.

The GIS team first used ArcView to produce maps for general orientation, allowing city and Red Cross officials to manage staff and volunteers for inspection of the city, block by block. In the field, inspection crews assessed the structural damage for each house on each tax parcel by assigning it into one of five classes ranging from 1 (unaffected) to 5 (destroyed). As inspection crews returned to the emergency operations center with damage information, the GIS team used ArcEditor to enter the damage assessment codes into the tax parcel layer. Having a central repository of this information in the GIS allowed not only near real-time updating of the neighborhoods that had been surveyed but also an immediate understanding of where the most severe damage had occurred. For media coverage, a map was produced showing the path of most significant destruction, which later proved to very closely match the National Oceanic and Atmospheric Administration's (NOAA) officially designated tornado path. In addition to tracking structural damage, ArcView was used in a similar fashion to monitor the extent of power outages. As reports of new outages or power reestablishment were coming in, maps were continually updated.

Primary data sources used in the damage assessment included the tax parcel layer, building footprints, and high-resolution aerial photography, as well as other common basemap features (e.g., street centerlines, hydrological elements). All data was updated or developed by North Arrow Technologies over the five years prior to the tornado's arrival. At the time, all data was maintained within ESRI personal geodatabases.

In retrospect, several key issues were revealed that are being addressed by the city to further improve emergency preparedness for the future, especially related to GIS support. First, a formal emergency response GIS team should be established and included as part of the first-response team. Second, the emergency management headquarters should be outfitted with proper GIS facilities and access to enterprise data. Previously, the city's GIS software and data were housed in city hall but the emergency response headquarters were located in the fire hall. Fortunately, in this case, city hall was only several blocks away so members of the GIS team were able to move back and forth between the GIS facilities and the emergency crews. Finally, ensure that network facilities have mission-critical redundancies allowing for GIS operations in severe weather and limited power conditions. During the response, the GIS team learned that the storm (most likely the lightning) had damaged one of the network routers that linked the GIS workstations with the plotter. The network administrators quickly resolved the problem, but it did serve to hinder the ability to print maps for a short period of time.

In the end, with ArcView and ArcEditor leading the way, the city and Red Cross successfully assigned their response teams to the most critical areas and documented, mapped, and reported all 235 damaged properties prior to the emergency management funding deadline. This emergency management application of GIS was noted by many as very successful since situational awareness, volunteer management, and reporting were all handled in an organized manner and in a very short time. While the situation led to several lessons learned, the City of Fenton's investment in GIS proved invaluable during this historic event.



Maps were produced using GIS to show the tornado's path of most significant destruction. Parcel-based damage assessments were generalized into a damage path map for the local media and general public.

Wind speeds over 100 mph caused significant damage to commercial and residential structures in the City of Fenton. More than 200 properties were damaged including hundreds of trees that were uprooted.

GIS flood model predicts how Mississippi River rise will impact Davenport's downtown area.

About the Authors

Dave Cox is the GIS specialist for the City of Davenport's Public Works Department. He has more than three years of experience working with infrastructure data, creating 3D models, and providing detailed GIS analysis. Kevin James is the GIS coordinator for the City of Davenport and manages the various GIS services provided to internal employees and the public.

More Information

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More Information

For more information, contact Tonya Molloseau, assessor, City of Fenton (e-mail: tmolloseau@cityoffenton.org); Dick Beauchamp, damage assessment officer, Genesee-Lapeer Chapter, American Red Cross (e-mail: beaucab@aol.com); or Dr. Jason J. Taylor, founder and partner, North Arrow Technologies, Inc. (e-mail: jtaylor@northarrowtech.com), or visit **www.northarrowtech.com**.

MapAction Helps Millions of People

With GIS, Charity Relieves Suffering in Developing Countries

Highlights

- ArcGIS supports the work of international aid organizations and helps save lives.
- GIS creates accurate, dedicated, real-time maps that are essential following a disaster.
- The work of MapAction is supported by GIS-skilled volunteers.

Earthquakes, tsunamis, mudslides, and floods can strike without warning—and the consequences can be devastating. Lives are lost; survivors face immeasurable hardship. International aid organizations respond to these tragedies. However, their work is often hindered by a lack of knowledge about the region they are working in. When a disaster occurs, the landscape changes, sometimes beyond recognition. Villages, roads, and railways may be destroyed; entire hillsides may slip into valleys; and people will be displaced. To address this challenge, one United Kingdom-based charitable organization creates and distributes real-time maps of a disaster zone. Called MapAction, the organization helps governments and relief agencies coordinate aid and relieve human suffering.

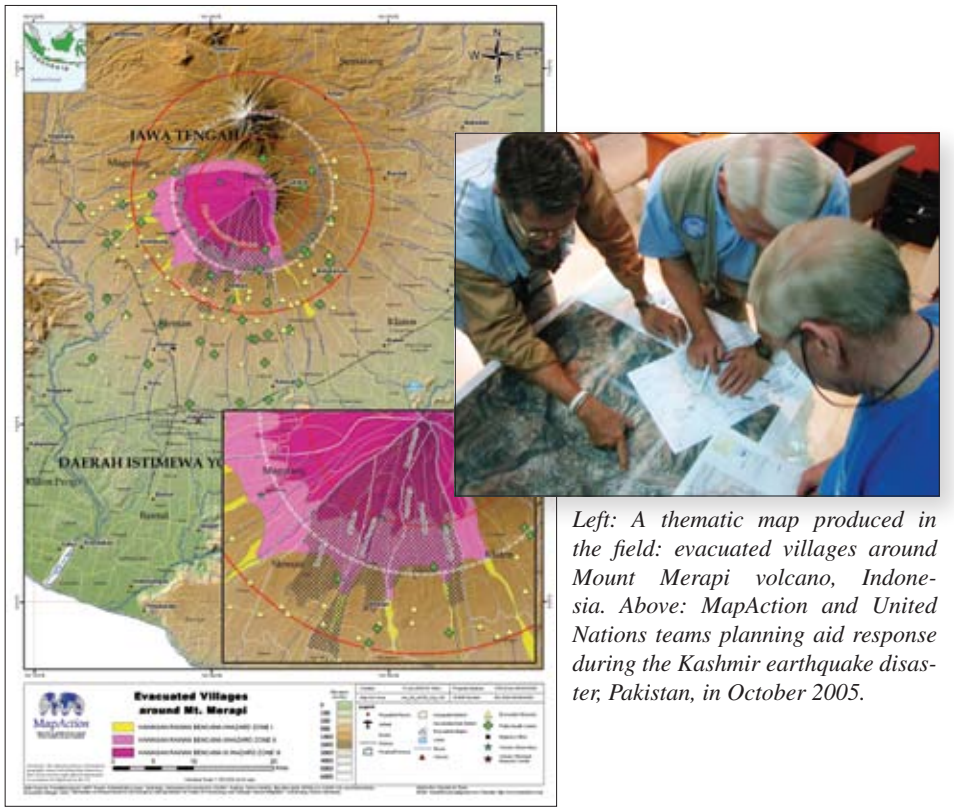
A Need for Greater Coordination

The idea for MapAction first occurred to Andrew Douglas-Bate. He explains: "In 1962, I was living in Tehran and a massive earthquake occurred in southern Iran. The government put out an urgent plea for blankets for the displaced survivors, and the international aid community responded. Many countries sent blankets. The disaster area was soon inundated with them. However, the survivors had many other needs that weren't adequately met. Most of the available money and effort had been focused on sourcing and distributing blankets alone. That lack of international communication, thus the lack of coordination between aid agencies, has stayed with me."

Many years later, Douglas-Bate's son Rupert became an aid worker in the former Yugoslavia and Africa. Despite the passage of over 30 years, Rupert Douglas-Bate witnessed the same problems with duplicated and uncoordinated aid that his father had observed many years before he was born.

"Problems become more manageable when efficient coordination on the ground occurs," says Andrew Douglas-Bate, now chairman of MapAction. "Rupert concluded that the best way to achieve better coordination was through the vehicle of GIS mapping."

From this and with the support of a major donor, MapAction was born. The organization was founded by Rupert Douglas-Bate in 1997 and began the long task of fund-raising, training volunteers, creating an organization structure, and purchasing equipment. In 2002, the charity had achieved sufficient funds and structure to appoint a team leader, David Spackman, who strengthened MapAction.



Left: A thematic map produced in the field: evacuated villages around Mount Merapi volcano, Indonesia. Above: MapAction and United Nations teams planning aid response during the Kashmir earthquake disaster, Pakistan, in October 2005.

An Invaluable, Life-Saving Service

MapAction knew that rapidly updatable electronic GIS mapping would play a crucial role in its work. After conducting some thorough market research, Spackman selected ArcGIS Desktop solutions, which ESRI has been providing since 2003. ESRI has provided MapAction with ArcGIS Desktop licenses. MapAction uses GIS to collate diverse datasets, topography, and satellite imagery and to create dedicated, real-time maps of disaster areas.

Spackman led MapAction's first major deployment to Sri Lanka following the tsunami that devastated the country in January 2004. A 12-person team stayed in the country for three weeks and created map after map, plotting everything from the locations of food stations to the areas where doctors and medical aid were most urgently required. Then president of Sri Lanka Chandrika Kumaratunga visited the MapAction team to see ArcGIS in action and to personally show her appreciation for the work of the team.

Since then, MapAction, often in close cooperation with the United Nations, has carried out more than 15 emergency and 55 disaster preparedness missions. In 2008, a typical year, the charity provided an invaluable service following three major disasters that together changed the lives of more than 4.3 million people. MapAction responded to extensive flooding in Bolivia, producing 76 maps in three weeks and distributing over 2,000 copies to government and relief workers. MapAction deployed a team to help deal with the consequences of Cyclone Nargis in Myanmar. It distributed over 3,000 maps and worked closely with the charity Save the Children to help track its relief aid program throughout the devastated region. MapAction also deployed a team to Haiti where more than 900,000 people were affected by hurricanes and tropical storms. In these ways—and others—MapAction helps save lives.

A Rapid Response to Disaster

MapAction team members, all highly trained volunteers, give their time and skills free of charge. The organization currently has over 70 volunteers, around 30 of whom are deployable at a moment's notice. Several employees from ESRI (UK) Ltd., ESRI's distributor in the UK, are actively involved in the charity. The majority of volunteers have GIS skills, but others have complementary operational or medical capabilities. Most importantly, the volunteers all have the right personal attitude and character to cope in very traumatic and challenging circumstances. One of the primary goals of MapAction is to provide a quick response.

"The first few hours of any disaster are absolutely crucial; this is when lives can be saved," says Rupert Douglas-Bate. MapAction receives an alert about a major incident, usually within an hour of it occurring. Spackman and the headquarters team immediately put volunteers on standby and begin to amass for the region as much GIS-based map data as possible. When the call to deploy comes, often from the United Nations, a team can usually be dispatched in a matter of hours.

On arrival in a disaster zone, MapAction volunteers, equipped with state-of-the-art GPS units, a satellite link, and communications equipment, survey the area and mark the locations of accessible paths, bridges that are still standing, and other waypoint landmarks. They collect situational information from any reliable source and plot it on accurate maps of the area using ArcGIS Desktop software and laptop computers. As the crisis unfolds and new information becomes available, maps are updated in real time and distributed to other aid agencies both electronically and as hard copies. In the future, MapAction plans to make use of ArcGIS Server to increase the efficiency of rapid mapping and to facilitate interoperation with other GIS-equipped agencies in the humanitarian sector.

An Ambassador for GIS

As a charitable organization, MapAction is dependent on donations to enable it to provide its free-of-charge service to developing countries. The organization has received support in kind and cash from many sources: other charities, corporate sponsors, and members of the public. "When a crisis occurs, donations follow," says Andrew Douglas-Bate, "but we need funds year-round so that we can train our volunteers, keep up-to-date with technology, and at all times be ready to deploy. David Spackman, our CEO, and Nigel Woof, our operations director, have brought to MapAction a strong organizational structure and clear processes that enable us to operate both effectively and cost efficiently. We have a small, lean headquarters; sophisticated storage and maintenance; and just two full-time and four part-time employees. As a result, MapAction is able to ensure that funding goes directly to where it is needed. Every financial gift really makes a difference to people in need."

Between major humanitarian crises, MapAction offers its services to the humanitarian community, thus helping it to help itself, in the use of GIS. These skills-transfer projects allow MapAction to play an important secondary role in promoting the benefits of GIS worldwide. In the words of Rupert Douglas-Bate, "MapAction is a good ambassador for GIS."

More Information

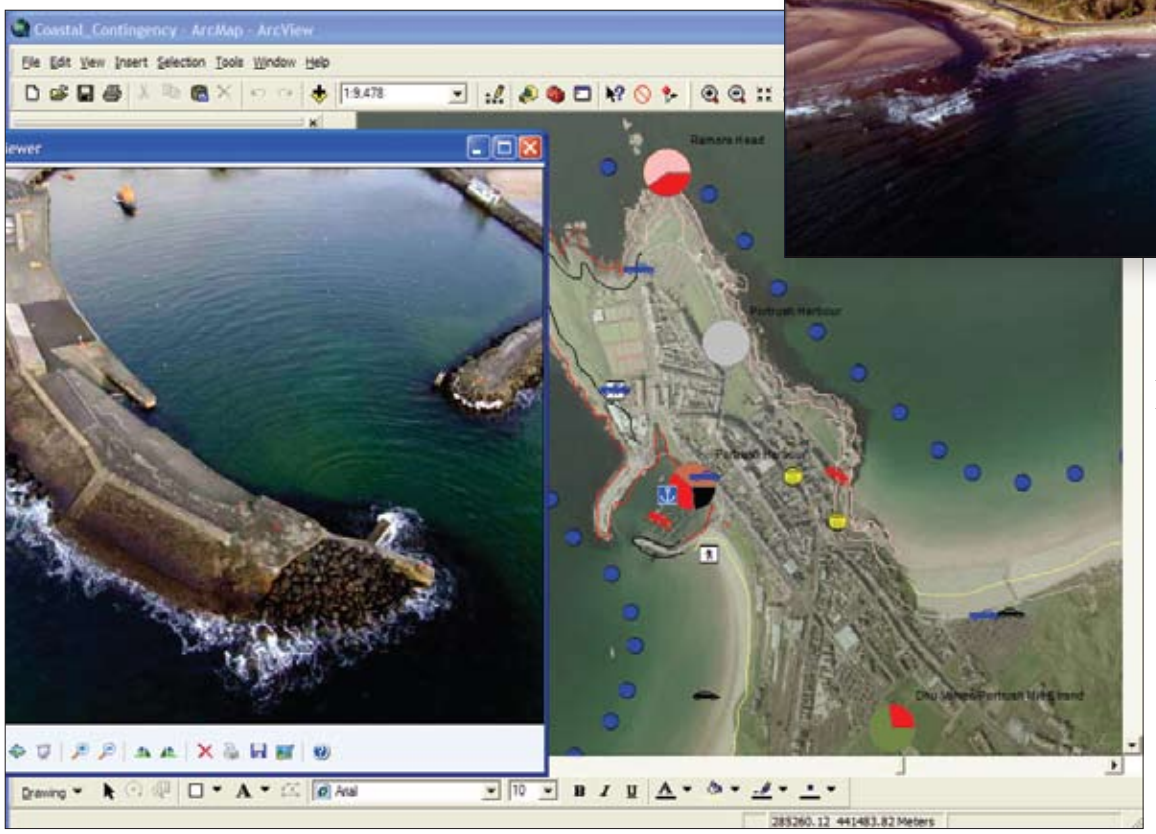
For more information, contact Nigel Woof, operations director, MapAction (e-mail: nwoof@mapaction.org), or visit **www.MapAction.org**.

Emerald Isle's Coastal Contingency Plan

Northern Ireland Environment Agency Quickly Responds to Pollution and Shipping Incidents with GIS

Highlights

- ArcGIS is used to create charts and graphs showing characteristics of the Northern Ireland coastline.
- Voluminous information is accessible via an online spatial data catalog served from ArcGIS Server.
- Enterprise GIS enables the NIEA Coastal Survey Team to represent more than 40 layers of data spatially.



Left: Ortho maps and aerial photographs are used in coastal contingency planning. Above: Aerial photography taken from an oblique angle.

Northern Ireland Environment Agency (NIEA) is the largest agency within the Department of the Environment in Northern Ireland, with approximately 700 staff. NIEA takes the lead in advising on and implementing the government's environmental policy and strategy in Northern Ireland. The agency carries out a range of activities that promotes the government's key themes of sustainable development, biodiversity, and climate change. Its overall aims are to protect and conserve Northern Ireland's natural heritage and built environment, control pollution, and promote the wider appreciation of the environment and best environmental practices.

NIEA is the body responsible for coordinating the response to any pollution incident that may affect the coastline of Northern Ireland and is a partner in the Emergency Response to Coastal Oil, Chemical and Inert Pollution from Shipping (EROCIPS) project jointly funded by Interreg IIIb (a European Union-funded program that helps Europe's regions form partnerships to work together on common projects), the United Kingdom's Department of Communities and Local Government, and NIEA.

The EROCIPS project aims to develop "a transferable methodology that communicates relevant information to responders and decision-makers involved in shoreline counter pollution operations following a shipping incident." In the context of EROCIPS, a shipping incident is considered to be the large-scale accidental discharge of hydrocarbons, chemicals, or inert material (timber, plastics, etc.), carried as cargo, into the coastal marine environment. The incident may result in contamination of coastal habitats and/or pollution damage to the natural, human, and built resources they support.

Migrating the Information

NIEA is the repository for a diverse range of coastline information concerning, for example, vehicle access points, pedestrian access points, equipment lay-down areas, wastewater treatment discharge points, coastal assets, booming sites, and National Trust areas—in total, more than 40 distinct types of data. This information is held in both hard- and soft-copy formats, sitting in disparate locations throughout the agency. On examination, all this information was found to have a spatial component, and as a result, a GIS was determined to be the ideal platform on which to integrate and communicate this information.

The challenge was to migrate all this information to a GIS platform that would enable the NIEA Coastal Survey Team to integrate all the information NIEA held on coastal assets and communicate this information to external stakeholders, such as local councils, port authorities, other government bodies, cleanup contractors, and waste management companies, which also play their part in the response to a large incident.

Conor Symington, EROCIPS and coastal contingency planning officer at NIEA, comments, "In 2002, I was tasked with compiling the data required to populate the data directory component of a coastal contingency plan for Northern Ireland. I spent the next 18 months or so out on the coastline carrying out surveys of all aspects of the physical coastal environment and liaising with a large variety of external and departmental agencies in order to draw together all the requisite datasets. My thinking at all times was toward producing a GIS-enabled set of layers and maps of all the data so that responders during a major coastal pollution incident (e.g., from a shipping casualty) would have at their fingertips all the necessary data and tools to mount a timely, effective, and appropriate response to the incident facing them."

Building on the Enterprise Environment

After examining the technology options, ESRI Ireland, ESRI's distributor in Ireland, was engaged to advise and assist NIEA in building a GIS platform to meet its needs under the EROCIPS project. To meet the objectives of the agency, ESRI Ireland carried out a requirements analysis that considered

- The nature of existing datasets and their readiness for inclusion in GIS
- How to collect new information and collate it for ultimate use within GIS
- How to synchronize and share information of common interest to multiple business units within the agency
- The technical specification of a GIS hardware and software platform that could store, integrate, analyze, and communicate this data

Following the requirements analysis, a decision was made to build on the enterprise GIS environment already implemented within NIEA. This solution is based on the ArcGIS 9 technology suite and utilized ArcGIS Server for the management, visualization, and dissemination of spatial data. ArcGIS Desktop (ArcEditor) clients are used for desktop visualization, analysis, and data capture.

Accessing and Visualizing Mapping

The solution was delivered through the development of an online spatial data catalog served from ArcGIS Server. Using ArcGIS Desktop, agency users can now access and visualize all basemapping from Ordnance Survey Northern Ireland—including all large-scale mapping and aerial photography—in conjunction with the NIEA Coastal Survey Team's own business layers that include hyperlinks to additional nonspatial data.

Rapid response is key to the effective management of any pollution incident. With the simple click of a mouse on a digital map, the agency's incident managers can now access all relevant information such as the harbor booming plans for Belfast Lough, where booms would be erected in the event of a disaster; ground-level photographs; additional aerial perspective photography (taken at oblique angles by coastal marine helicopters); and various vector datasets. Access to hyperlinked photographs of harbor piers, beach entrances, slipways, and other coastal assets will allow the Coastal Survey Team to ascertain the likely specifics of deploying beach cleaning equipment at the best possible vantage points.

Although pollution incidents cannot be readily predicted, contingency planning is undertaken by the agency. This is where the analytic capability of ArcGIS has been particularly valuable. The system has been used to create charts and graphs showing the characteristics of the Northern Ireland coastline section by section. Users are able to view shoreline substrate types and, as a result, determine the type of cleanup response required for that particular substrate type. This allows the agency to predetermine likely appropriate responses to various incident types, thereby feeding into the rapid response at the time of an incident.

