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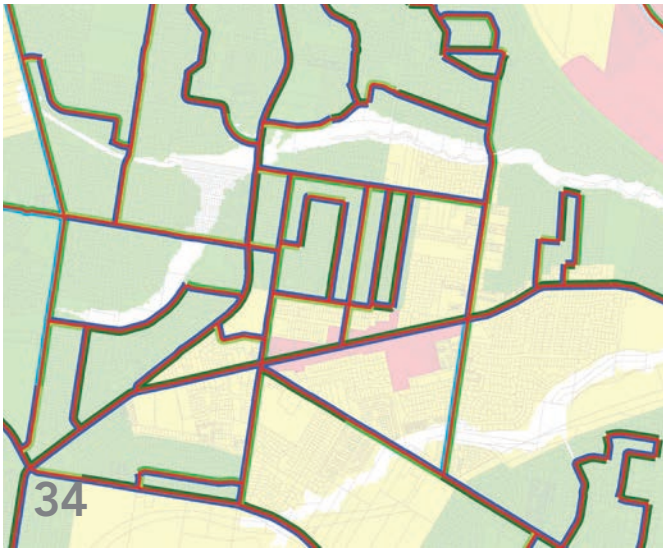

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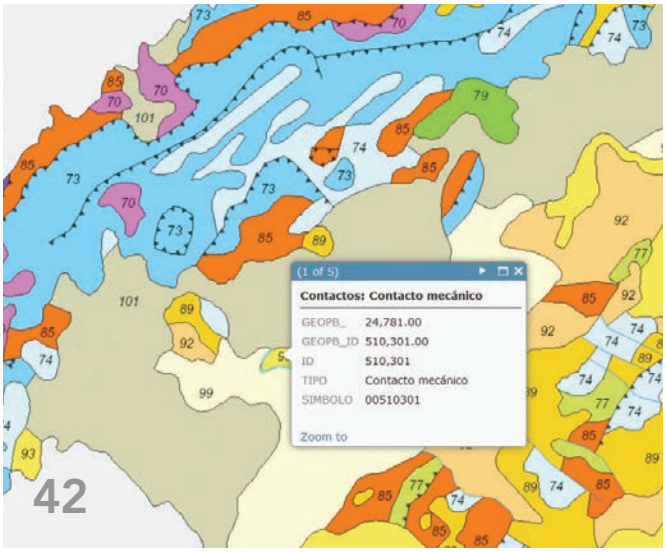

Special Section

Take *ArcUser* with You

Download the Esri Bookstore mobile app to access the contents of the current issue of *ArcUser* on Apple and Android mobile devices.

Empowering Organizations

The effects of a little revolution are starting to be felt. This past July, ArcGIS Online quietly evolved from web mapping to a true web GIS with the addition of powerful data analysis, ready-to-use apps, solutions for geoenabling existing business intelligence applications, and a living atlas of authoritative maps. That is also when this new powerful GIS became available to anyone with a license for ArcGIS 10.2 for Desktop.

Tightly integrated with the rest of the ArcGIS platform, the resources and capabilities of ArcGIS Online can be easily accessed from a browser or from inside ArcMap. Either way, you can use online services; serve web maps you've created without standing up a server of your own; access a wealth of data; and share your data, maps, and services so you and others in your organization can use them on any device. This significantly extends your desktop without radically changing your workflow. And because ArcGIS Online is cloud based, you are always working with the latest version of the software.

The wider availability of ArcGIS Online also means policy makers and knowledge workers—people in your organizations who typically couldn't directly access geographic information—now can. More than that, they can interact with that information and add to it using mainstream business applications because solutions like Esri Maps for Office come with an ArcGIS Online subscription.

As articles in this issue demonstrate, this more holistic view can have a real impact on the way organizations perform. A county used ArcGIS Online to integrate existing GIS implementations and improve both internal operations and external communication. An airport has streamlined the inspection process needed to keep it in compliance with federal regulations. A small town created a current and comprehensive inventory of its utilities that is available to field crews.

