ArcNews

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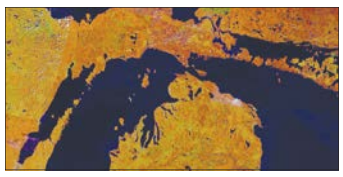
Understanding Our World with Landsat Data and ArcGIS

By Jack Dangermond



Easily access and analyze Landsat data with ArcGIS.

Landsat data from the United States Geological Survey (USGS) is one of the best sources for understanding and analyzing changes to our world that have occurred over the last 40 years. With the launch of Landsat 8 in February of this year, the continuity of the program is assured into at least the next decade. Esri continues to support making Landsat imagery and image processing part of our platform and has

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ArcGIS Online Functionality Now Available On Premises

ArcGIS 10.2 Brings Transformational Capabilities to Users

It's a great time to be a GIS professional. Dramatic changes are taking place in the enabling computing and communication technologies that GIS relies on, and new software is leveraging these changes to evolve and transform GIS and our user community. Esri is working hard and is in the process of releasing many new capabilities in ArcGIS 10.2, such as real-time data integration, online analysis tools, spatial analysis in the cloud, location analytics, new templates and apps, and web story maps for everyone. There are also new capabilities enabling new opportunities for developers. These advances are giving rise to a change in the very way we position GIS, from a software system designed to unlock the power of geographic information to a comprehensive platform that

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ArcGIS Tools and Hadoop Analyze Large Data Stores

Breathe Life into Big Data

With data influx reaching exabyte levels, *big data* can easily become unmanageable and useless without the proper tools to analyze it fast. The strength of your data stewardship therefore depends on how much command you have over big data. To bypass the capacity limitations of working with billions of records at a time, Esri created GIS Tools for Hadoop, a toolkit for executing spatial analysis in the Hadoop environment and looping it back into ArcGIS.

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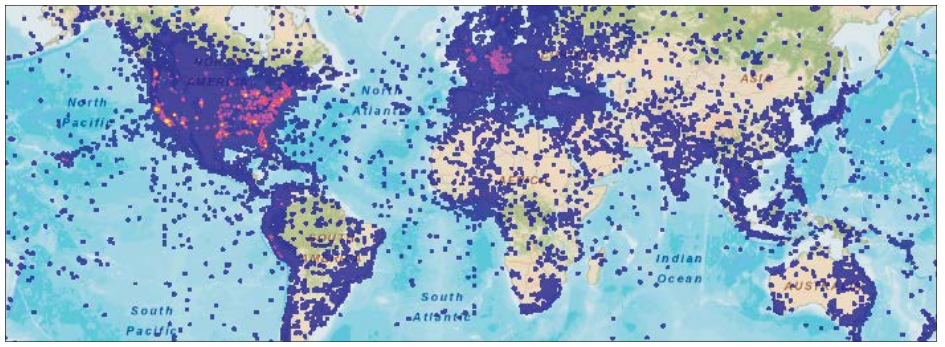
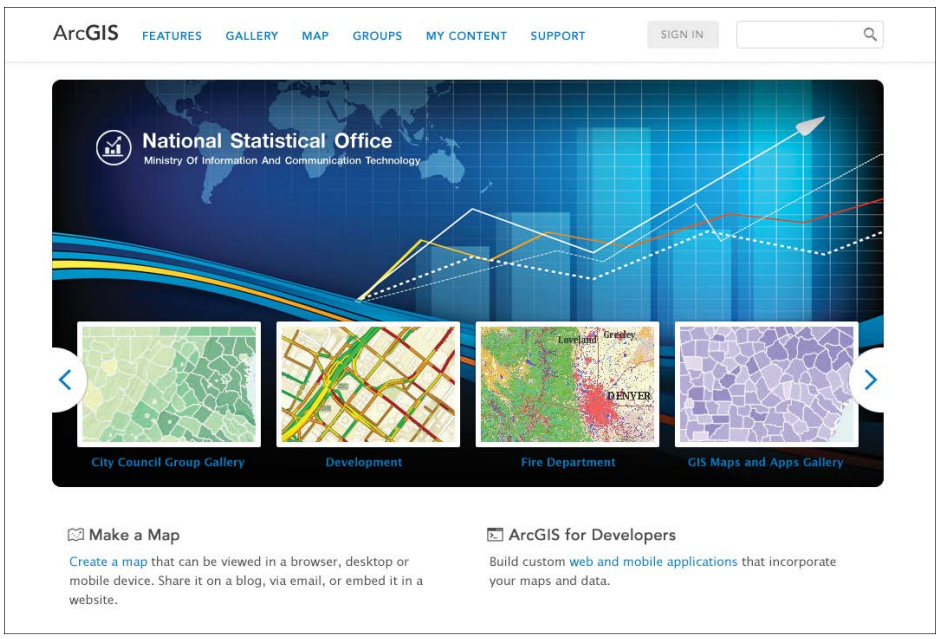


GIS Tools for Hadoop unlocks spatial patterns and relationships concealed within big data.



Portal for ArcGIS allows users to configure and deploy ArcGIS Online capabilities on premises—enabling organizations to easily integrate GIS everywhere.

US Navy Implements Broad-Based Sustainability Program

Energy awareness is becoming a major focus for the United States federal government as both costs and demand rise. Budget constraints across the military services put further emphasis on the need to secure the nation's energy supplies and create federally mandated programs.

The navy department known as CNIC (Commander, Navy Installation Command) has responded by creating the CNIC Energy Program, which was developed to provide guidance, policy, and tools for implementing broad-based energy reduction and sustainability practices within the navy—everything from replacing old windows and installing new heating systems to installing smart meters on buildings and seeking out and utilizing renewable and alternative sources, like wind turbines and solar panels. The goals of the program are to achieve by 2020 a 50 percent reduction in energy consumption and be at 50 percent usage of renewable energy.

To meet these goals in part and reduce energy demands across installations, CNIC has adopted a facility energy strategy that consists of innovation, expansion, and awareness. As the program expands, energy usage will become highly visible and the culture will change.

Advancing new technologies is key to the program's goals of streamlining the capture of data, leveraging business systems that contain energy consumption information, and combining them to create powerful tools for the program managers. The program aims to provide a means of measurement and verification and, most importantly, the knowledge base to make more informed decisions.

ArcGIS Streamlined Data Meets the Navy's Goals

The CNIC HQ Energy Program manager, Sandrine Schultz, had a vision of an overarching geospatial tool that would provide the navy with centralized information access for tracking, measuring, and planning energy usage to meet the program's goals. Previously, there was no effective way of visualizing and displaying the important tabular data in the business systems that tracked energy usage.

Schultz knew that Esri Platinum Partner Geographic Information Services, Inc. (GISi), of Birmingham, Alabama, was already supporting the Naval Facilities Engineering Command's

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The Navy Shore Geospatial Energy Module (NSGEM) dashboard provides a bread crumb tracker and date picker to drill down to the geographic extent and lens for specific charts and reports. The map viewer renders buildings according to benchmark score, and the Data Quality Score highlights the accuracy and completeness of the information behind the dashboard.

US Navy Implements Broad-Based Sustainability Program

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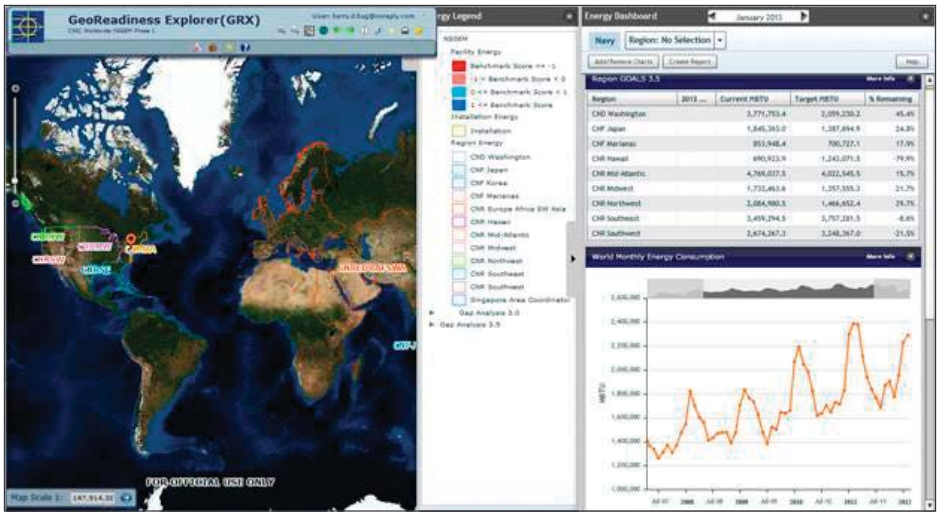
Highlights

- Energy security and legal compliance are the US Navy Energy Program's missions.
- GIS provides streamlined data for better decisions for potential savings on energy.
- US Navy Energy Program's new ArcGIS dashboard increases data credibility.

GeoReadiness Explorer (GRX) enterprise map viewer application, which contained worldwide geospatial data and services for business lines across the navy. Thus, she contracted GISi to review the navy's current energy appraisable capabilities and build an energy dashboard within GRX. This was possible because GRX is constructed on a .NET Framework using Adobe Flex, ArcGIS API for Flex, and ArcGIS for Server. This geospatial energy analysis solution would leverage that existing framework and ultimately become the Navy Shore Geospatial Energy Module (NSGEM).

As the NSGEM team started development, the data sources were gathered and compared. Initial benchmark scores were calculated for energy consumption and goals for reduction set. This in turn established the baseline metrics needed to go forward with the program's mission. A gap analysis was performed initially to identify disparities between the main data sources: the navy's real-property database, the utility allocation and billing system, and the GeoReadiness worldwide geospatial data. This effort pinpointed further needs and issues and generated the data quality score shown in the current interface. Data validation and correction are key components, and one of the most challenging aspects, to providing NSGEM functionality.

"What's very important is for people to become accountable for their data," Schultz says of the navy data owners. "Their data is really telling their story."



The GRX World Lens provides information for each region's energy consumption and its progress toward overall reduction. In the view above, the World Monthly Energy Consumption chart is shown with the scrolling function that enables the user to see consumption trends over time.

Processes were then built to extract, transform, and load the tabular data from the business systems into spatial data that is then published through ArcGIS for Server as a map service. The published map service contains layers depicting energy consumption and reduction efforts at the regional, installation, and facility levels. The map publishing process is done via a customized in-house web application called map publisher. The GRX map viewer is the front end of the system, and while the bulk of the NSGEM functionality revolves around the dashboard and various tables and charts, it does leverage this existing map viewer base to display and navigate to spatial data.

The Post-NSGEM Release Outcome

Upon the initial release of NSGEM in November 2012, it became apparent that myriad individuals throughout the navy echelons have a stake in its functionality and future, with each echelon requiring different reporting and analysis needs. One measure taken to support headquarters was the creation of regional energy map books (REMBs). ArcGIS and customized Python scripting were leveraged in an automation process for map book creation that employs the NSGEM data. These automated processes provide high-level, quality cartographic outputs for the leadership at CNIC and the Naval Facilities Engineering Command to be able to view statistics and consumption information in PDF format for which users do not have to access a separate application.

Agnes Sullivan, Regional Energy Program manager, Commander Navy Region Mid-Atlantic, says NSGEM is "really useful because you can visually see and manipulate the tool in various ways that serve the user. It is not limited to generic automated reports and can customize or drill down to whatever levels you need to see."

While the primary functions of NSGEM and the REMBs are heightened awareness and easier accessibility of energy consumption information, Schultz says the overarching end goal is to increase data credibility while identifying potential savings on energy consumption. NSGEM provides the energy program with a one-stop shop for viewing and using energy consumption data to make more informed decisions. CNIC and the Naval Facilities Engineering Command now have the ability to reveal the story of data that has been trapped in a business system and to smoothly and dynamically transition across all necessary temporal (many years), spatial (zoom in/zoom out), and organizational (world, regional, installation, and facility) scales.

NSGEM is geospatially enabling the energy program with tools to track and measure its progress toward meeting reduction goals, pinpoint specific areas for improvements or restorations, view new and alternative energy sources geospatially, create sustainable practices, and increase overall energy usage awareness.

"Geospatial capabilities are changing the way that we all do business. We turned data into decisions," says Schultz.

About the Author

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Understanding Our World with Landsat Data and ArcGIS

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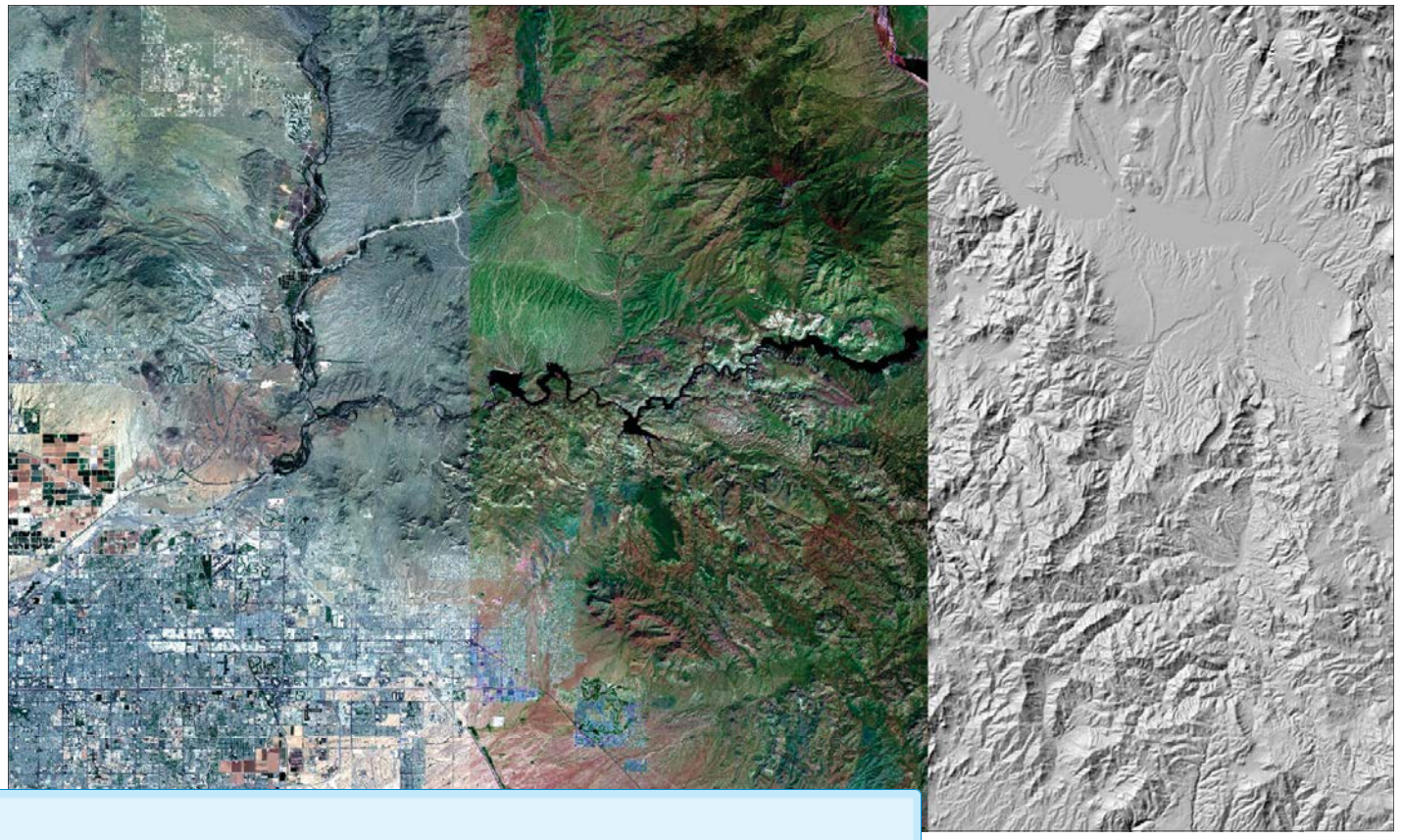
recently added more capabilities to ArcGIS that make it even easier to analyze and enhance Landsat data.

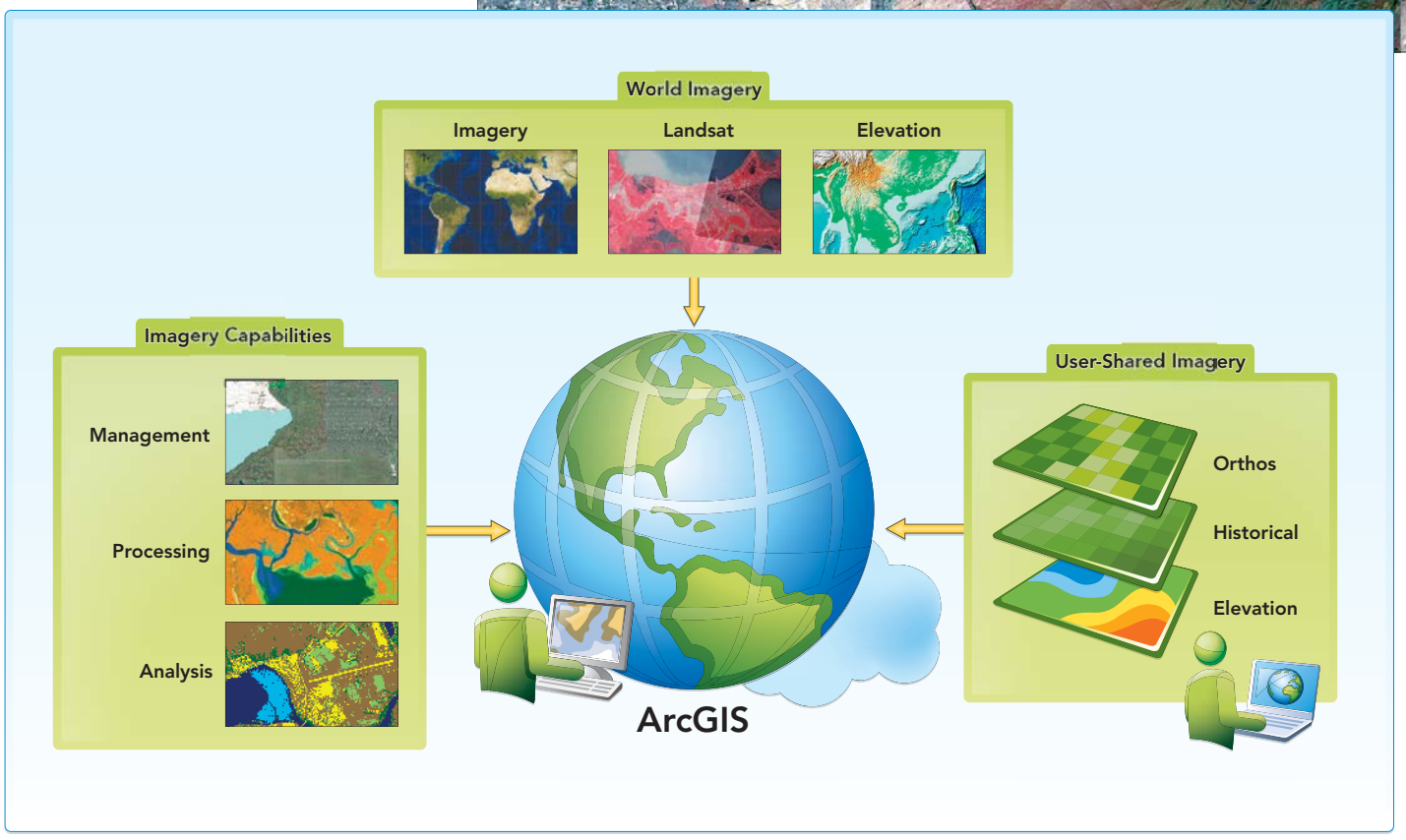
A Platform for Remote Sensing

Over the past several years, Esri has made major investments in enhancing the ArcGIS platform with image processing tools for visualization, analytics, and data management. This includes implementing dozens of high-performance image processing capabilities within the ArcGIS desktop and server environments. In addition, Esri has implemented online and on-demand image serving capabilities and made them available to GIS organizations around the world.

Working collaboratively with USGS, Esri hosted 40 years of Landsat Global Land Survey scenes in the cloud as dynamic image services for people everywhere to access. These image services take the multispectral imagery and process it on demand. They can be used in a wide range of applications for visualization of different multispectral enhancements; computation of products, such as vegetation indexes; and dynamic change analytics. Millions of users have access to these services and can look through time and see how Landsat has documented



Sample Landsat 8 imagery. Operational Land Imager (OLI) Bands 4,3,2 (Natural Color); OLI Bands 6,5,4 (False Color); and HillShade. (Courtesy of USGS.)



A complete imagery solution through the ArcGIS platform.

changes on the earth's surface. Esri also created an online Landsat analysis application as part of an initiative called Change Matters, which enables dynamic image processing of the entire planet (esri.com/changematters).

Esri also helped USGS stand up its own dynamic image services using the ArcGIS platform at the Earth Resources Observation and Science (EROS) Data Center for a USGS initiative called LandsatLook (landsatlook.usgs.gov). This set of services allows users to zoom in to any location and see the full-resolution data of all the Landsat scenes available. In many places, there are more than a thousand scenes taken at different times, providing an unprecedented opportunity to visualize temporal change. Not only can people see how the planet is changing with LandsatLook, but they can also access the full metadata and, if required, download the multispectral scenes. These services provide access to the complete archive of all Landsat data, going all the way back to 1973 and including scenes from the Landsat Multi-Spectral Scanner (MSS). USGS updates the LandsatLook services as new imagery is released from the existing Landsat 7 satellite and very soon will be updating it with the new Landsat 8 imagery when it becomes available.

In addition to the simple Change Matters application and USGS LandsatLook services, the Landsat image services are available on ArcGIS Online and for ArcGIS desktop and server users throughout the Esri community. The ease of access to this data through online image services has resulted in significant benefits to GIS users around the world.

Landsat 8 Launch

Working closely with USGS, the National Aeronautics and Space Administration (NASA) launched Landsat 8 earlier this year, providing a new global multispectral imagery data collection platform. Landsat 8 provides complete coverage of the world every 16 days, with clear coverage depending on clouds and other atmospheric conditions. It provides continuity to the previous sensors and also adds new multispectral and thermal bands to enable additional analysis.

Esri is exploring standing up Landsat 8 imagery as a web service through ArcGIS for use both as background image maps and for imagery analysis. Key to this new service is the rapid availability of the new Landsat imagery after it is acquired. This will allow users to enjoy the full benefits of fresh multispectral imagery content anywhere on the planet.

Esri wishes to acknowledge and thank the US government (NASA and USGS) for its contributions and for providing this strong science foundation of earth measurement and monitoring data.

A Complete Imagery Solution

In addition to enriching ArcGIS with technology enhancements for Landsat and remotely sensed data, Esri is also providing easy access to collections of other sources of remotely sensed imagery data. This includes cached DigitalGlobe imagery of the entire planet as a basemap, 40 years of Landsat image services from historical Landsat imagery, and global elevation data; in the future, it will include dynamic services from a variety of commercial partners (DigitalGlobe; RapidEye; AccuWeather, Inc.; etc.). This ensures that users will be provided with a complete imagery solution through the ArcGIS platform.

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Beginnings of Geodesign: A Personal Historical Perspective

By Carl Steinitz, Wiley Professor of Landscape Architecture and Planning Emeritus, Graduate School of Design, Harvard University

Geodesign is a method which tightly couples the creation of proposals for change with impact simulations informed by geographic contexts and systems thinking, and normally supported by digital technology.

—Michael Flaxman and Stephen Ervin, 2010

Geodesign is an invented word, and a very useful term to describe a collaborative activity that is not the exclusive territory of any design profession, geographic science or information technology. Each participant must know and be able to contribute something that the others cannot or do not . . . yet during the process, no one need lose his or her professional, scientific or personal identity.

—Adapted from C. Steinitz, 2012, *A Framework for Geodesign,* Preface

Howard Fisher (1903–1979)

My first contact with computing occurred in early 1965 at a lunch at the Harvard-Massachusetts Institute of Technology (MIT) Joint Center for Urban Studies, where I was a graduate student fellow. By chance, I was seated next to Howard Fisher, who was visiting Harvard while considering a move from the Northwestern Technology Institute (now Northwestern University) to the Harvard Graduate School of Design. Fisher, an architect, had invented the Synagraphic Mapping System—SYMAP—in 1963. SYMAP was the first automated computer mapping system that included spatial-analytic capabilities applied to spatially distributed data. It was based on line-printer technology. Its principal technical innovations for graphics were to enable the typeface ball on the printer to be stopped and a series of overprinting commands to be invoked, which then created a gray scale (figure 1). SYMAP had not yet been applied to a substantive problem.

Figure 1. SYMAP Conformant map (top) and Contour map.

I immediately seized upon the relationship between the capabilities that Fisher described to me and the needs of my doctoral thesis on the perceptual geography of central Boston. With Fisher as my tutor, I gave SYMAP its first applied test. I was trying to explain why some parts of central Boston were included in Kevin Lynch's book *Image of the City* and some were not. I acquired data and mapped and analyzed it (figure 2), including via a graphic spreadsheet-type program, which I had to invent.

Partly because of this work, I obtained my first appointment at the Harvard University Graduate School of Design in 1965 as an assistant research professor and as an initial appointee to the then-new Laboratory for Computer Graphics. The Laboratory for Computer Graphics was established in 1965 with a grant of $294,000 from the Ford Foundation's Department of Public Affairs and various smaller contributions from and to the Graduate School of Design. Under Fisher's direction, the laboratory assembled a group of bright, energetic, and experiment-minded people, including urban planner Allan Schmidt, water engineer and economist Peter Rogers, and architect Allen Bernholtz.

The laboratory's research was basically of two types. The first was investigation into the analysis and computer-graphic representation of spatially and temporally distributed data and was built largely upon Fisher's SYMAP, which became in its time the world's most widely used computer mapping program. In a very short time, we developed several innovative methods of high-speed electronic digital computer mapping and new techniques for data analysis and graphic display. These made full and efficient use of the accuracy, speed, and cost of the computers of the time.

The second type was research in spatial analysis, mainly related to city and regional planning, landscape architecture, and architecture, with emphasis on the roles of computers in programming, design, evaluation, and simulation. For example, Frank Rens and his team were developing SYMVU, which was programmed to control the view angle and distance of plotted 3D data by enabling rotation of 3D volumes. This was a key step both for animation and for geographically focused global representations.

My assigned role in the lab was to represent landscape architecture and urban and regional

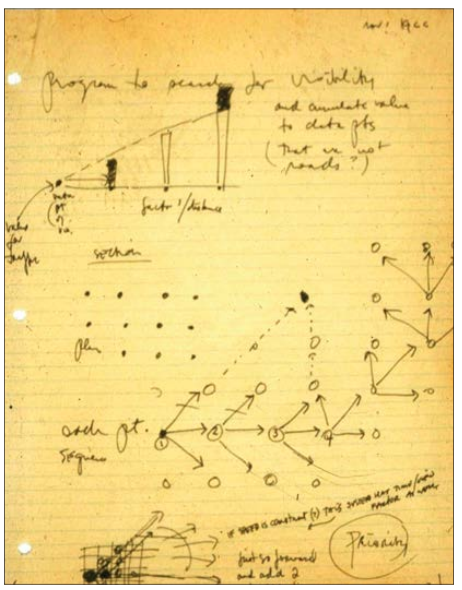


Figure 3. Ideas for analyzing networks, such as streets, and for assessing moving views in 3D, 1966. (Courtesy of Carl Steinitz.)

Figure 2. Data and analyses derived from photography and interviews to help explain why some parts of central Boston are memorable. (Courtesy of C. Steinitz.)

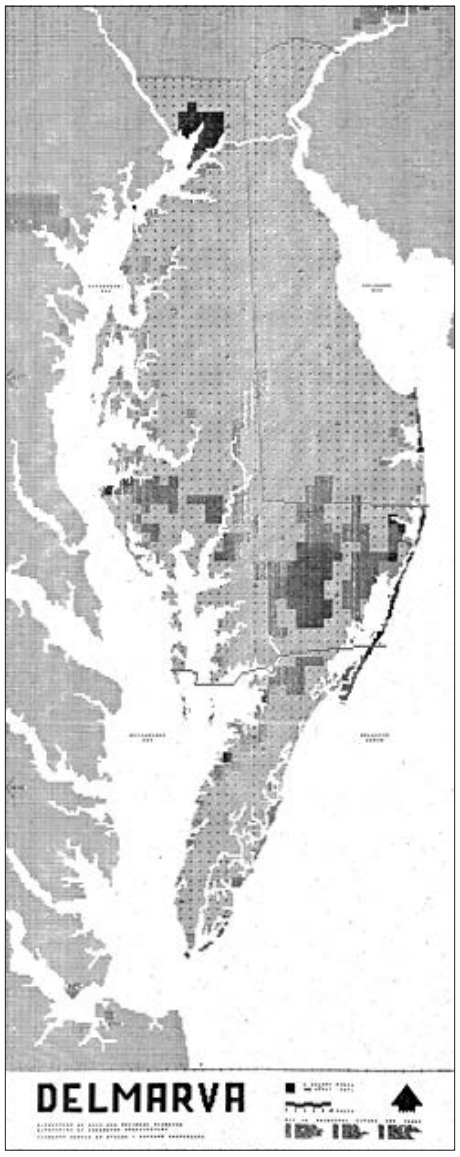
planning. However, my personal experience at MIT in thinking about regional change as a designed process with Lynch and Lloyd Rodwin clearly led me to see (and perhaps foresee) computing as providing essential tools and methods for design (figure 3).

My first teaching assignment was in fall 1966 in a multidisciplinary collaborative studio, sponsored by the Conservation Foundation, that focused on future regional development and conservation of the Delmarva Peninsula (Delaware and parts of Maryland and Virginia). In this study, I and a small group of students chose not to use the then-common hand-drawn overlay methods being used by the rest of the class but rather to prepare computer programs in FORTRAN and use SYMAP to make and visualize a series of evaluation models for the future land uses under consideration. A design was made that was visually informed by the resultant maps (figures 4A and B).

To my knowledge, the Delmarva study was the first application of GIS-modeled evaluation to making a design for a large geographic region. It is worth noting that this earliest GIS work was accomplished using Hollerith cards and the line printer to make paper maps in black and white. My first regional-scale GIS map was based on hand-encoded data to a grid base measuring 2 miles by 2 miles. It cost $35 (in 1965 dollars) for computing time on a $2 million IBM machine, the only accessible computer at Harvard. A registered user was only allowed one computer use a day. How happy I was to produce my first basemap, finally, after 30 days of effort.

Yet even in this first study, some rather sophisticated analytic steps were undertaken. These included a gravity model; various terrain-related analyses; the effect of one map pattern on another; and overlain data maps combined via quantitatively weighted indexes, such as the relative attractiveness for vegetable or grain agriculture. I cannot overstate the importance of the initial academic decision of Charles Harris, then chairman of the Department of Landscape Architecture, to support me to introduce GIS-based computing in a design-oriented studio rather than in a specialized "technical/computer" course. This would prove crucial to the future development of GIS at Harvard as a set of methods for design.