A Model of Data Management

The enterprise GIS environment has enabled the Coastal Survey Team to represent more than 40 layers of data spatially; see spatial patterns emerge; make informed decisions in planning response to minor and major shipping incidents, such as ship spillages; and visualize ship accident "black spots" and ship traffic density of the Northern Ireland coastline.

"The outcome has been extremely useful," remarks Symington. "The user-friendly desktop data management and planning tool has been as good as, if not better than, we had originally hoped for prior to the project completion. One of the most pleasing aspects of the finished tool is that it has an in-built versatility, because not only is it loaded onto the enterprise server within NIEA and therefore can be shared across the agency, but it also has offline capabilities, meaning that the datasets and tools can be utilized in the field using a notebook PC and an external hard disk drive, without being connected to the NIEA network. Other teams have expressed an interest in following our model."

More Information

For more information, contact Conor Symington, EROCIPS and coastal contingency planning officer, Northern Ireland Environment Agency (e-mail: conor.symington@doeni.gov.uk); visit www.erocips.org; or contact Joanne McLaughlin, ESRI Ireland (e-mail: jmclaughlin@esri-ireland.ie).

Mobile GIS Aids Victoria Bushfires Search Operations

Highlights

- With ArcPad 8, non-GIS-experienced law enforcement officers collected field data faster.
- An ArcGIS server within the fire perimeter provided updated information to search managers and field teams instantly.
- Mobile GIS was the only way field teams could comply with the coroner's mandate of proving 8,000 properties had been searched.

Search teams at work.

February 7, 2009, will forever be remembered as "Black Saturday," the day of Australia's deadliest natural disaster. Multiple days of temperatures above 41ºC (106ºF) combined with low humidity, 13 years of drought, and northerly 100 kilometers/hour winds to create an alignment of forces that produced extreme bushfire conditions that far exceeded the maximum fire danger ever recorded. Melbourne, Australia, recorded its hottest day ever, a blistering 48ºC (118ºF). Dozens of fires erupted across Victoria; the speed of the fires preempted the usually well-organized evacuations of those who decided to leave early. Several large conflagrations merged, forming the Kinglake Complex. Hundreds of residents who stayed to defend their homes, or who waited too long to evacuate, perished within the first 10 hours.

After the flaming front passed through developed, inhabited areas, the Victoria Police (VicPol) assessed the damage and number of fatalities. Entire towns and communities ceased to exist. Familiar landmarks, such as street signs, mailboxes, residences, and businesses, were reduced to smoldering rubble. The number of missing or unaccounted-for individuals continued to increase, along with the growing numbers of deaths during this unprecedented catastrophe covering more than 220,000 hectares. This prompted the use of geospatial technologies and real-time mobile GIS to determine the extent of the devastation and to document the location of human remains.

It was determined early during the search that additional specialist resources would be needed. A call was placed to the Australian Capital Territory Emergency Services Agency, which deployed its newly formed Mapping and Planning Support (MAPS) team. This unit, composed of government and private-sector GIS professionals, volunteers its time to respond to disaster management operations. It is the only group in the country organized specifically for this critical function, and this was its first campaign fire assignment. MAPS arrived on scene with laptops loaded with ArcGIS software and wireless communication modems. Each team had a lead GIS specialist and five to seven GIS technicians. They worked 12- to 18-hour shifts for five days, then would be replaced by another team. One day of overlap was scheduled to ensure consistency during the transition. The MAPS team achieved impressive statistics while assisting VicPol for 43 days:

- 44 total GIS personnel deployed
- 306 person-days worked
- 3,600 total hours donated

PDAs and GPS-enabled digital cameras were used to document properties searched during Operation Royals. The camera embeds the time/date stamp, coordinates, and geographic orientation into the image (see bottom of photo above).

GIS specialist downloads GPS tracklogs and waypoints collected by field teams.

Rugged PDAs running ArcPad 8 mobile GIS software were obtained from ESRI Business Partners Trimble Navigation and Motorola by ESRI developer Maptel. Maptel programmers worked tirelessly for extended hours to quickly develop an ArcPad custom applet that could be used for damage assessment. This applet displayed the same Rapid Impact Assessment (Premises) form commonly used by VicPol but in a digitized format automatically linked to parcel data.

Further assistance was requested from the public safety division of ESRI. The wildland fire specialist responded to work with Victoria Police field teams to deploy mobile GIS data collection units. Additional ArcGIS licenses were provided through ESRI Australia Pty. Ltd., ESRI's distributor in Australia, as well as ESRI's Professional Services staff who installed ArcGIS Server. ESRI Australia also arranged for additional computer hardware, including rugged GETAC laptops and notebooks from Toshiba.

As often happens in severe fire situations, destroyed communications towers and information technology service outages led to duplication of efforts among the numerous emergency services agencies. Crews worked around the clock to restore utility infrastructure.

In mid-February, after additional bodies were found in areas that had previously been searched, the Victoria State Coroner, who is not a medical examiner but a powerful judge, directed Victoria Police to search *every* property within the Kinglake Complex fire perimeter where anyone could have sought shelter during the fires. This new search, designated Operation Royals, was an enormous undertaking with additional legal documentation requirements. The Australian Defence Force, Australian Federal Police, and Victoria Police provided about 200 personnel, organized into five-person search teams led by a Victoria Police team leader.

In the high temperatures, the team members were extremely uncomfortable in full protective suits, rubber boots, gloves, helmet, goggles, and a respirator to prevent contact with hazardous

ArcPad applet uses the official green form data fields and automatically updates map when synchronized.

chemicals and asbestos. The mandate required the team to inspect each driveway, extending to 50 meters on either side, from the road to the house and 50 meters surrounding the residence and outbuildings. Removal of all fallen materials, including corrugated tin roofing, often necessitated the use of mechanical excavators to enable a comprehensive visual search of the ground for human remains.

Before the teams began using ArcPad, the team leader would certify that the property had been properly cleared by filling out a paper form that was color coded: green for residences and yellow for outbuildings, vehicles, tanks, mine shafts, drainages, etc.—anywhere someone could possibly hide to escape the inferno. Occasionally, the form was incomplete or inaccurate, and the property would have to be searched again. The final task required that a green tag be placed in plain view, indicating the property had been thoroughly searched, or a red tag if possible remains were discovered. Disaster victim identification teams would confirm if the remains were human or animal.

Team members used GPS and NAVTEQ street map data extensively for navigating to assignments. They used Ricoh GPS-enabled digital cameras to record findings and document photos. Each night a person from the Rescue Coordination Center would drive the 150-kilometer round-trip to the incident command post in Kinglake to retrieve all the forms and swap the secure digital storage cards in each camera. Information was manually typed into the database from the forms; updated tactical maps showed which areas had been adequately searched.

It took a couple of days for Maptel to develop a completely new ArcPad 8 applet that was password protected and reflected the additional search criteria ordered by the coroner. Officers trained in its use conducted field tests in parallel with the ongoing "analog search." The officers commented favorably on how much time the ArcPad applet saved them; by just tapping on the screen, they could select items from the drop-down menus. These were some of the same team leaders who had previously used paper forms and had limited or no prior GIS experience. They were extremely pleased to see the green- or yellow-colored indicators that had identical information as the paper forms. The built-in GPS would place them in the correct parcel, and the applet would not allow them to advance to the next screen unless all the required information had been entered, thereby ensuring complete and accurate information was recorded.

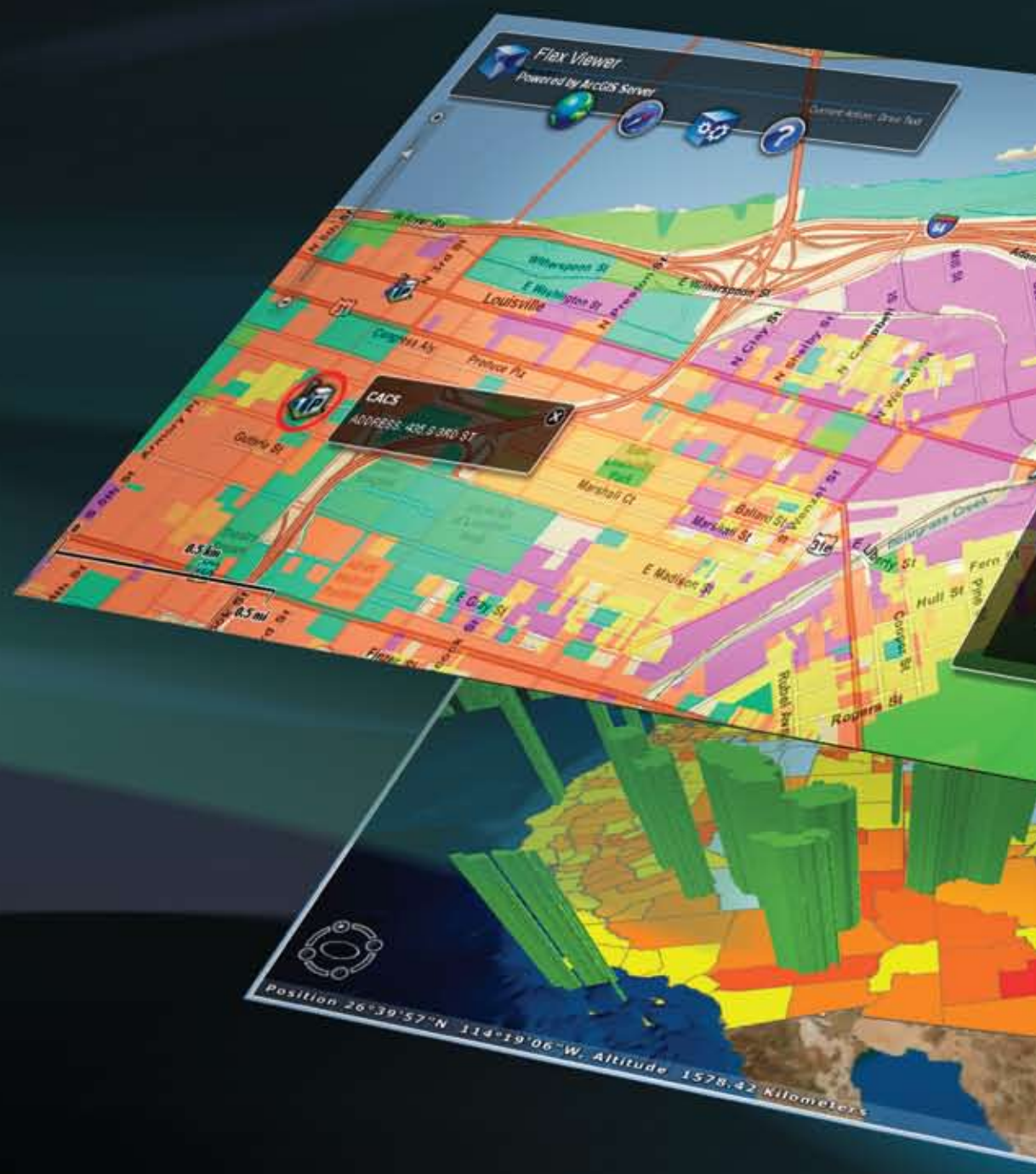
The officers quickly adapted to this new technology, and even the ones who were reluctant to learn a new way to collect the data admitted it was much faster getting updated tactical maps once ArcPad was deployed. There were no more 48-hour delays or duplication to determine where to look next. The reports were accurate with no omissions, and there was no need to go back to the same property to look again. The collected information was easily integrated into the existing VicPol Web mapping site via a Web Map Server feed as soon as the mobile devices synchronized with ArcGIS Server in the Rescue Coordination Center through the Telstra 3G cellular network. Any authorized search manager could instantly tell by a quick glance which areas were cleared and where to concentrate resources for the next shift. By the time Operation Royals came to an end, the teams used ArcPad exclusively to document the search progress.

Sergeant Greg Barras, situation unit leader, states, "By the time we developed the handheld mobile solution, QA'd the process, and trained our operators, we achieved the following: there were 5,781 total properties searched; 3,352 separate location searches conducted on buildings, sheds, vehicles, and water tanks; 9,600 photos taken using georeferenced cameras; and 1,539 records collected using ArcPad 8 and transmitted via the 3G cellular network to the server at the Rescue Coordination Center without any issues. I would argue that to acquire equipment, develop a system and process, get approval, train operatives, and successfully collect real-time data in less than three weeks is a mighty effort. Especially since we have not been able to achieve this over the last eight years for a raft of different reasons."

More Information

For more information, contact acting sergeant Greg Barras, Victoria Police (e-mail: gregory.barras@police.vic.gov.au).

Use Fast, Intuitive Web Maps to



By making their authoritative data available via fast, effective Web maps, GIS professionals give people throughout their organization the spatial intelligence they need to make better decisions.

Deploy modern Web applications.

ArcGIS® APIs for JavaScript™, Flex™, and Microsoft® Silverlight™ give Web maps an intuitive interface that meets today's expectations. Attractive, easy-to-use maps can also be made available to users via ArcGIS Explorer.

Create dynamic maps that render quickly.

New tools available in ArcGIS 9.3.1 make it easier to optimize maps for performance. The new ArcGIS Server drawing engine is faster than equivalent ArcIMS® services and helps users build map caches more quickly. It also improves performance and scalability when using dynamic map services.

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IS users can save time looking for basemap data by taking ntage of the many services available via ArcGIS℠ Online. e services provide ready-to-use basemaps that cover the e world. The 2D and 3D map services are available as as direct access to Microsoft Virtual Earth™ services.

Use sample viewers to help jump-start projects.

Sample viewers for the ArcGIS APIs for JavaScript and Flex are available for download on the ArcGIS Server Resource Center, and a sample viewer for the ArcGIS API for Microsoft Silverlight will be available soon. These sample viewers can be configured quickly and used to launch effective Web maps without your having to be a developer.

al of their authoritative data. Visit **www.esri.com/webmaps**.

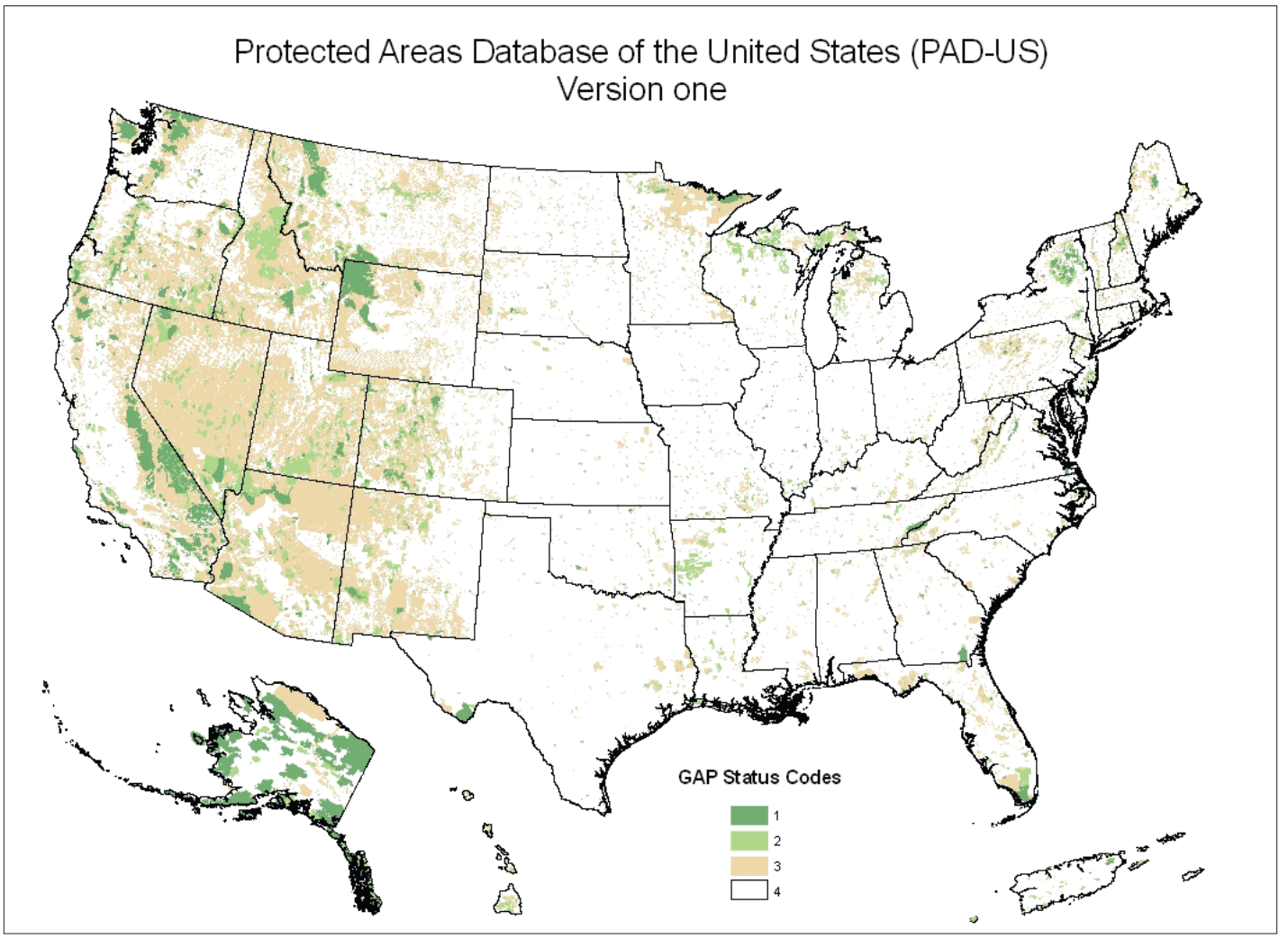
ESRI

USGS GAP Partnership Develops Protected Areas Database

FEDERAL GIS

Highlights

- The database, built in an ArcGIS file geodatabase, provides a wealth of attributes.
- ESRI's geodatabase manages the spatial and tabular complexity.
- The geodatabase made the integration of more than 800,000 records feasible.



Stewardship map of the United States.

Protected areas are an essential tool in the international effort to conserve biodiversity. These lands protect vital ecosystems and species; however, because they are owned and managed by a wide variety of federal, state, and local agencies; nonprofit organizations; and even private individuals, developing a clear picture of how much is actually being saved has been a problem. Similarly, although several conservation organizations have been collecting information about protected lands, there has been little agreement among these organizations about how to classify them. Yet without comprehensive data about the location, size, and management of lands set aside for biodiversity protection, it is difficult to establish and monitor regional and national conservation strategies.

A public-private planning consortium of conservation organizations has joined forces to address this issue with the development of the Protected Areas Database of the United States (PAD-US). Key partners in the effort are the Bureau of Land Management, the Conservation Biology Institute (CBI), the GreenInfo Network, The Nature Conservancy (TNC), the U.S. Forest Service, and the U.S. Geological Survey (USGS) Gap Analysis Program (GAP). The long-term vision of the group, which was funded by USGS and the Doris Duke Charitable Foundation, is to provide the guidance and infrastructure necessary to maintain protected lands data with greater accuracy and detail than previously possible.

PAD-US, released in April 2009, generally describes protected lands as those lands held in fee or easement ownership for permanent or very long-term open space uses. These include national parks and forests, public lands, wildlife preserves, state and local parks and reserves, wildlife management areas, lands held by nonprofit organizations, and other areas designated as protected.

The database, built in an ArcGIS file geodatabase, provides a wealth of attributes, including the name, location, ownership, land management designation, and measures of biodiversity protection, for each parcel in the dataset. GAP has long used ArcGIS to map land cover, land stewardship, and predicted vertebrate species distributions—first on a state-by-state basis and more recently on a regional basis.

In addition to providing a comprehensive picture of conservation lands in the United States, GAP has worked with the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) to link PAD-US to the World Database on Protected Areas (WDPA). To enable inclusion of PAD-US in the WDPA, International Union for Conservation of Nature classification designations were applied to each parcel in the database. This linkage will facilitate collaboration between conservation organizations by establishing a consistent understanding of protected lands status whether the focus is global or local.

"The U.S. data is extremely important to us," says Charles Besançon, head of Protected Areas Programme, UNEP-WCMC. "Integrating PAD-US and WDPA is a high priority." The UNEP-WCMC Protected Areas Data Unit, which maintains the WDPA, was established in 1981 to compile information on the world's protected areas and to be a resource for those requiring such information. Because it incorporates information from national governments, nongovernmental organizations, academic institutions, international biodiversity convention secretariats, and other organizations in each country into a single dataset, the WDPA is an important resource for the organizations and individuals making decisions about conservation.

Background

To create the stewardship layer, GAP aggregates public landownership and internal management boundaries and categorizes protected areas on a scale from 1 to 4 based on their conservation management practices. Prior to 2008, GAP focused on state and regional projects, creating the need for a national protected areas database that CBI initiated, with funding from sources such as the World Wildlife Fund and USGS GAP. CBI and GAP continued to manage data at different scales until it became apparent that a variety of stakeholders was required to provide the sustainable resources needed to meet demand, resulting in the initiation of the PAD-US design process.