In the past few years, mapping as a way to understand data and create information has become the norm. What was once exceptional is now expected. Consequently, GIS has become critical to many organizations. In an era marked by ever-increasing access to and use of geospatial information, GIS professionals have become more, not less, important. They perform the analysis, create and maintain the data, and produce the maps and apps that are empowering others to make better decisions and optimize operations.

Monica Pratt
ArcUser Editor

editor's page

ArcUser

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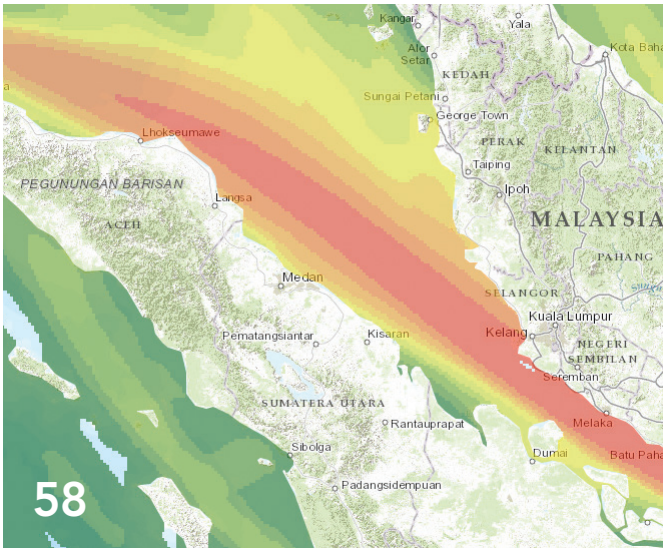
Departments



Visualizing ArcGIS Online Log Data

Esri uses its own Big Data tools

By Marwa Mabrouk, Cloud and Big Data Product Manager

Using ArcGIS tools it developed for Big Data analysis, Esri found a better way to analyze ArcGIS Online map tile requests so it can more intelligently prioritize basemap service updates.

Daily map tile requests—now in the billions—have outstripped previous methods that relied on RDBMS-based log file analysis. However, Big Data technology offers new options. Hadoop, an open-source framework that enables parallel processing on large data stores, has become synonymous with Big Data solutions because its cluster-based method allows billions of records to be analyzed in a few hours.

Because Hadoop lacks the native functionality to exploit the spatial component in Big Data, Esri designed GIS Tools for Hadoop and Geoprocessing Tools for Amazon Web Services (GP Tools for AWS) to extend the platform with utilities for spatially operating on billions of records at a time. The tools were released last year and are available on Esri's GitHub space (github.com/Esri).