In 1967, Rogers and I organized and taught an experimental multidisciplinary studio on the future of the southwestern sector of the Boston metropolitan region. The intent was to model the often-seen conflicts between the environmental vulnerability of the regional landscape and its attractiveness for development. We were also making a regional design for better managing the region's sprawling urban expansion. My initial diagram for this study was made in early 1967 and is shown in figure 5. Note that it begins with an understanding of decision processes. It distinguishes between land-use demands



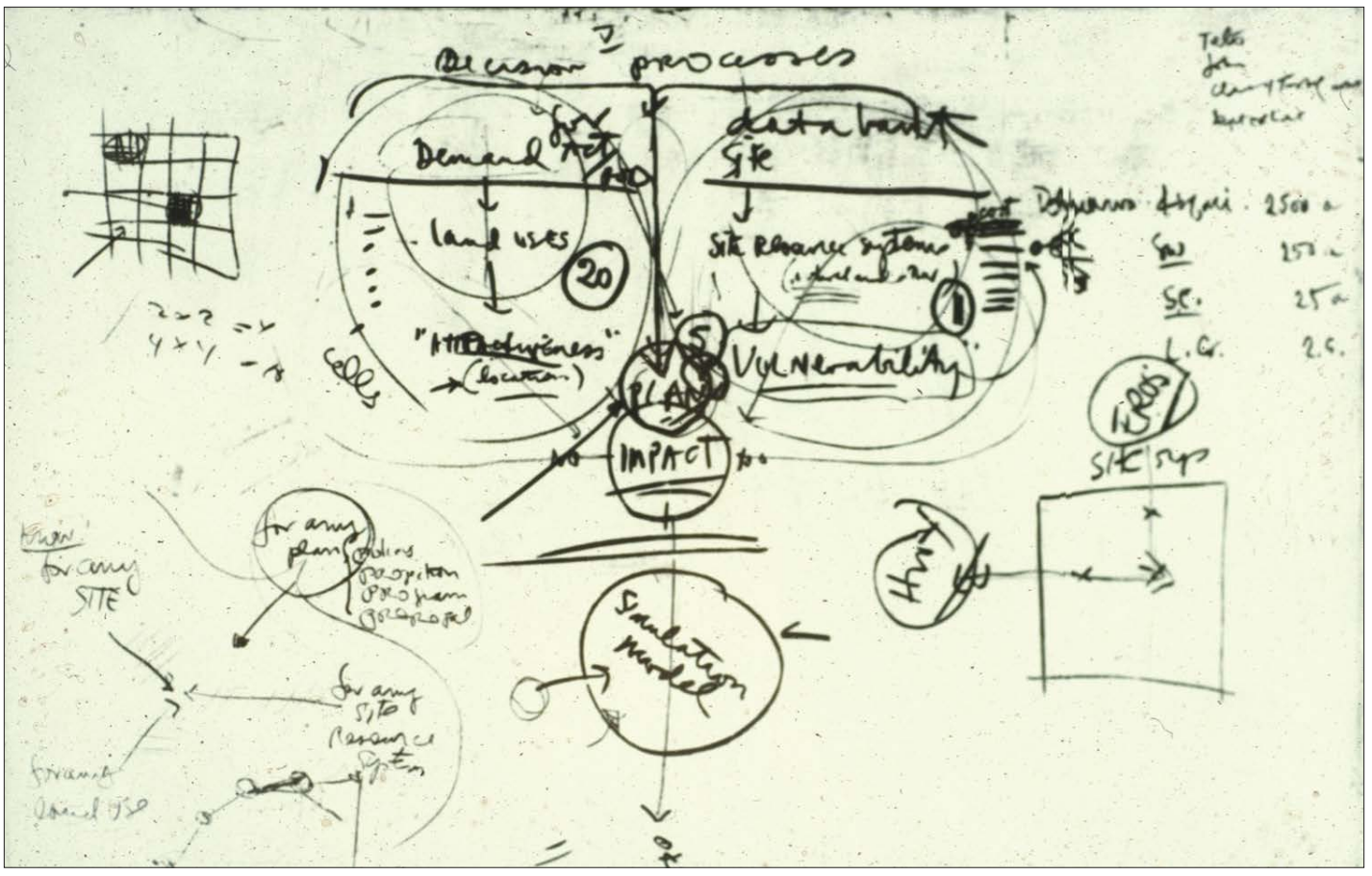


Figure 5. My earliest diagram for the information flow for a large-area design study, 1967. (Courtesy of C. Steinitz.)

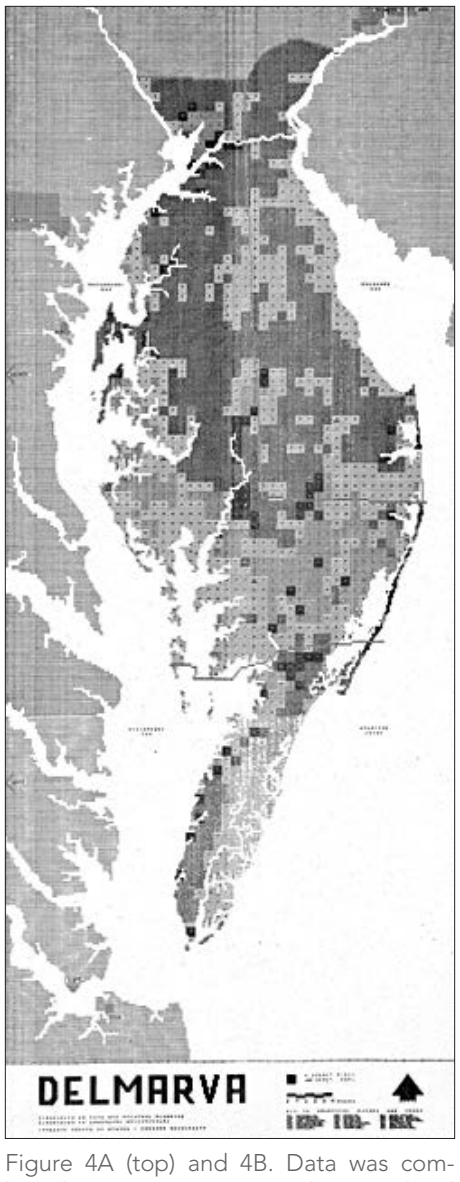


Figure 4A (top) and 4B. Data was combined using quantitatively weighted indexes to evaluate relative attractiveness for vegetable (top) and grain agriculture. (Courtesy of C. Steinitz.)

and evaluations of their locational attractiveness and site resources and evaluations of their vulnerabilities. It assesses risk and impacts and proposes generating plans with the rules of a simulation model. It is organized in the same sequence now outlined in the second iteration of the framework in my 2012 book *A Framework for Geodesign* (although we didn't call our work that at that time).

The entire flow of information for the study was designed by Rogers and me before any "work" was begun (figure 6). The study area was a rapidly changing suburban area. There was no digital data, so the students organized a GIS from air photo interpretation based on a 1-kilometer grid. (Remember, this was 1967.) Our students were also involved in all phases of the detailed specification, implementation, and uses of the models.

Ten process-related models were organized and linked, sharing what was then state-of-the-art GIS and programming software. Change was based on a demographic model that forecast population growth in different social classes and was allocated in 5-year increments for a period of 25 years. These created demand for new locations to accommodate industry, three residential types, recreation and open space, and commercial/institutional centers. This new land-use pattern then required new transport services. Four purposely different types of impacts were selected for assessment: local politics, local finances, visual quality, and water pollution. If these were deemed unacceptable by the students representing the decision makers, several feedback paths would result in redesign toward an improved land-use pattern for that stage. If the impacts were satisfactory, the set of models would then be used to simulate the next 5-year stage.

The evaluation of attractiveness or vulnerability for each land use in the future was based on a regression model of the locational criteria for that land use in the present. Computer-made maps, such as the following evaluations of locational attractiveness for low-, medium-, and high-income housing, were made by SYMAP.

While we were certainly aware of computer-based allocation models at that time, we deliberately had our students conduct the change model (the phase that changed the geography of the region) by hand so that they would be as personally engaged as possible in the process. They made the allocations based on a smaller 250-meter grid, guided by the computer-generated evaluation maps.

These unit-areas of change were represented by color-coded cards for the land use to be allocated. The population model established the demand for each land-use type in a time stage, and then student teams, each representing different land uses, engaged in the physical and verbal process of competing for the most attractive locations, much in the way that an agent-based change model would function. They first simulated a future trend through the several time stages.

The students then assessed the consequences of the trend changes with the several impact models. These impacts were visualized by overlaying colored pins and notes on the causal changes. The students then interpreted the impacts and decided whether changes in the trend's land-use pattern of any stage were required. Lastly, they re-allocated the changes by design, producing results measured to be environmentally superior and meeting the criteria for development (figure 7). This Boston study was published in 1970 as *A Systems Analysis Model of Urbanization and Change: An Experiment in Interdisciplinary Education* (MIT Press).

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Figure 6. Peter Rogers (left) and Carl Steinitz at the Laboratory for Computer Graphics, Graduate School of Design, Harvard University, in 1967. Photographs of the process of working were taken only rarely, unfortunately.

Beginnings of Geodesign

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Also in 1967, our research group, which included landscape architects Richard Toth, Tim Murray, and Douglas Way and engineer-economist Rogers, began a series of GIS-based studies that related various ways of making and comparing designs for large and environmentally vulnerable geographic areas with complicated programmatic needs. The Honey Hill study, named after its location in New Hampshire, was sponsored by the US Army Corps of Engineers. It involved a large proposed flood control reservoir and a new state park. GIS-based evaluation models were made of the attractiveness of this large area for recreation and other uses and of the vulnerability of the site's natural systems to harmful impacts. Each member of the research team then proposed a design for the new lake and park facilities, in summer and winter (figure 8). In addition, Rogers used a linear programming algorithm to produce a fiscally optimal plan.

These alternatives were all compared in yet another model, which simulated several levels of population demand and user movement to the area's facilities based on varied assumptions regarding number of persons and patterns of activity preference. Overcrowding and movement to second-choice locations or activities and capital and maintenance costs for the design alternatives were among the comparative impacts. Each design went through three iterations of assessment and redesign. The optimizing program performed best, and my design came in fourth.

This study provided important insights into the potential power of using GIS to link different model types and ways of designing to make better plans. This experience would shape our work for many years and, in my own case, to the present time. This research concept was the inspiration for a series of studies focusing on the Boston region in the late 1960s, as well as a major research program supported by the United States National Science Foundation in the early 1970s, which integrated GIS methods with sectoral models of the processes of urbanization and change.

Two additional early experiments may be of interest. In 1968, I designed a series of programs that automated the process of placing a series of prepackaged visual simulation forms for trees, houses, etc., on a raster terrain model and a land-cover map (figure 9). This program set then allowed one to specify the location and azimuth for a view or sequence (based on the work of Rens), and a pen plotter would painstakingly draw a series of perspectives in that GIS-generated landscape. The system was configured so that changes in the GIS terrain or land-cover map would automatically trigger changes in the landscape view. This technique was successful as an experiment but inefficient and uneconomical. It took several years before we efficiently linked GIS to automated allocation and animated visualization.

Also in 1968, and having made several experiments placing and visualizing a designed pattern of land uses on terrain, I had a series of discussions with architect Eric Teicholz about different ways in which rules could be established for the making of the designs themselves. We decided to make a series of experimental designs, which were rule based. There would be a street system and a pond, each with minimum setbacks; parking access within a minimum distance to every house; three housing types with prespecified locations for connections; and trees, which were allocated along roadways or near houses but could only be located on soil. The experiments varied the number of houses among the three types and the number and roles of trees. Figure 10 shows the first experimental rule-based design.

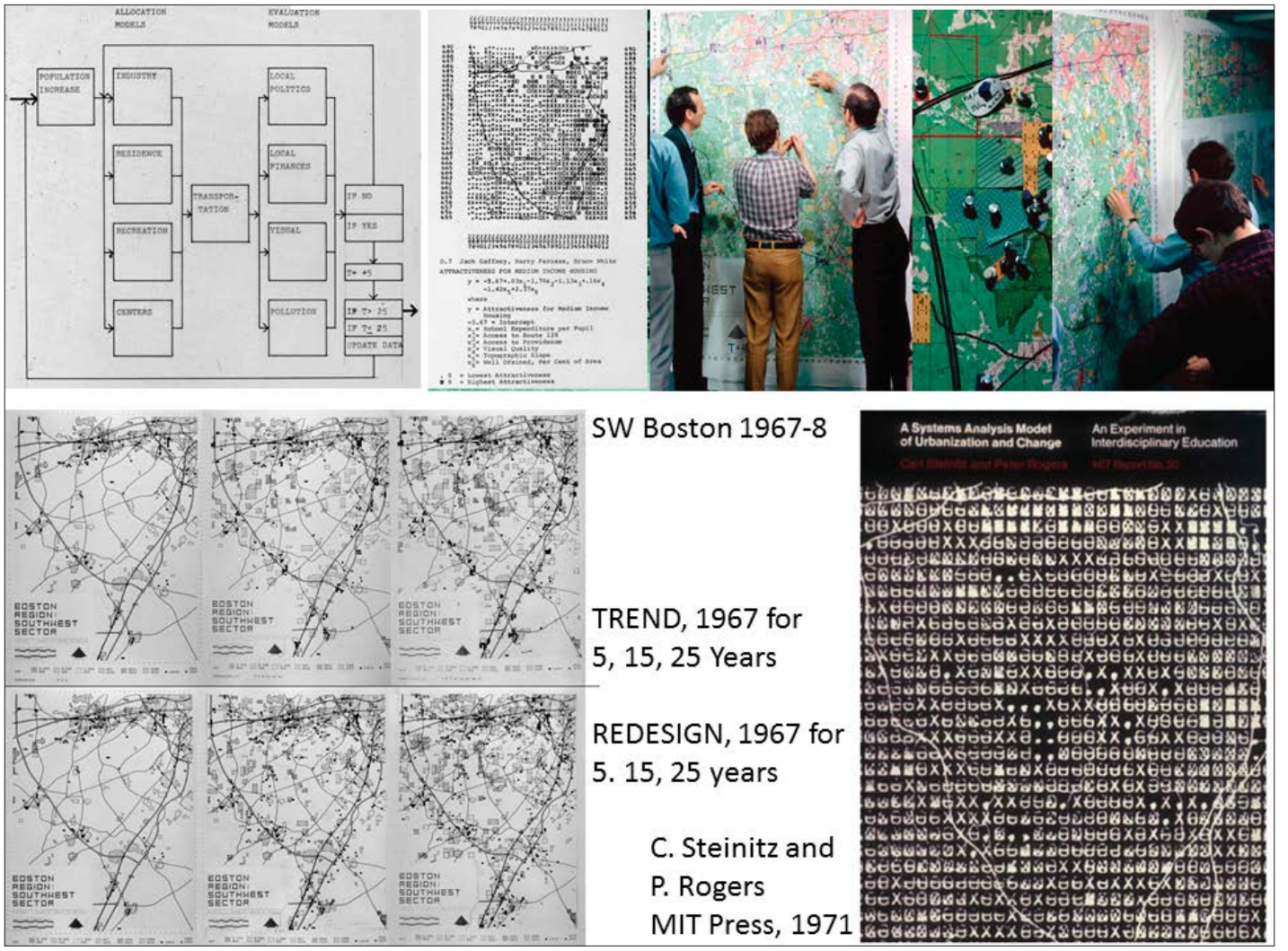
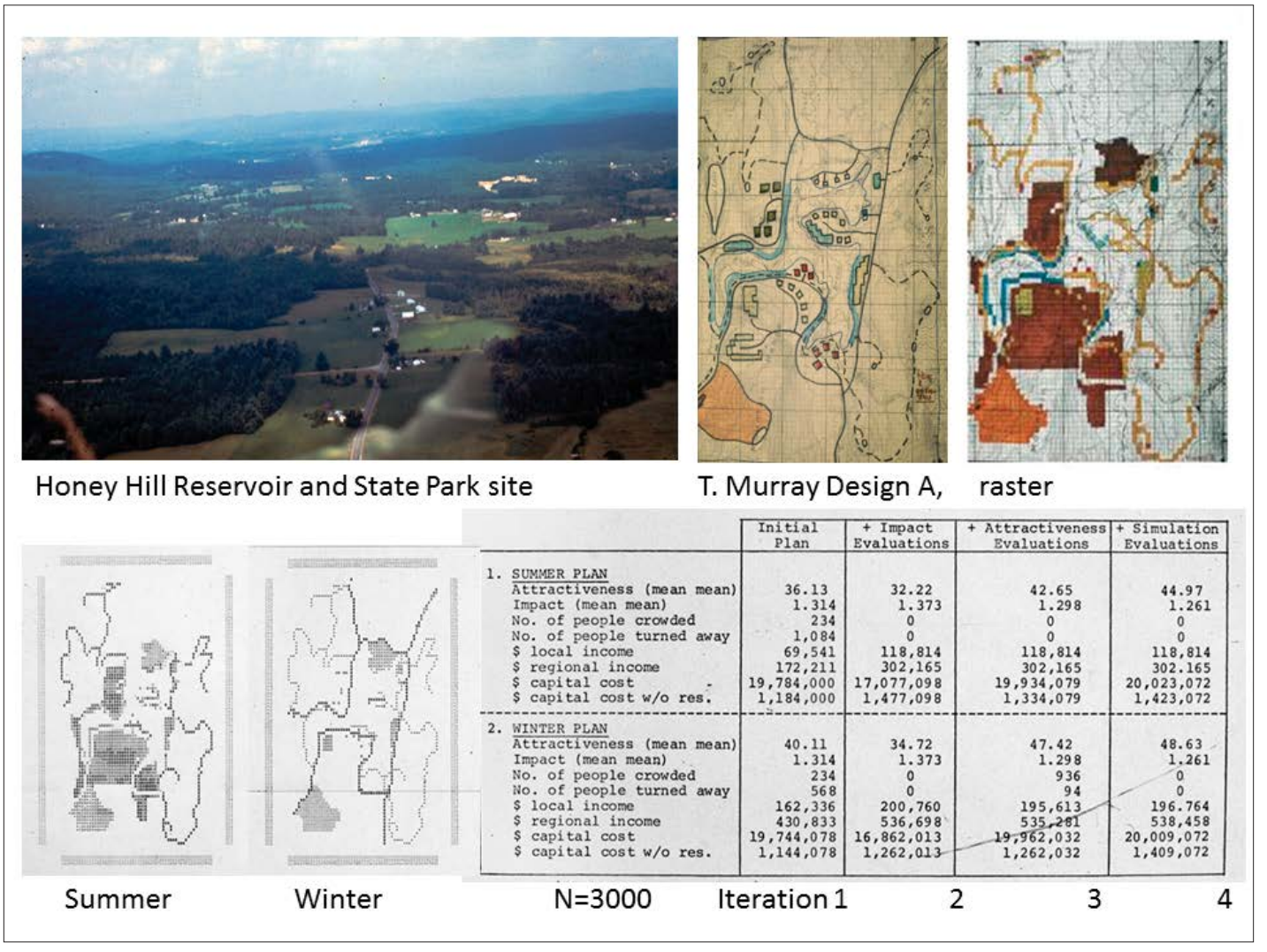


Figure 7. **Upper:** The structure of the study's 10 linked models, attractiveness for new middle-income housing, and allocating new development and conservation. **Lower left:** Trend growth (top three images) and improved growth (bottom three images). **Lower right:** Dust jacket of *A Systems Analysis Model of Urbanization and Change*, 1971.



	Initial Plan	+ Impact Evaluations	+ Attractiveness Evaluations	+ Simulation Evaluations
1. SUMMER PLAN				
Attractiveness (mean mean)	36.13	32.22	42.65	44.97
Impact (mean mean)	1.314	1.373	1.298	1.261
No. of people crowded	234	0	0	0
No. of people turned away	1,084	0	0	0
$ local income	69,541	118,814	118,814	118,814
$ regional income	172,211	302,165	302,165	302.165
$ capital cost	19,784,000	17,077,098	19,934,079	20,023,072
$ capital cost w/o res.	1,184,000	1,477,098	1,334,079	1,423,072
2. WINTER PLAN				
Attractiveness (mean mean)	40.11	34.72	47.42	48.63
Impact (mean mean)	1.314	1.373	1.298	1.261
No. of people crowded	234	0	936	0
No. of people turned away	568	0	94	0
$ local income	162,336	200,760	195,613	196.764
$ regional income	430,833	536,698	535,281	538,458
$ capital cost	19,744,078	16,862,013	19,962,032	20,009,072
$ capital cost w/o res.	1,144,078	1,262,013	1,262,032	1,409,072

Figure 8. **Top left:** Aerial view of the site. **Top right:** Tim Murray's design. **Bottom:** Assessment of impacts of Murray's design.

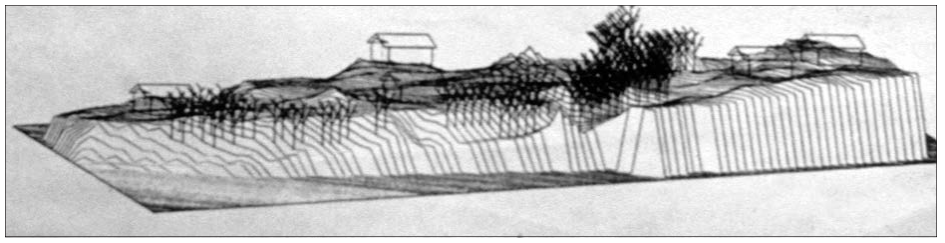


Figure 9. Buildings and trees on terrain. (Courtesy of C. Steinitz.)

In retrospect, I would divide these earliest years of GIS and its applications into three stages. In the middle 1960s, we used computers and computer graphics to do things we already knew how to do using noncomputer technologies. We acquired data and encoded it and produced maps. The analytic capabilities of the time were primitive, typically limited to applied studies on landscape classifications, sieve maps, or overlay combinations, all of which could have been accomplished with hand-drawn methods. Spatial and statistical analyses were difficult; professional acceptance was low, and public cynicism was high regarding analyses and the resultant graphics produced by computers.

The second stage, in the later 1960s, emphasized substantially more sophisticated GIS analyses: the merging of mapping and statistical techniques, the introduction of more sophisticated spatial analysis methods, and the introduction of graphic displays more diverse than two-dimensional maps. A strong research effort in theoretical geography was organized and directed by William Warntz and related to the theory of surfaces, the macrogeography of social and economic phenomena and central place theory.

During the third stage in the early 1970s, the laboratory saw important interaction with other disciplines and professions, particularly the scientific and engineering professions. We had the self-criticism that recognized the need for more predictable analysis and for better models. The view throughout this third stage was that information could and should influence design decisions. A critical professional role would be to organize that information, have it available and adaptable to questions, and thus provide decision makers with information relevant to decisions at hand. The focus on *aiding* decisions rather than *making* decisions increased both public and professional interest and acceptance.

I ended my direct affiliation with the laboratory in this period. By then, we had developed, demonstrated, and occasionally linked and used computer software to fully support a variety of design processes. We had collaboratively applied these to significant studies of real, large, and complex places . . . the stuff of geodesign.

The laboratory continued to grow in size and influence under the further directorships of Warntz and Schmidt. The later 1970s to the mid-1980s may be characterized by the introduction of smaller and far less expensive computers, more user-friendly programs incorporating commands in common English or the ability to point a computer cursor, more easily acquired data, and a proliferation of analytic and graphics capabilities. These advances resulted in an increased potential for decentralized and networked computer use and in increased freedom from predefined analysis and planning approaches. However, the need—and responsibility—for selecting wisely from a much larger set of technical and methodological options also increased in this period. We saw in the universities and then in the professions the first computer-comfortable generation of students. Professional acceptance broadened, and computer use was no longer regarded as something special.

The Harvard Laboratory for Computer Graphics and Spatial Analysis ceased to exist—for many complex reasons—in 1981. By then, 165 people had served on the laboratory staff at one time or another. Much of the credit for the lab's diverse accomplishments should go to Fisher, who died in 1974 and who was a remarkable person of uncommon energy and foresight. The many individuals linked to the lab and their ideas, computer programs, demonstrations, publications, and especially students were significant contributors to the development of today's GIS and many of its applications, including geodesign.

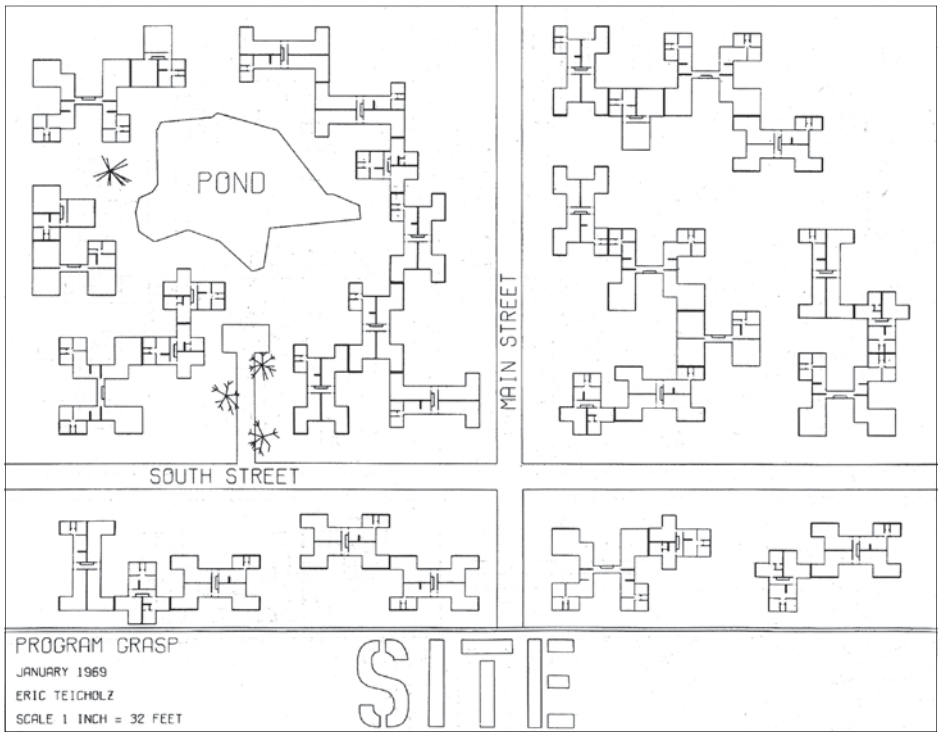


Figure 10. Our first experimental computer-generated, rule-based design. (E.Teicholz with C. Steinitz.)

About the Author

Carl Steinitz is the Alexander and Victoria Wiley Professor of Landscape Architecture and Planning, Emeritus, at the Graduate School of Design, Harvard University, and Honorary Visiting Professor, Centre for Advanced Spatial Analysis, University College London. In 1966, Steinitz received his PhD degree in city and regional planning, with a major in urban design, from MIT. He also holds a master of architecture degree from MIT and a bachelor of architecture degree from Cornell University. He is principal author of *Alternative Futures for Changing Landscapes* (Island Press, 2003) and author of *A Framework for Geodesign* (Esri Press, 2012).

For more information, contact Carl Steinitz (e-mail: csteinitz@gsd.harvard.edu).

Geodesign Goes International

The next Geodesign Summit in the United States is scheduled for January 29–30, 2014, in Redlands, California. Visit **geodesignsummit.com** to keep up-to-date with the latest information about this event. More organized events that focus on geodesign are planned worldwide, including the Geodesign Summit Europe, September 19–20, 2013, at the GeoFort in Herwijnen, the Netherlands, and the Geodesign International Conference, October 28–29, 2013, in Beijing, China.

ArcGIS 10.2 Brings Transformational Capabilities to Users

continued from cover

Highlights

- ArcGIS Online capabilities become part of the on-premises platform.
- Real-time mapping and GIS keep users synced with the real world.
- Location analytics equals more accurate business intelligence.
- New developer opportunities are available on the ArcGIS platform.

promises to transform your work; your organization; and, ultimately, our world.

Portal for ArcGIS

Portal for ArcGIS becomes a full part of the on-premises infrastructure of ArcGIS. In the past four years, Esri has been significantly developing ArcGIS Online deployed in the public cloud. At 10.2, this technology has been engineered into a fully supported product that can be easily deployed on premises and integrated with users' existing technology.

This technology supports many capabilities:

- Enterprise geospatial content management
- Simple mapping
- Esri Maps for Office
- Integration with enterprise security
- Sharing of data, maps, and apps
- Groups
- Mashups
- Dozens of apps
- Open enterprise integration with Office, SharePoint, SAP, and others

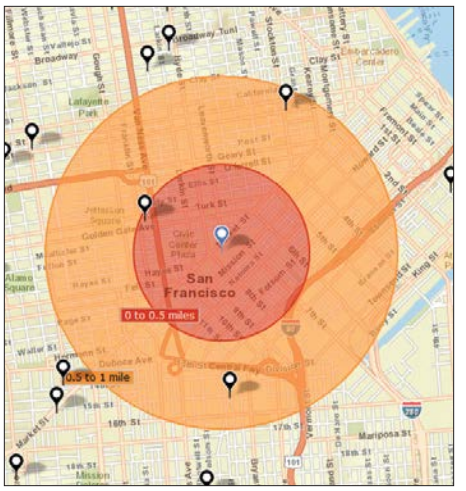
Portal for ArcGIS promises to enable users to easily integrate these mapping and Esri capabilities and to extend mapping and GIS across the organization.

This is a logical way to organize and make available via apps all the geospatial information in an organization. It provides the ability to easily share, integrate, and use information created by geocentric workflows, as well as desktop spreadsheets and enterprise databases across an organization. Apps include easy-to-deploy templates that are easily configured and leveraged.

Real-Time Mapping at Your Command

ArcGIS now brings real-time data into mapping applications, making it possible for people to stay synced with the quickly changing world. A number of new technologies enable the real-time collection and sharing of data with GIS, including the following:

ArcGIS GeoEvent Processor for Server, a new ArcGIS for Server extension, gives users the ability to connect to real-time data streams from a wide variety of sensors, perform continuous processing and analysis of those data streams, and send relevant information to users or other systems. This real-time capability



Location analytics delivers the geographic context to major business intelligence systems.

transforms GIS applications into frontline decision apps, helping decision makers respond faster with remarkable accuracy whenever and wherever change happens.

Operations Dashboard for ArcGIS provides a common operating picture for monitoring events. Operations Dashboard integrates maps and a variety of data sources to create comprehensive operational views that can include charts, lists, gauges, and indicators that update automatically as underlying data changes. Operations Dashboard can be used with GeoEvent Processor to monitor unfolding events and generate geofences on the fly using areas determined by specified drive-time analysis, a simple hand-drawn polygon, or existing map features.

Collector for ArcGIS is an app for Apple and Android devices designed with field crews in mind. It's used to capture and update both tabular and spatial information via smartphones using the built-in GPS capabilities of the device or by tapping on the map. Data captured using Collector for ArcGIS can be displayed immediately in Operations Dashboard and ArcGIS Online web maps.

Web Maps Bring GIS to Everyone

Web maps have emerged as the primary instrument for generating and communicating geographic understanding across enterprises, businesses, and constituencies. They're easy to use and, with ArcGIS, increasingly powerful and dynamic. ArcGIS is designed to help people easily create, deliver, and use web maps. The following new capabilities in ArcGIS make web maps even more important:

Hosted analysis services are available through a set of online tools that let users perform analysis against their layers hosted in ArcGIS Online, as well as other layers users have access to. Users can also create new hosted layers and tables. These new tools are easily accessible to users who may or may not be familiar with ArcGIS geoprocessing tools, models, or services. Additionally, these online analytics are available as services that developers can use to build custom, workflow-specific apps for use within any organization.

Premium content services now give users the ability to aggregate demographic data on any geographic area from existing administrative, political, or postal boundaries to any arbitrary area defined by a polygon. These new demographic capabilities are available for more than 100 countries through the geoenrichment API. Users can now get demographic data through ready-to-use dynamic web maps that can be brought directly into web, desktop, and mobile applications.

The addition of new landscape services gives users access to incredibly rich biogeographic data that can be used to support natural

Web maps bring mapping and GIS capabilities to everyone, on the web or on any device.

Web scenes provide 3D side-by-side views and fly-throughs of city models via WebGL browsers.

resource management efforts, as well as land use and conservation planning at regional and national scales. Landscape services include dozens of ready-to-use image services to support analytical tasks, feature services, web maps, and geoenrichment services.

Dynamic image services provide the ability to set the properties on image services within web maps and further mine the information content of image services—particularly for very large collections of imagery. For example, a web map can be used to filter a service containing thousands of Landsat scenes so that only a selection of the relevant scenes are rendered with a selected band combination or use a function such as the Normalized Difference Vegetation Index to return a vegetation index. Configurable web map pop-up windows for dynamic image services provide not only metadata about the specified image but also information about the specific pixel or data values for any location on the map.

Web scenes for 3D presentations are available through Esri CityEngine Web Viewer. They now allow users to add and explore location-based comments in 3D space, compare side-by-side views, and create fly-throughs of city models, all available through any WebGL-enabled browser.