The PAD-US project is addressing some long-term maintenance issues with protected land inventories. Partners are working to extend aggregations to local (easement parcel, city, county) levels, build capacity for improved/automated state data updates, and increase efficiency through more coordinated federal land inventories. The partnership will facilitate the maintenance of a national dataset by improving the spatial accuracy of inventoried lands and creating a standard for collecting and processing the data. The partnership has developed a uniform coding system that specifically categorizes the protection level for each parcel contained in the database and has developed more complete and descriptive attributions for the data. Finally, protected areas are both uniquely and uniformly identified by name and management designation to facilitate assessments at various scales (regional, continental, and global).

The geodatabase was a natural choice for creating and hosting PAD-US, which incorporates disparate data from numerous partners. Using a geodatabase made the integration of more than 800,000 records from hundreds of different organizations feasible. "It was challenging to design a user-friendly and accurate parcel identification system," says Lisa Audin, GAP stewardship coordinator. "Data sources provided an incredible variety of landownership and management designation descriptions, complete with spelling errors and various acronym combinations." The use of coded domains in the PAD-US geodatabase was pivotal to standardizing a parcel's class (federal, tribal, state, private, etc.), land manager (U.S. Forest Service, State Fish and Game, TNC, etc.), and management designation (wild and scenic river, wilderness area, national wildlife refuge) in a national context.

The complex nature of protected land data required a robust, yet flexible, geospatial database structure. The PAD-US technical team determined that ESRI's geodatabase technology offered the tools required to manage the spatial and tabular complexity inherent in the data. For example, the complexities of multiple designations for a single piece of land will no longer need to be handled in a limited fashion with the attributes table (Designation_1, Designation_2, etc.) but can be represented as separate but overlapping feature classes with associated topology rules.

The final geodatabase reflects the efforts of the year-old PAD-US partnership to increase collaboration among organizations and share resources. Due to this partnership, it is now possible to envision a mutually agreed-upon set of land and land-use classifications that incorporates public lands, as well as available data on privately protected lands such as easements held by land trusts and others. However, such privately protected lands information will be developed cautiously, so as not to violate any privacy concerns. By providing a comprehensive picture of protected lands, PAD-US data will help conservation decision makers develop a clearer understanding of how the combined efforts of public and private landowners have contributed to the conservation of wildlife and habitats across the country.

More Information

For more information, contact Lisa Audin, stewardship coordinator, USGS Gap Analysis Program, University of Idaho (e-mail: laudin@uidaho.edu), or visit **gapanalysis.nbii.gov**.

Celebrating 125 years

The U.S. Geological Survey (USGS) is celebrating the 125th anniversary of its national program for topographic maps. With the rise of the digital age and the explosion of Internet-based technologies, GIS technology has helped transform topographic mapping science. To help mark the celebration, *ArcNews* will highlight the USGS and some of its successes in this and upcoming 2009 issues.

GIS to Understand Dance, and Vice Versa

The Ohio State University Cross-Disciplinary Team Explores Complex Structures of Interaction

Highlights

- Geographers used ArcGIS to summarize and investigate spatial patterns of dancers.
- ArcGIS Spatial Analyst was used to generate density surfaces for each dancer.
- ArcGIS 3D Analyst showed final density surface as a topographic landscape.

When choreographer William Forsythe invited scientists from across all disciplines to investigate dance and choreography using their disciplinary lenses, it was not obvious that geography and spatial analysis could provide new insights. One of the goals was to make dance more accessible so that anyone, within a matter of seconds, would "get it," and also to explore the possibilities for placing dance at the center of cross-disciplinary dialog and research. After exploring the spatiotemporal data that was generated from tracking each dancer with centimeter and millisecond (ms) precision, a group of geographers saw some familiar and some unfamiliar spatial patterns emerge. Now their findings and visual explanations and those of other researchers at The Ohio State University (OSU) are presented in a new Web project, Synchronous Objects for *One Flat Thing, reproduced* (**synchronousobjects.osu.edu/content.html#/movementDensity**), which Forsythe developed in collaboration with Ohio State's Department of Dance and Advanced Computing Center for the Arts and Design.

Forsythe's bold, contemporary works have revolutionized classical ballet for our time, and he is widely viewed as the greatest innovator in this field since George Balanchine. With the formation of the Forsythe Company, based in Germany, he continues to actively explore his multidisciplinary interests in new forms and new modes of presenting his work. His installations constitute progressive additions to his extensive oeuvre: installations for galleries and public spaces, video works, digital media, and publications. The Synchronous Objects project is part of his idea to allow the transformation of choreographic principles from one manifestation—a performance on the stage—to an array of other possibilities, including digital information, animation, and installations.

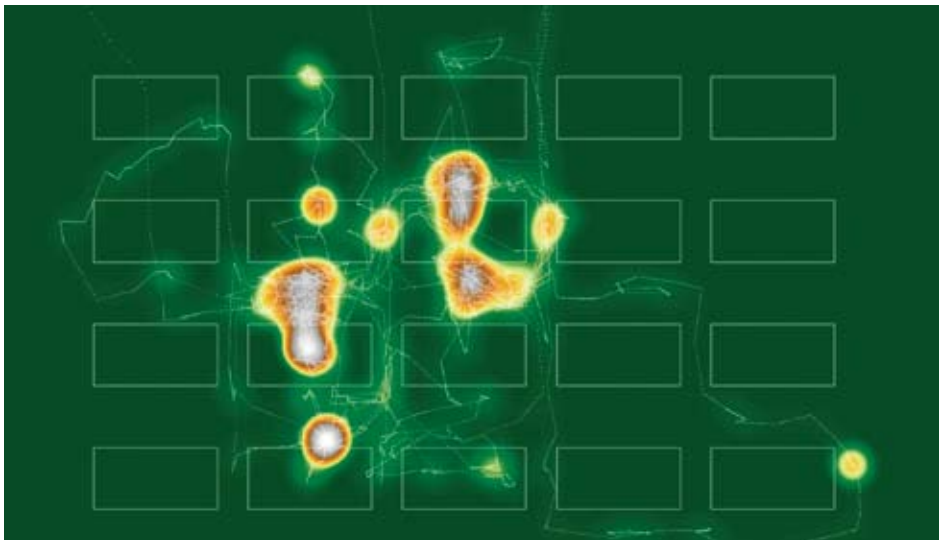
Researchers at Ohio State wanted to explore structures in the dance that were not apparent from watching the dance or might not even be known by the dancers and choreographer themselves. Starting with Forsythe's ensemble dance *One Flat Thing, reproduced* as the research resource, a diverse team of collaborators from OSU's Computer Science, Dance, Design, Philosophy, Geography, Statistics, and Architecture departments and schools sought to understand the complex structures of interaction in the dance through an array of creative tools, expressive animations, and information graphics. Among these, a team of geographers used ArcGIS software (through its ESRI university site license) to summarize and investigate the spatial patterns of dancers throughout the dance. The spatiotemporal data consisted of point records of each dancer's location in three dimensions as well as a time stamp for each record. The entire dance involved 17 dancers, and about 16 minutes of activity was recorded. The minute detail of the records, down to centimeter precision and temporal increments of 40 milliseconds, resulted in a dataset of around half a million points.

The recorded positions of the dancers left a trace of points wherever they moved. To explore potential spatial patterns, the researchers used ArcGIS Spatial Analyst and generated density surfaces for each dancer. Density surfaces are created by superimposing a raster dataset onto the stage, essentially dividing the stage into many small areas represented by pixels, and counting how many points there are within each pixel or within a particular distance from each pixel. A graded color scheme was then added to represent the number of points counted in each area, and the variation in color across the stage informed the researchers about when and where dancers had moved.

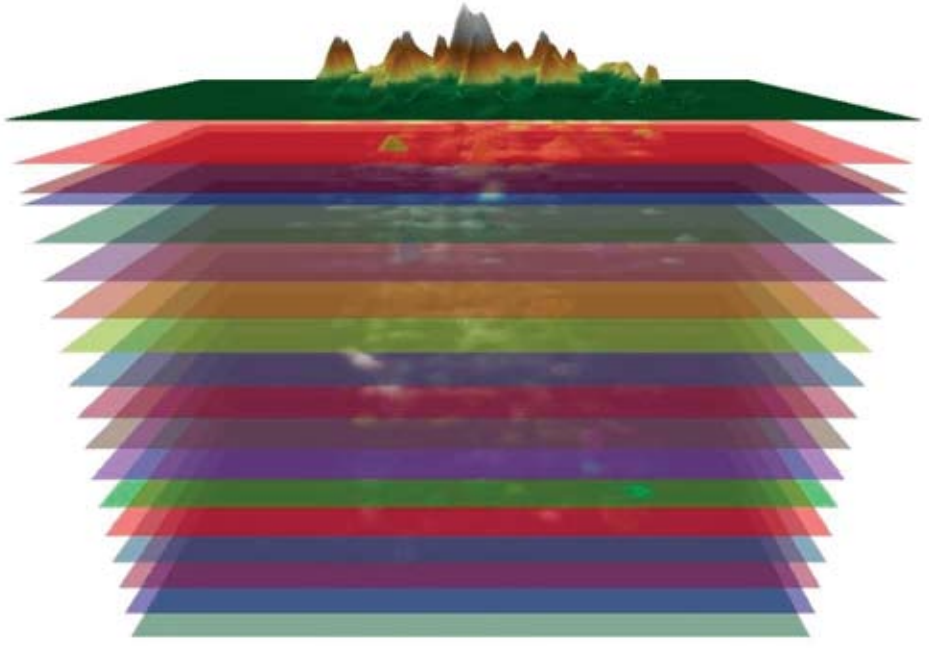
By generating a series of density surfaces with 10-second increments, it was possible to create an animation of how the dance evolved through time, and patterns started to emerge as certain areas were used more than others by the dancers. Halfway through the dance, hot spots, or places that were most used by the dancers, showed up as intense, brown-red areas, and places with little activity remained in green shades. The most obvious pattern that emerged from watching the density surface was that most of the activity happened in the center of the stage, but researchers could also observe how the tables that were part of the stage set seemed to act as a structuring element in this dance. Many of the hot spots were located around the back side of the tables.

To further enrich the visual experience, researchers used the ArcGIS 3D Analyst extension to turn the final density surface into a topographic landscape where the number of points was used as elevation values, creating a dance landscape of mountains, peaks, and valleys. In this representation, sometimes referred to as a statistical surface, the hot spots are depicted as mountaintops or ridges, and the deep valleys and flatlands represent little or no dancer activity. Separate surfaces for each dancer were visualized using this technique through which differences in individual dancer patterns could be explored. These helped highlight distinct patterns where some dancers were very active across the entire dance floor, while others spent most of their time in only a few areas. Most of the animations were created directly in ArcGIS 3D Analyst and exported to movie files for use on the Web site. The Web site and associated blog will also be used as a continually evolving area for communicating and discussing new findings, thoughts, and uses of these objects as tools for communication, discovery, and teaching.

The entire dance involved 17 dancers, and about 16 minutes of activity was recorded. The minute detail of the records, down to centimeter precision and temporal increments of 40 ms, resulted in a dataset of around half a million points. (Video still from One Flat Thing, reproduced *by William Forsythe.)*



One dancer's point data together with outlines of the tables on the dance floor and a density surface generated with Spatial Analyst from all those points.



A topographic rendering of the density surface summarizing all 17 dancers' activity (top layer), and individual dancer density surfaces also rendered as 3D topographies of different colors (underlying stack of layers).

The entire point dataset is shown with outlines of the tables on the dance floor. Each color represents a different dancer, and their locations were recorded at 40 ms intervals.

More Information

For more information, contact Ola Ahlqvist, assistant professor, Department of Geography, The Ohio State University (e-mail: ahlqvist.1@osu.edu), or Hyowon Ban, Ph.D. student, Department of Geography, The Ohio State University (e-mail: ban.11@osu.edu).

Brazil's Aracruz Celulose Breaks New Ground

Eucalyptus Forestry and Wood Pulp Production Applies GIS

Highlights

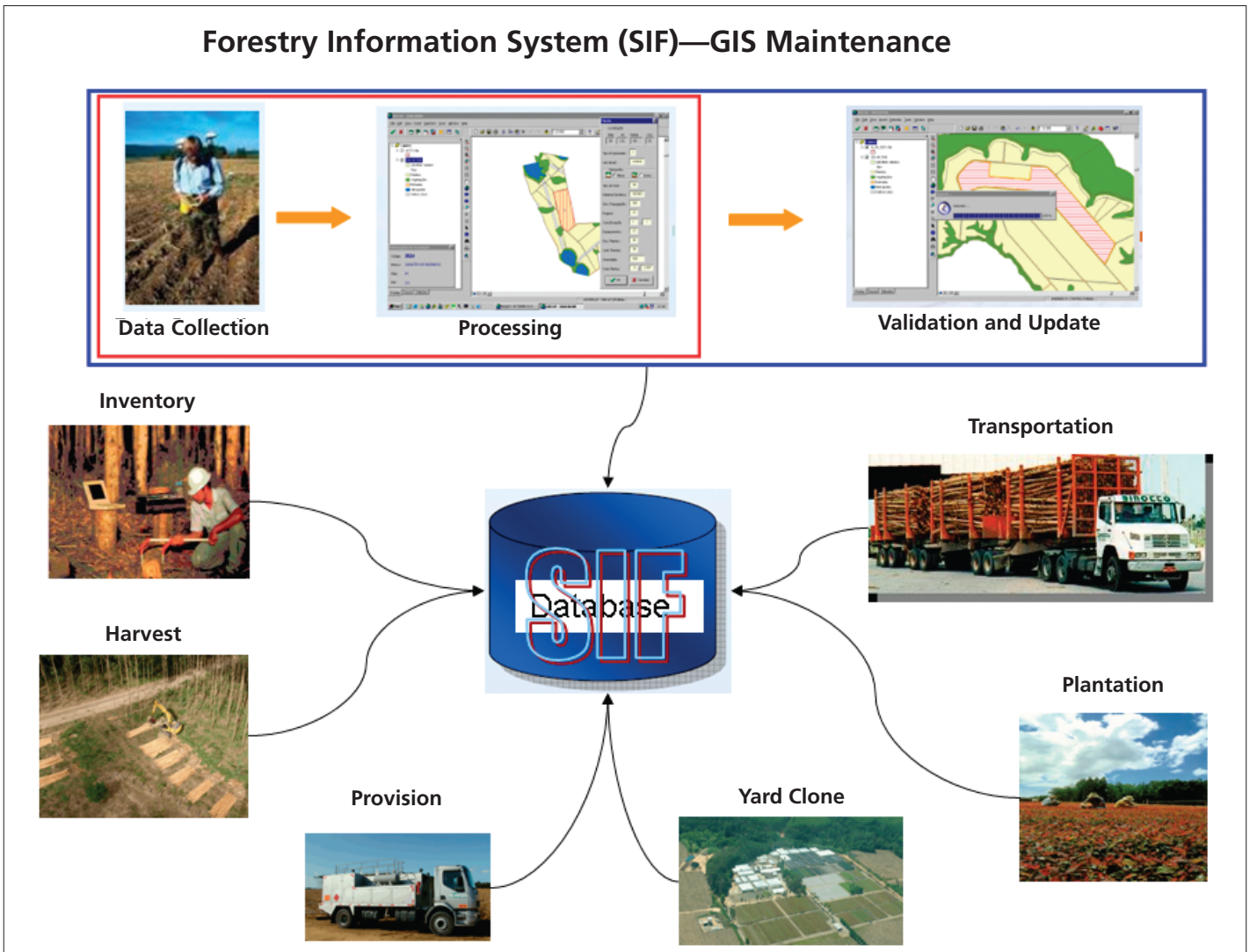
- ArcGIS Desktop allows fast information exchange between plantations and administration.
- Mid- and long-term forest planning is streamlined with GIS.
- GIS immediately benefits operations.

Brazilian forestry company Aracruz Celulose S.A. (headquartered in Espírito Santo) produces 3.2 million tons of eucalyptus bleached pulp annually—24 percent of the world's supply—which is used in the manufacture of papers for writing, printing, and sanitary purposes, as well as highly value-added special papers.

The company's forest operations are in the states of Espírito Santo, Bahia, Minas Gerais, and Rio Grande do Sul, with more than 286,000 hectares of renewable eucalyptus plantations interspersed with around 170,000 hectares of native plant reserves, which are essential for the ecosystem balance. In addition, the company encourages other (third-party) eucalyptus plantations, which consist of another 96,000 hectares contracted with more than 3,900 rural producers.

Before the implementation of GIS at Aracruz, the company could not develop a long-term forest plan. There was only one database, which was developed and updated by the company's employees based on field measurements through conventional topography. Furthermore, cartographic information was traditionally separated from the tabular data, and the maps were based on aerial studies.

In 1997, company officials concluded that it was important to streamline information exchange between the planting areas and the administrative sectors, and in 1998, the company started using ArcGIS Desktop (ARC/INFO at that time). This improved planning, planting, and the development of harvest and transport strategies for raw material and cellulose. To meet these goals, the company knew that it needed the most advanced GIS technology to be customized for its needs.



After evaluating GIS consultants, in 2004 Aracruz selected Imagem Geosistemas e Comércio Ltda., ESRI's Brazilian distributor, to help develop a GIS-based method of optimizing Aracruz's database to support its mid- and long-term forest planning. Imagem was selected because of its know-how and support, ensuring the utilization of ESRI products to the fullest.

Using ArcGIS Desktop and the Oracle 9.2*g* database management system in its forestry information system (SIF), Aracruz performs its updates with enhanced precision data capture using GPS. GIS has allowed the fast visualization of Aracruz plantation areas, which speeds up the process of obtaining raw material. The company also uses the database for environmental preservation and land use.

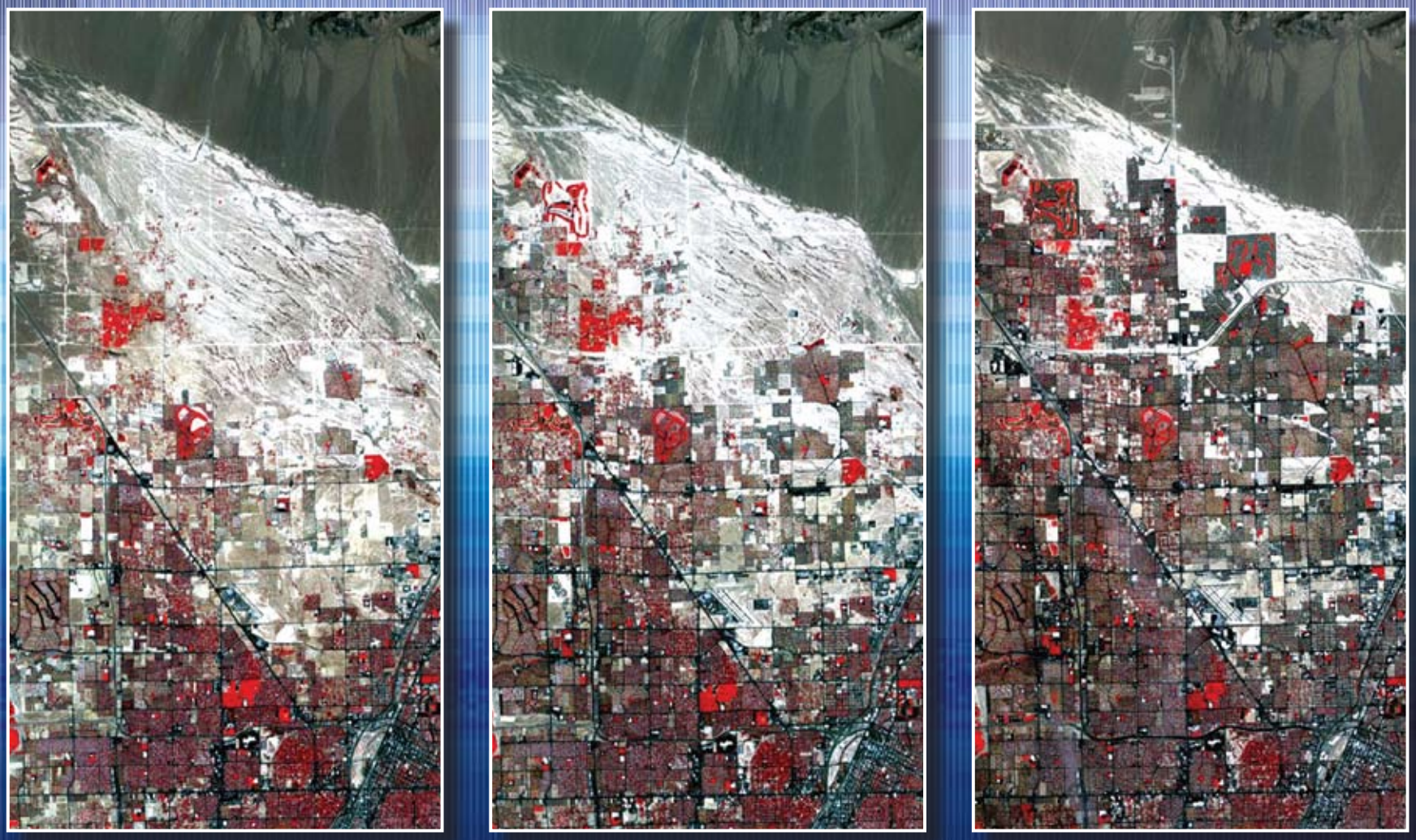
"Our geographic database is directly connected to the business spreadsheets," explains Jocival Luiz Domingos, geographic information system analyst, Aracruz. "Any update we do using GIS tools immediately affects our operations. At the same time, the field actions generate data recorded by GIS."