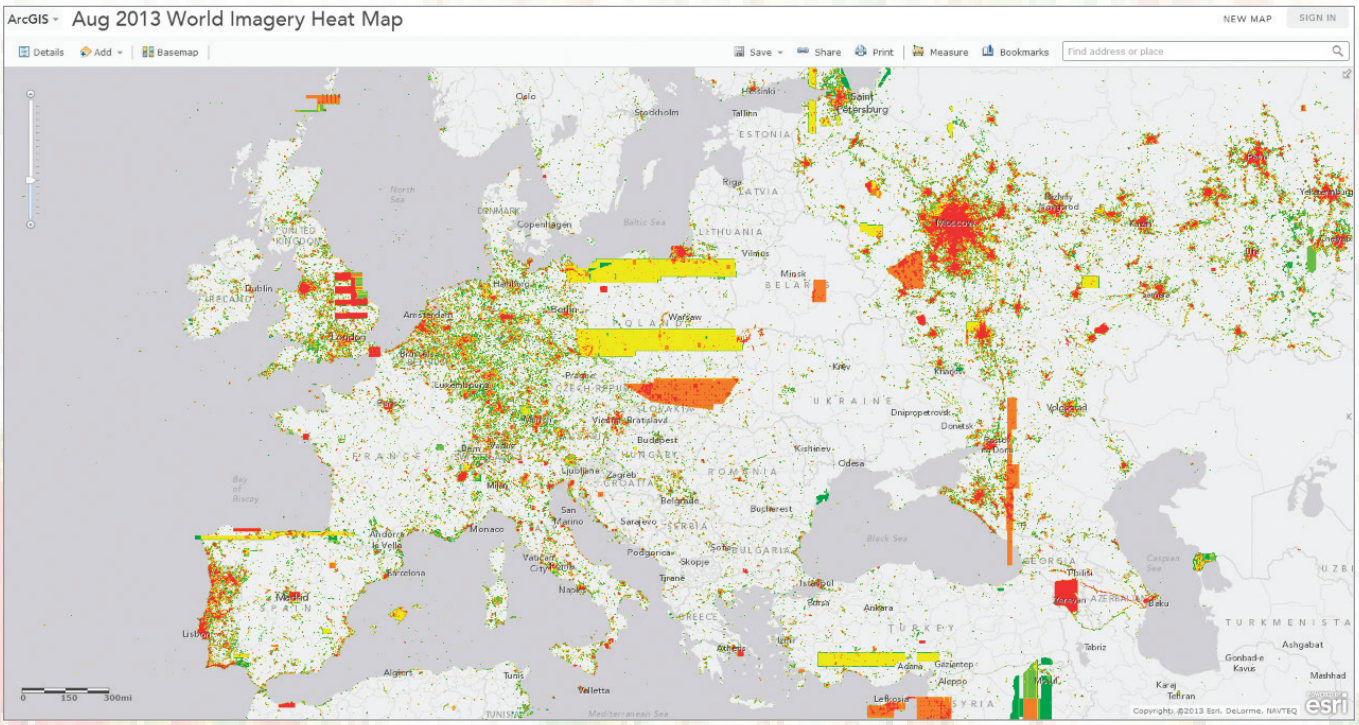
Esri processed and analyzed its own log files to get more fine-grained information about map tile requests such as where the requests originated and what geographies were being viewed.

A couple of team members, who had minimal Hadoop experience and little knowledge of Big Data analytics software and processes, were given the Esri Big Data tools to work with the ArcGIS Online log data. The goal was to see if every step in the traditional RDBMS cycle of data analysis (e.g., filtering, aggregating) could be extended to the Big Data analytics sphere. That turned out to be the case: every component of the "small" SQL analysis was analogous to the Big Data environment of Hadoop. For example, Hive is a component of Hadoop that allows users to make their queries in a SQL-like language called Hive Query Language (HQL).

Even on a large scale and even without Hadoop experience, the new process was so similar to familiar SQL analysis that team members could use these tools to run reports on Esri basemap usage around the world. These reports gave Esri a much more detailed understanding of which imagery tiles Esri customers used in a much shorter time frame.

Elastic Map Reduce (EMR) allows users

↓ A heat map, produced by refining ArcGIS Online log file data using the Esri Big Data tools, reveals that World Imagery map service use is concentrated around urban areas in Europe for August 2013.



with limited experience to take advantage of Hadoop's capabilities because it is hosted and managed in the Amazon Web Services (AWS) cloud. It also uses Simple Storage Service (S3) to store the data, which simplifies the operations side of storing the log files for analysis. By using EMR and S3 in AWS, the team didn't have to invest time building or maintaining a Hadoop cluster. Team members just started the EMR cluster when they needed to execute analysis and turned it off when they didn't need it anymore.

Using Hadoop, the team wrote scripts to comb the log data collected from Esri's servers and calculate and filter the needed information from them. The project used GIS Tools for Hadoop to geospatially enable Hadoop as part of the GP Tools for AWS implementation. GP Tools for AWS leverages AWS by allowing ArcGIS users to run analyses on log file data loaded in S3.