More Analysis Tools Online

Geographic analysis is the foundation of GIS, and this release of ArcGIS makes analysis more readily available. People working in a wide array of disciplines can make use of spatial analytics to reveal patterns in their data and create new map layers that can be added to web maps.

Advanced analysis tools have been added to ArcGIS Online for analyzing and measuring geographic relationships to uncover hidden patterns, assess trends, and make more informed decisions. These new tools include the following:

- **Overlay layers** for combining two or more layers into one single layer to find which features are on top of other features, such as finding what land use is on top of what soil type
- **Hot-spot analysis** to analyze incident data, such as traffic accidents, or the values associated with features (such as total sales for retail stores) and find statistically significant spatial clusters of high values (hot spots) and low values (cold spots)
- **Explore correlations** to examine the strength of relationships among the numeric attributes of features, such as determining whether proximity to liquor stores has a strong and consistently positive relationship with crime
- **Find existing locations** to select map features that meet a user's criteria either based on attributes (land value = vacant) or spatial queries (within one mile of a river)
- **Data enrichment** to get information about the people, places, and businesses in a specific area or within a distance or drive time from a location

Location Analytics Empowers More Business Systems

ArcGIS already delivers solutions for business intelligence (BI) platforms, such as IBM Cognos and Microsoft Office, and productivity and collaboration tools, like Microsoft Office and SharePoint. Now organizations with MicroStrategy BI and Microsoft Dynamics Customer Relationship Management will have the ability to analyze their data in a geographic context.

While working within the systems they use every day, these users can do the following:

- Make maps that put data in a spatial context
- Uncover and analyze spatial relationships that charts and graphs cannot reveal
- Enhance their data with Esri basemaps and demographic data

Esri Community Analyst and Esri Business Analyst Online also get productivity-enhancing facelifts and new capabilities, including the following:

- **Custom study areas** can be either hand drawn across multiple geographies (counties, block groups, etc.) or combined with existing geographies, such as three counties, into a single new geography for analysis and generating reports.
- **Custom variables** can be created by defining data ranges, such as "adults aged 55 to 75," to refine and focus analyses and color-coded maps.
- **Custom labels**, as well as photos, captions, arrows, and flags, can be added to further enrich maps.

Enterprise Security Integration

ArcGIS includes new, improved integration with an organization's enterprise systems, as well as security enhancements, such as federated authentication for ArcGIS Online and public key infrastructure (PKI) authentication for Portal for ArcGIS.

Federated authentication allows organizational account administrators to configure ArcGIS Online so that users can sign in using their enterprise user names and passwords that already exist within their organizations. This eliminates the need for multiple user credentials for separate applications and provides significant convenience to users in that they don't need to create and remember new user names and passwords. This type of authentication takes advantage of Security Assertion Markup Language (SAML), an open standard for exchanging authentication and authorization data between end users, identity providers, and service providers. For example, an organization can set up ArcGIS Online accounts to leverage the enterprise Windows Active Directory users, which allows the users to sign in once (aka: single sign on [SSO]) to access many different software systems.

PKI authentication involves using pairs of public and private keys and a certificate authority to verify online identity. Security administrators use PKI to encrypt communication and transactions so that the information is only readable by authorized users and applications with valid digital certificates. For example, an organization can use PKI authentication to create tighter integration between on-premises implementations of Portal for ArcGIS; ArcGIS for Desktop; other ArcGIS applications; and the organization's enterprise security, data, and services to produce highly secure environments.

New Opportunities for Developers

More and more companies, consultants, and Esri Partners are delivering mobile, desktop, and web apps built on ArcGIS APIs and software developer kits.

A new pricing and licensing model will offer scalable plans based on anticipated volume of use per month. Developers can use their ArcGIS Online subscription to take advantage of hosted services, including geocoding and place search, directions and routing, data query, and a wide selection of ready-to-use basemaps.

Later this year, an online marketplace-style venue will be available for developers to showcase their apps and sell them. More details will be coming soon.

Geotrigger, also available with ArcGIS, allows developers to build smart location-aware apps that are ideal for mobile advertising, analyzing when someone is in a place for a given amount of time, and monitoring the density of mobile users in regions. Geotrigger can be used in combination with other ArcGIS Online services, such as geocoding, routing, basemaps, and geoenrichment services. This state-of-the-art technology is designed to have low impact on mobile device batteries.

ArcGIS: A Continuously Expanding and Sustainable Platform

ArcGIS 10.2 in another milestone in a constantly evolving platform. There are significant improvements in design and usability. It works on personal devices, such as smartphones and tablets, as well as on web and desktop apps, and is increasingly embedded in enterprise systems, large and small, within governments and businesses.

ArcGIS serves real people by helping them add location to their workflows and giving them easy access to powerful analytic capabilities so that they can make plans based on solid information; respond effectively to issues affecting their communities and the environment; and, if necessary, take action in real time to protect their investments, assets, and personnel in the field.

ArcGIS also opens up tremendous opportunities for developers to build integrated solutions for solving their customers' problems while growing their own business.

ArcGIS is becoming part of everyday work–life for many more people around the world. They're using it to make better decisions and boost productivity. The work of GIS professionals is also expanding and growing more important. GIS-based maps and geographic analysis are in high demand and are used in nearly every industry to strategize, respond to events, and engage with customers and citizens.

Enables Users to Deploy ArcGIS Online Capabilities on In-House Server Platforms

Portal for ArcGIS Now a Standard Esri Server Product

Over the past year, Esri has installed a number of on-premises implementations of Portal for ArcGIS (esri.com/onpremises). These have been custom implementations done by an Esri Professional Services team. At 10.2, this technology has been turned into a standard product that can be easily set up by any user, immediately integrating ArcGIS server technology and providing complete geospatial content management for organizations. This technology provides a front end for ArcGIS for Server with dozens of easy-to-use apps and full integration with ArcGIS for Desktop. It also provides an open mapping and analysis platform integrated with standard enterprise IT infrastructure, including e-mail, search, business intelligence systems, SharePoint, and Office. It is accessible from any device platform or web client.

Esri is licensing this technology by a named user model similar to ArcGIS Online, permitting low cost and flexible deployment of the services.

Breathe Life into Big Data

continued from cover

Geoenable Big Data in Hadoop

Many data stewards and developers have come to rely on Hadoop's open source framework to handle large data stores. Because Hadoop lacks the native functionality to exploit the location component in big data, GIS Tools for Hadoop was designed to extend the popular data management platform with utilities for spatially operating on billions of records at a time.

Although most data includes spatial parameters, large volumes typically require tedious, sequential processing to do any meaningful work on them. For non-GIS users of Hadoop, the toolkit lets data stewards study big data as a whole unit in Hadoop format. Results from those analyses reveal patterns and relationships that traditionally could only be derived from smaller, more manageable datasets. For ArcGIS users, GIS Tools for Hadoop bypasses traditional geoprocessing workflows by enabling the execution of spatial queries on Hadoop data from ArcGIS.

This new ability gives developers and data analysts much-needed control—essentially transforming big data from being something to be dealt with later into an immediately useful resource.

Bring Big Data into ArcGIS

After conducting spatial analytics on your Hadoop data, the toolkit provides a way of importing big data into the ArcGIS environment. Results from spatial querying and analytics in Hadoop can be moved to ArcGIS for further processing and visualization. Those geoprocessed datasets can then be saved to ArcGIS or exported back into the Hadoop system, thus creating a looping workflow between the ArcGIS platform and the big data environment.

Forget about archiving your large data stores for later use. Command your big data now with GIS Tools for Hadoop.

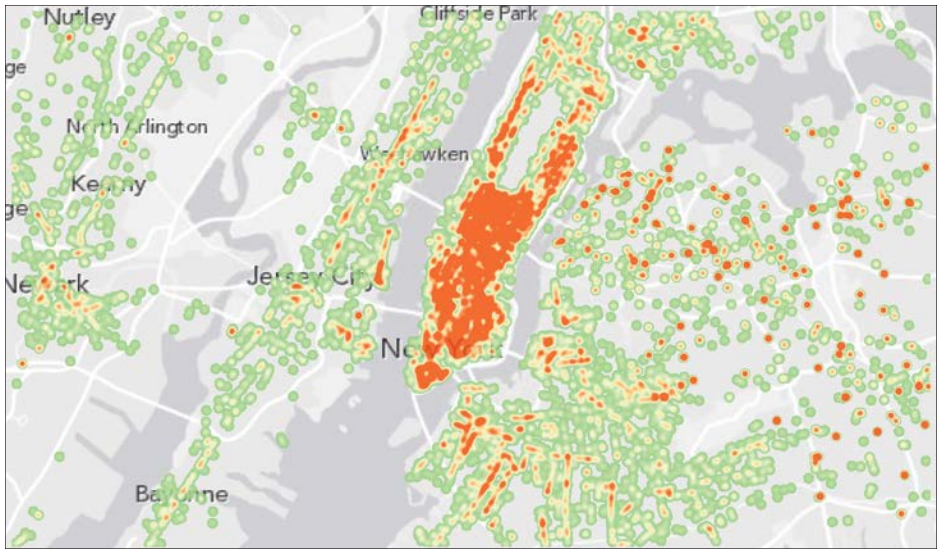
The free, open source toolkit lets you do the following:

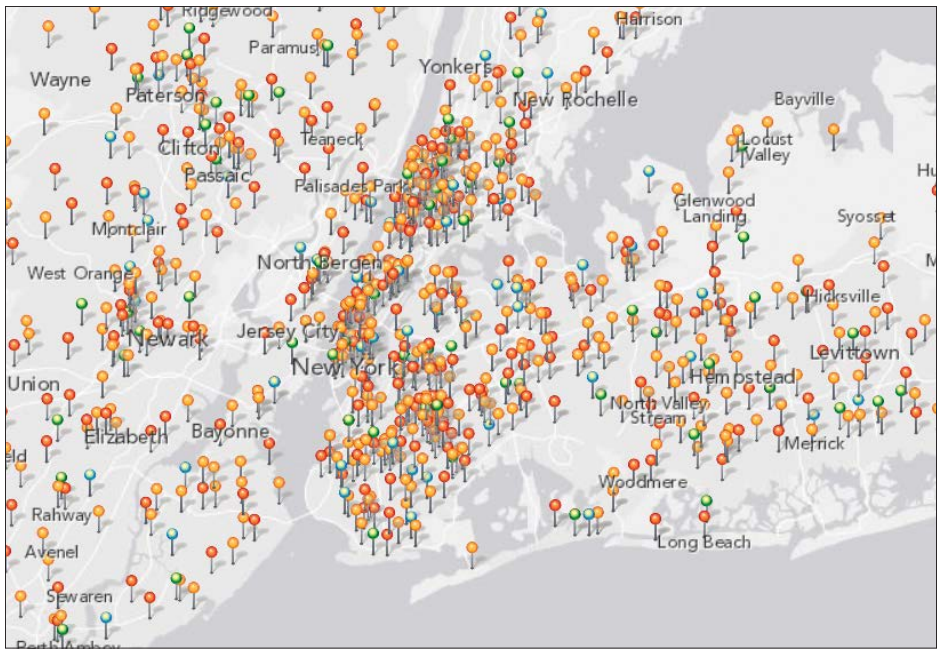
- Run filter and aggregate operations on billions of spatial data records
- Define new areas represented as polygons and run point-in-polygon analyses inside Hadoop
- Integrate big data maps in reports or publish them as big data web map applications

GitHub Project

Esri recognizes big data as being the next big frontier of IT and requiring many perspectives to help manage it. As such, Esri hosts GIS Tools for Hadoop for free on the popular open source project site GitHub. Esri encourages developers to download the toolkit, report issues, and actively contribute to improving the tools through the GitHub system.

To download GIS Tools for Hadoop, visit **github.com/Esri/gis-tools-for-hadoop**.





Both images: Analysis results within Hadoop can be exported to ArcGIS for map-based visualization of big data.

ArcGIS Online What's New?

This regular column contains information about the latest updates to ArcGIS Online, including new features and capabilities, basemap updates, and content contributed by the global user community through the Community Maps Program. This issue focuses on the March release of ArcGIS Online, which includes many improvements for working with maps, new ready-to-use application templates, and updates to existing applications.

Map Viewer
You can now get directions in the map viewer. These printable directions include optimized multistop routes and the ability to reverse directions with a button click. Also new are Esri map layers. Search Esri map layers to find selected ArcGIS for Server services published by Esri. This includes economic, demographic, and traffic map layers that can be added to maps. Both the Directions button and Esri map layers appear in the map area after signing in with the organizational account. Esri has also added support for three additional layers that can be added to the map: Open Geospatial Consortium, Inc., Web Map Tile Services layers; tile layers; and GeoRSS file layers. And speaking of layers, you now have the ability to change symbols on dynamic layers in ArcGIS 10.1 for Server map services.

Publishing
It is now easier to include multiple shapefiles with your hosted feature service. When publishing a hosted feature service, instead of having to add one shapefile at a time, you can now include multiple shapefiles within a single ZIP file.

Web Application Templates
A new configurable Parcel Viewer template is available for displaying government property tax and assessment information. The Edit template has also been updated to make it easier to use on mobile devices and to edit layers in a web map. The Swipe Tool template has been added to the Web Application template gallery. With this template, you can compare two web maps side by side.

Applications
Esri Maps for Office has a number of improvements. You can now enrich your spreadsheets with demographic and lifestyle data. For example, clickable infographics on the map tell more about what kind of people live in a certain location. Use Find Nearby to find all the points in one map layer that are within a certain distance of points in another map layer or that fall within a specific region. New configuration options for heat maps and smart clustering give you more control over styling a map, and Esri has added support for Microsoft Office 2013.

Updates for the Collector for ArcGIS app include the ability to sign in with your ArcGIS Online organizational account and open maps, search for maps, view more sample maps, and access help directly from the app. And to help you get started more quickly with the Operations Dashboard for ArcGIS app, new tutorials and videos were added.

Content
The World Geocoding service has been updated so you can now perform geocoding in China. There is improved geocoding quality for more than 30 countries, including Czech Republic, Denmark, Israel, Liechtenstein, Poland, Slovakia, and Switzerland.

Esri has expanded the World Network Analysis services to be available for Japan and added support for driving directions in Lithuanian, Polish, and Portuguese. The closest facility service, which is used to find the nearest location from one or more locations based on travel time or travel distance, now supports the solving of large problems with an asynchronous execution mode.

ArcGIS Online Account Administration
An administrator can now see usage reports for geographic context and demographics. Administrators now have the ability to change the organization's region. Region now determines the units of measurement on the map viewer scale bar, measure tool, and directions tool.

Complimentary use of Microsoft Bing Maps with ArcGIS has been phased out. However, you can continue to include Bing Maps in your map viewer basemap gallery by adding a Bing Maps key to the map configuration. A Bing Maps key must be obtained directly from Microsoft.

Application Development
Application developers whose organizations have an ArcGIS Online account can register their application with ArcGIS Online and obtain an application ID. This app ID identifies the application to the platform in the context of both user logins, as well as app logins based on OAuth 2.0, and is also the foundation for distributing apps, accessing billable services, and getting usage reports.

Other Enhancements and Changes
You can now share these static data files as items in ArcGIS Online: types now supported are DOC, DOCX, JPEG, PDF, PNG, PPT, PPTX, TIFF, URL, VSD, XLS, and XLSX. Log in with your ArcGIS Online organizational account and add these files to My Content and then share them with others. However, these files are not supported as data layers, so they cannot be added to a web map.

The list of available language options continues to expand. Estonian and Latvian are the two latest additions, bringing the total number to 22. The language option chosen determines the user interface and how time, data, and numerical values appear.

The regions that are available to choose from now include Egypt and Nicaragua. The region selected for the ArcGIS Online website sets the featured maps on the home page, the content in the gallery, and the default extent of new maps in the map viewer. Regions also now determine the units on the map scale bar, measure tool, and directions tool.

The Create Editable Layers in the map viewer is now called Add Map Notes. Adding a map notes layer lets you add your own data directly to the web map, and it's also stored in the map. But only the map's author can edit the layer.

ArcGIS Online Basemap Updates

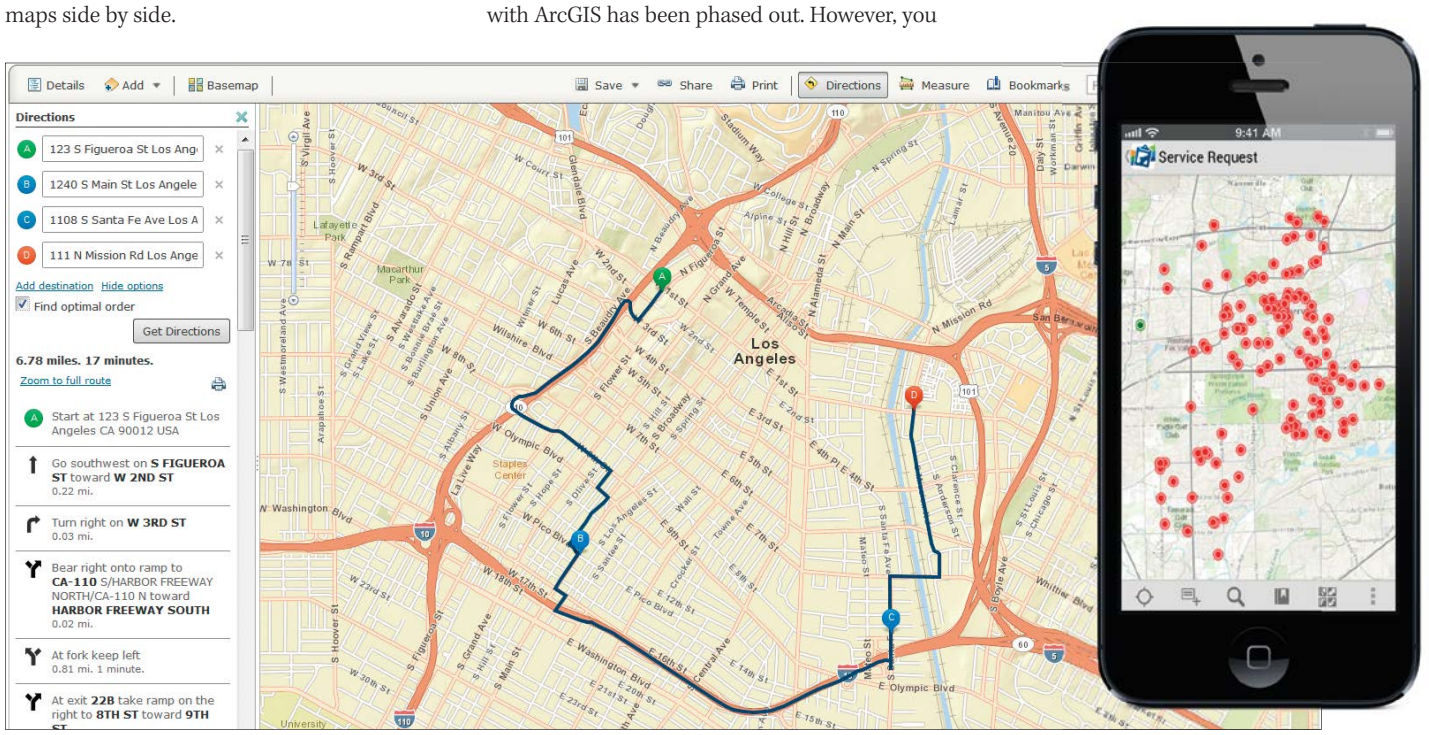
World Topographic Map
Since the beginning of the year, Esri has had quite a number of contributions from the Community Maps Program for the World Topographic Map. Below are some of the contributors. To see the entire list, go to esriurl.com/contributors. The Community Maps team has created ArcGIS Explorer Online presentations that showcase the contributors and will post updates regularly. The latest international contributions include content for the country of Romania (1:577,000 to 1:2,000 scale); country of Switzerland (1:9,000 to 1:2,000 scale); state of Baden-Württemberg, Germany (1:144,000 to 1:2,000 scale); and regional district of Thompson-Nicola, British Columbia, Canada (1:9,000 to 1:1,000 scale).

World Street Map
The World Street Map was also recently updated with community content for Ghana from 1:577,000 to 1:1,000 scale by Ghana Water Company Limited and Esri's distributor in Ghana, SAMBUS Company Ltd., GIS/GPS Section & Spatial Solution & Services. Coverage for India was updated from 1:288,000 to 1:144,000 scale, and new coverage was added from 1:72,000 to 1:1,000 scale using commercial data from DeLorme and NAVTEQ.

World Imagery Map
The World Imagery Map was updated with community content for the following areas from 1:36,000 to 1:1,000 scale: Cities of Coquitlam, Surrey, Langley, and White Rock, British Columbia, Canada; Sault Ste. Marie and Kenora, Ontario, Canada; Yorkton, Saskatchewan, Canada; Pori, Finland; Wrangell, Alaska, USA; and Town of Newtown, Connecticut, USA.

Ocean Basemap
New areas of higher-resolution bathymetric data that covers the Red Sea were provided by the Khaled bin Sultan Living Oceans Foundation. The National Institute of Water and Atmospheric Research in New Zealand provided a 20-meter bathymetric grid over the Hauraki Gulf at 1:4.5M to 1:72K.

If your organization doesn't have an ArcGIS Online subscription yet, sign up for a free 30-day trial. You can invite up to five named users to participate in the trial, and you get 200 service credits and these apps as part of your trial: Collector for ArcGIS, Operations Dashboard for ArcGIS, and Esri Maps for Office. Once your trial is over, purchase a subscription and continue to use all the features and services in the same ArcGIS Online subscription account. To sign up for the trial, go to esri.com/agoleval.



Add directions and optimized routes with multiple stops to your map. **Inset:** Capture, update, and report information directly from your Android or Apple device.

What Can Your Organization Do with 100 Credits?

Highlights

- ArcGIS Online provides an inexpensive, reliable, and fast way to create and share interactive maps.
- Esri assists local emergency response teams and news agencies with essential map services.
- Two current events with 500,000 views use only 54 credits.

With ArcGIS Online, your organization consumes credits when you use certain services as part of a project or your daily work. Perhaps you have been wondering how many credits ArcGIS Online will use when you publish web maps, and people then interact with those web maps. To give you a better understanding, this article describes real-world examples that illustrate how easy and inexpensive it is to make and serve maps to the public.

Recently, global sports fans were able to view interactive maps for seven big European cycling events, including Paris Roubaix, Ronde van Vlaanderen, Milan San Remo, Brabantse Pijl, Amstel Gold Race, Waalse Pijl, and Luik Bastenaken. The Flemish Broadcasting Corporation channel Sporza worked with SIGGIS, a company based in Belgium that specializes in integration of GIS projects, to integrate storytelling maps in the Sporza website for each event. Cycling fans were able to get instant access to routes, major milestones along the routes, and videos and photos and interact with the information. It turned out to be a successful project—over a three-week period, the Sporza site received more than one million hits. That translated into just 100 ArcGIS Online credits (about US$11.00) for the bandwidth to serve these maps to hundreds of thousands of visitors.

Sporza received a lot of positive feedback from the cycling fans and will continue to use ArcGIS Online to highlight events throughout the cycling season. Preparations for building storytelling maps for the Tour de France are already under way.

To take a look at the storytelling maps that were published for the seven big cycling events, go to **arcgis.com/home** and enter "Sporza" in the search box. On the results page, click Sporza Storymap or one of the individual races. Be sure that your search option is set to All Content.

Just like for planned events, maps are now indispensable when disasters and emergencies occur. A vital communication tool for emergency response teams, ArcGIS maps are also used by the media to keep the public informed and convey the facts of an event. In April of this year, over the course of one week, ArcGIS Online was used to help when two major events occurred in the United States: the Boston Marathon bombing and the West Fertilizer explosion in Texas. Esri assisted local emergency response teams and news agencies (for example, **FoxSports.com** and the *Dallas Morning News*) with essential map services and provided stand-alone maps for public dissemination. In Boston, this included maps of the marathon route, points of interest, and the locations of the bomb explosion. In Texas, the emergency management agencies urgently needed a map that showed the location of such critical infrastructure as schools and hospitals in relation to the West Fertilizer plant. In both cases, Esri assisted in the early stages of the event when local resources were overwhelmed and time was of the essence.

At the end of 10 days, the maps associated with these two tragedies received a combined total of more than 500,000 views. The cost? Just 54 ArcGIS Online credits (about US$5.40) to meet the demand and enable interaction with these important maps. To see the maps and web mapping applications that were created, go to **arcgis.com/home** and enter "Boston Marathon" or "West, Texas" in the Search box.

This map was used to show the public the Boston Marathon bombing crime scene perimeter.

These real-world examples show how ArcGIS Online can provide inexpensive, reliable, and fast ways to publish interactive maps. Whether it's a sporting or other kind of event for which you can plan ahead or in response to a developing news story, you can create interactive maps in very little time and with very little effort—with data you already have. You can provide thousands, if not millions, of viewers with instant access to the latest information and for the cost of only a few credits.

Unlike other mapping services, you only get charged when you use specific ArcGIS Online functions, like generating map tiles, creating feature services, geocoding, storing data in Esri's cloud, or transferring data out of Esri's cloud. And if you have ArcGIS for Desktop and/or ArcGIS for Server, you can alternatively use those to do some of the computational-intensive tasks. Running your analyses in ArcGIS for Desktop and then publishing the results as an ArcGIS for Server service doesn't cost you any credits. The ArcGIS platform gives you expanded options that include hosting your maps in Esri's cloud and providing access through ArcGIS Online, providing you with a cost-effective solution that gives you the flexibility you need.

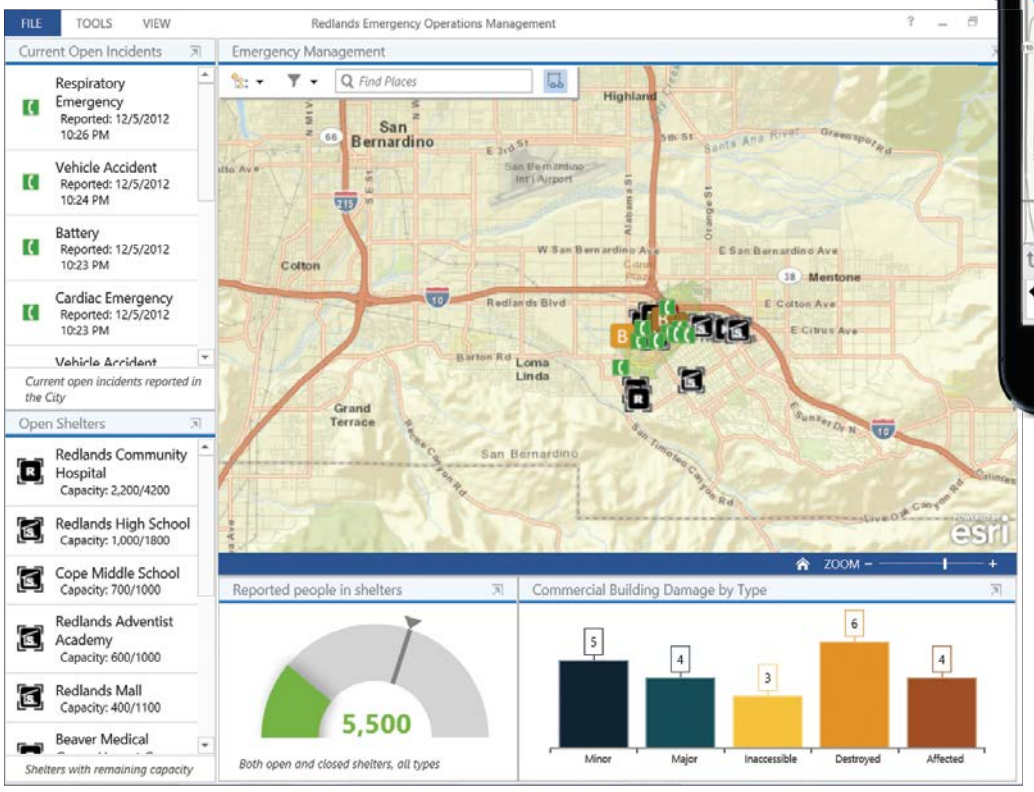
For more information, visit **arcgis.com**.

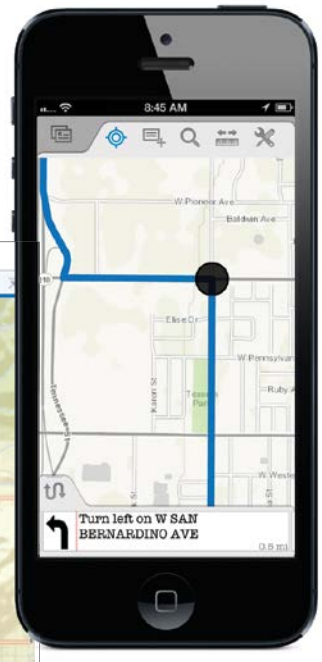
New Free Dashboard App Provides Decision Makers with Timely Insights

Companion "Collector" App Supports Real-Time Field Data Capture

Highlights

- Users can monitor events to make timely and informed decisions.
- They can track field personnel and assess daily operations across the organization.
- Operations Dashboard for ArcGIS and ArcGIS Online web maps allow users to display critical data immediately.





The new Windows-based Operations Dashboard for ArcGIS application leverages responsive maps and dynamic data to create operational views that include charts, lists, gauges, and indicators, which update automatically as underlying information changes. Inset: Plan routes and get driving directions using the new Collector for ArcGIS application accessible from your iPhone or Android smartphone.

Operations managers, planning and logistics specialists, and incident commanders frequently rely on the real-time flow of information to get the knowledge they need to make timely and more informed decisions. Two new ArcGIS offerings—Operations Dashboard for ArcGIS and Collector for ArcGIS—help them better monitor services, people, deliveries, vehicles, and more, while staff members simultaneously report critical information from the field.

A Common Operating Picture Visible across the Organization

Operations Dashboard for ArcGIS is a new Windows application that provides real-time access to information to allow the monitoring and managing of activities and events, tracking field personnel, and assessing daily operations within an organization. It integrates interactive maps and a variety of data sources to create operational views, including bar charts, lists, histograms, gauges, and other performance indicators based on live geographic data defined in a web map or web service.

Planners, decision makers, and operations managers can use Operations Dashboard to better monitor ongoing activities and focus on the aspects of the operation that matter most to them. For example, a public safety dashboard can be easily configured to monitor the number of open incidents sorted by type or report time and highlight the most recent incidents at the top of the list. Likewise, an assessor's dashboard may highlight neighborhood changes in assessed value and tax revenue, providing the most recent appeal, foreclosure, and sales information. This helps users see specific patterns and answer questions, such as Which type of incident is being reported most often, and where is it occurring most frequently? or What impact do sales and foreclosures have on year-to-year property values?

Operations Dashboard was designed for Windows desktops to create and manage focused views of real-time information that can be used and shared across an organization. In a typical operations center, Operations Dashboard takes full advantage of multiscreen workstations and large-scale monitors to allow visualization of and response collaboration on a specific system or event. For decision makers who are on the go, information can also be accessed using Operations Dashboard on Windows tablets.

Because Operations Dashboard is powered by ArcGIS Runtime SDK for WPF, developers can extend it by creating custom widgets and map tools that provide additional context and capabilities for monitoring and managing operations.

Improved Field Productivity

Information displayed in Operations Dashboard can come from staff gathering critical data in the field, such as field crews performing a damage assessment. Collector for ArcGIS, designed for iOS and Android smartphones, is a new native application to improve the accuracy and currency of spatial data. It is a companion to Operations Dashboard but can also be used in a stand-alone environment. Field crews can download maps using Collector and then capture spatial or tabular data, attach photos and video, plan routes, and get directions. Information can be transmitted and immediately displayed in Operations Dashboard and shared throughout the organization in real time.

Real-Time GIS in Action

How would Operations Dashboard and Collector work in a live emergency situation, such as a large earthquake that hits a major community?

The operations manager at a government Emergency Operations Center (EOC) can configure Operations Dashboard so that it maps the locations of fire trucks, law enforcement vehicles, and ambulances. It can also report traffic accidents and medical calls. A 911 call reporting that students and teachers are trapped inside an elementary school can be pinpointed on a map, along with information about the incident, such as the date, time, and the conditions of those wounded.