ArcGIS Desktop also improves information exchange between the plantation areas and the administrative divisions, as well as supports the development of harvest and transport strategies of both raw material and pulp.

More Information

For more information, contact Jocival Luiz Domingos, GIS analyst (e-mail: jldoming@aracruz.com.br), or Marcial Amoedo y Cervino, geoprocessing coordinator (e-mail: mayc@aracruz.com.br), Aracruz Celulose S.A., or contact Dorival Arthur Junior, Imagem (e-mail: djunior@img.com.br).

Aracruz has more than 286,000 hectares of renewable eucalyptus plantations interspersed with approximately 170,000 hectares of native plant reserves, which are essential for the ecosystem balance.



Landsat imagery showing the growth of Las Vegas from 1995 to 2008

Source: USGS/Landsat Program

Oregon Moves Ahead with Enterprise Technology

Continued from cover

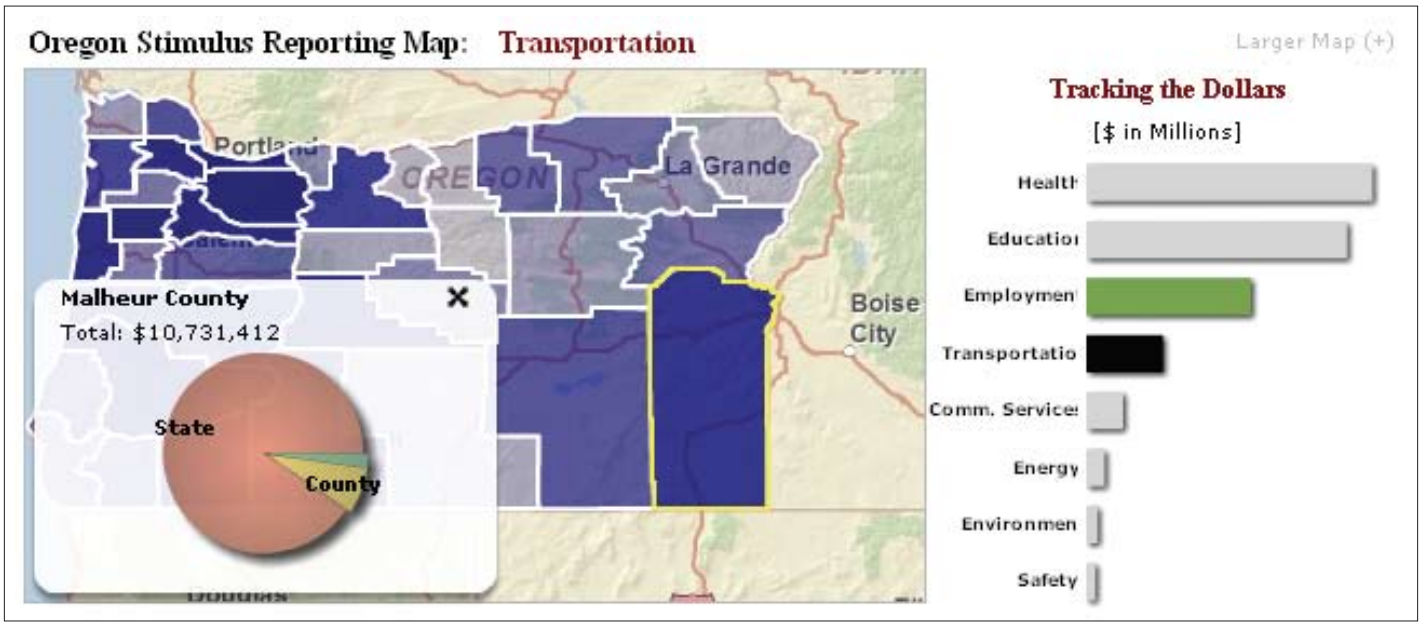
costs, and encourages widespread GIS application development for more efficient operations. Oregon joins Alabama, Maine, North Carolina, Delaware, and Montana in realizing the value of an ESRI ELA.

"Our goal is to meet the business needs of all our staff, from novice GIS users to experts," says Cy Smith, statewide GIS coordinator, Department of Administrative Services/Geospatial Enterprise Office. "Ongoing access to the software means agencies can expand application development. Agencies that have not yet started using it can do so. Now, a lot more people will create geospatial data to improve their specific business processes and government services that require interagency coordination."

Oregon also recently passed legislation making ESRI technology the standard for GIS in all state agencies. The administrative rule is Oregon's first statewide IT standard. Operating from this common foundation with wide access to ArcGIS software will ease GIS software administration and improve collaboration, data sharing, and communication across agencies.

The ELA provides full access to ESRI products, including ArcGIS Server, ArcGIS Desktop, and ArcGIS Mobile. Importantly, this access to ArcGIS software combined with the state's GIS standard will encourage rapid growth of navigatOR, Oregon's initiative to cost-effectively develop and manage statewide geospatial data in coordination with local, state, tribal, and federal government. The state's data and Web mapping applications are available via Oregon Explorer (go to **www.oregonexplorer.info** and choose the Maps link).

To offer an example of how GIS improves business processes in the state, Smith turns to emergency response. Like many government activities, he notes, delivering excellent emergency services requires all levels of government to work together and have a shared database (navigatOR) that facilitates their work.



*Oregon's data and Web mapping applications are available via Oregon Explorer (**www.oregonexplorer.info**).*

"With a good GIS, you can get an ambulance to a heart attack victim a minute faster and save a life or get firefighters from the city of Portland to a wildfire in a rural area three counties away who know from the data exactly where homes are within the fire perimeter," explains Smith. "With city firefighters focusing on homes, federal and state firefighters who are experts on fighting forest fires can focus on those areas."

Smith has seen real-world examples of how good data and GIS-supported coordination can save lives and property. "We've had a couple of fires in the state during the past few years," he remembers. "Where we had all of the right data easily shareable, every home and life was saved. Where base data was unavailable, homes and lives were lost. Having access to the same GIS software and having more people build data that everyone shares make a huge difference."

Oregon continues to expand GIS application development to enhance its operations and service to citizens. One example is the GIS-based recovery tracking site the state launched in March 2009. The Web mapping application allows the public to track state and local government spending of funds from the American Recovery and Reinvestment Act.

"This tracking tool is a national model for transparency and accountability in how the stimulus dollars are spent," says Oregon governor Ted Kulongoski. "It will not only empower taxpayers but eventually serve as a tool for the state in our efforts to put Oregonians back to work."

More Information

For more information, contact Cy Smith, statewide GIS coordinator, Department of Administrative Services/Geospatial Enterprise Office (e-mail: cy.smith@state.or.us). To learn more about ESRI ELAs for government, visit **www.esri.com/governmentela** or call 800-447-9778. AN

Indian Space Research Organisation

Indian Government Selects ESRI's Image Processing Platform

Continued from cover

Image extension. The RRSSCs in Jodhpur, Dehradun, Kharagpur, Nagpur, and Bangalore, use Indian Remote Sensing (IRS) satellite and other imagery to create thematic maps and GIS databases that provide valuable societal applications to various government agencies throughout India.

With India's success in remote-sensing technology through the IRS constellation, several new imagery-based and GIS-centric projects of national relevance are gaining visibility and importance. ISRO is presently implementing major programs related to natural resources, disaster management, environmental oversight, and groundwater and watershed management.

The remote-sensing centers are establishing a distributed architecture of server-based solutions designed to be the foundation for publishing, hosting, and serving images and data. Over time, RRSSCs have collected large volumes of map data and integrated them with developmental attribute data. The centers plan to combine and assimilate all the data with new-generation IRS high-resolution images and serve the data and application sets across the government sector.

ISRO implements major programs including those related to natural resources, disaster management, environmental oversight, and groundwater and watershed management.

The RRSSCs needed a GIS solution that met their needs and was scalable to meet growing demands for services from a large number of users for a variety of advanced applications. They selected ESRI's proven technology and superior solutions after several rounds of technical presentations, demonstrations, and discussions. RRSSC and NIIT GIS Limited (ESRI India), ESRI's distributor in India, have concluded a comprehensive training session, and RRSSC users have started developing the solution.

Dr. Yvn Krishnamurthy, director of the RRSSCs, says, "ISRO users have been using ESRI products for a variety of applications, and many national programs have been based on GIS solutions. IRS imagery has been the source of thematic mapping inputs and provides end-to-end solutions under the umbrella of the National Natural Resources Management System. ArcGIS Server with the Image extension is a robust and integrated product and has capabilities that can meet our application needs of serving images and thematic maps to a variety of users."

Dr. Mukund Rao, president and chief operating officer at ESRI India, notes, "ISRO has been pioneering the use of IRS imagery and advancing GIS solutions for a long time. We are proud to be associated with them on this prestigious, first-of-its-kind national project to serve image- and map-based solutions in a GIS portal architecture."

ArcGIS Server helps users connect people with the information they need via Web mapping applications and GIS services. It is built on a modern, service-oriented architecture. The ArcGIS Server Image extension makes it possible to take raw or preprocessed imagery and immediately deliver it as a Web service. It enables organizations to exploit the rich information content available in imagery and quickly access large volumes of imagery. This is far superior to traditional options that required significant efforts by users to locate and make file-based imagery available.

Says Lawrie Jordan, ESRI's director of imagery enterprise solutions, "We provide powerful new tools that enable things to happen in near real time—like delivering and displaying imagery, roaming around the imagery, zooming in to the imagery, and doing on-the-fly mosaicking and orthorectification of the imagery."

ESRI India envisions that this new software deployment and implementation will serve as a key reference within all Indian government agencies, especially those that disseminate and/or consume imagery and imagery-related data.

More Information

For more information, contact Narinder Thapar, ESRI India (e-mail: narinder.thapar@niit-tech.com, Web: **www.esriindia.com**). AN

Research Tool at ESRI.com

ESRI's Online GIS Bibliography Serves as Excellent Resource for Information

The ESRI GIS Bibliography, free on the ESRI Training and Education Web site, recently surpassed 75,000 entries, making it one of the world's largest online repositories for information about geographic information science (GIScience) and GIS technology.

Dr. Duane F. Marble, professor emeritus of geography at Ohio State University, began compiling the bibliography in the late 1980s. Because Marble and other academics were each creating individual GIS bibliographies, he saw the need for a more comprehensive public resource. When Marble retired from his academic position, ESRI became curator of the bibliography. The staff at the ESRI Library in Redlands, California, working with Marble, continues to update the content and maintain the Web site as a free service to the GIS and GIScience community.

The ESRI GIS Bibliography at www.esri.com/training/library serves as an excellent resource for scholars, scientists, geographers, cartographers, and professionals in a wide range of industries who want to learn about one or more aspects of GIS technology or geographic information science in their fields. The bibliography references more than 1,000 sources, mostly journals, magazines, conference proceedings, and books. Though mainly abstracts, the bibliography also includes some PDFs of articles, conference proceedings, book chapters, and theses. The bibliography encompasses a vast array of fields and industries, such as marine sciences, health, the environment, defense, land-use planning, surveying, petroleum, and forestry. "Although there are other specialized GIS bibliographies, the ESRI resource covers a broad span of disciplines, applications, and theory, as well as representing the history of GIS," says Marble. "The global reach of GIS is also clear. During the early years, North America, Europe, and Australia dominated the contributions, but now we see significant input from other regions, such as Asia—specifically China."

"Thousands of students and hundreds of professors have used the bibliography as one of their major starting points for GIS research," says Dr. Michael Gould, ESRI's director of higher education. "Besides being an educational resource, the abstracts and other materials point the way to finding experts in or other sources of information about geospatial research and technology."

ESRI librarian Patty Turner says the ESRI GIS Bibliography contains all the abstracts or PDFs to full papers for every year of the ESRI International User Conference going back to 1993. Many abstracts from the Association of American Geographers' annual meetings are also posted. Citations also come from hundreds of journals, such as *Applied Geography, Cartographica,* and the *International Journal of Geographic Information Science.* Turner adds that the bibliography contains a lot of "gray material," which means it's often unavailable anywhere else online.

The ESRI GIS Bibliography is easy to search using either the basic or advanced search engines. The advanced search includes fields such as title, author, keywords, and abstract, along with the type of material being sought and the year range. Under the search feature is an area where readers can browse for books, conference proceedings, reports, journals, magazines, and other materials.

More Information
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A visit to esritv (www.youtube.com/esritv) reveals a variety of videos, including technical demonstrations, industry seminar presentations, information about ESRI events, and many topical subjects. Viewers have responded enthusiastically to ESRI's presence on YouTube and expressed their appreciation for having this as a source of information and instruction. Some videos have been viewed hundreds or even thousands of times.

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More Information
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Evaluating Ghana Pilot Project Results—Part 3

GIS Brings Commercial Viability to Recognizing the Land Interests of the World's Poor

By Peter Rabley, International Land Systems, Inc., and Craig DeRoy, Corporate Initiatives Development Group

Highlights

- The pilot proved GIS can help develop a practical means of formalizing land registration for the poor.
- The Ghana model combines GIS/geospatial technology and an innovative paralegal registration process.
- GIS-based land registration can enable the poor to identify their land tenure rights.

This article is the fourth and last part of a series that has focused on GIS-based land and title registry. This is the third article to focus on the Ghana pilot program.

The first two articles in this ArcNews *series described how a team of partnered companies, brought together by a commitment made to the Clinton Global Initiative (CGI), set out to demonstrate in Ghana that implementation of geospatial technologies in the land registration process could enable the poor to gain access to the formal land titling process. This article assesses the early results of the pilot program begun late last year in Ghana and examines the promising potential for sustainability and scalability of a commercially viable land registration process to formalize property interests of the poor.* (For a complete description of the pilot as described in articles 1 and 2, see the summary sidebar at www.esri.com/arcnews.)

In his widely acclaimed book, *The Mystery of Capital,* Hernando de Soto states that "nearly every developing and former communist nation has a formal property system. The problem is that most citizens [the poor] cannot gain access to it." The barriers to access vary from country to country, but primarily are due to overwhelmed or corrupt bureaucratic government processes that are far too complex, cumbersome, and costly for the impoverished to navigate successfully. As a result, the poor, who represent as much as five-sixths of humanity, are unable to register the only real asset they may have—their land. This basic inequity literally cuts the poor out of a capital market largely recognized in the form of land rights that can be built upon, be financed, and serve as the foundation for asset accumulation and transfers of wealth or inheritance. Reversing this inequity formed the basis of a commitment made to the Clinton Global Initiative to develop a template for a sustainable and scalable, private-sector-led approach that leverages technology to make land registration affordable and accessible to the poor.

A pilot project begun less than a year ago in the West African nation of Ghana has proved that sustainable GIS-based technology can be used to develop a practical, commercially viable means of formalizing the land registration process for the poor. This new model combines geospatial technology and an innovative paralegal registration process to develop a land titling process and GIS-based land records system that automates much of the work involved in collecting property ownership information, creating low-cost and timely property descriptions and surveying of parcels. To most efficiently and responsibly identify and reach the poor in need, the pilot program utilizes the distribution network of a microfinance lender as the trusted broker partner. The program bases its unique approach on a foundation of commercial sustainability and scalability, which has been sorely lacking in other land reform projects that are typically highly subsidized.

Corporate Initiatives Development Group (CIDG), in conjunction with ESRI Business Partner International Land Systems, Inc. (ILS), designed and directed the Ghana pilot program and together formed a consortium of partnered companies that included Opportunity International, the microfinance lender; SAMBUS Company Ltd. (the ESRI distributor for Ghana); Trimble Navigation; and ESRI. The Ghana pilot program initially targeted the owners of 30 private schools in Ashaiman District, one of the poorest areas of Accra, Ghana. By late 2008, the Ghana pilot program was yielding results. The partnered team was beginning to see that it could produce its paralegal title at a cost that could—in a relatively short time—become easily accessible and affordable by the poor. That is, the team began to align the real cost for such practical registrations with the level of microfinance loans typically available to the poor. To achieve this cost- and time-effective result, the team leveraged key components of the very process used by the microlenders to make those loans.

Ms. Adamah receiving the paralegal title to her property upon completion of the paralegal registration process.

The premise of the pilot program is that human dignity goes hand in hand with certain basic rights. One means of restoring the dignity of the poor is to recognize their identity and the location of where they live through a formal land registration process assisted by a trusted broker in the community. Formal recognition of land tenure empowers leaseholders or landowners in many ways, the most important of which is the ability to leverage their property and be able to begin looking at property as an asset, including the potential for using it to obtain and build on microfinance loans. These loans, often less than $500, can assist individuals in making dramatic changes in their lives, such as starting or growing small businesses.

Overall, the project has been judged a success for achieving the primary objective of showcasing that private industry can implement a practical, informal land registration and paralegal titling system that is much simpler and faster than the traditional formal process. With microfinance loan officers serving as the trusted brokers and assisting the school owners with documentation, the titling process that once took years to arrive at an identity for the property and its landowner can now be completed in a few weeks. All 30 of the pilot schools have had their properties identified through mapping from high-resolution satellite imagery supplemented by GPS "walk-arounds," and the owners/tenants have received the paralegal title to the land under their buildings.

As the newly elected democratic government in Ghana takes hold and the newly appointed land minister continues the process of moving land registration ahead across the country, the paralegal titling process provides a ready-made starting point for official review and sign-off by the government. The land team is confident that the adoption of the ILS MultiCadastre Open Title system (based on ESRI technology) will drive the government's appreciation of the economies of scale now possible to make formal land registration truly accessible to the poor. A major factor helping cut the costs involved in conducting surveys and awarding titles is the time savings delivered by state-of-the-art technologies, such as GIS and GPS.

Several conclusions can be drawn from the early results of the pilot. Most notable is the fact that low-cost, sustainable, and scalable GIS-based land registration technology can indeed enable the poor to quickly and successfully identify their land tenure rights. Moreover, the pilot demonstrates that recognition of customary tenure as a validation of an individual's rights as a person—regardless of economic stature—can be accomplished within the framework of existing laws.

Mobile GPS-based GIS was used to survey Ms. Adamah's school.

Belief in the Process

In a project such as this, progress and success are often gauged by impersonal statistics or reports filed with stakeholders. But in Ghana, the people didn't read about progress in the newspaper; they witnessed it firsthand when survey teams equipped with high-accuracy GPS receivers began surveying their schoolyards in Ashaiman. Once a community begins to see that the process is actually working and paralegal titles are being issued to their neighbors, they begin to believe that it can work for them too, and they begin to feel empowered as a community.

Ms. Adamah is the owner of the Providence Educational Complex, which was one of the first schools in the pilot to be reviewed under the paralegal titling process. Looking back on the sequence of events, she believes the most significant benefit given to her under this program was the validation that the school was indeed hers. Her legal rights had been privately formalized, and as a result, she had confidence that the school could someday be used as an asset and would be passed on by inheritance to her family. She was visibly moved the day her property was surveyed and she was shown the outline of the school overlaid on a satellite image of Accra. For the first time, she literally saw her place in the world—and it had an address that reaffirmed her sense of identity.

Left: Ms. Adamah's school, the Providence Educational Complex, seen geocoded on the satellite image of the cadastral map.

As word of Adamah's experience, and others like hers, spread by word of mouth through the community, neighbors began approaching the land team's field personnel during the GPS boundary survey and field adjudication process, asking if they could be next. Many of them had attempted to navigate the government's titling process on their own but had been frustrated by the process. In a survey of the landowners conducted prior to the pilot program, 80 percent said they had tried to get formal title to their property for years, but all had given up. However, seeing is believing. When these individuals see their own property geocoded with a location on a map for the first time, they realize that their stature has just risen to a new level as they have joined the ranks of those who already enjoy what is rightly due them—access to capital based on the assets they own.

A Continuum

The pilot revealed some unexpected insights as well. Most notable among these is the importance of property rights recognition along a continuum of personal rights—beginning with the very basic property report showing a point location of that piece of land on the earth and moving to the official description of landownership rights supported by formal documentation in official government records. The pilot program has demonstrated that GIS-based technology is an effective tool that can be readily calibrated to match the need for definition of a range of property interests and information that is affordable. This pilot program utilized a level of specificity in the form of a paralegal title certificate. The next gradation is the primary level of formal title where the surveys produced are accepted and recorded in the official records of the government.