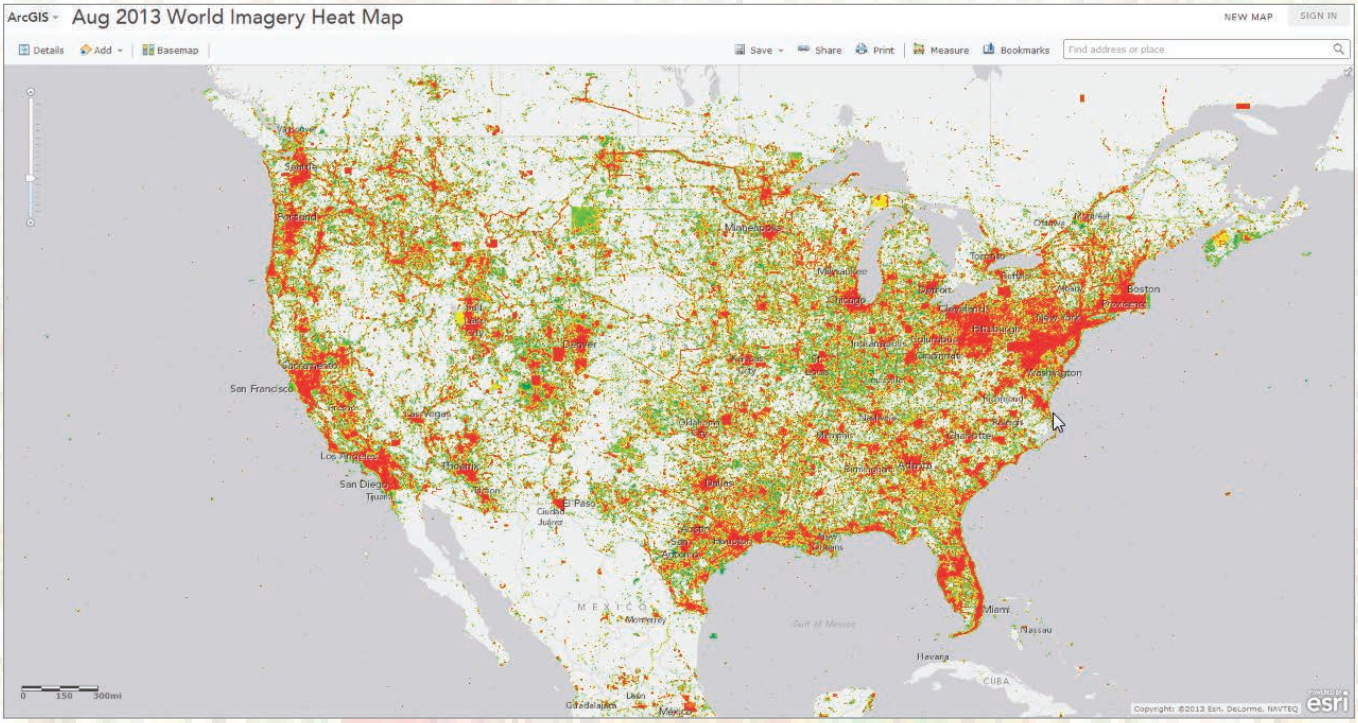
After processing and analyzing the data, team members imported the results into ArcGIS for Desktop. To visualize this data, they created heat maps of the United States and Europe that represented the billions of tile requests that came into ArcGIS Online during August 2013. Hadoop was instrumental in helping the team process the source data that populates these maps. This analysis revealed that most people who use the World Imagery map service are from urbanized areas in the United States and Europe.

Although this use case involved log files, the same principles of analysis apply to any flat files and datasets that have grown so unwieldy that nothing can be gleaned from them via traditional RDBMS methods.

Esri has shared the sample data and script used for this project on its GP Tools for AWS project page in GitHub. This sample data, along with instructions for generating a map based on web log analysis results, is contained in the sample 1 folder. The log data samples included in this example were extracted from ArcGIS logs, cleaned up, and formated as comma-separated (CSV) files. These CSV files provide a good starting point fo r getting familiar with this analysis.

For more resources and information on geospatially enabling Big Data, visit Esri's Big Data resource pages at esri.com/products/technology-topics/big-data.

↓ A similar heat map was created showing World Imagery map service for the United States in the same time frame. (Lower usage was filtered out to increase contrast.)