The EOC staff can consult the map, see the location of the closest paramedics, and immediately send the nearest available crew to the scene. Paramedics using Collector can then provide updates about the conditions of the students and their teachers. That information could automatically appear on the map or in a list on Operations Dashboard.

Field-workers assessing earthquake damage to the school can gather and report that information using Collector. Damage assessments can then be immediately sent to a municipal agency and appear on its Operations Dashboard app and be integrated into the city's GIS.

Download and Get Started

Operations Dashboard is available for use on Windows desktops and Intel-based Windows 7 and 8 tablets. It includes messaging integration via an Extensible Messaging and Processing Protocol (XMPP) hosting server, such as Microsoft Lync. Microsoft .NET 4.5 Framework is required before downloading Operations Dashboard from ArcGIS.com.

Collector can be downloaded directly from the Apple App Store and Google Play. Operations Dashboard for ArcGIS and Collector for ArcGIS are freely available, but users need an ArcGIS Online account to leverage their full capabilities.

For more information, visit **esri.com/dashboard** and **esri.com/collector**.

Managing an "Area of Outstanding Natural Beauty"

Northern Ireland's Strangford Lough & Lecale Partnership

Highlights

- The partnership uses hosted ArcGIS technology to manage the competing demands on the area.
- Users who want to create online maps can easily access the datasets and GIS capabilities.
- Partners and local community groups are better informed due to maps generated using ArcGIS.

The Irish Word *Lough*

The Irish word *lough* means an inlet of the sea. The coastal area around Strangford Lough and Lecale is one of the most beautiful and environmentally important in Northern Ireland. It is a vital feeding ground for thousands of birds and a significant site of marine biodiversity. Yet the region also serves a great many local businesses and communities.

Founded in 2010, the Strangford Lough & Lecale Partnership (SLLP) coordinates the management of this important site of natural beauty. It aims to protect the diverse natural, cultural, and historic heritage of the Strangford and Lecale Area of Outstanding Natural Beauty (AONB) while encouraging appropriate economic growth and recreational activity. The role of the SLLP involves representing local and special interests and engaging communities in the strategic and coordinated management of the area.

Strangford Lough is possibly the most important example of this coastal feature in Northern Ireland. Strangford Lough has long been designated as a marine nature reserve and protected by UK and European legislation. It has an abundance of diverse wildlife and is home to seals, porpoises, and thousands of birds. Decades later, the importance of the area was further recognized when it was redesignated an AONB.

When the SLLP was created, the protected area almost doubled in size. To add to the challenge, the new designation increased interest in the region, so the SLLP needed new ways to collate and disseminate information to interested parties.

The SLLP had more than 50 datasets, containing details of archaeological sites and marine species, from a variety of sources, including partners and government bodies. The SLLP decided that the best way to make this information accessible and understandable was via the medium of maps. But as a small organization with limited technical capabilities, it needed help to achieve this. As Esri's ArcGIS solutions are widely used in Northern Ireland, the SLLP contacted Esri Ireland for advice.

Esri Ireland developed the GIS solution for the SLLP using ArcGIS software, located on servers at its data center in Dublin. The solution comprises a number of customized, web-based GIS services, which are delivered to the SLLP website users via the cloud. Esri provided desktop links to the hosted ArcGIS solution for users and created a link from within the SLLP's existing web Content Management System (CMS). Consequently, when users want to create an online map, they can easily access the datasets and GIS capabilities needed while editing a page.

The flexibility of the deployed web services architecture, combined with the integration with the CMS, allows users to easily embed maps throughout the SLLP website on a range of pages. This application, therefore, moves away from the notion of a dedicated map viewer and allows maps to be inserted onto multiple web pages to support a variety of content.

"The GIS even allows complete novices to create some really effective and attractive online maps," says Stéphanie Baine, a project officer with the SLLP. To ensure the SLLP gained maximum benefit from its GIS, Esri trained staff, most of whom were new to GIS.

GIS now plays a key role in helping the SLLP to promote the AONB. The online maps are accessed by local residents and visitors to the area, as well as academics who are researching the history, geology, or biodiversity of the region. In the first two months after the GIS application went live, a staggering 1,894 unique visitors accessed the organization's interactive maps online. Since this time, the number of online map users has continued to grow. "The maps have been very popular—and I feel this is because they are so straightforward to use," says Baine.

The SLLP also uses its GIS solution to create maps that help visualize and analyze proposed development plans. For example, it can view data about the flora on the lough bottom alongside proposed sites for new yacht moorings. It can then recommend the sites that will have the least impact on important marine habitats. Baine says, "GIS enables us to look at management issues—both above and beneath the water—in a much more coordinated way."

In addition, maps generated using the ArcGIS solutions are put to good use in meetings with partners and local community groups. Depending on the concerns and interests of each individual group, the SLLP can tailor the maps to show pertinent data. "The maps make a very good impression and help us to promote

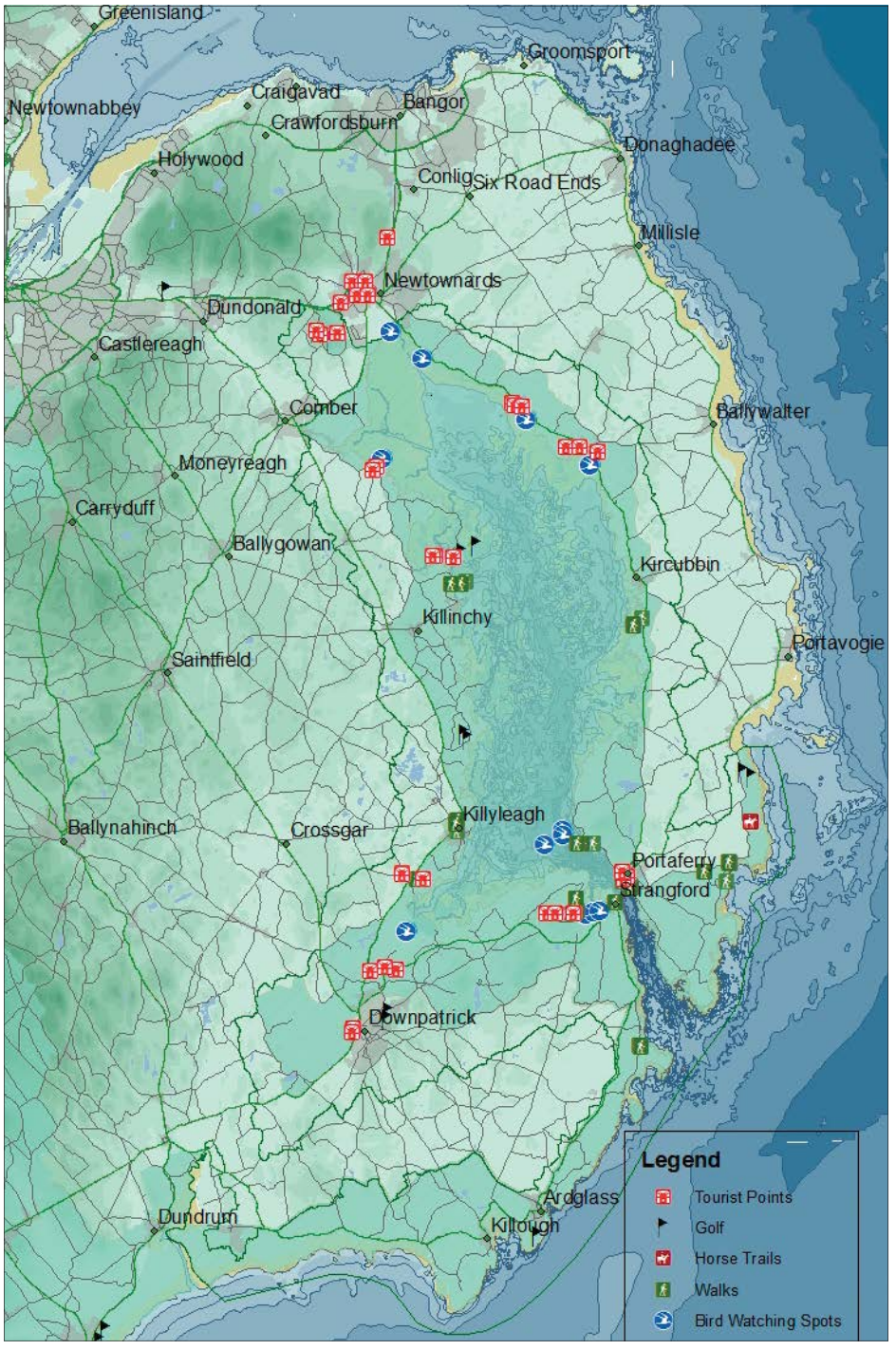
Between the contrasting north and south shores of Strangford Lough lie numerous paddies and about 70 islands, some smooth and rounded, others craggy rocks. (Photo courtesy of SLLP.)

ourselves and raise awareness of issues," Baine believes.

Through its work, the SLLP often faces situations where there is the possibility of conflict between environmental, leisure, and commercial priorities. In these instances, the organization acts in an advisory capacity to help groups make the best decisions. "Even in an Area of Outstanding Natural Beauty, there will always be a need for economic growth and recreational activity," Baine observes. "It is our job to promote ways for businesses and individuals to use the area in an environmentally responsible and sustainable way. Maps are very useful for helping us bring together a wide range of issues, find the common ground, and encourage cooperation."

For example, each winter, pale-bellied brent geese fly from Arctic Canada and Greenland to feed on the mud flats around the edge of the lough. They are tired and hungry from their flight and need peace and quiet to rest and recover. The SLLP used its ArcGIS solution to produce a map showing the locations of the eelgrass beds where the geese feed and alternative locations where kite surfers, canoeists, and other leisure users can access the water. The maps therefore helped the SLLP to improve the well-being of the geese without preventing leisure users from enjoying the lough.

For more information, contact Anna Liesching, GIS Department, Strangford Lough & Lecale Partnership (e-mail: sllpadmin@strangfordlough.org).



This interactive map on the www.strangfordlough.org website identifies land-based recreation around Strangford Lough & Lecale.

Canadian Hardware Heavyweight Builds Market Intelligence

Creating an In-House Solution Based on GIS Has Decreased Marketing Costs and Increased Sales

Highlights

- By using ArcGIS, RONA reduced its external consulting budget by 100 percent.
- With GIS, RONA's flyer distribution department can justify every promotional decision.
- RONA used ArcGIS to develop analysis tools that provide market intelligence at the touch of a button.

For a direct mail campaign to succeed, it must be targeted. It takes research, careful planning, and customization to ensure that the right message reaches the right individuals—those most likely to become repeat buyers. Nobody understands this better than Canada's largest hardware, home renovation, and gardening products retailer, RONA.

RONA is headquartered in Boucherville, Quebec, with administrative centers across Canada in Surrey, British Columbia; Calgary, Alberta; and Toronto, Ontario. The company was founded in 1939 by a group of independent Montreal-area hardware retailers to compete with larger wholesalers to get the best prices from manufacturers. Today, there are more than 800 corporate, franchise, and affiliate stores of various sizes and configurations across the country. All these stores are serviced by RONA's Geomatics and Market Intelligence department.

Tightening Up Direct Mail

Like many successful companies, RONA reaches out to its customers with direct mail that is delivered to a customer's door. After some initial research, RONA discovered that a high volume of flyers was being sent to areas that was not necessarily developing into sales. Since paper and direct mail campaigns are expensive, a more targeted approach to flyer delivery was required.

This map shows the highest-performing promotional flyer route for the store pictured based on the number of flyers delivered and sales generated.

In the past, RONA had been working with an external firm that provided a global view of the entire distribution network so that delivery areas could be planned strategically. While this approach facilitated a targeted distribution plan, working with an external firm had its own set of challenges. The process was difficult to manage, and there were costly delays. As a result, RONA decided to take matters into its own hands and develop an internal application that would optimize flyer delivery.

After assessing many solutions available, RONA decided to implement its own mapping system, based on ArcGIS and Microsoft Access. To analyze customer information, RONA used many different datasets from Statistics Canada, Canada's central statistical office that conducts a country-wide census every five years and produces statistics that are made available to individuals and organizations throughout the country. RONA also combined city maps and information from a popular national loyalty rewards program, AirMiles, to generate a nationwide snapshot of customers.

The system RONA developed allows staff to closely monitor customers through individual profiles linked to specific trade areas. By displaying information visually and effectively analyzing relationships between people, places, and behavior, new patterns and trends were revealed that would not have been evident using traditional business systems.

RONA also leveraged Esri's ArcGIS to develop analysis tools that provide market intelligence at the touch of a button. For example, users can analyze store market areas to see where markets overlap, find out which customers subscribe to newsletters, pinpoint neighborhoods that contain a high concentration of customers, and then print off their data in usage reports.

"We continuously scan Canada's markets, and using GIS lets us quickly develop distribution strategies for new, expanded, or relocated stores," says Simon Généreux, manager, Geomatics and Market Intelligence at RONA. "As a result, we're distributing 10 percent fewer flyers, which is saving us thousands of dollars per year."

Up to 100 Percent Cost Savings

Data can be extracted and shared with RONA's suppliers and distributors. Within minutes, RONA can determine the quantity and version of flyer that is needed for each trade area and provide this information to suppliers. A distribution module is directly integrated with ArcGIS so that the supplier can strategically plan the most effective flyer distribution runs using easy-to-understand map views. Flyer orders are then placed directly through the application.

With a more targeted approach to marketing, RONA is better able to serve its store network of 800 stores located across the country. By leveraging an in-house customized ArcGIS application, staff can analyze geographic areas and match the best flyers to the correct stores. This has virtually eliminated accidental shipping of promotional flyers to areas where the promotion was not occurring.

RONA's Geomatics and Market Intelligence department now finds it easier to create and adhere to annual budgets because it can see at a glance the precise number of flyers that will be distributed in the coming year. The company has saved money by eliminating promotional flyers in underperforming zones and by focusing energies on areas of high customer concentration. By no longer relying on an external company to conduct data analysis, RONA has also been able to save costs. In fact, by bringing the flyer distribution process in-house, RONA has reduced its external consulting budget by 100 percent.

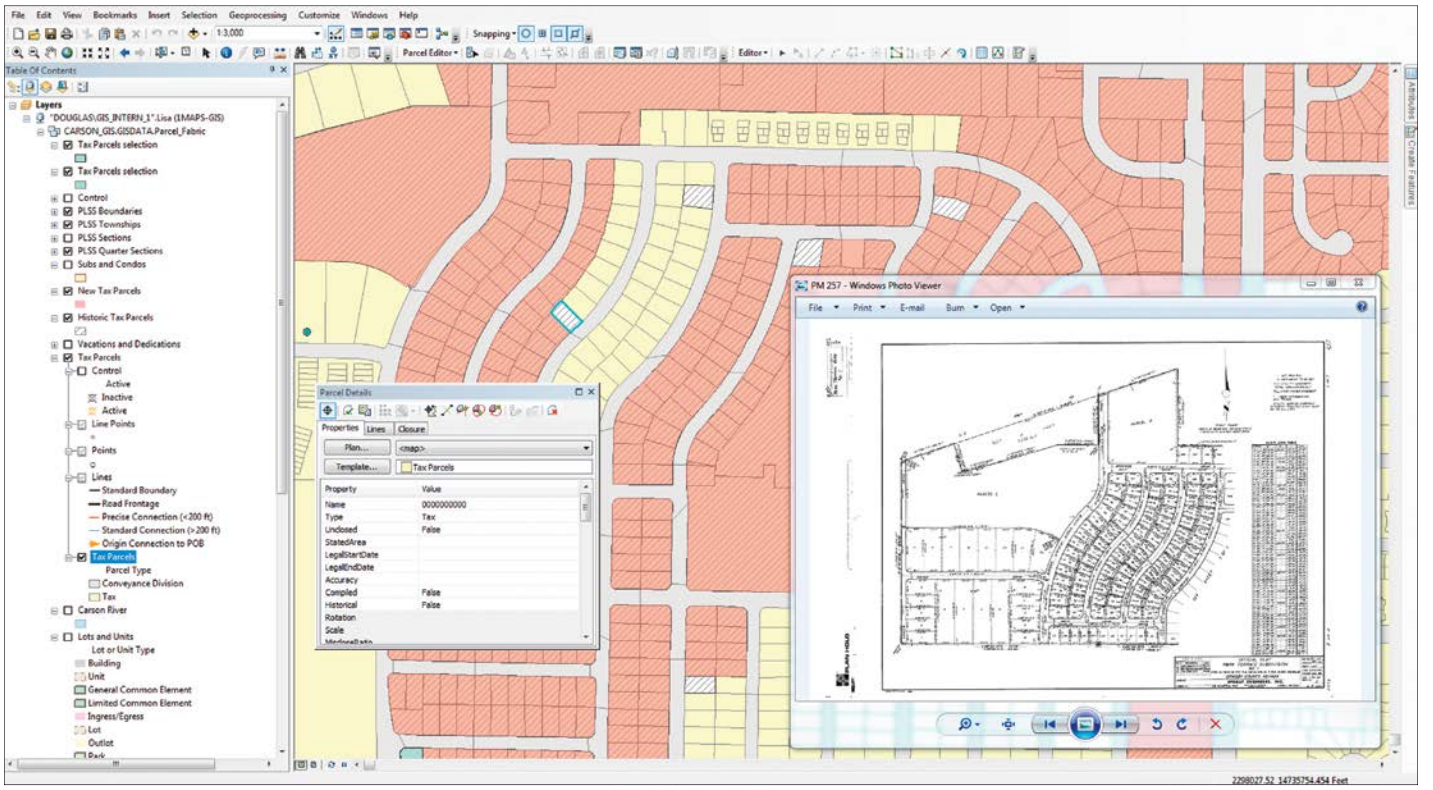
For more information, contact Simon Généreux, manager, Geomatics and Market Intelligence, RONA (e-mail: Simon.Genereux@rona.ca).

Douglas County Meets Growing Demand for Parcel Maps

ArcGIS for Land Records with Parcel Fabric Helps Create and Manage Parcel Maps

Highlights

- ArcGIS for Land Records delivers an array of powerful features, like parcel fabric, as part of the core software.
- Model workflows and templates enable GIS professionals to quickly provide tailored apps to end users.
- Jump start package accelerated the Douglas County GIS team's progress, helping deliver quick results.



The Douglas County, Nevada, GIS team uses the ArcGIS for Land Records solution and its parcel fabric to manage parcel maps for itself and other city and county governments it serves, including historic Carson City, Nevada.

Demand for the property maps maintained by local and regional governments is steadily growing. Their core function—showing where one property ends and another begins for tax levies—is now just one of multiple uses by government and others.

One recent example was the aftermath of Hurricane Sandy, which struck the eastern United States in 2012 and caused an estimated $71 billion in damages. To assist in recovery efforts, adjusters from private insurance companies and the Federal Emergency Management Agency relied on local land records to assess and understand the damage.

Yet, while demand for land records grows, funding for the agencies that create and manage them shrinks, forcing officials to seek efficiencies and reconsider traditional approaches. Hundreds of cities and counties have consolidated the many different functions that go into creating and maintaining land records by using the parcel fabric templates.

Consider Douglas County, Nevada. The county's challenges have a common thread to local governments everywhere in that they revolve around land records management.

In Minden, Nevada, the picturesque semirural community east of Lake Tahoe and the Sierra Nevada mountain range, Douglas County GIS supervisor Eric Schmidt's four-person GIS team delivers services not only for the team's employer Douglas County but also for neighboring Storey and Lyon Counties and historic Carson City, a tourist destination 14 miles to the north. Schmidt was experienced with Esri software before joining Douglas County and switched the department to the ArcGIS platform. Prior to Schmidt's arrival, the county used ArcView, but mainly for collaboration with the local 911-CAD system.

Douglas County is in the midst of advancing its GIS services using the ArcGIS for Land Records solution. Part of Schmidt's vision was to expand the GIS team's capabilities beyond producing printed maps for clients in departments throughout Douglas County and its neighbors. Because the GIS team was well established even before his arrival in 2010, it was kept busy filling requests for hard-copy maps.

"That left precious little staff time for anything else," Schmidt says. He and his staff were quickly able to take advantage of downloadable applications and workflow templates available for the land records solution. And even though their GIS department doesn't have a developer on staff, they could build the kind of applications they needed.

"These templates allow us to put GIS in the hands of non-GIS practitioners so that they can have immediate access to data for decision making," says Schmidt. "This is freeing us up to refine our workflows, deepen our data, and expand our sphere of service."

Since ArcGIS for Land Records is a commercial off-the-shelf (COTS) solution, it uses implementation patterns common in local government for land records. These include efficient data management, spatial analytical tools for value analysis, data access in the field, executive dashboards, and communicating information to the public. Unlike highly customized systems, COTS software is updated and supported.

In 2012, Schmidt's team was ready to start using the Esri parcel fabric—a dataset that is part of the Land Records solution—to help create and manage parcel maps. The parcel fabric enables users to stitch land parcels together like pieces of a quilt. That way, adjustments to one piece are automatically transferred to every other piece affected. Like the Land Records solution, parcel fabric is included as part of ArcGIS for Desktop Standard and ArcGIS for Desktop Advanced licenses.

With the parcel fabric, users can take advantage of parcel polygons that are created from boundary lines and points with associated accurate legal information stored as attributes. This allows the user to have a seamless network of parcels with important legal dimensions. These points, lines, and polygons are easily updated using efficient editing tools designed specifically for maintaining land records. Users can also easily track the history of parcels and link to related record documents like deeds and surveys.

Schmidt and his team worked with Esri Professional Services to help migrate parcel data into the parcel fabric in a process known as a jump start. Over a three-day period, Schmidt's team and Esri migrated all the data for Carson City. As part of the process, Esri consultants explained the structure of the parcel fabric, the parcel types defined in the Local Government Information Model, and parcel fabric editing. They also traveled with the team to Carson City to review assessor map books and the data structure.

For more information, contact Eric Schmidt, GIS supervisor, Douglas County, Nevada (e-mail: eschmidt@co.douglas.nv.us), or Dan Stone, Esri (e-mail: dstone@esri.com).

Mark DePenning

GIS Hero

Mark DePenning

Mark DePenning's path to GIS was literally trial by fire. DePenning was a fire fighter in Greenville, South Carolina, when he first heard about the technology. In 1983, he received an invitation from the fire chief asking him if he'd consider a desk job. DePenning balked, but his boss persisted. Recalls DePenning, "He asked me to help the Greenville Fire Department adopt this new thing—called GIS."

But DePenning was worried. He knew how to handle fire. He didn't know what to do with computers or GIS. He participated in a two-week in-house training course in ArcInfo 2.6. "I've always prided myself on being able to adapt and figure things out," he says. "Yet I have to admit it was the most intimidated I've been in my entire life." But the promise of what he could achieve convinced him to keep at it. "What I heard and saw really got me excited about the future of GIS. I knew there was something there and we were pioneering a new technology," DePenning adds.

Born in Oskaloosa, Iowa, DePenning attended college but never graduated. "When I left college, I figured I'd just stay in Iowa the rest of my life—working in a construction trade. It didn't occur to me that I would do anything else," says DePenning. But he had recently married, and his wife missed her family in South Carolina. The couple decided to move. Combing the local classifieds, an ad caught his eye. "It said the Greenville Fire Department had an opening for a fire fighter." He got the job and worked as a fire fighter for almost four years when he got the call from the fire chief to help the department use GIS.

"My first map was a demonstration map of fire incidents drawn on a single-pen plotter," he says. "It was pretty crude. But I really caught a vision of what GIS could do for us."

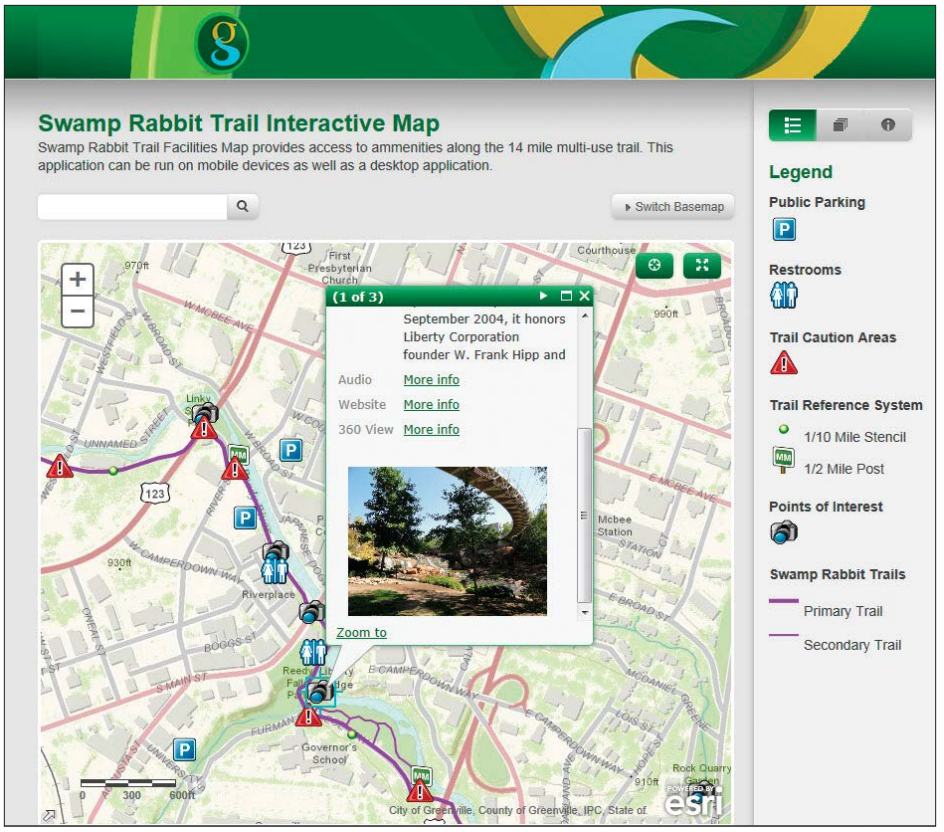
Greenville became the first city in the United States to successfully implement GIS in a municipal environment. An impressive goal given Greenville's size. Back then, it had just over 50,000 people.

Access to data was a big obstacle in those early days. "I realized the only way we could have meaningful data is if we built it in-house, incident by incident," DePenning says. "So I started working with our dispatchers to get fire incident reports automated. This laid the groundwork for eventually utilizing fire department data for trend analysis." Printing maps on the hardware was a hurdle, too. "Creating a zoning map of the city took over eight hours to generate, and then our pen plotter took another hour to draw," he continues. "Even when we upgraded to an electrostatic plotter, we had problems with humidity. We had to put a plastic tent over the whole thing and run a humidifier to keep it ready for map requests."

But DePenning worked through those challenges, ultimately coauthoring Greenville's first end-user GIS application. The application was a hazardous materials evacuation model, which overlaid a plume on demographic data to show emergency managers which areas needed to be evacuated in a chemical spill. It was internationally recognized with an award from URISA.

In 1989, DePenning transferred from the Fire Department to work full time in the GIS Department. "Right after making the move, my boss left," he says. "The city began looking for someone to lead the development. They wanted someone with a lot of hands-on GIS experience." None of the candidates were as qualified as DePenning. A year into the search, he was offered the position of GIS administrator.

Keeping data accurate was DePenning's number one goal and toughest challenge. "My other goal was trying to develop applications so people could actually use the data," he says. "I started the first regional GIS Day so key influencers could see GIS in action and provide us with more resources. I wanted to show them that GIS was not a joke. It was really making a difference in how the city was doing business."



Greenville's Swamp Rabbit Trail Interactive Map shows a variety of amenities along the trail, including pictures and links to audio and 360-degree imagery.

His vision paid off. "The accuracy of our data and access to it was a huge deciding factor in the sports arena coming here," he says. "It gave us the biggest arena in the state at the time. Our use of GIS landed us that contract. It has continued to make us a better city by supporting our day-to-day operations and decision making."

It was clear to DePenning that city operations had benefited from GIS. But he was determined to get Greenville residents more actively engaged with the technology. Recently, he saw an opportunity with a new trail the city opened called Swamp Rabbit. Safety was a growing concern because the trail runs 14 miles along the river and is isolated in some areas. He began to ask questions. How do first responders find people in trouble? How do those people communicate where they are? And what about daily issues like where are the closest restrooms? Where's the best parking? Those questions led DePenning and his team to create an application they call the Swamp Rabbit Trail Interactive Map.

DePenning and his team surveyed the entire trail using GPS and collected points of interest along the way. "ArcGIS Online provided the infrastructure to load the application on any device, so people can use it on their desktops before they leave or follow along on their cell phones once they're on the trail—it's taken off like crazy," he says. The team is now working on a similar application for Greenville's downtown events and attractions.

For more information, contact Mark DePenning, GIS administrator, City of Greenville, South Carolina (e-mail: mdepenning@greenvillesc.gov).

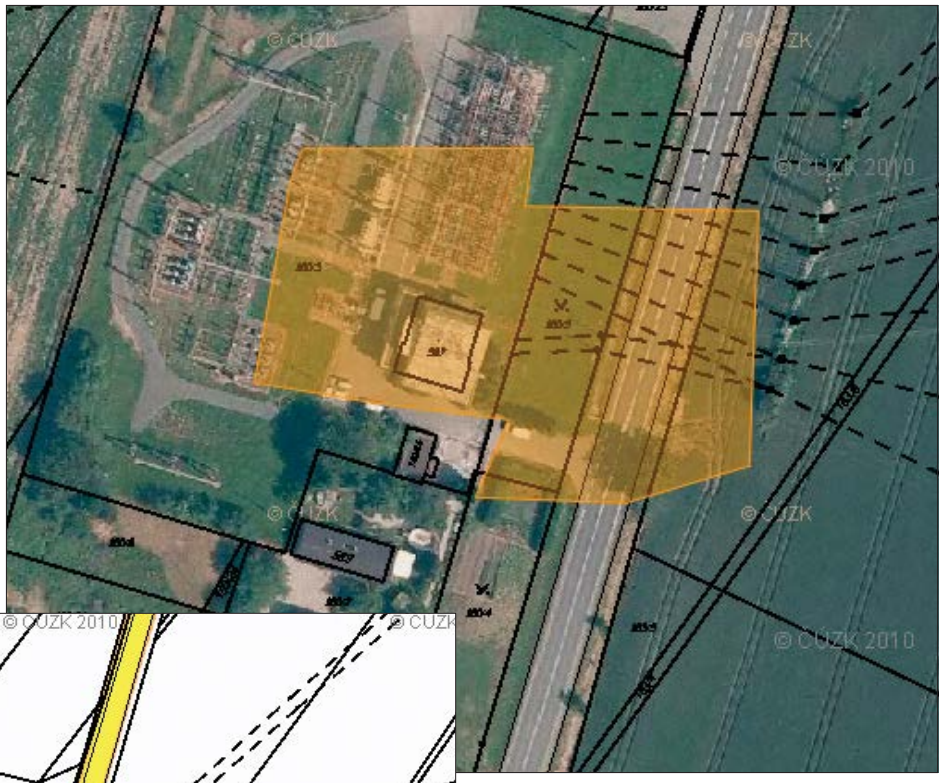
Czech Republic Electric Utility CEZ Streamlines Appraisal Requests

Geoportal Expedites Permit Requests for Staff and Customers

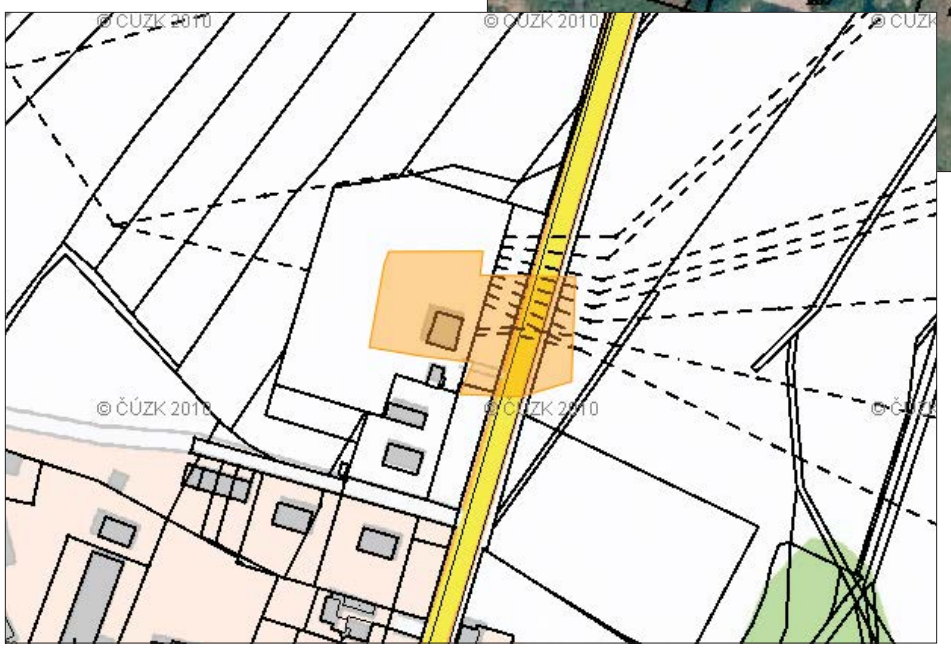
Highlights

- The CEZ Geoportal increases internal efficiency by delivering data to staff and customers.
- Submitting a request has been simplified with GIS.
- During the first year, 88 percent of the 160,000 requests were handled electronically.