From a technological perspective, the pilot is also proving that even in the poorest of areas, land adjudication with modern geospatial techniques yields benefits extending well beyond the low-income leaseholder and into the entire surrounding community. During the parcel survey, the introduction of real-time differential correction with the Trimble base station was a watershed event for both SAMBUS and the Ghana Ministry of Lands. Until the GPS began providing 10-centimeter accuracy in real time, the government did not consider GPS a viable technology for parcel mapping. But it does now. And local companies can realize a business model change overnight as the time required for a property survey was reduced from half a day to just 15 minutes. Companies can now offer GPS survey services at a fraction of the previous costs, making it affordable to a variety of new industries.

As ILS populated the MultiCadastre Open Title system's geodatabase with satellite imagery, geospatial data layers, and parcels, a land-use map of Ashaiman emerged for the first time. A land planner from the Ministry of Lands was provided with the map so he could better grasp difficult growth issues that need to be addressed. For example, many squatters have built their shacks in a flood zone, while others have encroached upon roadways and footpaths. The GIS is now a powerful tool that will assist in dealing with these problems.

The Commercial Viability and Future of the Program

The pilot program demonstrated that GIS-based land registration technology can indeed enable the poor to quickly and successfully register their land rights at a cost that is affordable and sustainable. Moreover, when these technology solutions are presented in conjunction with microfinance distribution partners, the potential for scaling and long-term commercial viability is dramatically increased. The global movement in microfinance has seen tremendous growth in recent years, and it is estimated to now be serving between 125 and 150 million customers, according to a recent article in *Financial Times.* By utilizing microfinance lenders that are already established as trusted brokers in the communities they serve, this program is able to leverage existing distribution networks, thereby reducing the cost of identifying and delivering land registration services to the poor. By offering the land registration services to the full spectrum of microlenders, from those that are more commercially based to those that are highly subsidized or donor based, there is an increased ability to ensure that the program will aid the poor at all levels of the poverty spectrum, including the poorest of the poor who are often considered too hard to reach or too expensive to serve.

As promising as the results of the Ghana pilot program have been, the project participants understand there is still much work to be accomplished. The most important goal now is to keep the momentum going in Ghana and elsewhere. The project partners will expand the Ghana pilot in 2009 to include support for new microfinance products under development. The group is also looking at expansion of its program in the rural areas outside Accra where farmers are granted oral permission to work the fields owned by local tribes. Looking globally, success will be declared as additional microfinance organizations validate the concept by embracing these innovative land registry services as part of their offerings to the poor. The project partners—CIDG, ILS, Trimble Navigation, and ESRI—are working with CGI to expand the program globally. They are interested in initiating new partnerships and are actively seeking suggestions from organizations operating in other parts of the world where the impoverished would benefit from easy and inexpensive access to paralegal title and land registration.

About the Authors

Peter Rabley is president of International Land Systems, Inc., with more than 20 years of experience designing and implementing land information systems around the world. Craig DeRoy is president of Corporate Initiatives Development Group and has more than 25 years of executive management experience. He is expert in designing and implementing services and solutions to meet the challenges and opportunities of emerging markets worldwide.

More Information

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ESRI Services

Updated Operations Center Helps U.S. Department of the Interior See Bigger Picture

Continued from cover

Highlights

- ESRI's Situational Awareness for ArcGIS solution is implemented rapidly enterprise-wide.
- Solution helps DOI visualize operations in a new way.
- GIS becomes critical aid to transition in leadership.

to American Indians and Alaska Natives. This work is done through the Interior bureaus: Bureau of Indian Affairs, Bureau of Indian Education, Bureau of Land Management, Bureau of Reclamation, Minerals Management Service, National Park Service, Office of Surface Mining Reclamation and Enforcement, U.S. Fish and Wildlife Service, and U.S. Geological Survey.

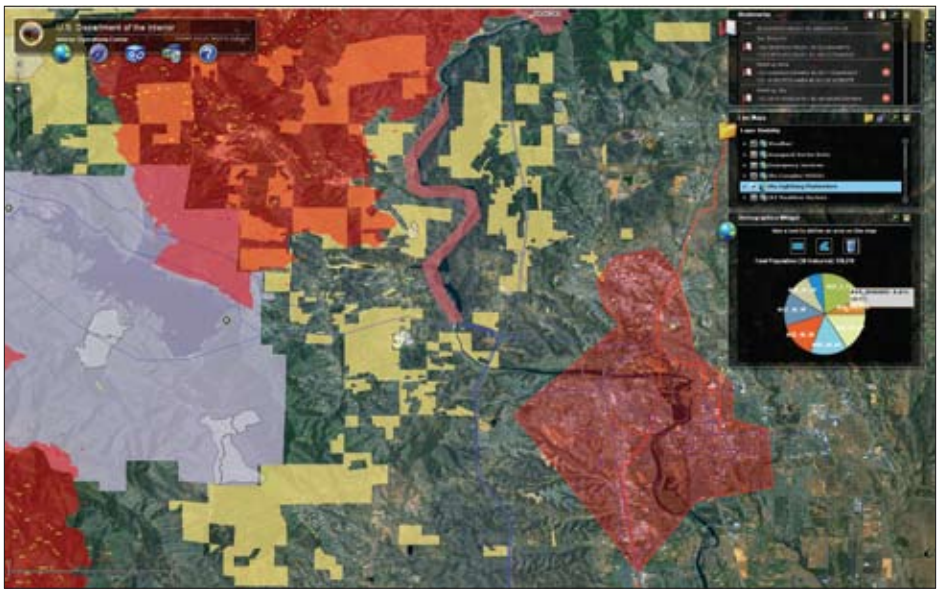
The department affects the lives of millions of people, from the family taking a vacation in a U.S. national park to the 48,000 children studying in Indian schools to the more than 67,000 employees and 280,000 volunteers located at 2,400 offices across the United States, Puerto Rico, U.S. territories, and freely associated states. DOI oversees 500 million acres of surface land—one-fifth of the country—and 1.7 billion acres of the nation's outer continental shelf. In that immense area, the department presides over the country's 391 national parks, 548 national wildlife refuges, and 479 dams and 348 reservoirs that provide water for 31 million people. In addition, the department administers 8,526 active oil and gas leases and operates 58 hydroelectric plants.

The scope and scale of DOI are hard to grasp on any given day. In an emergency, the effort to synchronize the people, resources, and data quickly for all the Interior bureaus becomes monumental.

Modernizing Emergency Operations at DOI

To help manage that effort, DOI completely redesigned and modernized its Interior Operations Center (IOC), a secure facility that serves as the principal focal point for reporting significant incidents to the Secretary of the Interior; sharing emergency information with the National Operations Center at the Department of Homeland Security; and disseminating alerts, warnings, and other emergency information to bureaus and offices.

The modernization included updating IOC's situational awareness capabilities by implementing ESRI's Situational Awareness for ArcGIS. This packaged enterprise GIS solution was selected because it can be implemented rapidly and with minimal effort on DOI's part. Situational Awareness for ArcGIS comprises hardware preloaded with terabytes of prerendered, precached basemap data for the nation; a powerful data fusion and analysis engine; and a set of fully customizable clients, including a 2D browser-based viewer, a 3D desktop client, and a data management and analysis client. The package includes the services and training to use the system quickly.



In a demonstration to DOI leadership, fire scenarios in the Redding, California, area were used to illustrate how the IOC's geospatial and demographic analysis capabilities could be used for situational awareness during the fires.

The solution lets IOC leverage the enterprise GIS infrastructure at DOI to merge emergency information from bureaus and offices with emergency management activities into a common operational picture for information sharing during an event. Says Karen Siderelis, geographic information officer for DOI, "We have thousands of datasets already available that we want to make available through the solution's capabilities. The ability to bring in our own rich data and fuse it with the basemap data and capabilities of the system is critical."

ESRI's Professional Services Division installed and configured the basic solution in a week, integrating spatial and attribute information from DOI's vast data repositories. It customized the 2D viewer to give users easy access to local data; data from other DOI databases consumed as Web services; and data from live MWS and RSS feeds, such as real-time hurricane, earthquake, and wildfire status.

The grand opening of the new IOC was held on January 9, 2009, and according to Larry Broun, head of emergency operations at DOI, it was pressed into service almost immediately for the presidential inauguration on January 20, 2009. The National Mall, in which many inaugural activities took place, is a national park and thus under DOI jurisdiction. IOC watch officers monitored reports of incidents around the National Mall, geolocating them as necessary and reporting to law enforcement staff or appropriate agencies. The inauguration, attended by more than 1.8 million people, proceeded without incident.

Seeing the Big Picture

At the grand opening of the new IOC, outgoing Secretary of the Interior Dirk Kempthorne was given a tour just before he was due to meet with incoming secretary Ken Salazar. Siderelis and her team capitalized on IOC's enterprise geospatial capabilities, pulling together data to demonstrate the full range of operations at DOI in a new way—through geovisualization. Using Situational Awareness for ArcGIS, demonstration team members navigated to areas around the globe that the IOC watch team was monitoring, such as Mt. St. Helens, and showed everything from dams to Indian schools under DOI jurisdiction. They showed fire scenarios in the Redding, California, area, demonstrating how IOC's geospatial and demographic analysis capabilities could be used for situational awareness during the fires. Using data about Hurricane Ike—a category 4 hurricane and the third costliest in U.S. history—they also exhibited how IOC could use GIS for everything from evacuations to recovery efforts before, during, and after an emergency. "We really wowed everyone with both the story of DOI and with the scenarios we generated," comments Siderelis.

Kempthorne was so impressed by the visual depiction of DOI's operations, says Siderelis, that when Salazar arrived, Kempthorne asked her team to give the incoming secretary the complete picture of the department he was to inherit. Salazar, too, saw the value of the demonstration, and when he officially took office on January 20, he began sending his staff to IOC to learn the story of DOI. Since then, Secretary Salazar has been briefed in the IOC and is so enthusiastic that he has used the center on several occasions to brief others. He is a great advocate of using science and technology to further the goals of the department.

GIS Becomes Critical Transition Tool

In short order, GIS became a critical part of the transition within DOI, helping new key staff members understand operations across all of DOI. This, in turn, generated a new awareness of the capabilities of enterprise GIS.

"The solution implemented at IOC has become the flagship and icon of a more enterprise approach to GIS," says Siderelis. She believes the fast implementation of a total solution, with everything—hardware, software, data—ready to go quickly, is affecting people's perception of the potential of enterprise GIS. For the past three years, DOI has had a geospatial modernization blueprint with the objective of coordinating and integrating enterprise GIS activities across all bureaus and offices. Siderelis says that the technology at IOC pushed that blueprint forward with tremendous momentum. "We're light-years ahead of where we would have been," she asserts.

Next Steps

Siderelis says that DOI's immediate next step is to make the IOC's geospatial capabilities accessible to a wider set of teams across DOI via Web services. DOI intends to continue to customize the 2D viewer to support the IOC operational workflow. ESRI Professional Services will assist DOI in creating widgets (pieces of code providing specific functionality) for the viewer that offer capabilities such as the ability to see the demographics about any area in the United States or the number of federal employees in a user-specified area. Another widget in development will provide integration with ESi's WebEOC product, which will become an integral part of the operational procedures to record, share, and archive information at IOC.

"Where we really want to take this is to have an impact on our programs," concludes Siderelis.

More Information

For more information, contact Karen Siderelis, Department of the Interior (e-mail: Karen_Siderelis@ios.doi.gov); Bob Pierce, U.S. Geological Survey (e-mail: rrpierce@usgs.gov); Larry Broun, Laurence_Broun@ios.doi.gov); or Pat Cummens, ESRI (pcummens@esri.com, tel.: 651-454-0600). AN

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City of San Diego, California, Takes Enterprise Management to the Field

Implementing an Integrated ESRI/SAP System

Highlights

- The city is carrying out asset management activities in the field with SAP's Mobile Infrastructure module, ArcGIS Server, and ArcGIS Mobile.
- Combining ESRI and SAP, the city anticipates a more efficient future with improved records management.
- The city has decided to extend its ESRI and SAP integrated system to other departments and divisions.

For years, government agencies across San Diego County, California, have been at the forefront of using GIS to better serve their communities. In 1999, the Street Division of the City of San Diego's General Services Department pioneered the implementation of an integrated ESRI/SAP system called SYNERGY. What started as a system for asset and work management in a single city division has now grown into a large integrated system that is being used by other city divisions and departments.

The City of San Diego is located in Southern California and is the eighth largest city in the United States. The city's economy is largely supported by dynamic modern industries. Growing from the city's world-renowned academic institutions are biotechnology/biosciences, computer sciences, electronics development and manufacturing, and software development that have helped diversify the city's economic base. Those industries join defense-related manufacturing, financial and business services, ship repair and construction, telecommunications, agriculture, and tourism to form the core of the city's economy and employment base.

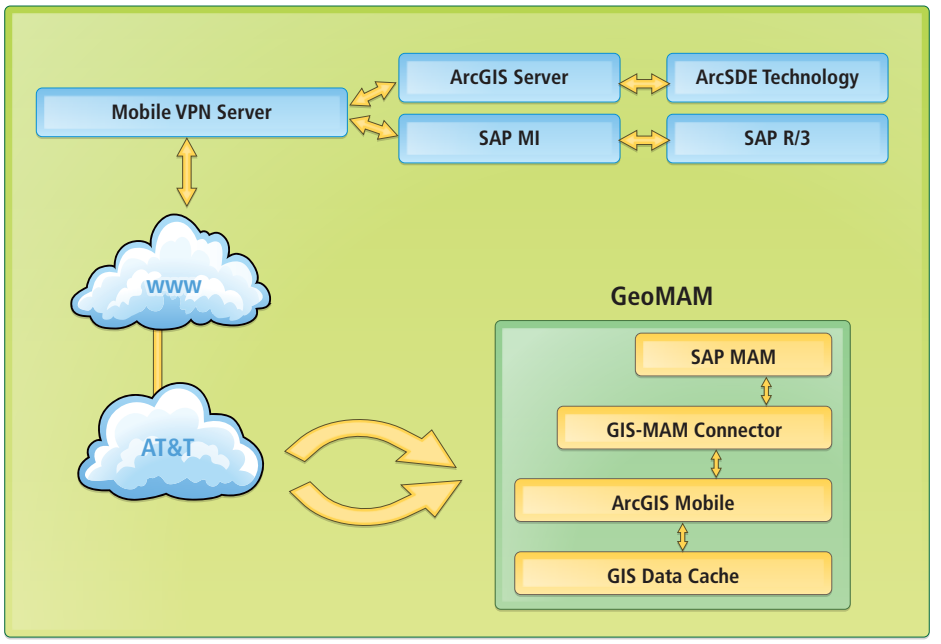
Even as the city copes with the impact of the global financial crisis, maintaining the infrastructure serving these businesses while also supporting the needs of city residents has remained a priority for the city's mayor, Jerry Sanders. "When I took office, the city didn't have a good inventory of its asset management needs," says Sanders. "We knew we needed to get a better handle on our tracking systems and the way we managed our asset data. Thankfully, we had some forward-thinking team members who were ready to accept my call for greater accountability and efficiency."

Intranet Empowers Employees

Initially, Project SYNERGY helped city employees track asset locations and the status of service requests using an intranet application. The project was completed with the development of a work management interface. GIS capabilities allowed users to quickly locate work order sites, track work order status, and perform spatial queries to create digital maps. As one example, an employee in the Water Utilities Division could locate a work request sent to the Street Division on a digital map, then click on the work site icon to view related information and completion status.

Internet Serves Citizens

Employees also provide online customer service to citizens using advanced GIS Internet applications. This advanced system allows citizens to report infrastructure issues and problems to the city throughout the day, helping staff keep task lists and job priorities current. Users have the option of locating assets by address, ZIP Code, or community. After an asset of work concern is located on the digital map, users can pull down a menu to request service and add additional information. The system then provides a service notification number that can be used to check the status of the request. Once the work order is complete, a status update is automatically sent to the citizen via e-mail. Customer service representatives answering calls from citizens also use GIS to verify the asset's location before generating work orders.



The City of San Diego's Geo Mobile Asset Management (GeoMAM) application (see technical sidebar below) *integrates ESRI's ArcGIS Mobile with SAP's Mobile Infrastructure (MI) module to facilitate enterprise asset management (EAM) in the field.*

Sweeping Changes with GPS

In 2003, GPS devices were added to the city's street sweepers, allowing their routing and operations to be managed by the integrated system. This system allows the city's Storm Water Department, responsible for sweeper operations, to capture and retain information such as the date and time that specific locations were swept, where and when the sweeper brushes were lowered and raised, where and when water was applied to assist the sweeping,

Field Enterprise Asset Management for City of San Diego

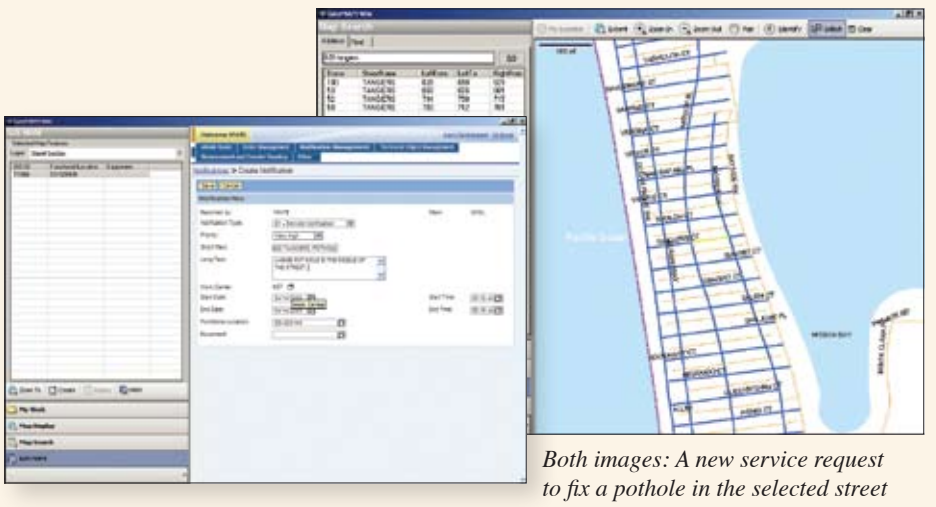
A Portable Mapcentric Asset Management Application

Highlights

- The integrated enterprise ESRI/SAP system reduces the time to address issues reported by citizens.
- The GeoMAM application enables workers to create new service requests in the field.
- Work orders assigned to Public Works staff are viewed and responded to directly from the field.

The City of San Diego's Geo Mobile Asset Management (GeoMAM) application integrates ESRI's ArcGIS Mobile with SAP's Mobile Infrastructure (MI) module to facilitate enterprise asset management (EAM) in the field. GeoMAM was designed to be a portable, mapcentric asset management application that would provide field staff with real-time access to the integrated enterprise ESRI and SAP system to reduce the time taken to address issues reported by citizens.

SAP MI facilitates the communication between the mobile device and the enterprise SAP system, while ArcGIS Mobile provides access to the enterprise GIS based on ArcGIS Server. This communication is streamlined by a VPN connection between the mobile device and enterprise systems via AT&T's broadband cellular networks. Potential disruption in the broadband connection is handled by ensuring the use of data cached on the mobile device. The application has been deployed on ruggedized laptops that are connected to the city's enterprise systems over wireless broadband data networks.



Both images: A new service request to fix a pothole in the selected street segment.

GeoMAM Application

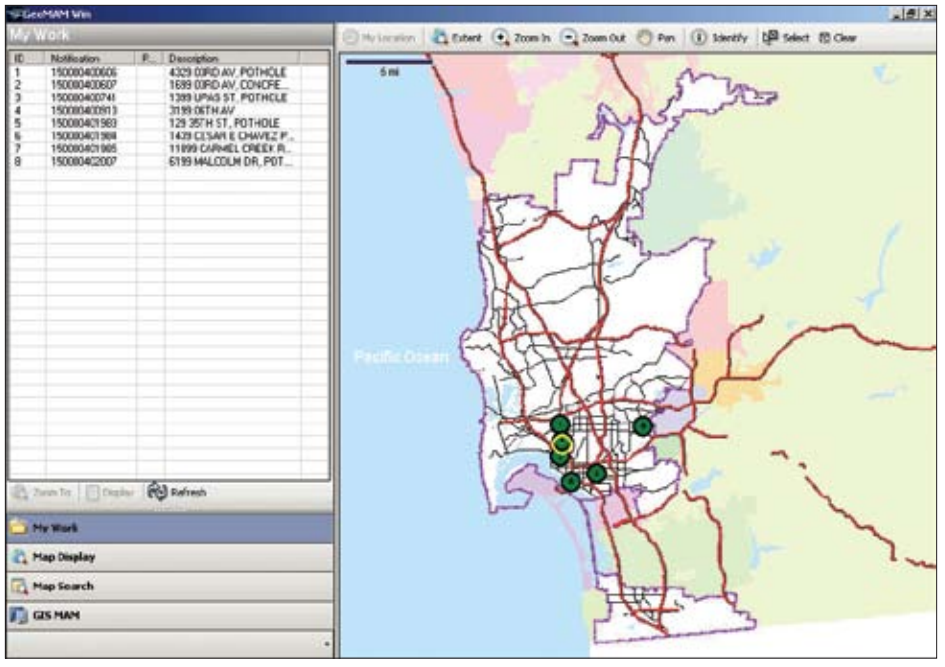
The user interface of the GeoMAM application is simple to use. Users log in to the application using their SAP login credentials and are presented with a list of work orders that have been assigned to them. Geographic locations of the work orders are displayed on the map in the right panel of the application. Standard map navigation and other GIS tools, such as Zoom In, Zoom Out, Pan, Identify, and Select, are available above the map display area. Users have the option to view the location and select the asset (piece of equipment) associated with a work order by clicking on it in the list of work orders.

Tools for zooming to the location of the work order or viewing additional information related to the work order are available at the bottom of the left panel. Clicking the Zoom To button centers the map on the location of the work order and selects the equipment associated with the work order. The Display button presents additional work order information by replacing the map with the relevant SAP MI screen.

Users can also update work orders with the SAP MI interface if they have the necessary privileges. All work order updates done by users in the field are transmitted back to the enterprise SAP system immediately. Conversely, any new work orders created in the enterprise SAP system are added to a user's list of open work orders immediately after they are created.

Integration with SAP Mobile Infrastructure allows users to update work orders directly from the field. Details of the work carried out in the field and the time taken to resolve the problem can be recorded and posted to the enterprise EAM system directly from the field. The status of the work order can also be updated by the field crew.

The GeoMAM application also enables users while in the field to create new service requests (notifications) for city assets by locating and selecting them on the map and clicking the Create button available under the GIS MAM menu option. This capability reduces the time it takes city staff to report and record issues with city assets.



The GeoMAM user interface is simple to use.

and other information pertinent to the street sweeping operations. When residents call, employees can check a digital map and obtain detailed information regarding past sweeping operations, often heading off or quickly managing questions and complaints, saving the city time and increasing goodwill.

Going Mobile

In 2007, Project SYNERGY's enterprise systems were enhanced and upgraded to SAP ECC 6 and ArcGIS 9.2. After completion of the upgrade, San Diego's integrated system was ready for the next big challenge—accessing the enterprise asset management system from the field.

Today, with the implementation of SAP's Mobile Infrastructure module and ArcGIS Server and ArcGIS Mobile software, the city is realizing its vision of carrying out asset management activities in the field. Tasks such as creating, viewing, and updating SAP service notifications and work orders are being completed in real time by field staff using a map interface. This system's continuing improvement will greatly enhance the overall efficiency of the city's business processes.

"We have come a long way since we first integrated ESRI and SAP technologies to leverage our GIS resources within the SAP framework," says Elizabeth Mueller, San Diego Public Works enterprise asset management project manager, who is now leading the way for other departments and divisions within the city to leverage the successfully integrated ESRI/SAP system for their operations. "We believe in empowering the city employees with the right tools to help provide excellent customer service to our citizens. Our aim is to get it right the first time, and get better at it.

"The capacity to visualize and analyze information geographically is now available to anyone using the Web application," continues Mueller. "In addition to helping different divisions share information efficiently, it helps them respond more quickly to requests from residents because they'll have quicker access to information stored online. With the combined capabilities of ESRI and SAP technology, we're seeing a future of efficiency, cooperation, and improved records management. In addition, it provides more transparency and accountability, something that is well appreciated by the employees who are continually striving to provide the citizens with a high level of customer service."

Extending the Footprint

Now, with its proven success in the Street Division, the city has decided to extend its ESRI and SAP integrated system to other departments and divisions. The program is making its way into the Storm Water Pollution Prevention, Storm Water Operations and Maintenance, Facilities Maintenance, Fleet Maintenance, and Communications divisions. All have started implementing and extending the functionalities of SYNERGY for their operations. Future implementations will include the city's water and sewer operations and maintenance functions.

"At its core, public works is an asset management business," says David Jarrell, San Diego's deputy chief operating officer for Public Works. "The SYNERGY system, leveraging the tremendous capabilities of both ESRI and SAP technologies, allows the city to make a great leap forward in the management of our assets. We have proven the SYNERGY concept within our Street Division and are now aggressively implementing the system for our other public infrastructure assets. The result promises to be an unsurpassed asset management tool for our employees and citizens. And we expect to see even greater system benefits upon completion of the implementation of the SAP enterprise resource planning system for the city's financial, logistics, and human resources functions."

This project, a comprehensive effort geared toward maintaining the city's progress in reforming and modernizing information systems throughout the agency, is called OneSD. When launched later this year, OneSD will provide city departments (including the central departments for financial and human resources) with the ability to consolidate asset and work management functions with costing and manpower availability and allocation using an integrated system.

"The City of San Diego's vision for the information technology system is to deliver best value services through the creative use of technology," says Nader Tirandazi, the city's director of financial management. "We have already realized that vision time and time again, one piece at a time, and we continue to evolve our systems to support the services that impact our community and its citizens."

"We are all very pleased with our successes to date," adds Mueller. "I also think that by partnering with ESRI, SAP, and our integration consultant Smartsoft, we're poised for even greater success in the future."

More Information

For more information, contact Elizabeth Mueller, EAM project manager, Public Works, City of San Diego (e-mail: emueller@sandiego.gov).

The Map Display menu option of the application replaces the list of work orders with a table of contents that can be used to control the layers that are visible on the map. An ArcGIS Server dynamic map service is used to render the map in the GeoMAM application. Users can turn layers on or off to enhance the map. They can also toggle between the table of contents and the map legend.

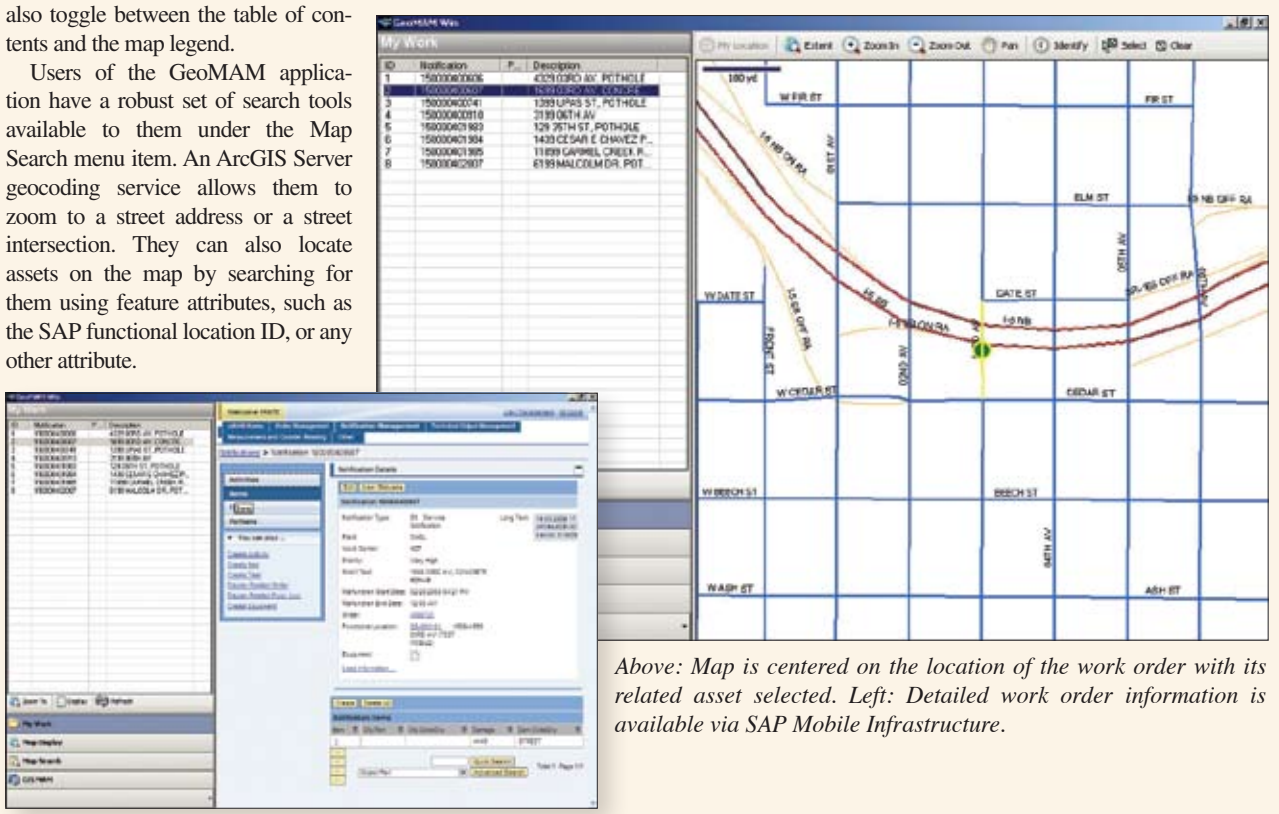
Users of the GeoMAM application have a robust set of search tools available to them under the Map Search menu item. An ArcGIS Server geocoding service allows them to zoom to a street address or a street intersection. They can also locate assets on the map by searching for them using feature attributes, such as the SAP functional location ID, or any other attribute.

GeoMAM Application Architecture

The architecture of the GeoMAM application is illustrated at the top of page 36.

More Information

For more information, contact Elizabeth Mueller, EAM project manager, City of San Diego, California (e-mail: emueller@sandiego.gov), or Steve Benner, ESRI (e-mail: sbenner@esri.com).



Above: Map is centered on the location of the work order with its related asset selected. Left: Detailed work order information is available via SAP Mobile Infrastructure.

Exclusive *ArcNews* Online Articles

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

The City of Quinte West Unifies Emergency Communications

In 2006, the City of Quinte West in southeastern Ontario, Canada, asked the city's GIS division and IT staff to develop a telephone call-out notification system after a series of boil water advisories were issued.

Romanian Civil Aeronautical Authority Creates and Edits High-Quality Data

As with other aviation authorities, the Romanian Civil Aeronautical Authority is faced with doing more with less. Three years ago, it looked for a solution that would allow it to efficiently create the products required to do its job and chose ArcGIS for data management and mapping and viewing spatial data.

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

Upcoming—ESRI Conferences for Latin America, Europe, the Middle East and North Africa, and the Asia-Pacific Region

ESRI International User Conferences Connect Countries and Colleagues

"Today, GIS professionals everywhere are playing a greater role," says Jack Dangermond, ESRI president. "User conferences offer a forum for these individuals to come together. These events help attendees take a significant step forward in their growth and ability as GIS professionals."

From the heart of South America to the European Capital of Culture 2009, over the next several months, ESRI distributors will give users the opportunity to explore the latest in geospatial technology firsthand. Regardless of industry or experience with GIS technology, professionals using ESRI software are encouraged to attend the most convenient conference for them. They will hear from Dangermond, see software demonstrations, discover new tools, build on their GIS knowledge and skills, and learn how to address trends and apply solutions and recent updates in their organizations and communities.

2009 ESRI Latin America User Conference

The 2009 Latin America User Conference (LAUC) is being held October 7–9 in Bogota, Colombia. This conference is the leading event for GIS users throughout Latin America. Participants will be able to create valuable relationships with their peers, meet with important contacts—from ESRI staff and business partners to industry leaders from Latin America—and find out everything they need to know to launch and grow successful GIS projects.

"The LAUC is a unique opportunity to share geographic knowledge and network with colleagues from different industries throughout the region," says Helena Gutiérrez, president of Procálculo Prosis S.A., the ESRI distributor in Colombia. "We are very honored to have the chance to organize this important event for the third time, and we're working wholeheartedly to provide Latin American users with an unforgettable experience, one that will inspire them to continue to grow as individuals and organizations."

Attendees are also invited to share their work with other participants from more than 19 Latin American countries. This knowledge sharing helps users more fully leverage their GIS investments. The deadline for presentation abstract submissions is July 31. Visit **www.procalculoprosis.com/lauc09** to learn more and register.

2009 ESRI European User Conference

The European User Conference is dedicated to users throughout Europe and is being held October 14–16 in Vilnius, Lithuania, the European Capital of Culture 2009. This is an honor that gives the city a chance to showcase its cultural life and development. The conference focus is geographic awareness, providing preconference seminars, paper sessions, technical workshops, and other activities that will discuss how to best apply geography and technology for measurable results in any market. Visitors will be able to advance their understanding of GIS, access helpful resources, and delve into topics that interest them, from IT integration and cost-saving ideas to best practices in both the public and private sectors.

Linas Gipiskis, managing director of HNIT-Baltic, UAB, ESRI's distributor in Lithuania, says, "This is the biggest GIS event in Europe this year and a great way for decision makers, GIS professionals, and other IT specialists from different countries and cultures—with different experience and expectations—to come together and discuss the best user cases, gain deeper knowledge of GIS, and get valuable advice directly from GIS product specialists. Hospitality is one of the most striking features of Lithuanians. So we hope our guests will take away good memories from the conference social events and our country."

Attendees can also share their work with GIS by submitting an abstract for possible presentation during the conference. The deadline for submissions and to register early and save is August 14. Visit **www.esri.com/euc** to learn more.

2009 ESRI Middle East and North Africa User Conference

The Middle East and North Africa User Conference, being held November 10–12, 2009, in Manama, Bahrain, will give users in the Middle East and North Africa an excellent place to gain information and insight, get answers to pressing questions and project challenges, and establish a network of contacts that spans the international ESRI user community. Attendees will hear from their colleagues, thought leaders, and ESRI staff, as well as learn innovative tips and tricks that will help them achieve more GIS-driven results in their businesses, societies, and communities.

Dr. Ghulum Bakiri from MicroCenter, the ESRI distributor in Bahrain, says, "GIS is slowly transforming into a pervasive technology, and many countries in the region are embarking on a national NSDI [National Spatial Data Infrastructure] initiative to act as the platform of choice for integrating diverse islands of information that exist in various departments and government organizations. This conference will serve as a wonderful forum for GIS professionals and decision makers to share their experiences and gain valuable insight into essential best practices in this challenging undertaking."

Participants are also invited to share their work with their fellow professionals. The deadline for presentation abstract submissions is September 2. Visit **www.esri.com/meauc** to learn more and register.

2010 ESRI Asia Pacific User Conference

The 2010 Asia Pacific User Conference, combined with ESRI Australia Pty. Ltd.'s 2010 client conference, will take place next year, March 3–5, at the Conrad Jupiters hotel in Queensland's Gold Coast, Australia. The conference agenda will be geared to show how the latest location intelligence solutions are making it easier to extend the reach of GIS, whether it be externally, geographically, or technically. From user case studies to technical presentations, attendees will see how organizations across industries and regions have extended the use of location intelligence to solve complex problems, reveal opportunities, and find success.

Says Brett Bundock, CEO, ESRI Australia, ESRI's distributor in Australia, "We've themed the conference 'GIS: Extending the Reach' in recognition of how GIS has evolved from being seen as a tool to link location to information to being acknowledged as a serious business system that delivers real benefits."

Visit **www.esriaustralia.com.au/ozri** to find out more about this event and how to get involved.

More Information

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

2009 ESRI Developer Summit Highlights New Technology and Real-World Applications of GIS

Highlights

- User presentations, a new feature of the Developer Summit, drew huge crowds.
- Attendees previewed ArcGIS Explorer 900 with integrated Microsoft Virtual Earth.
- The unveiling of ArcGIS API for Microsoft Silverlight coincided with the beta release.

More than 1,100 developers eager to learn more about GIS and share their experiences building software applications recently converged in Palm Springs, California, for the 2009 ESRI Developer Summit (DevSummit). This year's event at the Palm Springs Convention Center featured presentations by Adobe, IBM, and Microsoft in the technology spotlights; previews of new technology; and user presentations. A new feature at the DevSummit, the user presentations showcased developers' work using the latest GIS software and served as an ideal platform for discourse between developers of all skill levels.

Plenary Session Take Aways

ESRI president Jack Dangermond began the Plenary Session by acknowledging the importance of developers, calling them "the glue that makes everything really work." ArcGIS program manager Jim McKinney remarked on the impressive turnout in these tough economic times, proof that GIS isn't an extravagance but a necessity. ESRI director of software development Scott Morehouse emphasized the key role developers play in extending the GIS framework for more strategic solutions.

Then the highly anticipated previews and unveilings began. Users learned about the latest tools in ArcGIS 9.3.1, ESRI's next release, that will help them optimize and automate performance for fast map creation. ESRI's continued support for ArcGIS APIs, such as Flex and JavaScript, was detailed, to the delight of many of the attendees who use these APIs in their daily work. ESRI software development lead Jay Theodore talked about how users can extend and develop Java extensions for ArcGIS Desktop, ArcGIS Engine, and ArcGIS Server in 9.3.1. Developers were pleased to hear that they will be able to create custom geoprocessing tools, renderers, and server object extensions in pure Java in ArcGIS 9.3.1.

The new ribbon user interface in the upcoming release of ArcGIS Explorer 900 was unveiled next. Product manager Bernie Szukalski demonstrated the new version's ability to leverage all the ArcGIS Desktop cartographic capabilities within ArcGIS Explorer. The latest version also fully integrates Microsoft Virtual Earth and includes a new integrated 2D and 3D display capability that allows users to switch from 2D to 3D views. Szukalski demonstrated a new set of presentation tools that will give users the ability to create a slide show presentation using data and maps created in ArcGIS Explorer, with the capabilities to zoom, pan, and interact with maps and data.

ArcGIS Server development lead Art Haddad talked about the beta release of the ArcGIS API for Microsoft Silverlight, treating the crowd to an impressive demonstration of the API's attractive simplicity. The ArcGIS API for Microsoft Silverlight will allow developers to use any Microsoft .NET Framework-supported language to add GIS capabilities and consume services from ArcGIS Server, ArcGIS Online, and Microsoft Virtual Earth. Many of these new software features were added based on feedback from users who attended the 2008 DevSummit.

Code Challenge Winners Announced

The winners of ESRI's Mobile and Server Code challenges also were announced during the DevSummit. Lisa Tunnel of Digital Cartographic Services won the US$4,000 first prize in the Mobile Code Challenge for her Environmental Compliance Field application. Chad Yoder of GeoCove won second prize for his ArcGIS Mobile Backup and Restore Utility application. The Server Code Challenge first prize went to Alper Dincer of the Ministry of Environment and Forestry, Ankara, Turkey, for his Summit ExtMap Mashup Framework application, and Matthew Petre of Petris Technologies won the second prize for his Flex Viewer Dice Job Searcher Widget. Code challenge submissions can be downloaded from the ArcGIS Resource Center Code Galleries.

Left: Keynote speaker David Chappell delivered an informative address on SOAP versus REST. Above: Developers discussed GIS solutions with ESRI support staff in the demo theater.

The keynote focused on Web services. David Chappell, principal of Chappell & Associates in San Francisco, California, gave a rousing address on REST versus SOAP. Initially an advocate and supporter of SOAP for delivering and disseminating Web services, Chappell explained how his views changed as he learned more about the RESTful approach. Using diagrams showing how ESRI uses the protocols in its services and software, Chappell demonstrated the applicability of SOAP and REST in Web service delivery. "The road that ESRI has traveled with these services reflects the path taken by our industry as a whole," said Chappell. "ESRI clearly understands that both SOAP and REST have value, and so they're using each one where it makes sense."

Following the keynote, users presented successful applications of ESRI software, from enterprise GIS implementations to simple utility creations for streamlining tasks. Overflow crowds were a signature of each presentation, which showed that developers at all experience levels are eager to learn from tried-and-true applications of GIS software.

When the presentations ended, many developers made a beeline for the demo theater where ESRI support staffers were on hand to answer their questions. There, ESRI's technical staff gave attendees demonstrations of ESRI software. Whiteboards were used to help developers visualize how spatial technology can be implemented into existing infrastructures to speed services and simplify workflows.

Many of the user presentations at the 2009 DevSummit showed how the technological strides of last year were incorporated into real-world solutions. Judging from the crowd's keenness to put these new geospatial capabilities into practice, the 2010 DevSummit is sure to produce even more user success stories.

More Information

If you missed the conference and would like to watch the plenary and keynote speeches, visit **www.esri.com/devsummit**.

Many Connections Made During Business Partner Conference

ESRI business partners and distributors from around the world came together at the 2009 ESRI Worldwide Business Partner Conference (BPC), held March 22–24 at the Palm Springs Convention Center in Palm Springs, California, to examine the latest ESRI products and services, discuss successful sales and marketing strategies, build their networks, and explore future business directions. "I came away invigorated and full of ideas," says Scott Hutchinson, sales and marketing manager, Symology Ltd.