In the Czech Republic, most electric wires, telecom lines, and gas pipes are buried in the ground. Therefore, the law requires landowners to obtain construction permits before building. When a landowner needs a construction permit, he or she must first go to the utility company to obtain an appraisal form—an explanation of the type and location of buried wires and pipes.



In the Czech Republic, most electric wires, telecom lines, and gas pipes are buried in the ground.



CEZ is implementing GIS as a core enterprise system. The CEZ Geoportal is one of the results of the synergy of GIS and enterprise resource planning systems.

CEZ, the largest electricity producer in the Czech Republic, recently used ArcGIS technology from Esri to implement the online Appraisal Request Form Portal, also known as the CEZ Geoportal, to quickly deliver appraisal forms to customers. CEZ processes 160,000 requests per year, an average of 13,000 per month. CEZ operates the CEZ Group, which delivers electricity to nearly 3.5 million customer supply points in the Czech Republic.

Before CEZ Geoportal, staff members had to manually process about 120,000 appraisal request forms per year on the location and parameters of its networks, work that had to be done within 30 days of the request. Those tasks were handled by expertly and technically skilled GIS operators.

"In the past, it was quite difficult for customers to request an appraisal form," says Frantisek Fiala, an expert consulting specialist at CEZ. "The process involved a lot of paper work and usually took more than half a day for the common citizen to make the request properly and to send it through mail. The web portal simplified the process to minutes."

The CEZ Geoportal was designed to significantly increase internal efficiency by delivering data to staff at the CEZ Group, as well as to customers. The main benefit of the solution is that it facilitates faster delivery of appraisal forms to customers. It is estimated that at least 30 percent of the appraisal forms can be processed fully automatically. Similarly, in many cases in which there is an actual interference with the network, the forms can be processed without needing an operator's intervention.

Another important benefit lies in expected savings for the public—an estimated 84,000 workdays will be saved each year. Furthermore, the implementation of automatic electronic communication aids the environment by reducing the use of paper.

During the first year of operation, 88 percent of the 160,000 requests required were submitted electronically through the geoportal. CEZ customer service staff then needed to handle only the remaining 12 percent of the requests. In addition, 96 percent of customers requested a response via e-mail instead of regular mail.

The main reasons for building the Appraisal Request Form Portal included the need to reduce expenses for internal processes and to respond to growing customer requests for online communication.

The CEZ Geoportal is also used to facilitate online data sharing and communication with government officials and emergency management centers and other stakeholders. Users enter their requests via the portal in several steps. At their disposal they have advanced locating functions for looking up the area of interest and tools for drawing request polygons and submitting necessary information for follow-up communication.

Submitted requests are consequently handled by a set of tools that, via e-mail, confirm to requesters the enrollment of their requests into processing. Thanks to the use of ArcGIS for Server, it is possible to automatically generate reports on interference (or noninterference) with the network and produce output prints or digital data. After comparison with records from SAP databases, the resultant appraisal form gets finalized as a digital document, or a printout is forwarded to the courier service in cases where the user requires paper.

The process is fully automatic and provides users, by means of a web application or a thick client, instant access to up-to-date information on the current state of the processing of their requests.

CEZ is implementing GIS as a core enterprise system. The CEZ Geoportal is one of the results of the synergy of GIS and enterprise resource planning systems. It performs geoprocessing tasks that were formerly carried out by a large group of operators, dramatically saving operating costs and time. Data sharing is essential for enterprise and government cooperation, and the CEZ Geoportal is a solution designed to distribute spatial information to support the government decision-making process.

For more information, contact Jan Soucek, ARCDATA PRAHA, s.r.o. (e-mail: jan.soucek@arcdata.cz).

Using the Story Maps Publishing Platform

Story maps are simple web applications that let you combine web maps with text, photos, and other content to tell geography-based stories. Esri has developed a series of apps that accommodate various forms of storytelling, including point-to-point tours, points-of-interest collections, and thematic map series.

These pages present an overview of Esri's storytelling apps. All the apps are open source and can be downloaded from the story maps website or GitHub. Increasingly, configurable apps are directly accessible on ArcGIS Online. Use the share function to choose an app and configure it to suit your needs. These apps are changing rapidly; visit the story maps website for the latest.

storymaps.esri.com

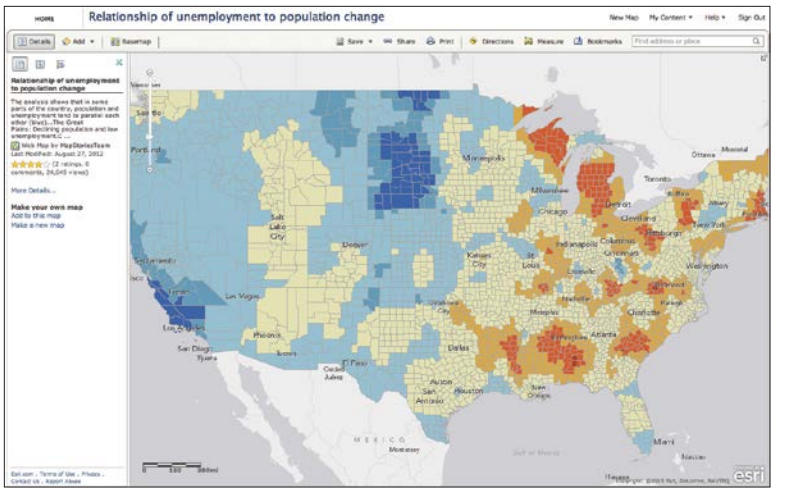
How to make a story map

1 Consider your audience

Before building your story map, it's important to think about exactly what story you're trying to tell and the audience you want to reach. Text should be brief, maps simple, and message as clear as possible.

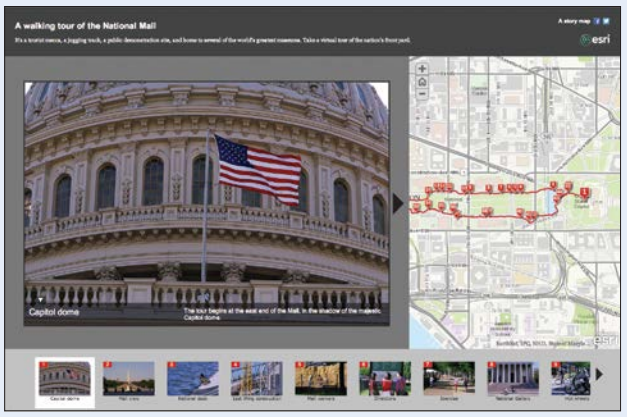
2 Build your web map

Web maps combine basemaps with overlays, map and feature services, and additional data derived from spreadsheets and shapefiles. Before you build your map, determine which storytelling template you'd like to use. Some have special requirements; various apps consume either a single web map, two or more layers of a single map, or several web maps.



Featuring four story map apps . . .

Map Tour

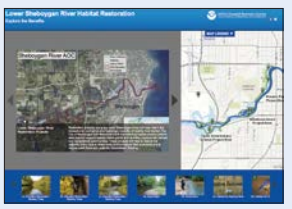


Use Cases

TOP: National Parks of India by Abhishek Sindal.

MIDDLE: Lower Sheboygan River Restoration by NOAA Coastal Services.

BOTTOM: Downtown Santa Cruz Buildings by the City of Santa Cruz.



A sequential, place-based narrative

A growing community of storytellers has found many uses (right) for the Map Tour app. The app presents a place-based narrative of photos and captions, each with a map location. A recent enhancement provides "responsive" design, adjusting the format to suit a variety of screen sizes. A builder mode facilitates easy compilation and editing.

Features

- A series of geotagged photos with map and thumbnail carousel is available.
- Previous/Next pointers enable users to click sequentially through the tour.
- Users can use the map controls and carousel to move around at will.
- Responsive design accommodates smartphone screens, as well as tablets and PCs.
- Builder mode enables easy editing.

Tabbed Viewer

Use Cases

TOP: Poverty in School Age Children by Blue Raster.

MIDDLE: Toronto Crime: Mapping over Time by Esri Canada Limited.

BOTTOM: Utah Fire Suppression and Restoration by State of Utah Department of Natural Resources.

A single map or series of related maps

The versatile Tabbed Viewer app is useful for featuring a single map or presenting a series of related, thematic maps. If the author adds two or more maps to the app, a tab for each map appears along the bottom of the title panel. If these maps have a temporal component, a timeline will also appear.

Features

- The app accommodates a single web map or between two and five related maps.
- The side panel text is generated from the web map descriptions on ArcGIS Online.
- A timeline is included (if enabled).
- Coming: responsive design to accommodate smartphones and tablets; builder app for easier editing.

Other story map apps . . .

Although the apps described above are the most popular with users, additional storytelling formats are available. Check the story maps website regularly, as apps are being enhanced and updated frequently.

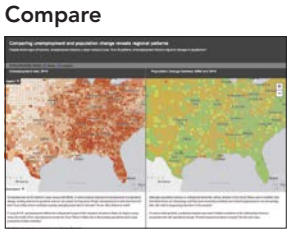
Playlist

This app is useful for featuring web maps that display an array of locations and associated images. It gives users the option of clicking a map icon or perusing a "playlist" of thumbnail images and titles.

Map Matrix

This app is useful for showing off a collection of web maps. It taps an ArcGIS Online group to display maps in a rotating array of preview windows. Users can access descriptions and larger web map views.

Compare

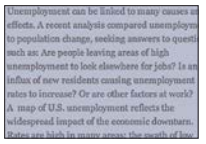


Two or three maps are displayed side by side in this app. As the user pans and zooms on one map, the other maps also pan and zoom. Users can toggle descriptions and legends on and off.

Basic

Occasionally, a web map is more or less self-explanatory. This app provides a clean and simple context for displaying a map, adding only a title banner and drop-down map legend.

3 Assemble multimedia content



Text should be brief. Make your headlines active and descriptive if you can. Some story apps tap web map descriptions; read our how-to documents for details. Images must be accessible via web addresses, unless they're part of a feature service (Map Tour app). Remember: Large images take longer to load, so optimize them to fit the story map.

4 Configure your story map app

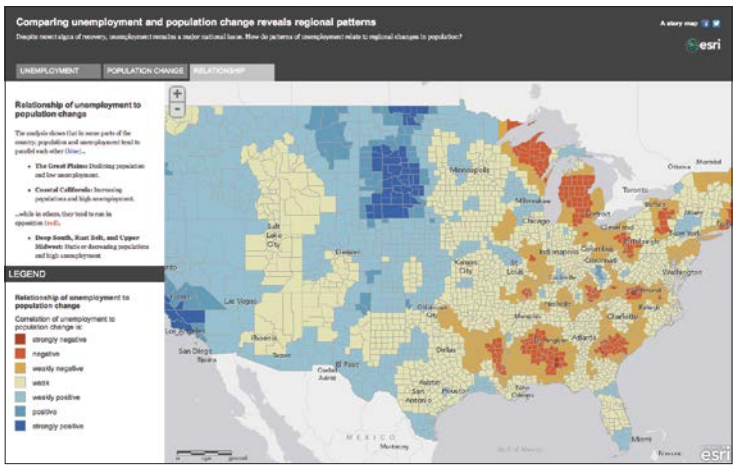
Story map apps can be configured by providing your web map ID number and selecting a few preferences. Many can be configured directly through an ArcGIS Online web interface. For the rest, a README file provided with every app steps you through configuration and hosting options.

5 Refine your story map

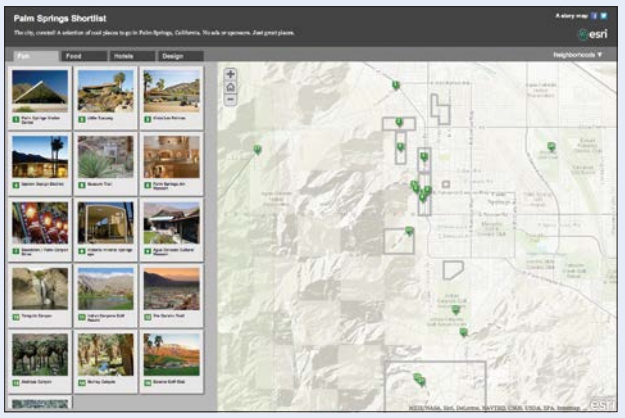
Our apps enable users to quickly create and publish story maps. As with all creative efforts, however, the quality of your story will increase as you refine it. Details, such as map colors and symbols, pop-up design, wording of map legends, and choice of photographs, are all vital. Don't be afraid to go back and forth—perhaps many times—to make adjustments.

6 Publish your story map

Place your story map on a server that is accessible to your audience—whether it's the general public or a specialized group behind an organizational firewall. Your ArcGIS Online account provides an ideal platform for publishing your story maps—and for sharing your data, collaborating with colleagues, and accessing the best and latest storytelling apps.



Shortlist

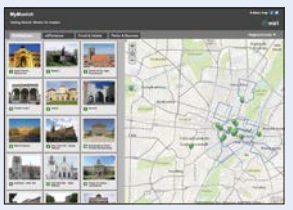


Use Cases

TOP: MyMunich by Esri Deutschland GmbH.

MIDDLE: Citadel Agriculture, Italy, by GeoCare GIS Lab.

BOTTOM: Ruins of Carthage Tour (Tunisia) by Graphtech.



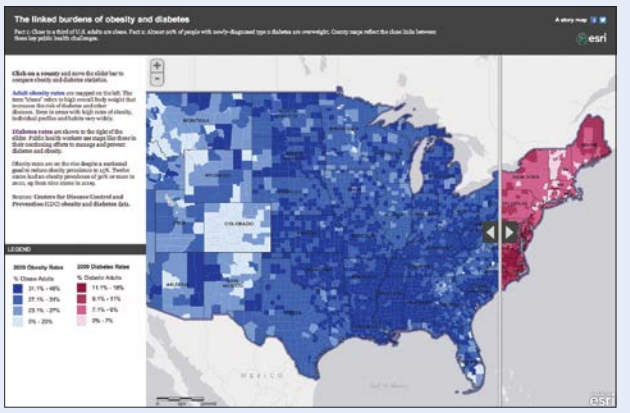
Points of interest in and around a destination

A curated list of points of interest can be organized into two to four categories, presented in the Shortlist app as tabs. Clicking a map icon causes an overlay panel to appear, with photo, text, and web link. Neighborhoods can be featured in a drop-down list.

Features

- Points of interest (POIs) appear as a thumbnail grid in a side panel.
- POIs can be organized into categories, which appear in the app as tabs.
- As users pan and zoom around the map, the thumbnail list updates to show only the POIs in the current map extent.
- Clicking a map icon calls up an overlay panel with more detailed description, photo, and web link.
- A drop-down menu enables users to zoom to neighborhoods or other locations.

Swipe

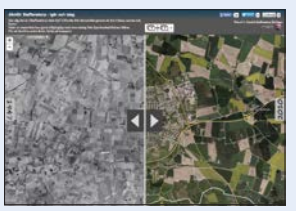


Use Cases

TOP: Staffanstorp Then and Now by Geoinfo Staffanstorp-Kavlinge.

MIDDLE: Human Activities Are Reshaping Earth's Surface by Esri.

BOTTOM: Feeding the World by University of Minnesota Institute on the Environment and Esri.



Comparing two maps using a swipe function

The Swipe app makes it easy for users to compare two thematic layers by moving a swipe bar back and forth across the screen. The app consumes a single web map with two layers. Although the Compare app (opposite page, bottom) also enables comparison of two maps, the swipe function is generally more engaging. It's effective for showing change over time with imagery, as well as comparing related polygonal map themes.

Features

- Two layers of a single web map are displayed.
- Users move a swipe bar back and forth across the screen.
- If both map layers include pop-up windows, these will change as the swipe bar moves across a point.*
- Dual map legends and text are displayed in a side panel.*
- A series of views can be created by adding bookmarks to the web map.*

* Note: The last three features were in production at press time.

What's next for story maps?

Esri is continuing to produce new stories and develop new user experiences. Meanwhile, a growing worldwide community of storytellers is using these open source apps, spinning new tales and often modifying the apps in interesting ways. We want you to join this community!

Responsive design

A high priority of the story maps team is ensuring that all its apps work flawlessly across all viewing platforms, from desktop to tablet to mobile. The team is working to retrofit its templates with this capability.

Geoblog

This new app will integrate blog entries with a web map. Part of the authoring process for each blog item will enable customizing the state of its accompanying web map, including scale extent, pop-up window, and theme.

Briefing book

A tablet app will enable users to present "books," or reports, that include text, web maps, and other multimedia content. Some books might be organized around text narratives; others might focus on collections of maps.

Tracker

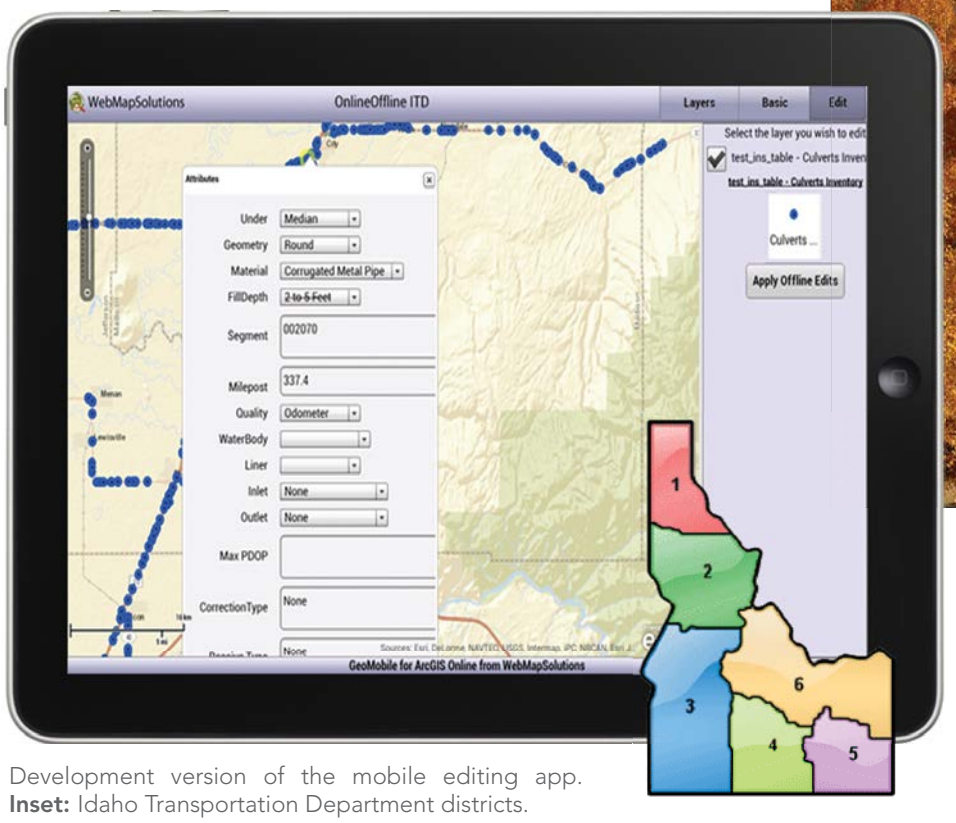
An app will specialize in presenting routes or tracks along with associated information. Tracks might include radio-collared animals, scientists in the field, or motor vehicles. Data might be archival or near real time.

Idaho Transportation Department Connects Field Crews with ArcGIS Online

Web-Based, Cross-Platform Mobile Application Is Just the Ticket

Highlights

- ArcGIS Online helped overcome the organizational and data access challenges currently faced by ITD District 6 and other districts.
- Updated and new feature attributes, as well as images, are uploaded directly to ArcGIS Online from mobile devices.
- The mobile application is versatile and highly configurable.



Development version of the mobile editing app. **Inset:** Idaho Transportation Department districts.

Idaho is a land of diversity that is linked by its road system.

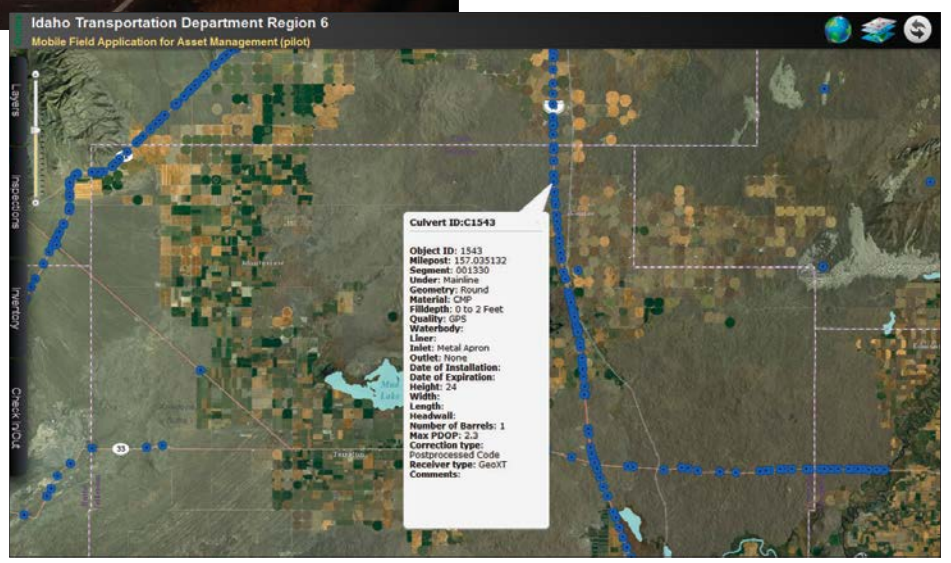
Once considered part of the American Wild West, today the state of Idaho is a large, sparsely inhabited state. It is a land of contrast, with spectacular mountains, deep gorges, and nine national forests covering two-fifths of the state. Most of the state's population lives in the semi-arid southern Snake River Plain, a land of rolling hills, in marked contrast to the rugged, mountainous central and extreme eastern parts of the state. Naturally, Idaho's roads link all this diversity together.

The Idaho road network is administered by the Idaho Transportation Department (ITD). ITD has jurisdictional responsibility for almost 5,000 miles of highway and more than 1,700 bridges. The remoteness of much of this network is a key challenge to many of the ITD field crews. Hauling equipment for inspection and repair, over large distances, to uninhabited areas makes the work both difficult to do and coordinate. Often, cell phone access is not possible.

ITD is organized into six districts. ITD District 6 covers the northeastern portion of the state. In 2012, Bill Shaw, a project engineer and manager of the Planning and Public Involvement Section in ITD District 6, turned his attention to overcoming some of the challenges faced by ITD. The purpose was essentially twofold. First, streamline by moving away from the paper-based system used by field crews and reducing the number of data silos within the district. Second, install a mapping system to better coordinate field-workers and share information within the agency and with the public. ArcGIS Online was to be the technology at the center, given its potential to provide a unified solution. The goal was to build a mobile application targeted at field crews, which leveraged ArcGIS Online and helped demonstrate the capabilities of this new platform to ITD District 6 and the wider organization.

Project Planning

ITD District 6, under Shaw's guidance, was looking to work with a US-based company with ArcGIS Online expertise, which specialized in the development of mobile applications. He narrowed the field down to WebMapSolutions, a GIS software company and Esri Partner based in Salt Lake City, Utah, specializing in the development of both web and mobile GIS applications. Much of the company's focus is now on ArcGIS Online. Given this in-depth knowledge of ArcGIS Online and mobile development, ITD District 6 commissioned WebMapSolutions to help with this investigation. The work was funded by the US federal government and closely supported by Esri under the American Association of State Highway & Transportation Officials Technology Implementation Group UPlan initiative. The mobile application planned was to provide data collection and editing capabilities to field crews. So inspections of ITD assets, such as culverts, would be done using a tablet-based mapping application instead of pen and paper. Feature attributes could be updated, new features added, and



The IDT mobile interface.

images attached to individual features and then uploaded to ArcGIS Online directly from the mobile device. Given the lack of Wi-Fi access in much of the state, a key requirement of the mobile app was for it to function in both connected and disconnected modes.

Mobile Data Editing App Project Phases

WebMapSolutions took a two-phase approach to the development of the mobile editing application. In the first phase, a technical investigation was undertaken, the planned end result being a working prototype. The second phase targeted a production release.

Mobile technology continues to evolve. There are two "flavors" of mobile apps: those accessed via a web browser and those that are installed and can be downloaded from the Apple and Android mobile app stores. In phase 1 of the project, it was decided to develop a web-based, mobile, cross-platform application built in HTML5.

Phase 1 was successfully completed at the end of 2012. Since the data had originally been published in ArcGIS for Server, it was decided to simply optimize the data and remain focused on mobile development. ArcGIS Online was to be part of the second phase. Many technical questions were answered in this first phase and application workflows and design put in place. This work and what was learned would help guide the next phase.

Work began on phase 2 of the project in January 2013. Phase 2 specifications included the following:

- Publishing and accessing data through ArcGIS Online
- Greater focus on the data, most notably the application of the Transportation Data Model
- The ability to use the mobile app in disconnected or offline mode

ArcGIS Online was an important addition to this second phase of the work. The use of this new platform offers both short- and long-term benefits. From a development perspective, the mapping platform simplifies the code required. ITD District 6 staff can now publish web maps without the need of specialized GIS knowledge.

Given the new requirements, most notably offline data access and editing, it was decided to develop an installed application in place of a web app. Adobe's Flex was used in place of HTML5.

Online/Offline Mobile App Development

The mobile application was designed to be intuitive. In areas of poor or no Wi-Fi service, users have the option to switch to offline mode. When offline, the data used by the app is local, or stored on the mobile device. Features can be added, edited, or deleted. Feature attachments—images, audio, and video—can also be included. When back in Wi-Fi range, users can upload the changes to the mapping platform.

An important finding in the first phase was performance degradation when more than 1,500 editable features were visible. Both map panning and zooming were slow with a large feature count. ITD District 6 is subdivided into field office areas. Since field crews operate from these offices, servicing these areas, it was decided to publish web maps for each field office area. Crews operating from each field office loaded their own web maps in the mobile app. This eliminated potential performance issues and provided field crews with targeted, task-specific data.

The mobile app was designed to be highly configurable. It relies on a configuration file, which allows administrators to not only control the web map consumed by the app but also the look and feel of the interface (logo, title, and color).

Looking Ahead

Phase 2 of this development effort was ongoing during the first quarter of 2013. Providing new tools to ITD District 6 field crews is the immediate goal. ArcGIS Online, as a mapping platform, helped overcome the organizational and data access challenges currently faced by ITD District 6 and other ITD districts.

For more information, contact Bill Shaw, project engineer and manager of the Planning and Public Involvement Section in ITD District 6 (e-mail: bill.shaw@itd.idaho.gov), or Matt Sheehan, principal at WebMapSolutions (e-mail: matt@webmapsolutions.com).

Sandy City Implements GIS to Clean Up Its Streets

By Ryan Kammerer, GIS Coordinator, Department of Public Works, Sandy City, Utah

Highlights

- The city is tracking 62 vehicles using Esri Tracking Server and Tracking Viewer.
- Vehicle history can be adjusted from a few minutes up to several days of vehicle use.
- Data can be easily viewed in real time using a Flex-based web map application.

Located in the southeast portion of the Salt Lake Valley, Sandy City is nestled at the base of the Wasatch Mountain range and is just minutes away from Utah's famous world-class skiing. Sandy is the sixth-largest city in Utah, with a population of more than 87,000 residents. The city covers a total area of about 23 square miles and contains a network of city-maintained streets spanning over 300 miles. Like most municipalities that are this size, keeping the roads safe, clean, and well maintained is no easy task. Sandy City's Public Works department removes snow from these streets in the winter, sweeps and maintains them in the summer, and offers bulk waste cleanup to all residents twice a year in the spring and fall.

The Public Utilities department has vehicles throughout the city as well, maintaining the underground infrastructure of waterlines and storm drains. Public Utilities employees routinely inspect city wells to ensure safe drinking water and are responsible for the upkeep of all city-owned streetlights. At any given time during the day, these two city departments have vehicles citywide, delivering the important services at the high standards the citizens have come to expect.

Both of these departments recognized the importance of tracking their fleets of vehicles by using an automatic vehicle location (AVL) solution. Specifically, to ensure that the vehicles are being used efficiently, keep residents and employees safe, and monitor vehicle use, Sandy City needed a way to track its fleets. It was determined that an AVL solution was needed that provided real-time data of vehicles, to be updated frequently, and the ability to store this data for analysis. Initially, an AVL tracking service was set up using an outside company. Though department management was able to view a vehicle's location, speed, and direction of travel in real time, ownership of the data and monthly expenses for this service became an issue. Furthermore, a backlog of only eight hours of data was kept available for analysis. It was decided that the city needed to take more control of how the data was being stored, accessed, and viewed.

After carefully reviewing options from several sources, Sandy City decided that Esri Tracking Server offered the best solution to monitor and record its fleets of service vehicles. Because Sandy City already used Esri products to store and manage its GIS, it was apparent that adding Esri Tracking Server was an easy choice. Not only could the server be modified to receive vehicle information from existing modems already installed in vehicles, the data could also be easily viewed in real time using a Flex-based web map application; this viewer was customizable to fit the city's needs, and data could be stored in the enterprise geodatabase, where it could be accessed for analysis at any time.

Since implementing Esri Tracking Server in February 2012, the city has continued to add vehicles, as well as expand the way this data is viewed and used. With the help of Esri Professional Services, a customized vehicle tracking widget was created for the Flex-based viewer. This widget allows the user to subscribe to a service based on department, track a specific vehicle within that department in real time, and view a bread crumb history of where that vehicle has been. The vehicle history can be adjusted from a few minutes up to several days of vehicle use. Since this information is retrieved directly from Sandy City's enterprise geodatabase, the data is displayed quickly and stored safely. The tracking widget displays all the currently active vehicles on a map of the city, and a pop-up window quickly gives any particular vehicle's current speed and an accurate date/time record down to the second. Vehicles are easily identified by type using customized icons that reflect the actual direction the vehicle is traveling.

Vehicle data that is logged with the enterprise geodatabase is archived monthly as its own feature class. This feature class is then added to a vehicle archive history map service, which is used by a modified search widget on the viewer and enables the user to view a prior month's vehicle history by selecting either a vehicle or a specific area of the city. All this means that management can easily bring up information on any vehicle's location, anywhere in the city, at any given point in time.

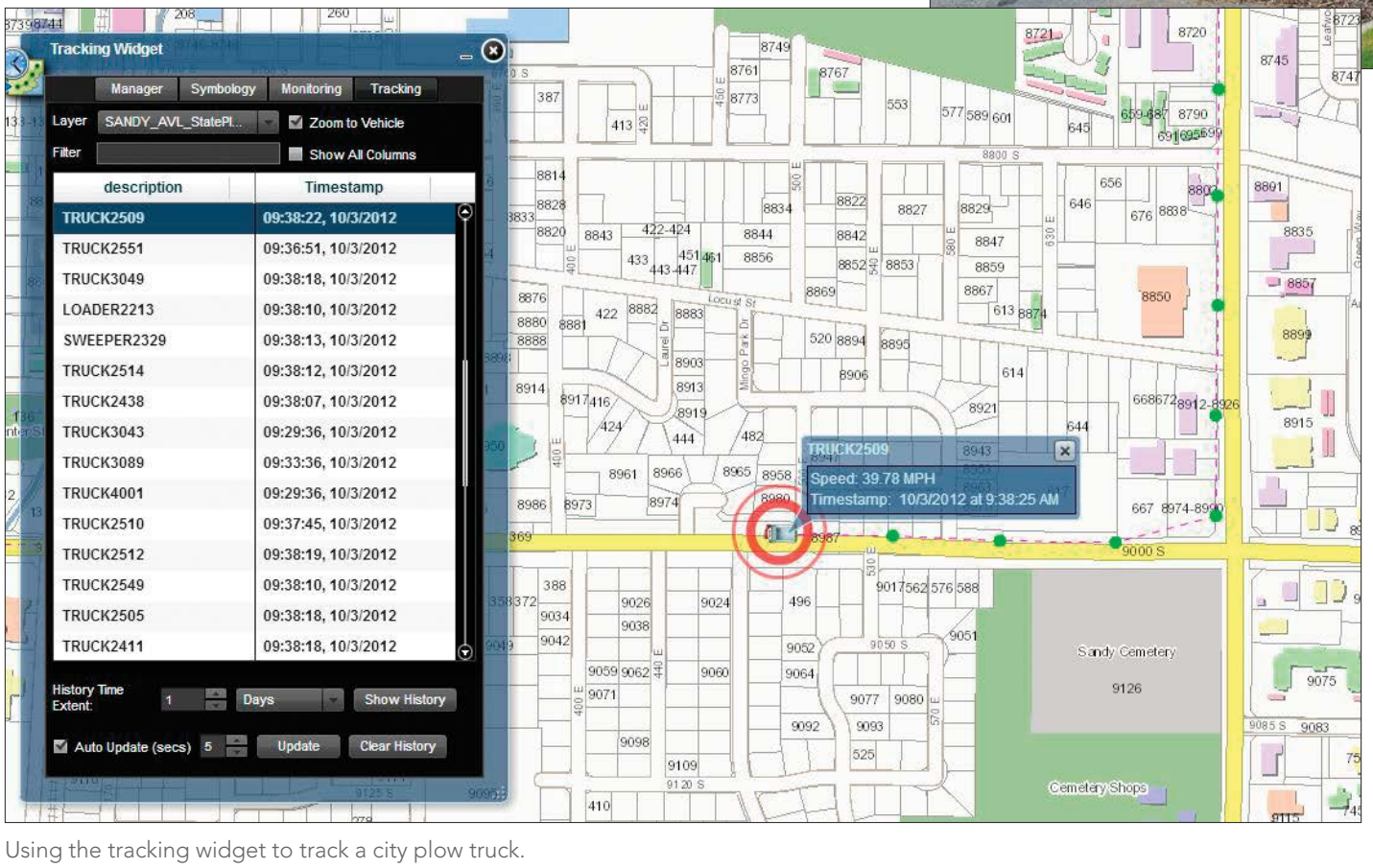
Sandy City's Public Works department has found Esri Tracking Server particularly useful to monitor its fleet of work vehicles year-round. In the winter during snow removal season, it is very important to be able to track where a vehicle is at all times, day or night, and to be able to dispatch a vehicle to another high-priority location if needed. Furthermore, a concerned citizen can receive accurate information concerning the last time a street was cleared of snow or if a city vehicle may have been in the area when damage occurred. Tracking vehicles has become an asset both in planning routes and preparing for the next snowstorm.

"The GIS software has been a very useful tool for training our drivers," says Paul Browning, Sandy City's Public Works assistant director. "During the winter, we can look at the vehicle history after a snowstorm and show the driver how to more efficiently plow his area of the city."

In the spring and fall, Public Works department trucks are busy picking up and hauling away bulk waste from residents. Using the Esri Tracking Viewer web map application, street supervisors are able to see which neighborhoods have been visited and schedule areas that still need to be cleaned up. During the summer months, street sweeping, machine leveling, and routine maintenance take place. The software has helped Sandy City employees keep their streets clean and well maintained.

At the current time, the city is tracking 62 vehicles, including standard work trucks, 10-wheeled dump trucks, street sweepers, front-end loaders, and bucket utility trucks. Though only two departments in the city are currently using Esri Tracking Server and Tracking Viewer to monitor their vehicles, future use may expand to other departments throughout the city, and many more vehicles are expected to be added to the system. As the city continues to develop GIS services, a simplified web map application may be offered to the public to access information concerning vehicle locations. Sandy City also hopes to continue to enhance how the vehicle history data is accessed and analyzed to further streamline workflow, improve city services, and continue to encourage safe and efficient driving practices throughout the city.

Tree branches being chipped for mulch during Sandy City's spring bulk waste cleanup.



Using the tracking widget to track a city plow truck.

About the Author

Ryan Kammerer is the GIS coordinator for the Sandy City Department of Public Works. He has earned a master's degree in geographic information technology from Northeastern University, Boston, Massachusetts, and is fascinated with technology and computer science. Having worked for several municipalities, he is passionate about using GIS to improve city workflows and operations.

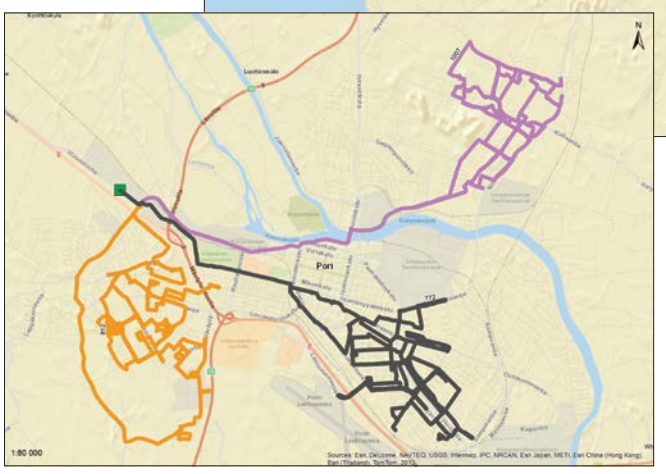
For more information, contact Ryan Kammerer, GIS coordinator, Sandy City Department of Public Works (e-mail: rkammerer@sandy.utah.gov), or Chad Helm, Esri (e-mail: chelm@esri.com).

Finnish City Enlists GIS Against Annual Snow Assault

Highlights

- Route optimization models reduce the overall number of kilometers driven by each snowplow driver.
- The city has unlimited access to ArcGIS software and its extensions through an Esri enterprise license agreement.
- GIS helps determine when and how a roadway should be plowed and what type of vehicle should be used.

John III, Duke of Finland and son of King Gustav I of Sweden, founded Pori in the Grand Duchy of Finland in 1558. Located at the mouth of the Kokemäenjoki River, the settlement was to serve as a harbor and market town to revitalize trade with continental Europe. Pori was originally populated with approximately 300 residents who relocated from the nearby town of Ulvila. The new city quickly became commercially successful, and Pori prospered as a regional center for commerce and shipbuilding.



Three examples of optimized snowplowing routes on pedestrian streets.

Today, Pori has nearly 84,000 residents who enjoy a high standard of living. The city is home to three universities, and the Pori Jazz Festival is one of the best-known music festivals in Europe.

Because of Pori's location in northern Europe, snow cover in the city lasts more than one-third of the year. Snowstorms can start as early as October and last into late April. During this time, city workers must keep 1,163 kilometers (723 miles) of streets and 295 kilometers (184 miles) of bicycle paths free of snow and ice.

Pori's public works department is a longtime user of GIS software, primarily for asset management and infrastructure maintenance projects. However, snowplowing operations were traditionally managed on a large wall map that detailed the city's service areas. Supervisors dispatched drivers to plow streets and bicycle paths in the service areas in the same way they had been plowed for the past few decades. That is, the supervisors assigned the drivers to successively plow and replow each area during the winter without any consideration of how the routes and snowplowing service might be optimized.

"The city's snowplow drivers just followed the same procedures that they had in the past," says Pori GIS specialist Timo Widbom. "It wasn't efficient, and while most roads were plowed regularly, some were plowed less frequently because of their location and the unavailability of specialized snowplows for particular sections of roadway."

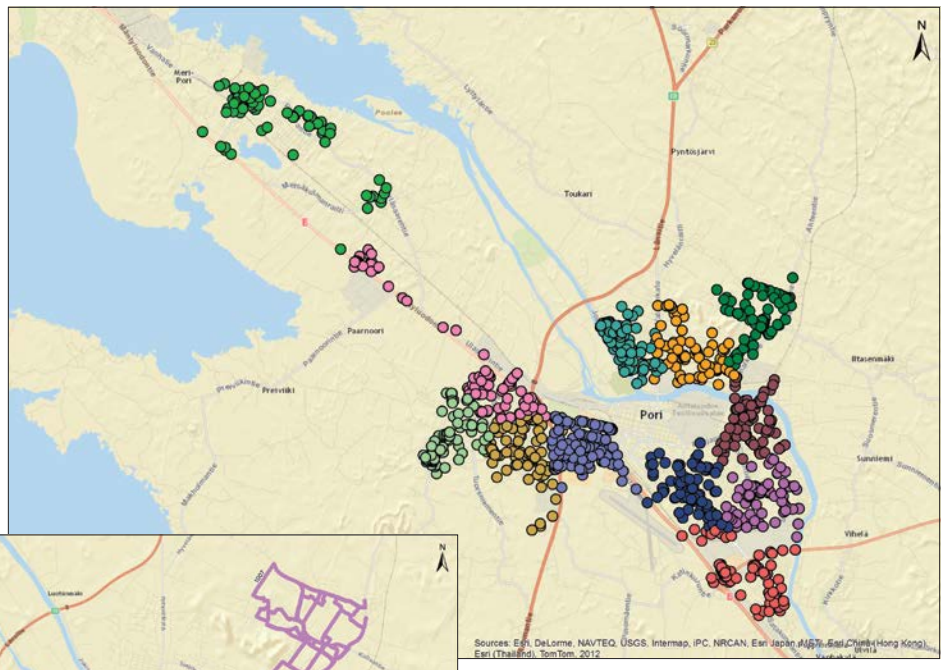
In early 2012, Pori entered into an enterprise license agreement with Esri, which allowed the city unlimited access to ArcGIS software and its extensions, including ArcGIS Network Analyst. With greater access to GIS for city employees, Widbom teamed with Aki Kaapro, GIS analyst at Esri Finland Oy, Esri's authorized distributor in Finland, to build geoprocessing models to facilitate snowplowing and provide access to the geodatabase for those public works employees involved in snow clearance.

First, they had to collect specific data on the existing roads in the city. To do this, the entire city was divided into approximately 800 grids, each measuring one square kilometer. All roads and paths within each grid were then visually inspected and categorized. While the city's pavement department maintains the road network in its GIS, there was little information on street care classifications, such as the amount of accumulated snow allowed on a specified roadway before it should be plowed. Street care classifications also include a road's width and its topology, which can affect the snow buildup and the way that the road is plowed. It took more than a year to collect all the required data.

"The data collection process took us some time because we carefully inspected and collected data on all the roads and pathways in each grid, as it was critical to the development of our geoprocessing models," adds Widbom. "The collected data allows us to determine when and how a roadway should be plowed and the type of vehicle that we should use. For example, we use small plows for our bike paths, but our larger roadways sometimes require two plows used simultaneously."

When the categorization of the city's roads and bike paths was complete, Kaapro began to develop the two geoprocessing models. One determines the optimal snowplowing areas, and the other optimizes the routes to and through those areas. The models use a number of factors, including the data previously collected in the inspection of the city's streets and bike paths, street maintenance priority classifications, the type of snowplow vehicle required, and the total number of areas to plow. The first model uses the Location Allocation tool in Network Analyst to create demand points on those areas where snowplow service is required. After the demand points have been determined, the second model uses the Network Analyst vehicle routing problem solver to find the optimal routes to service and plow them. The model also allows multipoint routing and route reordering.

"Time stamps are calculated for each section of an optimized route to provide us with information about the length of time it takes to plow a specified road section and allow us to facilitate an animation of that section," says Kaapro. "Supervisors can then enable the Time Slider window in ArcGIS and discuss the routes with their drivers via the route animation. In addition, there are the conventional means to examine the routes via maps, driving directions, and so on. The main goal is to get the optimized routes to the drivers' mobile navigators."



Location allocation optimized snowplowing zones for pedestrian walkways.

Widbom has received a positive response from the drivers and their supervisors in the Pori public works department and plans to expand the implementation of the models' results during this year's winter season. In the future, he would like to make the city's geodatabase available on smartphones so that drivers can interact with the routing assignments from the field and review route history, if needed.

"Our route optimization models will allow us to reduce the overall number of kilometers driven by each snowplow driver while increasing the number of roads each plows," says Widbom. "This provides us with a savings in both time and fuel costs."

For more information, contact Timo Widbom, GIS specialist, City of Pori (e-mail: timo.widbom@pori.fi).

Sticking Pins in Maps Is History

Lincoln, Nebraska, Uses GIS to Protect Citizens, Fight Crime and Fire

Highlights

- GIS helps identify promising areas where crime prevention efforts should yield results.
- ArcGIS and Network Analyst were used to carry out a station relocation study for 14 fire stations.
- Fire fighters use GIS to access building preplans and stage operations for major incidents.

The city of Lincoln, Nebraska's dashboard provides a comprehensive view of information.

"Cops and fire fighters have been sticking pins in maps since there were cops and fire fighters," says Tom K. Casady, director of public safety, Lincoln, Nebraska. "Today, however, GIS has essentially replaced the paper map. And mobile GIS takes information with the officer and fire fighter wherever they go."

Indeed, Lincoln's police—and now its fire, emergency medical services (EMS), and emergency management operations—are empowered with GIS analytics to effectively prepare for and respond to incidents. The city has extended its GIS benefits to the field using applications that run on smartphones and tablets. It helps staff understand any type of situation they are walking into as part of their daily work. It also enables two-way information exchange between managers in the office and personnel on the street.

"The early returns are very encouraging, and the feedback is almost universally positive," says Casady.

Lincoln Police and Fire Service

The city of Lincoln, Nebraska, has a population of 262,000. Casady serves in the newly created position of public safety director. He is responsible for police, fire, EMS, and emergency communications. His background is in law enforcement; prior to being appointed as public safety director, he served as Lincoln's chief of police for 17 years.

Casady has overseen powerful high-tech transitions at the city. From deploying geospatial analysis and visualization to fight crime to moving those capabilities to other public safety sectors, Casady has been at the forefront of keeping Lincoln Police well equipped with intelligent mapping technology. Back in the mid-1990s, Lincoln Police Department was an early adopter of GIS software.

"Crime analysts would then use GIS to reveal relationships that were concealed in the green-striped paper that rolled off those line printers," says Casady. "We took advantage of GIS for three primary purposes: improving situational awareness, discovering and analyzing crime trends and patterns, and deploying resources more effectively."

Today, following a focused hunt for the perfect solution, ArcGIS and the CrimeView suite of solutions from Esri Gold Tier Partner The Omega Group are at the core of Lincoln Police Department's Crime Analysis Unit. Crime analysts work with incident and crime data; police dispatches; and arrest and accident reports; as well as with data on parolees, sex offenders, people with wants and warrants, and gang members. All these different data sources are then compiled and analyzed to generate bulletins and reports used by frontline officers and management staff and to feed interactive web mapping applications for both police employees and the public.

The law enforcement agency also uses GIS to propel crime prevention strategy. For instance, 25 percent of Lincoln's residential burglaries occur through garage doors—many of which are left open or unlocked. GIS analysis revealed when and where these burglaries were most likely to occur. Armed with this information, at-risk areas were identified and targeted to find open garage doors and to alert residents.

"This strategy has been immensely successful in preventing this specific type of burglary, and this in turn has driven an overall reduction of residential burglary in Lincoln," says Casady. "GIS helped to identify the most promising areas where this prevention effort would be most likely to yield results."

GIS solutions have been extended to Lincoln Fire and Rescue Service. The agency makes extensive use of ArcGIS software for analyzing fire and medical calls for service, planning resource deployment, and navigation to an incident. Fire fighters also use GIS to access building preplans and stage operations for major incidents. Fire analysts use GIS to discover incident patterns, analyze alternative deployment strategies, study historical trends in service demand, and more.

For example, Lincoln Fire and Rescue deployed GIS to carry out a station relocation study for its 14 fire stations. In response to population growth, annexations, and increased calls for service, the agency needed to ensure that travel time to incidents would stay under four minutes, the mandated national benchmark standard. Using ArcGIS and Network Analyst, the agency looked at a variety of potential changes to fire station locations and the impact these moves would have on response times. GIS-based maps helped visualize information and make it actionable. Commanders could evaluate and answer critical questions, such as the following:

- Where are the areas of greatest service and areas of highest population density?
- What buildings are most susceptible to fire?
- What populations are most likely to suffer cardiac arrest?

They can then ask questions, such as these:

- What would happen to response times if some fire stations were relocated?
- What would happen to response times if the agency added fire stations?
- What would the new area of coverage be for each fire station if a new location was added?

In addition, maps created with ArcGIS for both fire and law enforcement are used in the department's emergency communications center and integrated with the 911 telephone system for instant map display of incoming calls.

GIS Where and When You Need It

Mobile GIS has become increasingly important to both police officers and fire fighters. Approximately 15 years ago, the agency first began deploying mobile GIS by distributing Esri ArcGIS Explorer projects locally on mobile data computers in police cars and fire apparatus.

Today, web-based interactive maps are used. The emergence of broadband capabilities has made cloud GIS practical on mobile devices. Lincoln police officers and fire fighters have access to various Esri-based applications not only on mobile computers docked in their vehicles but on several types of handheld devices, including iPads, iPhones, Android smartphones, and Android tablets.

At the police department, officers use an innovative location-based services application, Proactive Police Patrol Information (P3i), that presents officers with a GPS-enabled map of points of interest in their immediate vicinity as they go about their work. Information that was previously accessible via desktop computer or mobile data terminal is now available on mobile devices in a mapping application that moves with the officer. Officers can view and access records related to calls for service, arrests, crimes, warrants, citations, parolees, probationers, gang members, and sex offenders. They can identify recent criminal activity, persons of interest, field interviews, and other information at or around a specific location. This supplies vital operational intelligence in the field for true situational awareness.

Instead of coming back to the vehicle or report room, officers can quickly look up information from wherever they are located. They can view a specific location's 911 call history or an individual's crime history. They can also view a map showing crime patterns for an area of interest. For example, a patrol officer can look at vehicle theft or home burglary in a neighborhood when responding to an individual incident to see if there is a possible crime trend that warrants more immediate attention or greater long-term strategic response.

The mobile GIS capability improves tactical crime prevention, response, and suppression. It also helps protect officers on the street by giving them detailed, accurate, and timely information. A similar technology is under development for Lincoln's fire fighters and paramedics. The Fire and Rescue Department has created a GIS viewer linked to the department's computer-aided dispatch records that allows a user to click an address from a dispatch record and immediately be launched into the GIS viewer. The user is automatically zoomed to the address of the dispatch and presented with a variety of critical information: basemap, aerial photos, ownership information, fire hydrant locations, and even detailed floor plans for high-risk facilities.

"The benefits of this type of mobile GIS work are numerous," says Casady. "The net result is that we can perform at a higher level of excellence, and often with fewer resources than would otherwise be required."

For more information, contact Tom K. Casady, director of public safety, City of Lincoln (tcasady@lincoln.ne.gov).

Intelligent Emergency Management

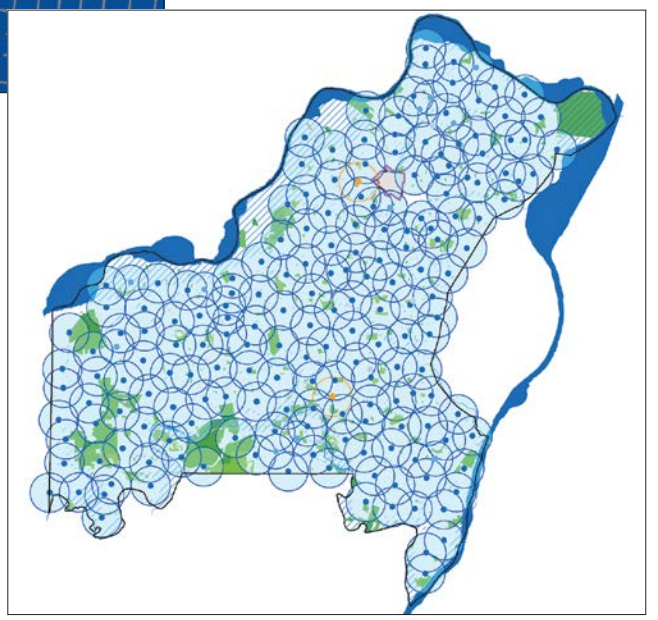
St. Louis County, Missouri, Saves Millions Using GIS to Rebuild Siren Network

Highlights

- A GIS-based siren network design built by the county replaced the old system and saved $2 million.
- The new siren network design increased safety and should ultimately save lives.
- County staff used ArcGIS to track noise complaints, design a test strategy, and record the outcomes of these tests.

Siren loudness in the area in and around St. Ann, Missouri. Output is from the SPreAD-GIS sound model, written in Python for ArcGIS for Desktop. The numbers show field measurements in c-weighted decibels.

This siren is placed on a side entrance to Faust County Park from Olive Boulevard in Chesterfield, Missouri.



The current countywide coverage in the new system, including two planned future sirens.

In an age of fiscal uncertainty and budgetary restraint, one local government agency shows how intelligent planning can help build a better emergency response warning system—and save millions in the process. St. Louis County, Missouri, grapples with the continual threat of tornadoes. Its warning system—sirens spread out across the county in populated areas—supplies advance notice for citizens to move to protected areas before the next powerful twister strikes. Yet time waits for no one—or disaster. The system of outdoor warning sirens had been in place for more than 40 years, with most sirens in the system between 20 and 40 years old. Sirens were breaking down or malfunctioning, and the county had grown over the last four decades, with more people spread across a wider area, requiring new sirens.

"The system was originally implemented on a city-by-city basis, with clustering of sirens around some cities and gaps in unincorporated or recently incorporated areas," explains Brett Lord-Castillo, information systems designer/GIS programmer, St. Louis County Police, Office of Emergency Management. "As the system aged, sirens began to malfunction due to age or were destroyed by lightning strikes, and replacement parts were difficult to obtain. We knew we needed to rebuild the system."

A GIS-based design built by the county helped replace the old system—and saved more than $2 million in the process. The original plan involved replacing or upgrading 210 existing sirens and installing 50 new sirens to cover the entire county at a cost of more than $10 million. Using GIS to map siren coverage and spatially plan out all the details involved in creating an up-to-date network, county staff developed an improved design that required only 169 new sirens for a total of 185 sites. This resulted in a project that cost $7.5 million, which was not only nearly $3 million under the original projected bid, it was more than $2.4 million under the budget allocated for the project.

Replacing an Aging Network

St. Louis County, Missouri, is part of the St. Louis metro area yet borders the city of St. Louis, which is independent from the county. The county has a population of nearly one million.

The county previously maintained 210 outdoor tornado/disaster sirens: 194 of these models needed to be replaced and the 16 others upgraded to meet new radio standards. The county performed a study in the 1990s that determined an additional 50 sirens were needed to cover the western unincorporated part of the county, which today mostly comprises the city of Wildwood.

In 2009, an emergency communications sales tax passed that included $10 million to repair and extend the siren system. Yet, when county staff conducted a price feasibility study, they found that $10 million was not sufficient to rebuild the system and fill gaps, much less purchase new communications equipment and take care of potential incidental costs, such as land purchases.

Enter GIS

Insofar as the county was a longtime user of ArcGIS for Desktop and ArcGIS for Server, expanding into an enterprise GIS during the last five years, when confronted with this unexpected problem, Lord-Castillo came up with the original and novel idea of a complete system redesign.

"We knew that each siren would, at minimum, have to be moved a few feet from its current location to install," he says. "Since there was no cost savings using the same locations, it was worthwhile to determine how much could be saved by a complete redesign."

In an ideal seamless coverage, the county sirens are arranged in a regular hexagonal grid, with side length equal to the radius of the siren. As a proof of concept, Lord-Castillo overlaid this type of grid over the county. He excluded areas that would not be covered by the new system, such as state parks and undeveloped floodplains.

Under this optimum model, the siren count would be brought down to 211. That shaved more than $2 million off the cost of the system.

"In comparing this design to the original, I found the city-by-city build-out had created a highly inefficient design," explains Lord-Castillo. "Replacing all existing sirens and filling coverage gaps with newly constructed siren towers would be much more expensive."

To learn how to effectively arrange a siren system, Lord-Castillo carefully studied Federal Emergency Management Agency (FEMA) design guidelines. He further consulted siren vendors and even received feedback from existing siren system design firms. An independent engineering consultant already hired by the county for a different project validated the design procedures as a last step in the system design process.

In addition to targeting high-noise areas, three other criteria were needed for fulfillment: public land use, pavement access, and high ground placement.

Building a Better Network

After conducting research and examining FEMA procedures, the county went to work on building out the system. The first step was getting the right data records and mapping the different variables to find matches for all three previously identified fulfillment requirements.

The sirens needed to be placed on public land whenever possible since eminent domain would not be applicable. The first preference was county-owned land and rights-of-way. Fortunately for emergency management staff, the metropolitan sewer district constructed an impervious surfaces dataset in 2005 that covered most of the county. This dataset was used to select public land paved areas, other than roads, as additional possible sites.

County parking lots and public driveways were analyzed for site access. Lord-Castillo created mapping buffers around the street centerline data layer corresponding to the type of road. Secondary roads were considered two lanes, and major roads were considered four lanes. Interstates and major highways were excluded, since they were too dangerous for maintenance access.

Once the paved surface layer was built, a 10-foot outside buffer around these sites was created. Why an outside buffer? The county had to place the sirens *adjacent* to these roads and parking lots; they could not be placed *in* the roads and parking lots.

An analysis was done combining countywide digital elevation model data with neighborhood focal statistics to construct a local standard deviation of elevation grid. This would ensure the sirens were placed on local high points relative to surrounding warning areas.

Each of the eventual 183 new sites had to be individually placed using these criteria selection layers. Sixteen existing sirens from the old system were retained because they were modern-generation siren models. These sites were placed on the GIS map first. From these sites, the county expanded out to place each new siren to achieve seamless coverage.

"With ArcGIS, the new editing tools made it simple to construct the buffers around each new point," Lord-Castillo says. "This greatly sped up the workflow. I no longer need to stop editing and run a model to see new range visualizations."

A site that fits all the needed criteria can have other obstacles as well. The foremost obstacle was overhead power lines. The next was trees, especially trees south of the solar-powered sirens. Storm sewers presented an additional obstacle, and no siren would be placed within 100 feet of a building unless there were no other feasible locations. These latter two issues were dealt with using sewer line and building footprint data from the sewer district.

Staff used ArcGIS to track noise complaints, design a test strategy, and then record the outcomes of these tests.

In most cases, testing found that the system was performing as intended. In a few cases, though, the agency found that large buildings, unusual terrain features, or loud highways made it difficult to hear the sirens above ambient noise. The system design now stands at 199 sirens. This is still a savings of $2.4 million over the originally proposed 260-siren design and a dramatic savings in maintenance costs too. More important, the new system covers more than 99 percent of the just under one million people in St. Louis County. The previous system covered roughly 80 percent.

Says Lord-Castillo, "We not only saved $2 million through using GIS for our system redesign, we also increased safety and awareness and should ultimately save lives."

For more information, contact Brett Lord-Castillo, GIS programmer, St. Louis County Police (e-mail: blord-castillo@stlouisco.com).

Emergency Fire Response with Critical Real-Time Data

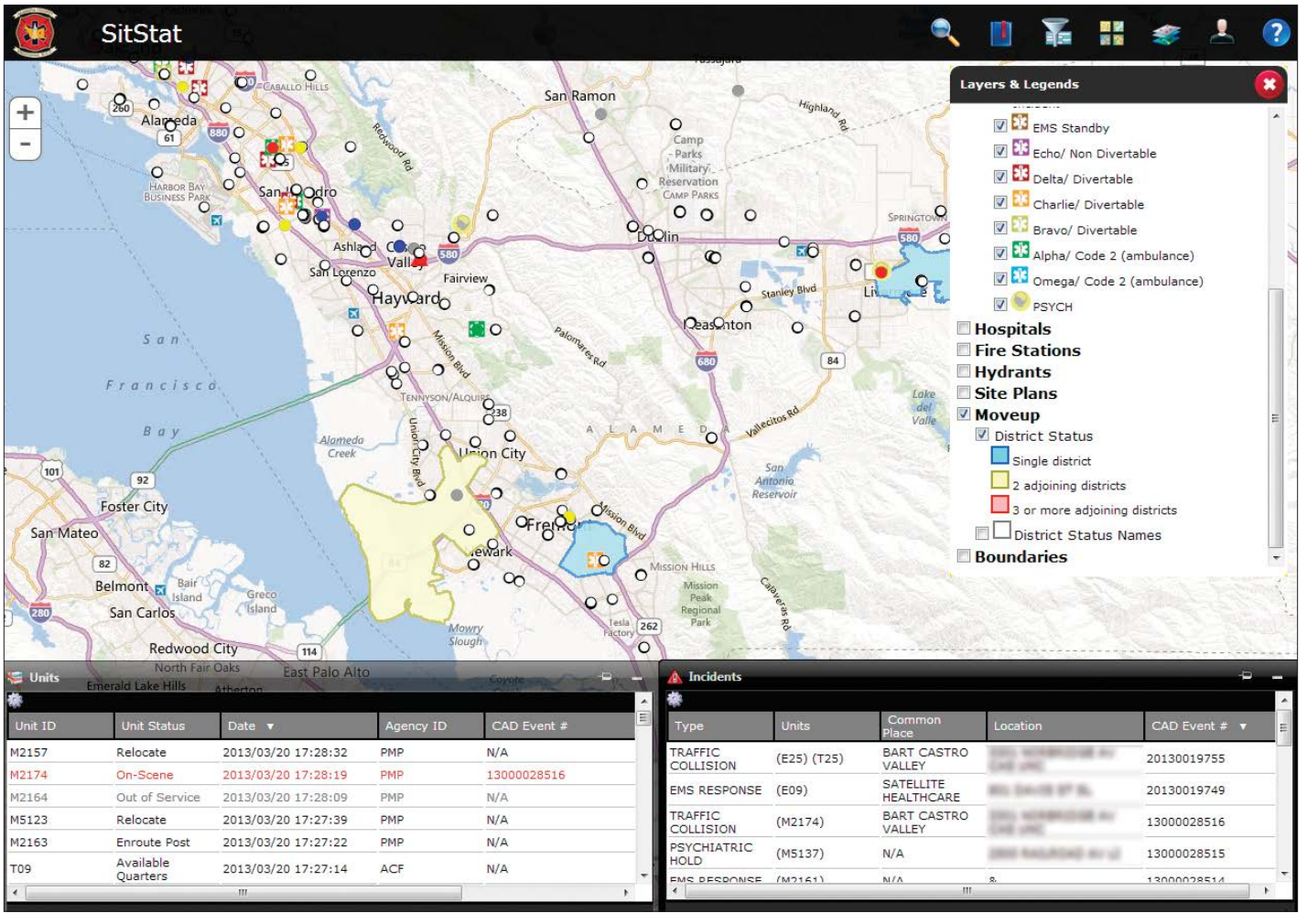
By Scott Doan and Craig Gooch

Highlights

- Using GIS, a common operating picture is provided on tablet computers, smartphones, and wall monitors.
- ArcGIS for Server integrates and presents diverse CAD, GPS, and enterprise emergency incident information.
- ArcGIS API for JavaScript enabled multiplatform deployment of common code.