"The conference allows us to connect with our partners to find ways that we, together, can benefit from advances in the industry and the technology," said Jack Dangermond, president, ESRI. "Even more important are the connections our partners make with one another: this interaction is incredibly valuable."

Plenary Shows Great Strides

The conference began with an informative Plenary Session led by Dangermond and ESRI staff. Dangermond welcomed attendees with examples of innovative partner solutions in industries ranging from forest management to business and economic development. He also announced the business partner award recipients. A complete list of award winners can be found at **www.esri.com/bpc**.

Attendees were guided through the latest enhancements in ESRI software, primarily ESRI's most recent release, ArcGIS 9.3.1. Dangermond and ESRI staff shared how this release enables users to deploy fast, modern Web maps; create layer packages; connect to Microsoft Virtual Earth services; and more. Bernie Szukalski, product manager for ESRI's ArcGIS Explorer, discussed new innovations in ArcGIS Online. He also demonstrated to an applauding audience the new features and capabilities of ArcGIS Explorer 900.

"I liked the whole [plenary] session, as it was informative and covered a lot of ground," says Mike Hollis, president and CEO, Geospace Inc. "The demos were particularly valuable since I wasn't familiar with ArcGIS 9.3.1."

In addition to software updates, attendees were also introduced to new ESRI directors Josh Lewis, director of business partners, and Lawrie Jordan, director of imagery enterprise solutions.

Exploring GIS Continues

The opportunity to enhance business practices and explore cutting-edge technology did not end at the Plenary Session. The ESRI Showcase included a collection of product and program islands where attendees could view ESRI products in action and get their questions answered. Beyond enabling interaction with ESRI staff, the showcase was ideal for networking with other partners and learning more about their offerings.

A broad range of interactive breakout sessions—organized into tracks covering best practices in business, marketing opportunities, and products and technologies—provided real-world insight for attracting new business and keeping existing customers. Attendees could also drop by the GIS Solutions EXPO to view the latest products, solutions, and services from fellow ESRI partners.

A key concept Dangermond shared during the Plenary Session, which carried over into the rest of the conference activities, was the important role that ESRI partners and their solutions play in creating a better world. "We are living in a very sensitive time," said Dangermond. "It is your footprints of good work that are helping create a better world through GIS. We are so thankful you are here."

More Information

Find out more about the 2009 BPC, and watch for updates about next year's event, at **www.esri.com/bpc**.

Identifying Case Studies and Examples

National Geospatial Advisory Committee Seeks Best Practices

The National Geospatial Advisory Committee (NGAC) needs the assistance of *ArcNews* readers in identifying best public and public-private partnership practices. As described in the Summer 2008 issue of *ArcNews,* NGAC is responsible for providing the Federal Geographic Data Committee (FGDC) "advice and recommendations related to management of federal and national geospatial programs, the development of the National Spatial Data Infrastructure (NSDI) and the implementation of Office of Management and Budget (OMB) Circular A-16 and Executive Order 12906." Pursuant to that charge and at the request of the FGDC chairperson, NGAC has established a number of workgroups to provide advice on a variety of key policy issues.

One of the principal NGAC focus areas at this time is the development of recommendations on minimizing/removing investment barriers that impede public and public-private partnerships in advancing the collection, use, and dissemination of geospatial data, products, and technology. The Partnerships Subcommittee of NGAC is currently tasked with developing a series of recommendations to facilitate productive federal, state, local, tribal, academic, and private partnerships to advance NSDI efficiently and effectively.

Understanding that there are a number of exemplary models of existing partnerships among organizations that have roles and responsibilities for NSDI, the subcommittee is conducting an "environmental scan," resulting in the development of a database with best practice recommendations as its initial deliverable. The scan will identify and highlight existing partnership programs that the geospatial community could learn from and take advantage of. This activity is expected to result in an online database containing case studies, best practices, and examples that will be useful to anyone who is exploring public-private sector partnerships to meet shared geospatial mission objectives. This database will ultimately be broadly accessible inside and outside the federal government and will be designed to be a living system that is continually updated as new examples and references are brought forward.

The NGAC Partnerships Subcommittee is requesting input from anyone who has experience and examples to share that might be useful for the development of this data resource. Some of the types of materials that may be useful for this effort include, but are not limited to, the following:

- Case studies in public-private partnerships that demonstrate increased efficiency, cost savings/avoidance, etc.
- Academic papers and published studies on best practices in governmental public-private sector partnerships
- Examples of public-private sector partnerships in the international geospatial community
- Conference proceedings on public-private partnerships in geospatial science
- Examples of novel and effective procurement methods that enable public/private sector partnerships, particularly those with a federal contracting component
- Visioning documents/blueprints/goals and objectives that involve partners from multiple sectors of the geospatial community
- Contact information for organizations or individuals that may have useful information to share on partnerships
- Examples of progressive or creative joint funding between the public and private sectors

Please provide information to the NGAC Partnerships Subcommittee at ngacpartnerships@gmail.com to assist in this national effort.

More Information

If you have any questions or wish to discuss this NGAC effort, contact Partnerships Subcommittee cochairs Gene Schiller (e-mail: gene.schiller@swfwmd.state.fl.us) or Jerry Johnston (e-mail: Johnston.jerry@epamail.epa.gov).

Hanan Samet Details Spatial Data Indexing Processes

In his latest book, *Foundations of Multidimensional and Metric Data Structures,* Hanan Samet, renowned authority on this topic, presents a comprehensive view of spatial data structures and indexing that includes some of his own major algorithms, as well as those of other computer scientists. He is considered an expert in the use of hierarchical data structures, such as the quadtree, which is often used to partition a two-dimensional space by recursively subdividing it into four quadrants, thereby providing a means to index the data that they span.

The book is the result of Samet's longtime research at the University of Maryland's Computer Vision Laboratory investigating the applicability of his work to geographic information systems, computer graphics, image processing, image databases, and visualization. It was an award winner in the 2006 Best Book in Computer and Information Science competition from the Professional and Scholarly Publishers Group of the American Publishers Association.

At the Computer Vision Laboratory, Samet leads a number of research projects on the use of hierarchical data structures in GIS. His research on the integration of spatial and nonspatial data into a DBMS has resulted in the development of two systems by his research group: QUILT, a GIS based on spatial data structures such as quadtrees and octrees, and Spatial and Nonspatial Data (SAND), which integrates spatial and nonspatial data and enables browsing through a spatial database using a graphical user interface.

He has also been developing the Spatio-Textual Extraction on the Web Aiding the Retrieval of Documents system, a spatiotextual document search engine that enables the retrieval of documents on the basis of spatial proximity as well as matching keywords, which has been used for documents of the research division of the U.S. Department of Housing and Urban Development.

Foundations of Multidimensional and Metric Data Structures, part of the Morgan Kaufmann Series in Computer Graphics, is published by Morgan Kaufmann (ISBN-13: 978-0123694461; 2006; 1,024 pages) and is available from Elsevier for $64.95.

"Crossing Borders"

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

Geography, GIS, and Mental Health

For those of you who were hoping this column might offer a groundbreaking treatise on the state of mind of geographers and GIScientists, you can stop reading here. I'm saving that project for when I retire.

What I would like to discuss here are the opportunities and needs for geography and GIScience to participate in the rapidly expanding field of mental health research, a relatively unexplored area for geographers but one in which geography and GIS can, I'm convinced, be a significant and potentially paradigm-changing contributor. It is also a research area in which geographers and GIS specialists can engage with and help address enormous human and societal needs.

As many of you know, the AAG has been working for several years to try to build relationships with the National Institutes of Health (NIH) on behalf of geography and GIS and help medical researchers in the many different NIH centers better understand what geography and GIScientists have to offer to the field of medical research. This work has continued to develop new inroads for geography at several NIH institutes, as well as in the broader medical research communities outside NIH. For example, the AAG and the NIH's National Institute on Drug Abuse (NIDA) have jointly sponsored special symposia at AAG's Annual Meetings during each of the past four years on the previously relatively unexplored research area of geography and drug addiction. That ongoing effort has now drawn attention throughout NIH and resulted in the publication of a book entitled *Geography and Drug Addiction,* which is being widely circulated in medical research circles and is available from the AAG.

The AAG's work on geography and drug addiction with NIDA has sparked further interest at other NIH institutes, including the National Institute of Mental Health (NIMH), regarding the potential for GIS and geography to also make contributions to the field of mental health research. We have been in lengthy and productive discussions with several NIMH researchers engaged in genomic studies that are attempting to identify genetic markers, the presence or absence of which, it is hypothesized, may correlate with various complex mental disorders, such as schizophrenia, depression, and so forth. The challenge here is that genetic factors are rarely determinant and are nearly always highly interactive with environmental risk factors.

This new genetic research has revived old debates about nature versus nurture, or genes versus environment, but at a whole new scale and level of detail and sophistication. As mental health and other medical researchers are increasingly able to obtain highly detailed and sophisticated genetic information, there is now also developing a counter-demand for more highly detailed and sophisticated information about the environment in order to attempt to sort out complex gene-environment interactions. This is where geography, with its emphasis on place and related geographic methodologies for organizing and understanding environments, and GIS, with its ability to integrate and correlate vast amounts of different environmental data with observed conditions, such as mental health disorders or genetic risk factors, become central to this new research.

Consequently, geography and GIS are now on the threshold of enabling substantial new breakthroughs in medical research involving complex gene-environmental interactions. We still have a long way to go in understanding genetic and environmental interactions, and our GIS systems and geographic methods are both challenged by the complexity of these systems. However, I have found that medical researchers everywhere, from NIH to universities to private companies, are highly receptive to the promise that geographic methodologies and GIScience and GIS systems hold for a better understanding of the etiology, treatment, and prevention of disease, addiction, and mental health disorders.

These explorations with NIH have been both interesting and productive. An illustration of the unexpected pathways and intriguing outcomes of these creative interactions between geography and the medical and mental health researchers at NIH is an invitation I received last fall to help organize a special session, together with others from NIH, on the topic of Geography, Addiction, and Mental Health for a meeting of the International Federation of Psychiatric Epidemiologists, which was held in Vienna, Austria. While generally not at a loss for words, I must admit that at first I was not sure what I should say (or not say) to a room full of psychiatrists. However, the meetings went very well, and there was genuine excitement on the part of the many psychiatrists, geneticists, psychologists, and medical researchers present in learning more about GIS and about geography's potential contributions to research on understanding the role of place and the environment in mental disorders and their treatment. Examples of the dozens of research themes with geographic dimensions we discussed included genetic and environmental interactions in schizophrenia, research on the consequences of refugee displacement, psychiatric morbidity of homelessness, psychopathology among Holocaust survivors and their children, urbanicity and psychoses, the global economic burden of mental disorders, public policy and the measurement of happiness, and searching for genes with environmental interactions in complex disorders. Plans are under way to follow up both organizationally and individually to help link these research programs with geography and GIS.

As one NIH scientist noted at our session, "To date, most mental health research has focused largely on biomedical pathways. Increasingly, however, researchers are considering how people's environments—the physical and cultural contexts in which they live—influence the prevalence and consequence of mental health disorders." The AAG will continue to engage these issues of geography's potential role in medical research at all institutes of NIH, and I encourage geographers, GIScientists, and GIS specialists to also consider how you might work together with researchers at NIH's National Institute of Mental Health to help address these complex but pressing mental health research and human needs.

For more information, contact **www.aag.org** or **www.nimh.nih.gov**.

Doug Richardson
drichardson@aag.org

ESRI Business Partner Offerings to the GIS Community

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**.

Mobile Hardware

Trimble
www.trimble.com
Trimble Yuma is a fully functional rugged tablet computer that mobile workers can use in any outdoor environment, no matter how extreme. The Trimble Yuma tablet computer is the latest offering from Trimble, a provider of advanced positioning solutions, software, communications, and services to increase mobile worker productivity. The Trimble Yuma device is just one way that thousands of organizations can empower their mobile workforce through the use of Trimble solutions to quickly, efficiently, and effectively collect and maintain their spatial data.

Petroleum

Schlumberger Information Solutions
www.slb.com
ProSource technology provides petroleum exploration and production professionals with the ability to browse, edit, create, manage, and transfer industry-specific data in multiple distributed repositories. Because GIS is an important visualization tool for oil and gas organizations, ProSource includes built-in ESRI technology for map display, coordinate data conversions, spatial data management, and interoperability. ProSource acts as a single quality analysis desktop application and also offers workflows to securely load, manage, and deliver key corporate master data within the enterprise.

Landmark
www.halliburton.com
The *Landmark* suite of petroleum industry products from Halliburton comprises GIS solutions that seamlessly complement the existing GIS infrastructure and workflows of petroleum organizations. These technologies enhance the productivity of interpreters by delivering GIS data and workflows through a unique interpretation suite. The Landmark family of GIS products leverages years of experience to provide value-added functionality to different exploration and production organizations in the petroleum industry.

Utilities

Accenture
www.accenture.com
Accenture delivers enterprise ArcGIS solutions using its *High-Performance Utility Model,* a transformational utility operating model based on industry best practices, utility comparison levels of mastery, and a suite of over 350 utility T&D life cycle processes. Leveraging this model, Accenture is working with utilities across the globe to integrate ArcGIS with work management, asset management, field force, smart grid, and other technologies across the utility enterprise, such as the integration between ArcGIS and SAP. More importantly, the High-Performance Utility Model enables automation of business processes involved in effective data maintenance and managing ongoing integrity of that data.

Public Health

Electronic Data Solutions
www.elecdata.com
B & G Sentinel GIS is a solution designed specifically for mosquito control operations. B & G Sentinel GIS provides specialized functions and toolbars that are natively embedded within ArcGIS and ArcPad. With B & G Sentinel GIS, maps and GIS databases are immediately updated with information related to larvicide, adulticide, surveillance, service requests, and other mosquito-specific data. B & G Sentinel GIS was developed by Electronic Data Solutions in conjunction with B & G Chemicals & Equipment Co., Inc.

GeoDecisions
www.geodecisions.com
The *Rat Information Portal* (RIP) provides users with information about controlling pests on properties they own, manage, or live in. RIP was developed as a joint project between GeoDecisions, the New York City (NYC) Department of Health and Mental Hygiene, and the NYC Department of Information Technology and Telecommunications and is based on ArcIMS and ArcGIS Server technology. RIP contains map-based tools that allow users to gain a better understanding of rodent activity in their communities.

K–12 Education

Davis Demographics & Planning
www.davisdemographics.com
SchoolSite Locator is the hosted solution from Davis Demographics that allows school districts to quickly visualize and locate home-to-school assignments. SchoolSite Locator combines mapping, imagery, and geocoding Web services from ArcGIS Online with locally hosted attendance boundary maps and school information into a simple Web application. This application, which is provided to school districts as a URL to post on their Web sites, allows staff to spend less time on calls about student assignments, saving districts time and money.

ARCNEWS

Submit Your Story to *ArcNews*

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

Web 2.0 Is Driving New Software Development

Virtual Geographic Environments

Virtual geographic environments are essential to using GIS in design. For example, before a design for a city or landscape can be produced, an environment must be created through GIS. This is then fashioned into a form where users have access to it, first to enhance their understanding through exploration, and then to enable them to change various components in the effort to solve problems that can realize better designs. Only now, through the development of virtual city models and through new ways of enabling users to interact with geographic information using new screen technologies, is the point being approached where design is possible.

Virtual Geographic Environments, edited by Hui Lin and Michael Batty, collects key papers that define the current momentum in GIS and "virtual geographies." In some sense, such environments are the natural consequence of linking GIS to other technologies that deal with information, design, and service provision, and this will undoubtedly grow as it becomes ever easier to integrate diverse software and data across the Web.

The idea that geographic information can be both collected and made available through Web-based services, using Web 2.0 technologies that network many millions of people together, has formed a major research thrust in software development over the last decade.

The numerous contributions by leading members of the geospatial community to *Virtual Geographic Environments* illustrate the cutting edge of GIScience, as well as new applications of GIS with the processing and delivery of geographic information through the Web and handheld devices, forming two major directions to these developments. But the notion that these Web-based systems can be used to collect information of a voluntary kind through methods of crowd sourcing is also an exciting and widely unanticipated development that is driving the field. As these services gain ground, new business models are being invented that merge proprietary and non-proprietary systems and novel ways of integrating diverse software through many different processes of software development from map hacks to open system architectures.

Virtual Geographic Environments is published by Science Press, China (**www. sciencep.com**), 350 pages, hardcover. For more information, contact the responsible editors Peng Shengchao and Guan Yan, Science Press (e-mail: guanyan@mail.sciencep.com).

Busy Rest of the Year for URISA

Following its presence at ESRI's International User Conference, the Urban and Regional Information Systems Association (URISA) is busy for the remainder of 2009. The long-standing Addressing Conference, which is cosponsored by the National Emergency Number Association, will take place August 4–6 in Providence, Rhode Island. Sessions will cover addressing basics, coordination, and standards; emergency response and 9-1-1; and case studies of GIS integration with public safety.

URISA's 47th Annual Conference & Exposition will be presented in Anaheim, California, September 29–October 2. Preconference workshops on topics ranging from Agile Project Management to Crime Mapping and Analysis will be popular with attendees. Your peers from around the world will present within these program tracks:

- GIS for Best-Managed Communities
- GIS for Growing Communities
- GIS for Safe Communities
- GIS for Educated Communities
- GIS for Healthy Communities
- Professional Development & GIS Leadership

The conference merges important educational content with exhibits, networking events, and interactive discussions, along with recognition of the 2009 inductees into URISA's GIS Hall of Fame.

URISA and the University of South Florida's National Center for Transit Research at the Center for Urban Transportation Research will present the 2009 GIS in Transit Conference in St. Petersburg, Florida, November 16–18. Asset management, transit operations, service planning, and federal programs and priorities are just a few of the topics that will be discussed during this event.

Last, but certainly not least, URISA's Leadership Academy (ULA) will be presented in Seattle, Washington, December 7–11. 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!

More Information
For more information about all URISA conferences, workshops, and webinars, visit **www.urisa.org**.

Build a Geographic Analysis Skill Set with ESRI Press Books

The true power of a GIS lies in the ability to do analysis. It's fun to see where things are located on a map; however, what can be more exciting is determining why things are located where they are or how specific information can lead to choosing a certain course of action. ESRI Press books can be useful resources in developing the skills needed to perform these types of analyses using GIS analysis tools.

GIS Tutorial II: Spatial Analysis Workbook is the latest addition to the GIS Tutorial book series. Developed for intermediate to advanced GIS users, this book offers hands-on experience learning to use the analysis tools in ArcGIS Desktop. Users are able to discover through spatial analysis how new information and new relationships within their data can become apparent.

GIS Tutorial II: Spatial Analysis Workbook was written by David Allen, and it complements previous ESRI Press publications, *The ESRI Guide to GIS Analysis,* volumes 1 and 2, by Andy Mitchell (see below).

The book includes a 180-day evaluation of ArcGIS Desktop 9.3 on DVD. In addition, instructors can request a teacher resource disk with finished maps, a sample syllabus, and a teacher's guide with answers to study questions. ISBN: 9781589482012, 418 pp., $79.95.

Also Available
The ESRI Guide to GIS Analysis, Volume 1: *Geographic Patterns and Relationships,* ISBN: 9781879102064, 188 pp., $34.95

The ESRI Guide to GIS Analysis, Volume 2: *Spatial Measurements and Statistics,* ISBN: 9781589481169, 252 pp., $34.95

More Information
To learn more about ESRI Press books or to place an order, visit **www.esri.com/esripress**.

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

Balancing Infinite Needs Against Finite Resources

GIS Project Intake Process

By Leeanne W. Pacatte, GIS Manager, City of Austin, Texas

The Austin, Texas, metropolitan region of 1.4 million people has a technologically savvy, environmentally sensitive, and highly educated citizenry with a penchant for good music and a laid-back lifestyle—a great place to grow GIS. The local slogan, "Keep Austin Weird," says a lot about Austin's creative and accepting attitude. Over the last two decades, the city's GIS has grown up in this innovative and eclectic environment. What started out as a very specialized niche technology for land planning and utility mapping with a steep learning curve is now essential to the daily workings and management of our city. Geospatial technologies play a part in almost everything we do, from police, fire, and emergency management services vehicle routing to Web map viewers serving up an array of neighborhood and business information.

As elsewhere, there has been a strong and steady increase in GIS usage and understanding throughout City of Austin departments over the past 20 years. The corporate GIS function resides within the central IT department, Communications and Technology Management (CTM). In the not too distant past, with our ever-increasing GIS appetite, we became victims of our own success. And in our zeal to take full advantage of the benefits of the technology, GIS staff became overextended. We were rolling out GIS applications and providing rich stores of spatial data and information, but we were also struggling to keep up with demand. Simply adding more staff has not been an option for some time.