In fire departments across the United States, emergency calls are received by the dispatch center, which transmits and coordinates critical information to response units. Fire incident commanders responding to the incident and on the scene must take down essential information transmitted to them via radio, jotting it down on notepads or even on their hands. In some instances, they don't have the critical information that the dispatchers have at their fingertips to manage operations or incident responses.

Above: On-site incident command resource coordination requires logistical coordination with a broad group of responders. (Photo credit: Danny Barlogio.) **Right:** The dashboard displays units, incidents, and station move-up analysis results, alerting a chief to possible resource concerns.



The Way Things Work Today

A couple of scenarios illustrate the current inefficiencies in fire incident response. In Alameda County, California, as in fire stations across the country, battalion and division chiefs are responsible for several fire stations, with multiple units in each station, as well as providing backup when the primary battalion/division chief is responding to an incident.

- Hard-copy binders are used to reference detailed site plans. This detailed information may not be available when a backup battalion chief is in charge and needs access to full information about an incident scene.
- When service areas go empty due to resource assignments, second chiefs step in to make operational decisions depending on remaining resources. Unfortunately, they cannot easily see the status of all units because they do not have access to this information in a visual and easily understood format.

Getting Diverse Emergency Information to First Responders

The Alameda County Regional Emergency Communication Center (ACRECC) is addressing this inefficiency in fire incident response by implementing SitStat—Situation Status.

SitStat addresses the shortcomings of existing procedures by dynamically showing the location of all emergency units and their availability throughout the entire Alameda County area. When at an incident, the SitStat user can zoom in to the incident on the map and see the location of each of the response units and the conditions in the surrounding area. Site plans can be opened with a single click. This rich interface is intuitive and provides the incident commander with key information for decision making.

Implemented with Esri technology, a common operating picture is provided on tablets, smartphones, and wall monitors. ACRECC is deploying the application to serve its several fire stations and agencies in Alameda County, about 50 miles southeast of San Francisco, California.

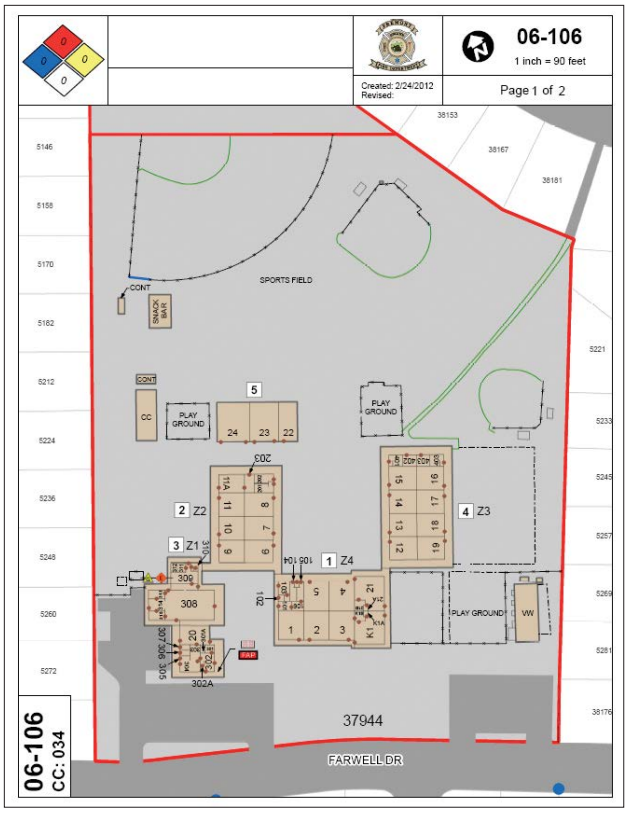
ACRECC turned to Esri Silver Partner Psomas of Riverside, California, to implement SitStat because of the firm's expertise in Esri software design and implementation, experience and understanding of emergency management business processes, and involvement in deploying enterprise GIS at Alameda County. Working as part of an integrated project team, Psomas provided overall project coordination and managed the design, development, and deployment of SitStat.

ArcGIS for Server was selected as the platform for SitStat because of its ability to integrate and present diverse emergency incident information, including real-time CAD event information, GPS tracking data, county enterprise GIS data, and Esri basemaps. ArcGIS API for JavaScript was a critical design element enabling multiplatform deployment of common code to desktop, tablet, and phone platforms. ArcGIS for Server also provided advanced geospatial modeling for assessing station areas with resource depletion for dynamic display through the SitStat map interface.

Overcoming Challenges

In the process of implementing the SitStat application, a number of challenges presented themselves:

- **Overcoming difficulties in data collection**—The data collection process was extensive and complex, including the need to integrate with ACRECC CAD, get current site plans from the fire agencies, and ensure multiagency coordination for training and deployment.
- **Ensuring security**—It was a challenge to manage access control, data transmission, and firewalls, integrating secure and nonsecure information for the multiagency ACRECC organization.
- **Supporting multiplatforms**—As a regional system solution, SitStat must operate on various devices used by the participating agencies. The application must work on Apple, Android, and Windows devices on desktop, tablet, and phone screen sizes. Four different browsers are supported, as well, which required extensive functional testing to ensure all combinations of devices and viewers work consistently.
- **Managing multiple interests**—The multiple participants involved (dispatch, CAD vendor, technology host, fire leads, GIS implementer) each had specific responsibilities and proprietary interests. As a result, the project required significant coordination among the stakeholders to ensure system integration, security, and reliability.



A fire preplan shows critical site information.

Realizing Benefits

With SitStat now in place in fire stations throughout the 738-square-mile ACRECC area, all emergency responders act with the same set of information. They now have a common operating picture showing real-time information to everyone who needs to know.

The rich content includes GIS layers featuring hospitals, fire hydrants, station area coverage, and jurisdiction boundaries, along with several basemaps, including topography, streets, and aerial photos.

About the Authors

Scott Doan is a division chief of the Alameda County Fire Department. Craig Gooch is vice president for Psomas, Spatial Technology Solutions.

For more information, contact Scott Doan, division chief, Alameda County Fire Department (e-mail: scott.doan@acgov.org), or Craig Gooch, vice president, Psomas, Spatial Technology Solutions (e-mail: Cgooch@psomas.com).

GIS Supports the Grand Prix

Baltimore Leverages Municipal Government and Public Safety Information

Highlights

- City staff and residents can quickly learn public safety information, mass transit features, and more.
- Key location-based information helps staff respond to public safety events quickly.
- With the new mapping application, incoming 311 calls were reduced significantly.

IndyCar racers on the Baltimore Grand Prix circuit.

Situated on the mid-Atlantic coast, Baltimore, Maryland, is representative of many US cities with an urban core (population of about 620,000 in 80 square miles) situated within a larger metropolitan area.

Unlike other cities, Baltimore offers the thrilling experience of watching racecars speed down its streets each Labor Day Weekend. The Grand Prix of Baltimore, presented by SRT (a high-performance automobile group within Chrysler LLC) was first held in 2011. This IndyCar Series and American Le Mans Series event runs on an interim street circuit around the Inner Harbor.

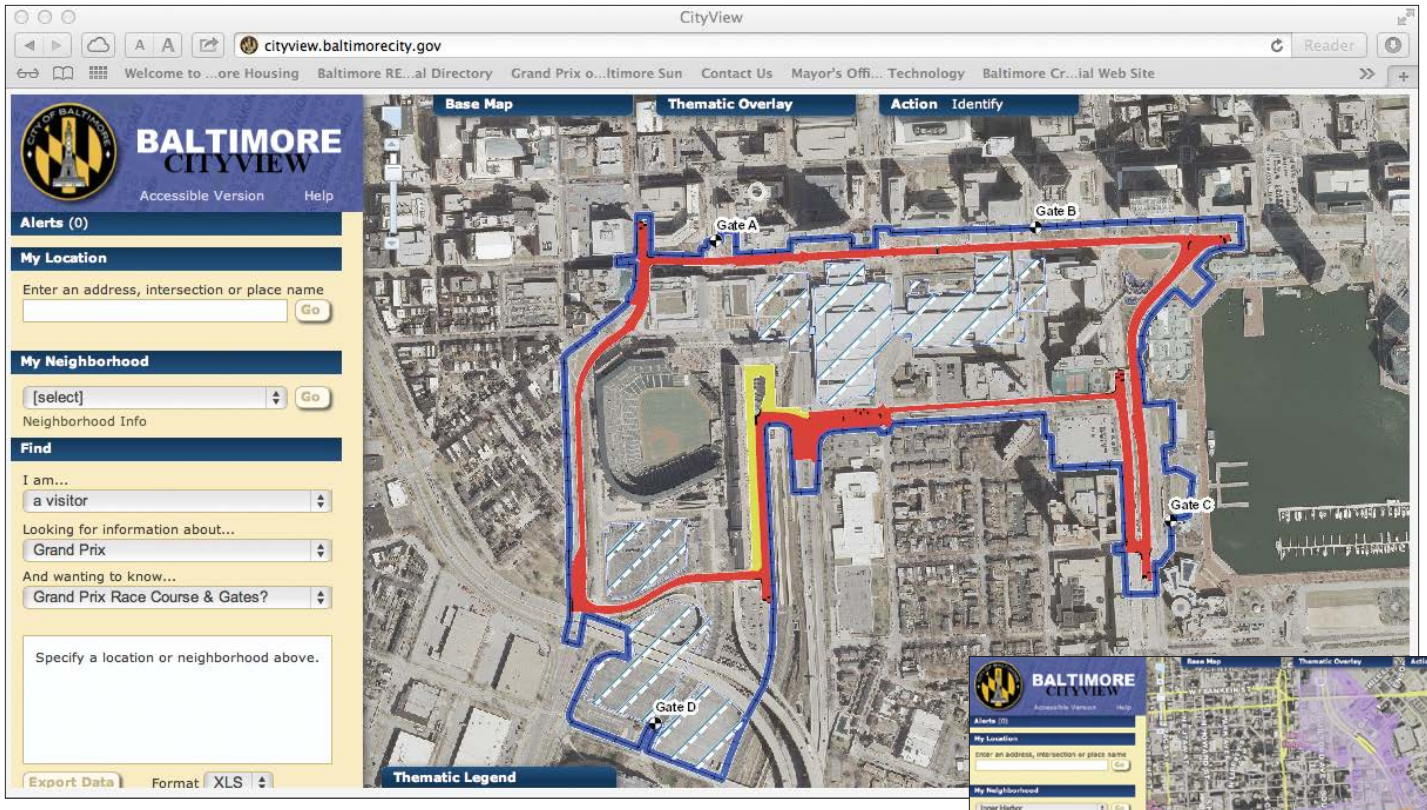
Yet, even as this event excites and delights, public safety is an issue that must be first and foremost for city officials. During the 2012 Grand Prix, a new easy-to-use web mapping application had been introduced and helped race organizers and public safety officials communicate important information to race enthusiasts like street closures and medical and security locations. Fans were able to map and find directions to the starting line, the pit lane, parking, gates, paddock areas, shuttle stops, and bike parking zones, plus nearby hotels and restaurants.

The mapping application was the result of city officials understanding that with the need and demand for real-time digital information becoming more prevalent than ever, the city needed an application built to deliver a find-it-yourself capability for Baltimore's municipal website that addressed citizen and visitor demand for relevant and important location-based information. Called CityView (cityview.baltimorecity.gov), the application was a collaborative effort between the City of Baltimore and Esri Silver Partner Applied Geographics, Inc. (AppGeo), of Boston, Massachusetts, with the intent of keeping citizens and visitors alike informed and safe at all times.

Informing the Public and Keeping Baltimore Safe

The city fields thousands of calls daily not only about special events like the Grand Prix but also routine citizen questions about trash pick-up, snow routes, polling places, and other topics handled by different departments. A common denominator of these calls is that they relate to specific places within the city. Baltimore's vision for its mapping application was to provide specific constituencies (residents, businesses, visitors) with location-based information regarding public safety, city life, and special events tailored to their needs. Residents and visitors now have an easy way to find out where the nearest police station, fire station, or hospital is or where the nearest evacuation center is should yet another superstorm reach the East Coast.

Users can go directly to specific addresses, locations, or neighborhoods, or they can identify as a resident, visitor, or businessperson looking for information about a particular topic. For example, one could identify as a resident of the Inner Harbor and then select a specific subtopic—public safety, weather, or planning—and quickly and accurately find if they are in a floodplain, the latest track of an approaching hurricane, and nearby evacuation shelters, or one could identify as a visitor, select the subtopic "stadiums," and find the quickest route to Camden Yards. The results are displayed on a map and in a list that provides links, driving directions, and other useful information. Users can also download the results to a spreadsheet or share the map via e-mail.



By creating the Grand Prix street circuit map, Baltimore helps residents, visitors, businesses, and city staff enjoy this annual event.

Public safety information is also available on the splash page and through an Alerts function that are updated by the city in response to events. For example, when temperatures exceed 90 degrees or during extreme cold temperatures, the city updates these links to notify citizens on the locations of cooling or warming centers, plus contact information, intake hours, and capacity. Alerts delivered through the website might identify closed streets due to a water main break or show residents where the potential flood areas are during catastrophic storm events and where vehicles should be moved.

Baltimore's Enterprise GIS (EGIS) Group's longtime commitment to Esri software made its platform choice for CityView an easy one. The application is powered by mapping services and published via ArcGIS for Server to deliver city map layers and interactive functionality. After working collaboratively with EGIS on design, AppGeo built the application using Esri's ArcGIS API for JavaScript and HTML5.

Beyond public safety and special events, the new web capabilities make a difference for city staff and residents alike on a daily basis. Here are a few examples:

Fewer Calls and Quick Property Reference in the Planning Department

Since its launch, Planning Department staff use the application as a quick property reference, and they frequently refer callers to the application. City planner Jamie Williams has noticed a significant reduction of phone calls to her office, particularly multiple requests from the same citizen, providing verification that the application is getting repeated use and is meeting the need for self-service information.

Calls to 311 Center Reduced by Nearly 20 Percent

In 1996, Baltimore was the first US city to introduce the 311 phone number for residents to report nonemergency situations like potholes or graffiti.

Today, Baltimore 311 relies on CityView more than any other city department. Employee Sharron Rosenbaum noted that Baltimore 311 takes about 3,000 calls a day. The 311 Call Center agents use the application to respond to callers' questions, verify locations, and determine service information. The application makes it easy for 311 staff to enter the location of interest by street number/name, intersection, or a common place (e.g., City Hall). Om Poudel, application developer with the EGIS, studied CityView website traffic and found that it increased significantly in the first six months of 2012. Currently, daily hits average 500 during the workweek and 300 on weekends, equaling hundreds of fewer calls to Baltimore 311 every day. He attributes the steady traffic to the fact that EGIS staff continuously adds new layers or updates in response to user demand. Plus, CityView links appear on several of the city's web pages, such as the small business development website that provides a hyperlink to the application and automatically populates the search fields based on where the user was within the website.

Beyond Trash and Recycling to Community Outreach

In the Bureaus of Solid Waste and Water and Wastewater, staffer Amanda Huber explains the application enables staff to assist residents with their trash and recycling collection days and differentiate between a missed collection and items that were mistakenly set out on the wrong day. The application is also used in outreach efforts, like advising residents who to contact for programs like the Community Pitch-In, a community cleanup event.

Huber also says staff use the application to quickly determine property information, mass transit and other transportation features, locations of businesses and city services, and historic districts and landmarks—key location-based information that helps staff do their jobs more efficiently.

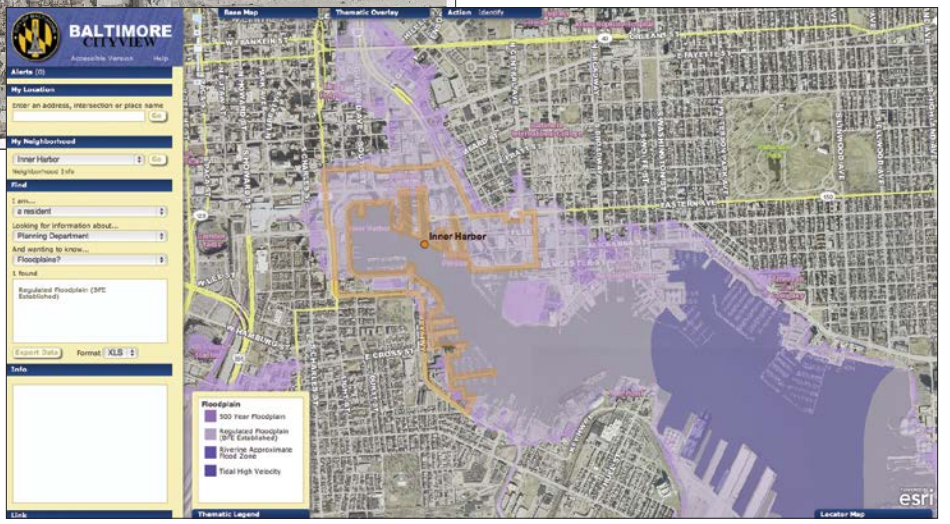
From a Public Safety Standpoint, Current Data Is Useful Data

From the beginning, Baltimore recognized that the application design had to ensure information could be kept up-to-date by city staff. AppGeo built the application so that staff could extend CityView (maps and data) themselves. Mike Blake, AppGeo's project manager, says, "City staff now handles all content additions to the map through a configuration interface. They easily add the layers—cooling centers, food trucks, and special events, for example—and can customize and update their site to include the mundane to the critical."

Basemaps Add Important Context

The city also understood that users of the site would need access to a variety of basemaps to provide context for their questions. Esri's Community Basemap, Esri Streets, and Light Gray Canvas basemap options are available, as well as aerial photography, Bing Streets, Bing Bird's Eye, and more. Switching among basemaps is easily done from a drop-down menu. The user has control over the transparency of basemaps and the thematic maps that overlay the basemap, and city staff can easily add new basemaps.

For more information, contact Samantha Luckhardt, EGIS supervisor, City of Baltimore (Samantha.Luckhardt@baltimorecity.gov), or Mike Blake, PMP, senior project manager, AppGeo (mblake@appgeo.com). In 2012, the Public Technology Institute recognized Baltimore's CityView with an award for GIS Significant Achievement.



Floodplain information layered over a map of the Inner Harbor.

Offering Opportunities to Learn, Connect, and Collaborate

2013 Esri Regional User Conferences

2012 Esri Latin America User Conference.

This fall, Lima, Munich, and Singapore will become epicenters of GIS training for regional users who want to collaborate and connect with colleagues while learning the latest advances in geospatial technology.

Esri's regional GIS events—the Europe, Middle East, and Africa User Conference; the Latin America User Conference; and the Asia Pacific User Conference—are expected to draw participants from three vast GIS regions and the world.

These three-day celebrations of all things GIS are packed with technical workshops, keynote plenary sessions, seminars, map galleries, paper presentations, vendor exhibits, and gala social events. They also offer much, much more, according to Esri president and founder Jack Dangermond.

"The focus is on you," says Dangermond of the regional user conferences, urging users to teach each other. "We are a regional and global network of professionals working on all the world's challenges. We are building a new kind of infrastructure . . . a new kind of powerful information that will be used for creating a sustainable future. And these conferences are a primary way to make that happen."

Once arrived at a regional user conference, you will be immersed in seminars, technical sessions, and other training led by world-class experts—all dedicated to teaching you state-of-the-art GIS and how to boost your analytical skills. Afterward, your colleagues back home will notice how much better connected you are within the industry and how adept you are in the latest GIS software. The regional user conferences will equip everyone who attends with tools and skills for moving their organization forward in the 21st century's technically challenging business environment.

If you would like an early start, spend some time at a regional user conference booth at the July Esri International User Conference (Esri UC) in San Diego. If you're planning to attend, you can meet host distributors for the conference in your region who will brief you on the event and help you finalize plans, including registration and reservations. The Esri UC booth staff also will provide promotional resources and media tools for raising your organization's visibility across the region and publicizing your upcoming event to ensure its success.

2012 Esri Asia Pacific User Conference.

Esri Latin America User Conference

Latin American users—join hundreds of your colleagues in Lima, Peru, October 16–18 at the Esri Latin America User Conference (LAUC), hosted by TELEMATICA, Esri's official distributor in Peru. You'll have an opportunity to let your geospatial ambitions soar and be immersed in three days of cutting-edge training led by Esri staff and your peers. The LAUC will be held at Lima's JW Marriott Hotel.

"The Esri Latin America User Conference provides an opportunity for GIS professionals, IT specialists, and decision makers from all over the region to experience the future of GIS and to get connected and learn from each other," says Alberto Guillen C., general manager of TELEMATICA.

"Heir to ancient Incan culture and a rich colonial tradition, Peru is a magical place that includes one of the richest biodiversities on earth and an unparalleled cuisine. We are very pleased to host the 2013 LAUC," says Guillen. "We have designed a comprehensive agenda, including the latest software demonstrations, technical workshops, user presentations, and industry solutions exhibitions, along with social and cultural events. Don't miss out."

A major highlight for attendees of the LAUC is the Plenary Session, where Esri leaders will review Esri's vision for the future and how GIS will continue to evolve and play a vital role in our lives. You'll also explore the latest advances in Esri technology directly from Esri staff through workshops, presentations, technology demonstrations, and exhibits. Another excellent reason to attend LAUC is the opportunity to collaborate with Esri product specialists and other GIS professionals who can help you best leverage your current GIS resources.

Registration is now open. Visit **esri.com/lauc** to register, get involved, and start planning your trip to the LAUC.

Esri Europe, Middle East, and Africa User Conference

Esri Deutschland GmbH will host the Esri Europe, Middle East, and Africa User Conference (EMEAUC) in Munich, Germany, October 23–25. More than 2,000 users will convene at the International Congress Center to explore the latest advances in Esri technology via seminars, demonstrations, workshops, and exhibits.

"We have created a unique conference agenda with something for everyone: users, developers, decision makers, partners, GIS experts, and specialists, as well as schools, universities, and interested GIS visitors," says Michael Sittard, president of Esri Deutschland. "The EMEAUC is the right place to connect, share, and collaborate with an international GIS community. Attendees will get in touch with technology innovations and GIS solutions."

For three inspiring days, Munich will become "GIS central" for a massive, multinational region spanning seven time zones. In addition to honing their skills, attendees will have an opportunity to meet other Esri users and decision makers seeking innovative solutions to their GIS challenges.

"Free expert round tables are a special new element we are offering on the first day of the conference," says Sittard. "GIS experts will present their projects and provide insight into the use of the technology in energy management, public administration, land use, logistics, security, and urbanization. Participants who want to introduce GIS in their sector will find information and answers to many questions during these events."

In the GIS Solutions EXPO, users can meet with more than 40 exhibitors representing regional companies and organizations at the forefront of GIS technology.

To register for the EMEAUC or submit an abstract for consideration, visit **esri.com/emeauc**.

Esri Asia Pacific User Conference

The 2013 Esri Asia Pacific User Conference (APUC) in Singapore November 12–14 is expected to draw tech-savvy users from across the region for three days of intensive exploration of the science and art of Esri ArcGIS.

Hosted by Esri South Asia Pte. Ltd., the event will be held at the Suntec Singapore International Convention and Exhibition Centre in the Southeast Asian island city-state.

"We are pleased to be bringing the excitement of the Asia Pacific User Conference to Singapore—one of the world's most vibrant, dynamic cities," says Leslie Wong, managing director of Esri South Asia Pte. Ltd. "As the largest GIS conference on the Asian spatial calendar, APUC 2013 will see hundreds of users from across our region come together to collaborate, learn, and be inspired."

A packed agenda will ensure that attendees get their fill of technology trends, workshops, plenary sessions, luncheons, networking, and collaboration, which can take the form of sharing innovative work with colleagues.

"Attendees will hear from visiting specialists about some of the most cutting-edge applications of GIS technology in the world—as well as be in a position to showcase their own successful projects to an international audience."

To view the agenda, register for the conference, or submit an abstract for the APUC, visit **esri.com/apuc**.

November 20, 2013

GIS Day Is on Its Way

For many in the worldwide GIS community, the start of summer means sunny days, vacations, and—of course—ramping up for GIS Day!

Many event hosts are well into planning for the Wednesday, November 20, 2013, celebration of GIS technology. Others are looking forward to attending a GIS Day event in their community, school, or workplace or serving as volunteers. Last year alone, more than 950 hosts and thousands of participants across the world made GIS Day 2012 one of the largest ever.

As in previous years, GIS Day festivities can take many forms: demonstrations; corporate or civic open houses; public library, high school, and university events; map gallery tours; hands-on GIS technology training and workshops; and expos on educational and career opportunities. We encourage you to consider any one of these venues and approaches as you plan your event.

To help you put together a fun and successful GIS Day, we've provided several resources—plus new ones added this year—on the **gisday.com** website. These will assist you in planning and publicizing your celebration to create maximum excitement leading up to November 20. These include logos, flyers, posters, postcards, desktop backgrounds, a PowerPoint template, and certificates of participation.

There is also a new web template that allows event hosts to create a GIS Day page on their website to provide specific information about their local event. The template has the same design as **gisday.com** to keep the same look and feel of GIS Day but leaves you with the ability to customize, including adding your own pictures and event information.

Register your GIS Day event by September 20, 2013, on **gisday.com** to receive a custom package of branded GIS Day items. The package will be customized for the specific age group attending your celebration. The items are a fun way to get your audience excited about November 20.

If you are attending the 2013 Esri International User Conference, a quick visit to the GIS Day interactive booth is a must. Meet the GIS Day team and discuss your event plans. We would love to hear about what you have in store and are happy to offer suggestions on event promotion and activities during your celebration.

You also can learn about new activities from National Geographic that you can replicate at your own venue. National Geographic will be on hand Tuesday–Thursday, July 9–11, during the Esri International User Conference to demonstrate fun activities that show geography in action.

By hosting an event, you'll be giving people in your community a behind-the-scenes look into a powerful technology that has the capacity to revolutionize the world around us.

Interesting ArcGIS Services

Esri's ArcGIS for Server adds geographic data and analysis to web applications that serve organizations and communities in a variety of ways. To submit an ArcGIS for Server site address and view other websites powered by ArcGIS for Server, visit **esri.com/serversites**.

Source Water Assessment and Protection
mapcase.deq.idaho.gov/swa
Created by the Department of Environmental Quality in Idaho, this application provides information on assessed water sources in the state of Idaho. Designed with ArcGIS API for JavaScript, it includes a potential contaminant inventory and legend denoting hydrography and agricultural land in various states of use.

Interactive Atlas of Heart Disease and Stroke
apps.nccd.cdc.gov/DHDSPAtlas/viewer.aspx
Created with ArcGIS API for Flex, this site was created by the Division for Heart Disease and Stroke Prevention at the Centers for Disease Control and Prevention. The digital atlas documents geographic disparities in cardiovascular diseases and their risk factors at the county level.

Landscape and Imagery Explorer
maps.larimer.org/LandscapeExplorer
The Larimer County GIS website allows users to visualize the county landscape via aerial imagery 1999–2009, US Geological Survey quadrangles, digital elevation models, and basemap data.

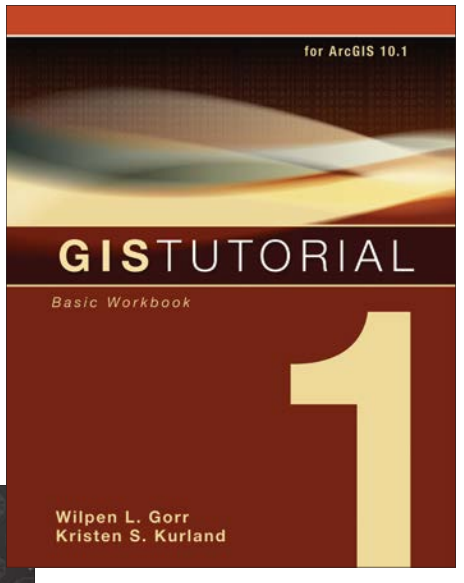
New from Esri Press

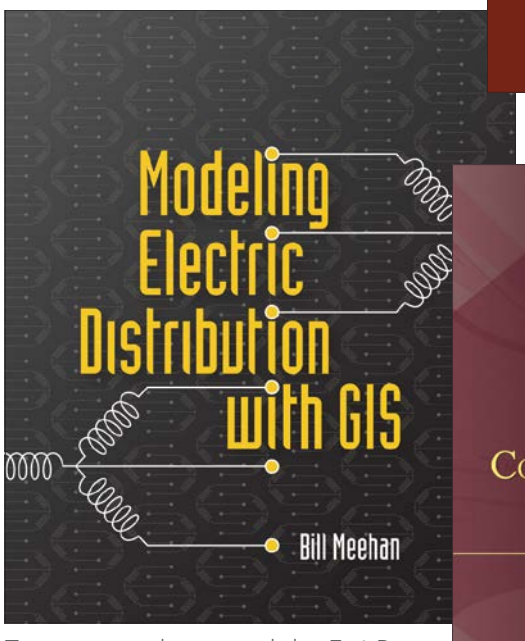
***GIS Tutorial 1: Basic Workbook*, 10.1 Edition**
By Wilpen L. Gorr and Kristen S. Kurland
More enhanced than ever, *GIS Tutorial 1: Basic Workbook* is compatible with and now includes online access to ArcGIS 10.1 for Desktop Advanced software (180-day use) in its fifth release. As the first book in the Esri Press GIS Tutorial series, it provides a foundation to teach and study basic GIS tools and analysis functions, such as how to query interactive maps, collect data, and run geoprocessing tools. A data DVD for working through the exercises is included. In addition, the exercises, as well as the "Your Turn" sections and homework assignments, can be adapted to learning GIS in a classroom setting. Instructor resources are available by request. May 2013. ISBN: 978-1-58948-335-4, 440 pp., US$79.95.

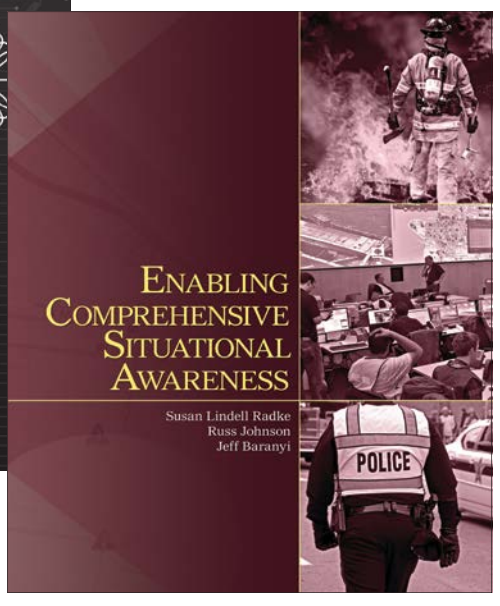
Enabling Comprehensive Situational Awareness
By Susan Lindell Radke, Russ Johnson, and Jeff Baranyi
Learn how and why an integrated emergency management common operating platform implemented with a GIS can help save lives and mitigate loss during crises and disasters with the book *Enabling Comprehensive Situational Awareness*. Written for emergency managers and public safety personnel, the book describes how to use the platform to analyze extensive spatial data collections and field-level data and how to coordinate efforts across agencies and jurisdictions to develop collaborative mitigation and recovery plans. June 2013. ISBN: 978-1-58948-306-4, 204 pp., US$18.95.

Modeling Electric Distribution with GIS
By Bill Meehan
Modeling Electric Distribution with GIS shows why a successful implementation of an enterprise GIS in the electric distribution industry requires a sound and thorough data model. The book provides an overview of the engineering and business aspects of the electric distribution system in detail and demonstrates how building a GIS can add value throughout the enterprise. This book is beneficial for GIS managers, business executives, and information technology managers. July 2013. ISBN: 978-1-58948-241-8, 318 pp., US$42.95.

For more information and to order Esri Press books, visit **esri.com/esripress**.







To see new releases and the Esri Press catalog, visit esri.com/esripress.

New Training and Certification Offerings from Esri

Training

ArcGIS 10.2 Foundational Courses
ArcGIS is a complete platform for visualizing, managing, analyzing, and sharing geographic data and GIS resources that support decision making. The instructor-led courses below teach underlying concepts and best practices for working with ArcGIS 10.2.

Because ArcGIS users have diverse educational backgrounds, workplace responsibilities, and areas of interest, this foundational set of courses is designed to provide distinct entry points into the ArcGIS platform while also supporting a progressive approach to learning key GIS workflows. Each course teaches knowledge and skills that will enable you to move forward with ArcGIS. Together, they provide a solid foundation in creating, sharing, and applying geographic knowledge.

- **ArcGIS 1: Introduction to GIS—**For those new to GIS who need to learn fundamental concepts to begin working with ArcGIS
- **ArcGIS 2: Essential Workflows—**For those who understand fundamental GIS concepts and need to efficiently use ArcGIS tools to visualize, edit, and analyze geographic data
- **ArcGIS 3: Performing Analysis—**For professionals who need to perform more advanced analysis and modeling to create reliable information and repeatable workflows
- **ArcGIS 4: Sharing Content on the Web—**For professionals who need to create and share authoritative GIS maps and other resources with decision makers, colleagues, or the general public

For detailed course information and to view the class schedule, visit **esri.com/foundation**.

ArcGIS Online Workshop
A half-day instructor-led workshop is now available to help GIS professionals quickly get up to speed with recommended workflows to support their organization's ArcGIS Online subscription. ArcGIS Online Subscriptions for Organizations: Publisher Workflows is designed for GIS analysts, specialists, and others who will create and publish GIS resources. Attendees will learn how to author ArcGIS services, web maps, and web applications, then share that content so it is accessible to organizational users and to the public.

For more information, visit **esri.com/agolcourses**.

Certification

The Esri technical certification exams below are the latest to open for registration.

- **ArcGIS Desktop Developer Associate (version 10.1)**
- **Enterprise Administration Associate (version 10.1)**
- **Enterprise Geodatabase Management Professional (version 10.1)**
- **Enterprise System Design Associate (version 10.1)**

Recommended training resources to help prepare for an ArcGIS 10.1 exam are now available in a print-friendly PDF document. To assist candidates who want to acquire or refresh skills on a specific topic, resources are organized according to each exam's skills-measured categories. View the PDF document on the Training Resources tab of each 10.1 certification page.

View detailed information for all certifications and register to take an exam at **esri.com/certification**.

Esri ArcGIS Desktop Associate Certification Study Guide (Available August 2013)
The *Esri ArcGIS Desktop Associate Certification Study Guide* will be published by Esri Press in August. The book offers a comprehensive review of the skills and knowledge measured in the ArcGIS Desktop Associate certification exam. Conceptual overviews of the essential tools and workflows needed to accomplish a GIS task and hands-on exercises to reinforce understanding are provided. ArcGIS for Desktop Advanced software (180-day use) and a data DVD for working through the exercises are also included. ISBN: 978-1-58948-351-4.

For More Information

Training website:	**esri.com/training**
Find a course:	**esri.com/coursecatalog**
Training Matters blog:	**esri.com/trainingblog**
Training on Twitter:	**twitter.com/Esritraining**
Subscribe to the training newsletter:	**esri.com/trainingnews**
Esri Press books:	**esri.com/esripress**
Esri Technical Certification website:	**esri.com/certification**
Esri Technical Certification exam registration site:	**pearsonvue.com/esri**
Esri Technical Certification prep resources:	**esri.com/skillsreview**

Online-Only Articles

More *ArcNews*

The Summer 2013 issue of *ArcNews Online* (**esri.com/arcnews**) presents the following special online-only articles:

- Arnold Arboretum Uses Mobile Mapping Technology to Increase Access to Botanical Collections.
- Introducing Geospatial Concepts to General Education Students
- Ships Use Sea-Ice and Iceberg Maps to Navigate in Polar Regions

NATIONAL GEOGRAPHIC™

"Geo Learning"

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

Charting a Path for Precollege Geography Education in the United States

The problems of education can seem intractable, but four organizations have been working together to improve geography education in the United States for more than 30 years, and they continue to do so. These organizations—the Association of American Geographers (AAG), the National Council for Geographic Education (NCGE), the American Geographical Society (AGS), and the National Geographic Society—have recently recommitted themselves to this important work through the publication of several landmark documents.

The first of these is a major revision to *Geography for Life: National Geography Standards*. *Geography for Life* lays out learning goals for geography in three grade bands: K–4 (ages 5–10), 5–8 (ages 10–14), and 9–12 (ages 14–18). These goals represent a consensus among geographers and geography educators of what geographically informed individuals should know and be able to do with their knowledge.

First published in 1994, *Geography for Life* has been thoroughly revised to bring it up-to-date with the state of geography and of research on education. For example, when the first edition of *Geography for Life* was published, GIS only merited a mention in an appendix. In the second edition, GIS figures very prominently in the section of standards called "The Earth in Spatial Terms."

While the federal government in the United States does not adopt or endorse educational standards, *Geography for Life* carries the weight of the four national geography organizations. The organizations created the standards to provide guidance to state and local educational agencies in the creation of their educational standards and curriculum programs.

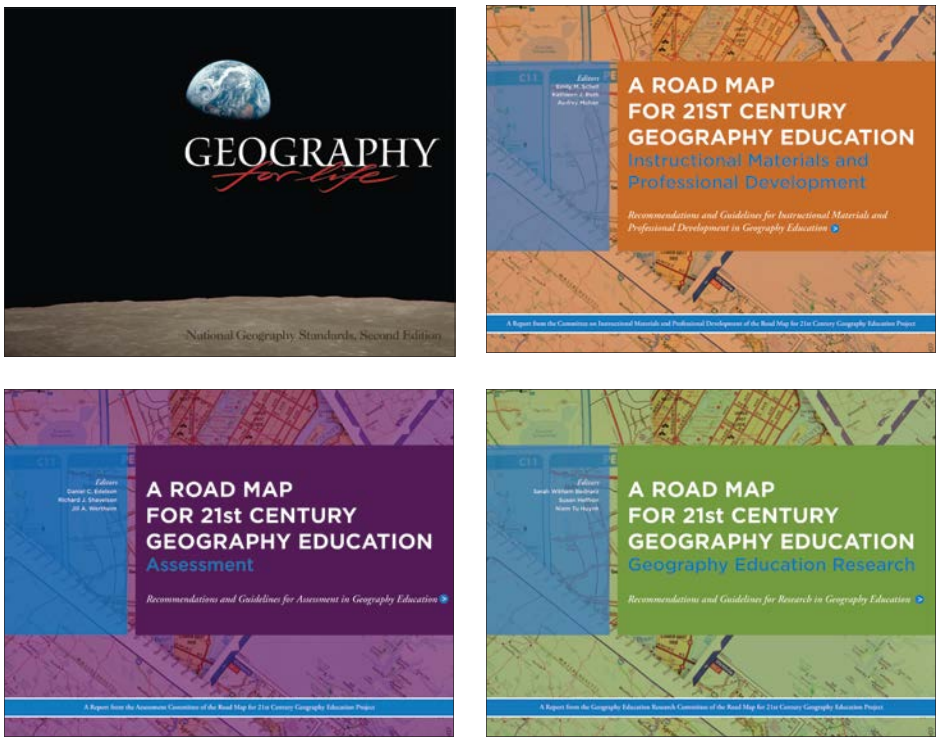
Around the time that the second edition of *Geography for Life* was going into final edits, the four geography organizations, which collaborate on education initiatives under the auspices of the Geography Education National Implementation Project (GENIP), began discussing how to ramp up the speed and increase the reach of their collective efforts.

The result of these discussions was a proposal to the National Science Foundation to create a set of strategic plans for the improvement of geography education over a 5- to 10-year timeline. The organizations declared that it was time to create "a road map for geography education in the 21st century" and, with the support of the National Science Foundation, launched into an intensive 24-month research and planning project. The resultant road map, which lays out a path to the effective implementation of the learning objectives detailed in *Geography for Life*, was released this spring in the form of three topically focused reports.

The work of the Road Map Project was conducted by three committees composed of leading geographers, educators, and researchers in the science of learning who were selected by a leadership committee representing the four organizations. The committees were charged with creating recommendations for how to improve the effectiveness of geography education in three areas that the geography organizations identified as being important levers for change: instructional materials and professional development for teachers, assessment of student progress, and research on learning and teaching.

The committees conducted a review of current practices and current research in their assigned area and then formulated recommendations for how to improve geography education over the next decade through focused work in their area.

The Instructional Materials and Professional Development Committee considered the current state of the instructional materials for teaching geography and the preservice and in-service education that teachers who are responsible for geography education receive. Based on this analysis and a review of the literature, the committee formulated recommendations and guidelines for both instructional materials and professional development that will lead to improvements in instruction and in learning outcomes.



A road map, which lays out a path to the effective implementation of the learning objectives detailed in *Geography for Life*, was released in the form of three topically focused reports.

The Assessment Committee studied the current state of assessment in geography and reviewed its history. Based on the analysis of existing practices and a review of the literature on assessment as a support for improving educational outcomes, the committee formulated guidelines for developing assessment instruments and for conducting assessment that will lead to improvements in instruction and outcomes.

The Geography Education Research Committee reviewed the existing education and cognitive science research literature to identify gaps in our ability to answer significant questions about geography education based on research. Drawing on this analysis, the committee formulated recommendations for research questions and approaches that will build a knowledge base to guide improvement efforts for geography education in the future.

The result is a set of specific recommendations to improve geography education over the next decade that is grounded in the most comprehensive study of geography education that has been conducted in the United States. It is, in fact, a road map for achieving the goals laid out in *Geography for Life* that the four members of GENIP are committed to implementing over the course of the coming decade.

Achieving the goals of *Geography for Life* will require a greater public commitment to geography education and the allocation of more funding than we have seen before in the United States. By creating the road map, the geography education community has provided a strong justification for making that commitment and described how those resources can be used most effectively.

The next step in this process is to bring these landmark documents to the attention of policy makers, funders, and educators who are in a position to act on their recommendations. To assist with this effort, contact any of the GENIP organizations.

For more information, *Geography for Life* can be viewed online at **natgeoed.org/standards**. The print edition can be purchased from the National Council for Geographic Education online store at **ncge.org**. The reports of The Road Map for 21st Century Geography Education Project and executive summaries are available at no charge from **natgeoed.org/roadmap**.

Follow Daniel Edelson on Twitter @NatGeoEdelson.

CEGeoIC2013 Bogota Conference

International Environmental Dialog in South America

The consequences of environmental information for our modern information society and its active role in collecting, assessing, and using environmental information were highlighted at the recent CEGeoIC2013 Bogota conference in Colombia. This international and interdisciplinary conference was dedicated to scientific and technical methods of environmental information and communication. Special regard was given to the central role of geoinformation.

Parallel to the English language international conference were three workshops in Spanish organized by Esri distributor Procálculo Prosis S.A., Bogota (the main sponsor of the conference), on the application of geoinformation in the broader domain of environmental practical applications.

The panel discussion on risk showed that links to past events underline the need of developing an appropriate prevention strategy for investment and prevision of technical and organizational security measures. Furthermore, postdisaster costs must be better assessed and normalized to allow a more efficient strategy for reaching prevention goals; the importance of sharing knowledge and experience was identified as being crucial for developing countries. The ethical issues are part of this complex process and must not be forgotten.

It was noted that digital public "environmental observatories" used as virtual public arenas and communication channels open a new, broad field of action, interaction, and social construction. Arenas supporting the collective definition and observation of environmental problems are urgently needed. Interaction of "agents" engaged in democratic activity may be contributing to such a public sphere. A comparative content analysis of available information, participation tools, and interaction showed how these aspects are expressed.

A special postconference meeting of the organizers with the president and general secretary of the Colombian Academy of Physical and Natural Sciences gave the perspectives of broad and stimulating exchange between scientists, as well as mutual information and communication on strategically important aspects that arise from major international action fields.

For more information about the CEGeoIC2013 Bogota conference and to order proceedings, visit **CEGeoIC.net**.

From left to right: Vladimir S. Tikunov, Lomonosov State University, Moscow (Russia); Margarita Marino de Botero, CEO, International Congress of Environmental Sciences, Bogota (Colombia); Paulo Márcio Leal de Menezes, vice president Int. Cartographic Association (ICA), Rio de Janeiro (Brazil); Chuang Liu, Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing (China); and Horst Kremers, CEGeoIC2013 conference director and chair CODATA-Germany, Berlin (Germany).

Esri Partner Solutions

Esri has relationships with more than 1,700 partners globally that provide customer-focused, geoenabled solutions. These partners have extensive experience providing GIS solutions and services across our core industries, ranging from custom-built applications to complete ArcGIS system implementations. In this issue, we recognize those partners that won a 2013 Esri Partner Conference Award for exhibiting practical yet innovative application of ArcGIS software and taking geographic visualization and analysis to a higher level. For a complete list of our partners and their offerings, visit the Esri Partner Directory website at **partners.esri.com**.

ArcGIS for Desktop Application—Utilities and Communications

DIG-SMART, LLC
www.dig-smart.com
Dig-Smart Enterprise
Dig-Smart Enterprise provides one-call ticket management in support of damage prevention initiatives. The Dig-Smart Enterprise suite offers technology to support 811 call centers using a GIS-centric approach to locating excavation requests. Compliance and reporting are integral components of the solution that allows the production of accurate maps and fast response times on positive response mandates. A suite of additional tools is included for specific workflow requirements, including tracking and reporting damages/hits, photo and video capture, GPS integration, CMMS integration, labor/effort tracking and reporting, and mobile work force balancing.

Location Analytics—Retail

Galigeo
www.galigeo.com
Geodashboard
Geodashboard, part of Galigeo's Location Intelligence and Analytics platform, is a business intelligence visualization solution to assist companies in making complex location-dependent business decisions by representing and displaying business intelligence data on maps. Geodashboard is stand-alone, location analytics software capable of integrating geospatial and business information of all types (transactional, operational, analytical, and aggregated) from small or large databases. Geodashboard enables retailers and organizations with field sales forces to integrate location applications with performance management and reporting, predictive analytics, and campaign management solutions to increase sales and optimize marketing operations.

Best New Partner

MindMixer
mindmixer.com
MindMixer Community Engagement
MindMixer is a tool that leverages the power of the Internet and social media to connect organizations with their constituents. Founded by urban planners, MindMixer provides cities, school districts, and health care professionals with a website for two-way conversations with community members, making it possible to hear the ideas of people who may not come to public meetings. Clients can comment on and implement participant ideas, and community members can contribute new ideas or show support for their peers, creating a meaningful dialog online that leads to action offline.

Organizational Use of ArcGIS Online

GEO-Jobe GIS Consulting
www.geo-jobe.com/services/arcgis-online
ArcGIS Online Services Packages
GEO-Jobe's ArcGIS Online Services packages are designed to help clients fully realize the benefits of their ArcGIS Online subscriptions. *Launch Package:* A variety of setup, configuration, and training services designed to accelerate implementation and ensure clients have a solid ArcGIS Online platform that will scale to support users across their organization. *Integration Package:* Consulting services focused on the iterative process of using ArcGIS Online to integrate the value of GIS into business processes and systems. *Cloud Package:* Pairing ArcGIS for Server, through GEO-Jobe's GEOPowered Cloud, with ArcGIS Online to provide clients with the full power of the hybrid approach to ArcGIS Online. *Application Package:* Extending the application-level functionality of ArcGIS Online through configurable apps that ensure clients are fully realizing the benefits of GIS in their daily operations.

Innovation Application—Transportation

RideAmigos Corp.
RideAmigos.com
Gaming, Rewards & Tracking Module
RideAmigos' Gaming, Rewards & Tracking Module effectively "gamifies" commuting with leader boards, shareable virtual badges (via Facebook and Twitter), prizes, and the rewarding of egos. Users can rapidly log trips, like biking, walking, transit, and ride sharing, and compare how they and their team, company, or neighborhood rank against one another at a glance and view trip history in their calendar. The platform promotes alternative transportation and commuter behavior change and produces detailed administrative reports (environmental, health, and dollar savings), along with intelligent mapping and visualization tools for administration. The program is ideal for Bike to Work Week; Rideshare Week; and general tracking, rewards, and compliance needs.

Public Web Application—Forestry and Public Safety

DTS (Data Transfer Solutions)
www.dtswildfire.com
www.WildfireMaps.com
WildfireMaps.com provides maps and incident information about current wildfires across the nation. The site integrates data from a variety of sources providing a single dashboard to keep users updated on where fires are occurring. Basic wildfire status is available in the Public Viewer app, while custom subscriptions and applications are available for more advanced capabilities.

Stand-Alone Desktop Application—Mobile Field Service

Blue Dot Solutions
bluedotsolutions.com
Cyan Patrol Inspections
Cyan Patrol Inspections combines Blue Dot's mobile enterprise asset maintenance experience with the power of Esri's ArcGIS Runtime SDK technology to provide a highly configurable solution optimized to meet the challenges of inspecting geographically distributed assets in a fast, accurate, and effective manner. Users may now complete inspections on foot, from the road, or in the air and update their back-office systems with critical asset data.

Private Web Application—Federal, State, and Local Government

Accela, Inc.
www.accela.com
Accela Automation
Accela Automation is the heart of the Accela Civic Cloud. The web- and cloud-based enterprise application helps agencies create a more citizen-centric, performance-based government. It provides a complete solution for automating critical tasks associated with permitting, code enforcement, community development and planning, and more. Accela Automation embeds map services from ArcGIS for Server within Accela's web-based business process management software, mobile solutions for field force automation, public-user web portal, and apps for citizen engagement.

Mobile Application—Utilities and Telecom

National Information Solutions Cooperative
www.ivueappsuite.coop
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National Information Solutions Cooperative's iVUE AppSuite provides convenient access to important data and is an integrated communication tool for organizations to use on tablet devices. Being connected when it matters no longer means being tethered to a desk. Be able to manage service interruptions, easily check meter information and work orders, capture and upload images, get pick lists, and monitor active jobs. Get access to all this functionality through a spatial interface by representing GIS data with integrated workflows to help users work more efficiently—from anywhere.

"Crossing Borders"

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

Stunning New African Ecosystem Maps

The AAG is pleased and honored to announce the publication of *A New Map of Standardized Terrestrial Ecosystems of Africa* as a special supplement to the *African Geographical Review*, an AAG journal edited and managed by the AAG's African Specialty Group in close collaboration with African scientists and one of the leading continent-wide geographic journals for African scholars.

This stunning series of new and detailed maps of African ecosystems that comprises this special supplement was created by the US Geological Survey (USGS) in partnership with the conservation nongovernmental organization (NGO) NatureServe and with an international team of scientists from most African countries, as well as from North America and Europe. Significantly, these beautiful new maps also represent the finest spatial resolution (90 m base resolution) data of its kind ever produced for the entire continent.

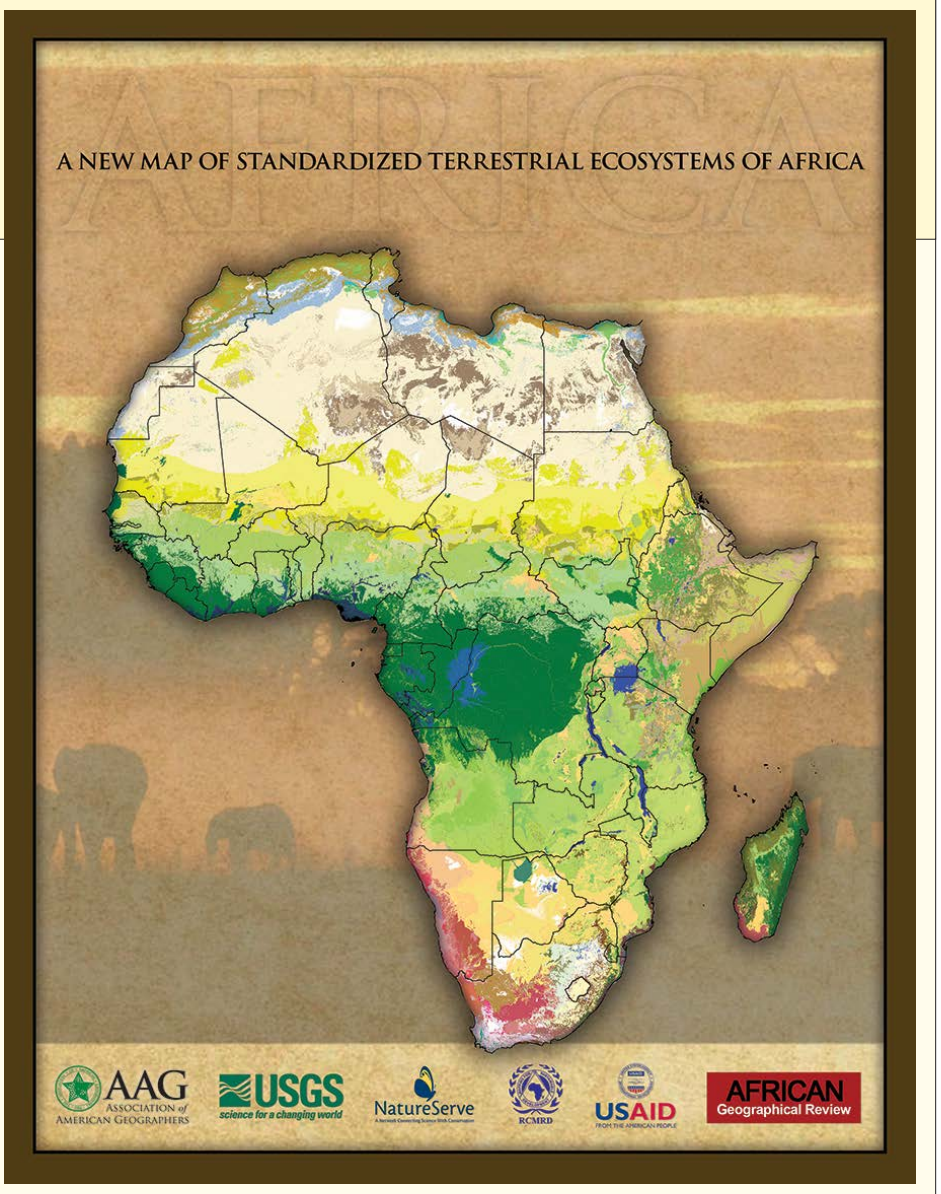
The new maps show the potential distribution of 126 ecosystem types modeled using a cartographic statistical regression approach based on knowledge of vegetation types and environmental features at more than 32,000 locations. It is the first continental map to show modeled vegetation types in their physical environments, derived from rigorous assessments of data.

USGS and its partners developed several new continent-wide data layers and maps (landforms, lithology, soils, bioclimate regions, etc.) as inputs to the modeling process. African scientists developed a new ecosystem classification and provided sample points representing known locations of the newly described ecosystems. The Regional Centre for Mapping of Resources for Development, in Nairobi, was an in-region partner and host of key workshops for the project. NatureServe led the modeling efforts for the new ecosystem map, and 37 experts from 18 countries collaborated on this project, which was funded by US Agency for International Development (USAID).

Esri mapping tools and software were central to the development of the new terrestrial ecosystem maps of Africa. The mapmaking was largely accomplished with ArcGIS, the raster processing was mostly conducted with ArcGIS (GRID), and the continent-wide maps were developed using standard Esri data on county/administrative boundaries for every country in Africa.

These new ecosystem maps are a significant improvement over previously existing maps in several ways. For example, the final ecosystems map is a product of a sophisticated, predictive analytics modeling process that uses multiple input data layers for the entire continent and was created specifically for this effort. These input layers include a first-ever continental landforms layer developed from a 90-meter digital elevation model, a new bioclimate regions layer developed from long-term records of temperature and precipitation observations, and a new lithology (rock/substrate type) layer produced as a compilation of existing regional geology datasets. These ecosystem maps are thoroughly integrated with the physical settings in which the vegetation exists.

The AAG has been involved for many years in working with universities, NGOs, and others in Africa, especially around themes of geographic science and sustainable development. These programs have included the AAG's My Community, Our Earth as a core program and have involved long-term partners, such as EIS-Africa, Harvard University, UN-HABITAT, the United Nations Environment Programme, the late Wangari Maathai's Green Belt Movement, Esri, and other organizations, and funding from Global Dialogues on Emerging Science and Technology programs, the Jane Goodall Institute, the National Aeronautics and Space Administration, the National Science Foundation, USAID, the US Department of Housing and Urban Development, the US Department of State's Bureau of Oceans and International Environmental Scientific Affairs, and private foundations. These collaborative efforts respond to needs as defined by Africans around issues of sustainable development, environment, education, and economic development.



This new ecosystems map and its underlying data will provide a valuable and synergistic resource for all these efforts and organizations throughout Africa. The new maps also will be crucial for a broad range of conservation applications and, in particular, gap analyses to identify unrepresented or underrepresented ecosystems in protected areas. The maps also can support biodiversity, agricultural, and resource management strategies that incorporate an ecosystem approach. The maps will also contribute a new knowledge foundation for research on impacts of climate change, fire, and invasive species on ecosystem productivity in Africa and for better understanding the interactions of economic and social policies on the goods and services (e.g., food, fuel, fiber, water) that African ecosystems currently provide.

I would like to thank Dr. Roger Sayre, an ecosystems geographer and senior scientist for ecosystems in the Land Change Science Program at USGS and the lead author of the special supplement to the *African Geographical Review*, for his input to this column and for his vision and sustained leadership of this complex and enormously valuable mapping project.

The complete article, "A New Map of Standardized Terrestrial Ecosystems of Africa," including the new map series in full color and links to the underlying data for these maps, is available free of charge on the AAG's website at **www.aag.org/AfricaEcosystems**.

Doug Richardson
drichardson@aag.org

URISA's GISCorps Celebrates 10 Years of GIS Professionals Giving Back

Ten years ago, in 2003, GISCorps was officially adopted as a URISA program to coordinate short-term, volunteer-based GIS expertise and support to underprivileged communities worldwide. Volunteers provide their GIS expertise remotely or on-site and have been involved in a variety of missions, supporting humanitarian relief, emergency response, health and education, local capacity building, and community development. Since its debut, 414 volunteers have been deployed to 117 missions around the world.

Supported in part by URISA staff, GISCorps is run by a core committee of volunteers (including cofounder and GIS hero Shoreh Elhami, GISP—see **esri.com/news/arcnews/summer10articles/urisas-giscorps.html**) who keep the program running. Core committee members work with partner agencies to determine project needs, query the extensive volunteer database for individuals with required skills, and coordinate the interaction between project sponsors and volunteers.

Some high-profile GISCorps missions have provided GIS expertise in response to disasters (Hurricanes Katrina and Sandy, the Asian tsunami, and the Haiti and Japanese earthquakes), while other missions have had more of a humanitarian focus (mapping health and educational facilities in Sierra Leone; trend analysis and data collection to combat wildlife poaching in Zambia; development of a web mapping portal in Armenia; and GIS education and training in Afghanistan, Thailand, and Albania).

Note that URISA's GISCorps will have a comprehensive display within the Map Gallery at the Esri International User Conference in San Diego, California. Stop by the display or the URISA booth (#519) to learn more.

For more information, visit **www.giscorps.org** or **www.urisa.org**.

Costa Rica—Where Esri T-shirts Rule!

Amy Work, Geoporter director, shows off her Esri T-shirt high above the *tombolo* (sandbar) in Parque Nacional Marino Ballena in Bahia Ballena-Uvita, Costa Rica. Bahia Ballena-Uvita is home to Geoporter, a volunteer-based program that educates and trains teachers in local schools, tour guides, and community residents on how to use GIS to identify and map resources they think are important to their community. This is the first community project for Geoporter (**www.geoporter.net**).

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. Upload digital photos at *ArcNews Online* or send them via e-mail (tmiller@esri.com). Digital images are preferred, but prints or slides can be sent to *ArcNews* T-shirt Feature, Esri, 380 New York Street, Redlands, California 92373-8100 USA. See *ArcNews Online* at **esri.com/arcnews**.

Amy Work shows off her Esri T-shirt in Bahia Ballena-Uvita, Costa Rica.

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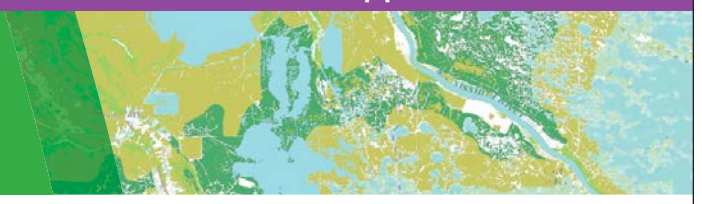

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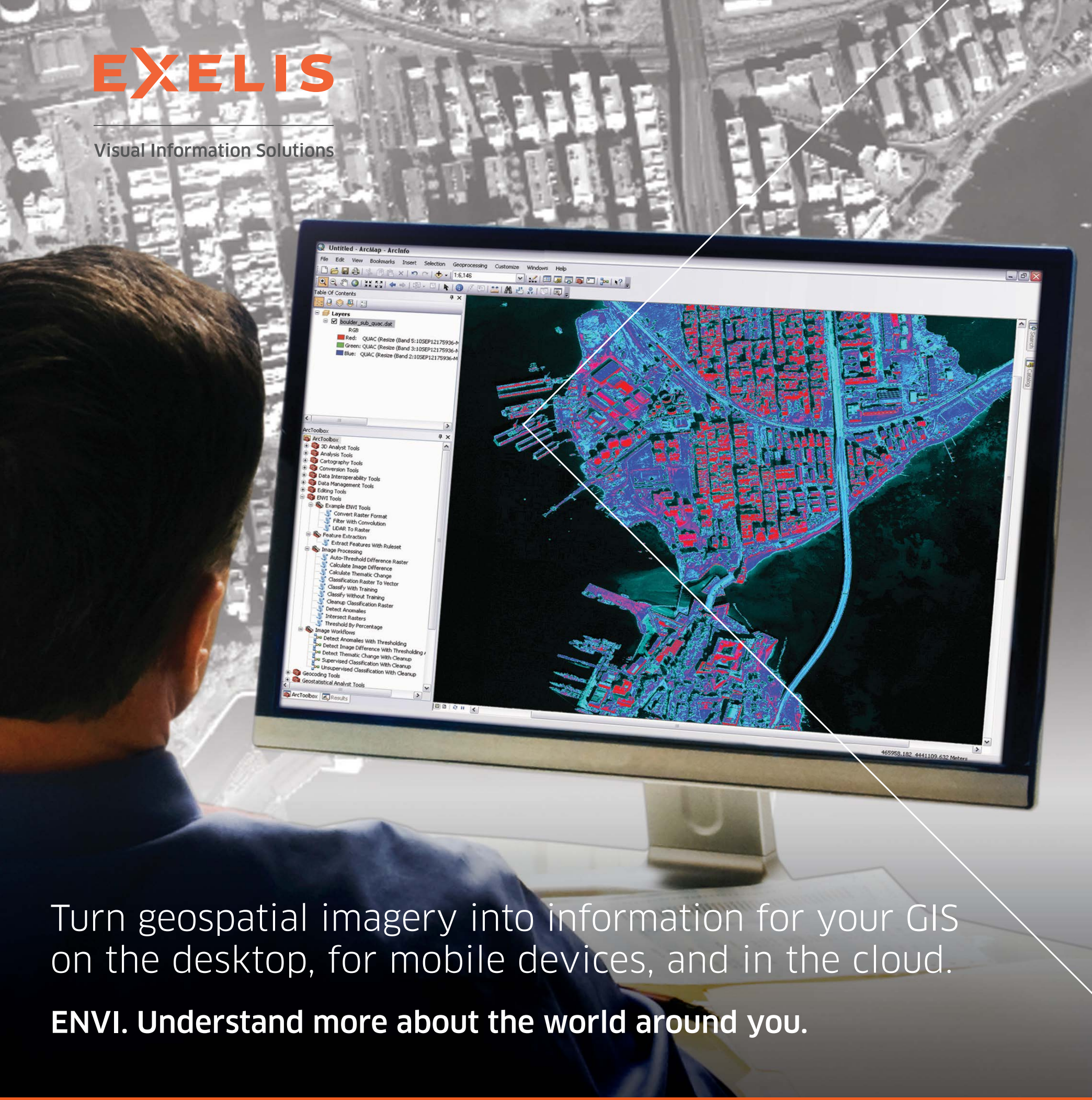

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