You are the exception if you have access to all the resources needed to accomplish all the projects requested of you. Although resource scarcity is nothing new to local governments, and the constant pursuit of greater and greater efficiencies is the norm, our diminishing tax revenues make the pursuit more urgent. Most of us make difficult decisions daily on how best to allocate increasingly limited funds, whether on the job or at home. So how do you decide where to focus? Which projects get done and which ones do not? Is your decision-making process flexible enough to adjust quickly to changing economic climates, technology advances, and strategic directions?

Project Intake Process Improvement

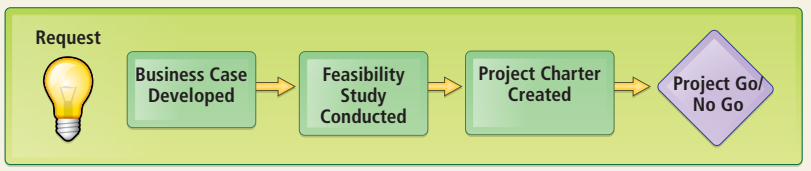
One of the strategies we employed to help us better focus our efforts and remain in alignment with the city's strategic direction in a rapidly changing environment was to fine-tune our project intake process. The corporate GIS group was not the only IT group suffering from overextended resources. Several CTM workgroups collaborated to help evolve our current project intake process, still a work in progress.

First things first: Have a plan. Strategic business plans come with many names and in different forms; use whatever makes sense in your particular circumstance. If you don't have a plan, get one. If you have a plan, use it. To stay on track, you have to know what track you are on. Your project intake process should align the selection of projects with your strategic business plan.

Optimizing your project intake process is an iterative and continuous endeavor. The process starts with a project request.

Project requests must be tracked through the various review gates, not only for internal efficiency, but also to help keep customers and stakeholders informed on the status of their project requests, a critical communication component. Our tracking system, Electronic Technology Review and Coordination System (eTRACS), was developed in-house to track all proposed projects through our project intake process and, at a very high level, through project completion. All proposed projects, which are roughly estimated to be greater than 40 hours of work and/or involve multiple workgroups, are entered into the system by either a customer department IT single point of contact or a CTM supervisor/manager. (Efforts deemed to be less than 40 hours go through the help desk process and are tracked there.) Proposed projects then show up as pending and are reviewed weekly by the project intake committee, made up of CTM managers.

Projects are categorized as either Run, Grow, or Transform based on strategic impact. Run projects are core internal projects designed to keep the city's IT infrastructure functioning and efficient. Run projects generally do not need to go through the business case and feasibility study review gates. Grow projects enhance or improve existing processes and procedures within the city's IT infrastructure. Transform projects are those that change existing processes and procedures or deliver new ones that provide an advantage to the city in supplying services to citizens.



Project Intake Process: Proposed project must be reviewed and approved at each gate.

All Grow and Transform projects go through the full intake evaluation, which includes the development of a business case, a feasibility study, and a project charter. Below is a sampling of the many questions these three review gates address:

- Business Case
  - What problem is this project trying to solve?
  - What are the benefits to the City of Austin?
  - What are the risks and impacts?
  - Does it align with the strategic business plan?

- Feasibility Study
  - What will it take to do it?
  - Can we do it?
  - Should we do it?

- Project Charter
  - Who is responsible?
  - What are the deliverables?
  - What is the timeline?
  - Where is the funding coming from?

The project intake committee decides to approve, decline, cancel, or put on hold each project based on the information gathered during the intake evaluation. How these decisions are made will likely become more formalized as we evolve the process. When a project is approved and a project manager is assigned, the project then goes through the project coordination process, which further refines the project charter and coordinates and assigns the resources needed to complete the project.

How does the project intake process just described fit into the overall project management model? CTM's project management model is based on the five project process groups defined in the Project Management Institute's *Project Management Body of Knowledge* guide. The process groups are initiating, planning, executing, closing, and monitoring and controlling.

Once all the initiating processes are completed, the project moves through the other process groups to completion. When the project is finally closed, the project manager circles back to eTRACS and updates the project as completed.

Conclusion

The project intake process is not the sole influence on project approval decisions. Information technology governance, how IT decisions are made in an organization, will play the ultimate role in keeping you on track. For the City of Austin, refining our project intake process has improved our ability to allocate limited resources in a rapidly changing environment, while we structure our IT governance model. In the end, it all comes down to focus. Is your organization focused on your strategic objectives?

About the Author

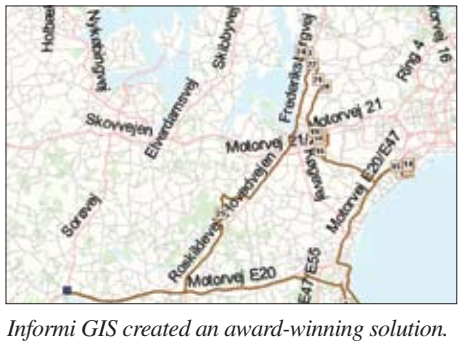
Leeanne W. Pacatte, GISP, PMP, has been with the City of Austin for 19 years. She has worked in several departments (Planning, Water Utility, and Watershed Protection and Development Review) and worn many hats (planner, GIS programmer and supervisor, business systems analyst, project manager). She is currently GIS manager in the city's IT department.

More Information

For more information, contact Leeanne W. Pacatte, GIS manager, Communications and Technology Management, City of Austin, Texas (e-mail: leeanne.pacatte@ci.austin.tx.us, tel.: 512-974-2614).

Routing Solution Helps Danes Breathe Easier

Your cough, headaches, and gasps for air may be symptoms of a cold, or they may be caused by smog. Unfortunately, GIS cannot cure the common cold, albeit we wish it could. But it can be used to significantly reduce air pollutants, the bane of urban living. Denmark's transportation companies are considering how route optimization can reduce their carbon (CO_2) emissions.



Informi GIS created an award-winning solution.

Global green initiatives include information technologies to identify problem areas, create plans, and measure the effects of environmental programs. GIS supports the science for measuring and analyzing environmental impacts, as well as providing environmental management solutions that effect change. One solution is to use GIS for intelligent fleet management. This can reduce CO_2 emissions and provide the benefits of saving time and money.

Denmark's University College Sealand is using GIS to efficiently meet cost reduction objectives. A way the university serves the surrounding community is through an outreach program that delivers books and training materials to educational institutions in the region, which includes 17 municipalities. This project has three distribution centers, each with five drivers. Informi GIS A/S—ESRI's software distributor in Denmark—created a routing solution for the university, using ArcLogistics, that optimized these drivers' routes. GIS calculated routes and schedules that reduced kilometers driven by 25 percent, drive time by 8 percent, and number of routes by 13 percent. The solution also revealed a more profitable placement of distribution centers. Day-to-day routing became more responsive to changing routing requirements.

Denmark's transportation sector accounts for more than 20 percent of the country's CO_2 emissions. In an effort to highlight effective pollution solutions that include an element of sustainability, the Danish IT Industry Association and the Ministry of Science organizations hosted an event called the First Danish Championship in Green IT. Informi entered its University College Sealand routing project and received a second-place award.

Contest jurors were impressed that the GIS routing solution both improved the delivery project's efficiency and reduced its fleet's CO_2 emission by 20–25 percent. The sponsoring organizations will publish the contestants' projects so that the transportation industry and others can consider them.

Read More About How GIS Is Used to Help the Environment

Download the free handbook *GIS for Air Quality* at **www.esri.com/library/bestpractices/air-quality.pdf**. Visit the GIS for Environmental Management Web site at **www.esri.com/environment**. Find out more about ArcLogistics at **www.esri.com/arclogistics**.

Mark Your Calendar for GIS Day 2009

Planning Begins

On Wednesday, November 18, 2009, GIS users around the world will celebrate the 11th annual GIS Day. This international grassroots event promotes the use and importance of GIS throughout the world and provides users with the opportunity to share their passion with others.

Event Ideas
Each GIS Day event is unique. The creativity displayed by GIS Day participants has made the program a worldwide success. Keep in mind that GIS Day events can be customized to fit your available time and resources. Whether large or small, your GIS Day event is helping educate people around the world about the importance of GIS in our daily lives. Here are a few ideas to consider for this year:

- Organize an open house at your organization and display GIS work.
- Host a training session for fellow colleagues and the public.
- Participate in your local school's science fair or career day.
- Organize a GIS Day informal gathering during your lunch break.
- Contact local community and youth organizations and give a presentation.

"I didn't get into GIS until I was 39 years old, but I really have a passion for it," says Matt Morris, GIS analyst, West Texas Gas. "If I can find just one like-minded soul out there and let them know about it [GIS], that would be really cool." Morris visited a local school's career fair for GIS Day.

Available Resources
The GIS Day Web site (**www.gisday.com**) is a valuable tool to gather ideas and obtain free materials. Visit the Web site to find

- Agendas, posters, signs, PowerPoint presentations, and much more
- Activities for K–12 students
- Affordable GIS Day items to purchase
- Videos showcasing GIS Day events
- Success stories and photos from past participants
- *GIS Day Watch* e-newsletter archives

Learn from Others
Last year, people from more than 75 countries celebrated GIS Day. Learn more about two of these events:

San Juan County GIS Day Provides Seminar and Highlights Map Book—The San Juan County, Washington, GIS department organized a successful GIS Day event in 2008 for county employees and the public. The day began with a one-hour presentation titled GIS for Professionals: Beyond the Assessor's Parcel Search. This session was ideal for local real estate agents, surveyors, delivery personnel, architects, contractors, and any other interested community members.

Attendees were made aware of ready-to-use GIS data, as well as low-cost GIS applications that could improve their current business practices. This gathering also provided the perfect opportunity for the county to gain feedback about their new interactive mapping application and publicize the county's new map book. Following the presentation, GIS staff answered questions, provided technical support, and demonstrated GIS applications. The day concluded with a seminar specifically for county employees that provided tips and tricks for improving workflow efficiency and accessing data quickly and easily.

U.S. Army Corps of Engineers Virtual Event Makes for Cost-Effective GIS Day Celebration—In 2008, Will Rogers, regional geospatial program manager, North Atlantic Division, U.S. Army Corps of Engineers, was faced with several obstacles when planning for its 2008 GIS Day event. As part of a national geospatial team, he wanted to share GIS initiatives from many locations throughout the agency in a cost-effective way to a very large group of geospatial colleagues located across three continents. His solution was to organize an agency-wide virtual GIS Day Webcast event.

The virtual GIS Day event encompassed 15 presentations broadcast to more than 1,100 agency members worldwide. Rogers acted as session moderator and coordinated 30-minute presentations that were jointly conducted by GIS professionals and project managers. The virtual format benefited both the presenters and the agency's geospatial community of practice by allowing participants to attend from their own desks, in their own time zones, according to their own work schedules.

"The audience thought the event was wonderful. Everyone was excited and eager to see more," Rogers says. The geospatial community of practice is considering leveraging the idea by offering monthly webcasts based on the nine main business elements of the U.S. Army Corps of Engineers.

More Information
For more informaton, visit **www.gisday.com**.

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 about software tips and tricks. ESRI Speaker Series podcasts feature GIS technology insights from users, business partners, and ESRI staff. ESRI Instructional Series podcasts and software tips and tricks 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**.

New Training and Education Offerings from ESRI

Free Training Resources Help Maintain GIS Skills
To keep your skills up-to-date, take advantage of the following free training resources:

Live Training Seminars—These one-hour online seminars feature presentations and demonstrations on focused topics by subject matter experts. You can ask the presenter questions and get answers in real time. Visit **www.esri.com/lts** for a schedule of upcoming seminars and to sign up for convenient reminders. A list of archived training seminars is available at **www.esri.com/ts**.

Instructional Series Podcasts—These short audio recordings are on specific topics delivered by subject matter experts. You can listen online or download to an MP3 player. Visit **www.esri.com/podinstruct** for a list of available podcasts and to subscribe to the podcast feed to be notified when new content is available.

ESRI Training Matters Blog—This blog offers practical tips for working with ESRI technology, as well as information about ESRI training and education products. Visit **www.esri.com/trainingblog** for the latest news and to subscribe to the blog's RSS feed to receive updates.

Desktop GIS
Creating and Publishing Maps with ArcGIS—Using a standard cartographic process, learn how to create maps that are easy to interpret and properly designed for your audience and delivery medium. *Instructor-Led Course*

Performing Analysis with ArcGIS Desktop—Find out how to solve a variety of spatial challenges, such as site selection, line-of-sight (visibility) analysis, hot spot analysis, and regression analysis, with a proven process that you can apply to your spatial analysis projects. *Instructor-Led Course*

Creating and Analyzing Surfaces Using ArcGIS Spatial Analyst—Become proficient in using advanced ArcGIS Spatial Analyst tools to model surfaces, evaluate results, and create a variety of maps for informed decision making. *Instructor-Led Virtual Classroom Course*

Geoprocessing Raster Data Using ArcGIS Spatial Analyst—Learn various modeling techniques used in spatial analysis and work with ModelBuilder to implement a suitability modeling workflow. *Instructor-Led Virtual Classroom Course*

Regression Analysis Basics in ArcGIS 9.3—Learn valuable regression analysis techniques and workflows to help explain the factors behind observed spatial patterns. *Virtual Campus Web Training Seminar (Free)*

Introduction to ArcGIS Engine Functionality—Get a primer on ArcGIS Engine core functionality and how to use it to execute advanced or specialized GIS applications. *Instructional Series Podcast (Free)*

Server GIS
*Authoring and Deploying Fast Web Maps***—**Discover how to create rich, modern Web maps that are optimized for performance. *Virtual Campus Web Training Seminar (Free)*

Building Web Maps Using the ArcGIS API for JavaScript—Learn how to design high-performing Web mapping applications to use in mashups as well as Web services for efficient querying. *Instructor-Led Course*

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*

Cartography
Map Use: Reading and Analysis, Sixth Edition—This hardcover reference guide depicts high-quality maps and full-color illustrations and discusses topics such as map projections and spatial pattern analysis. *ESRI Press Book*

GIS Applications
GIS Tutorial for Health, Third Edition—This workbook gives public health professionals and students hands-on training in managing and analyzing health-related issues using GIS software. It includes a 180-day trial of ArcGIS Desktop 9.3. *ESRI Press Book*

GIS for Decision Support and Public Policy Making—This book presents case studies and exercises that demonstrate how GIS has improved the communication, collaboration, and decision making of daily operations in the public sector. *ESRI Press Book*

For More Information

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The Grand Canyon and the Sea of Cortez

The World Loves ESRI T-Shirts!

Michael Parma, GISP, GIS coordinator, City of New Braunfels, Texas, backpacked into the Grand Canyon to reach the confluence of Kanab Creek and the Colorado River, a goal of his for several years. He says, "I was sure to bring along my ESRI T-shirt for the adventure!" And so happy we are that he did.

Barbara Kent, GIS coordinator, GIS/Project Development Support Branch, Caltrans District 11, San Diego, California, was on a sea kayaking vacation off Los Islotes in the Sea of Cortez. Los Islotes is a sea lion colony off the coast of the north end of Isla Espiritu Santo, Baja California Sur, Mexico. Here, she is shown having just snorkled with the sea lions. We're sure the sea lions appreciated her ESRI T-shirt!

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**.

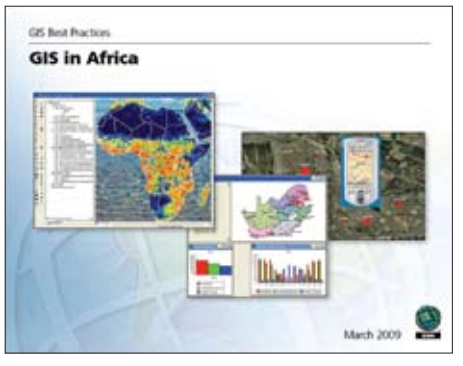
Barbara Kent

Michael Parma

New Best Practices e-Book

GIS in Africa

ESRI is pleased to make available *GIS in Africa,* an easy-to-access, no-cost booklet featuring recent articles dealing with GIS applications across the continent of Africa, from sustainable development to rural education. Find *GIS in Africa* at **www.esri.com/bestpractices**—a new, exciting addition to our no-cost Best Practices series. Many ESRI GIS Best Practices e-books are available on a variety of topics—at no cost. Published as PDFs with color illustrations, these e-books can be read online at the ESRI Web site or downloaded and printed.



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Geospatial Services Supported by ArcGIS Server

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**.

One Maryland, One Map
www.mdimap.com/imap
The State of Maryland's MD iMap site provides government and public access to state, local, and municipal government performance using a common authoritative basemap and the best available data and tools.

School District Demographics System
nces.ed.gov/surveys/sdds/map00.asp
This site provides access to demographics, social characteristics, and economics of children and school districts from the National Center for Education Statistics (NCES) of the U.S. Department of Education. NCES and ESRI Business Partner Blue Raster used the ArcGIS API for Flex to create this informative site.

ORIGIN Property Information Map
gis.greeleygov.com/origin/propinfo.html
The ORIGIN Property Information Map is the first release of an interactive, public GIS data site by the City of Greeley, Colorado. The site was custom built within the city's GIS program using the ArcGIS API for Flex and ArcGIS Server.

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.

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.

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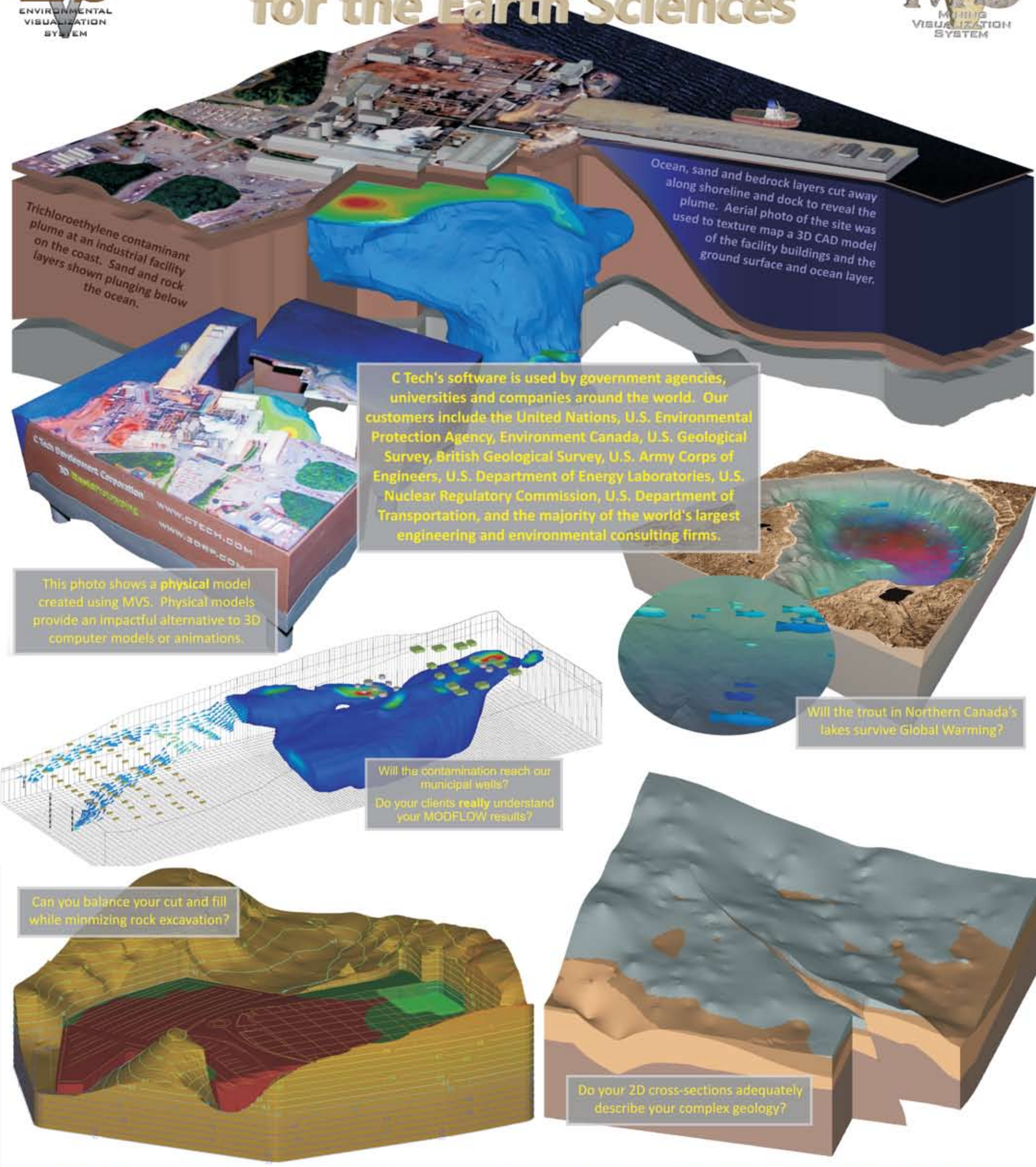

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