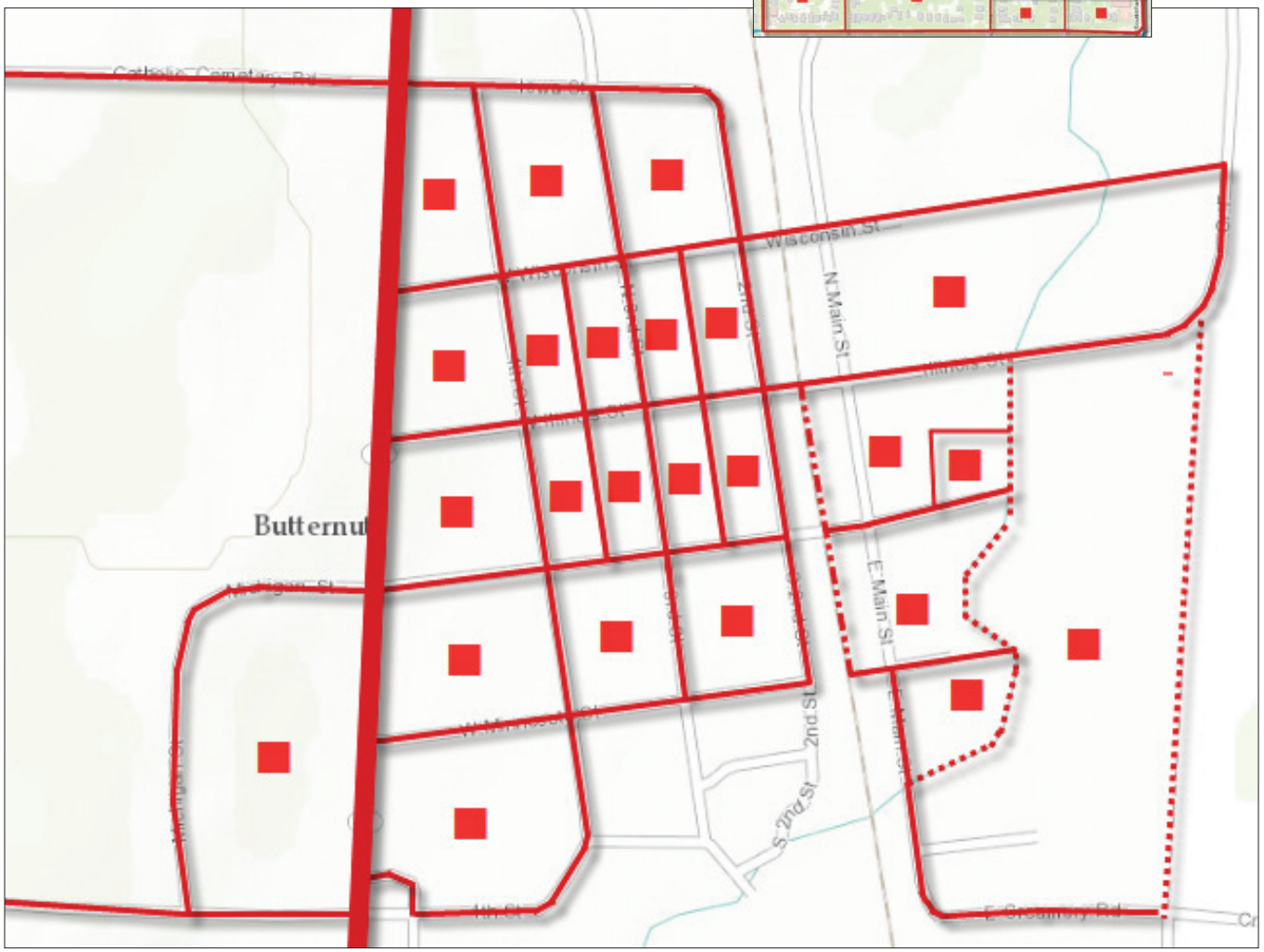


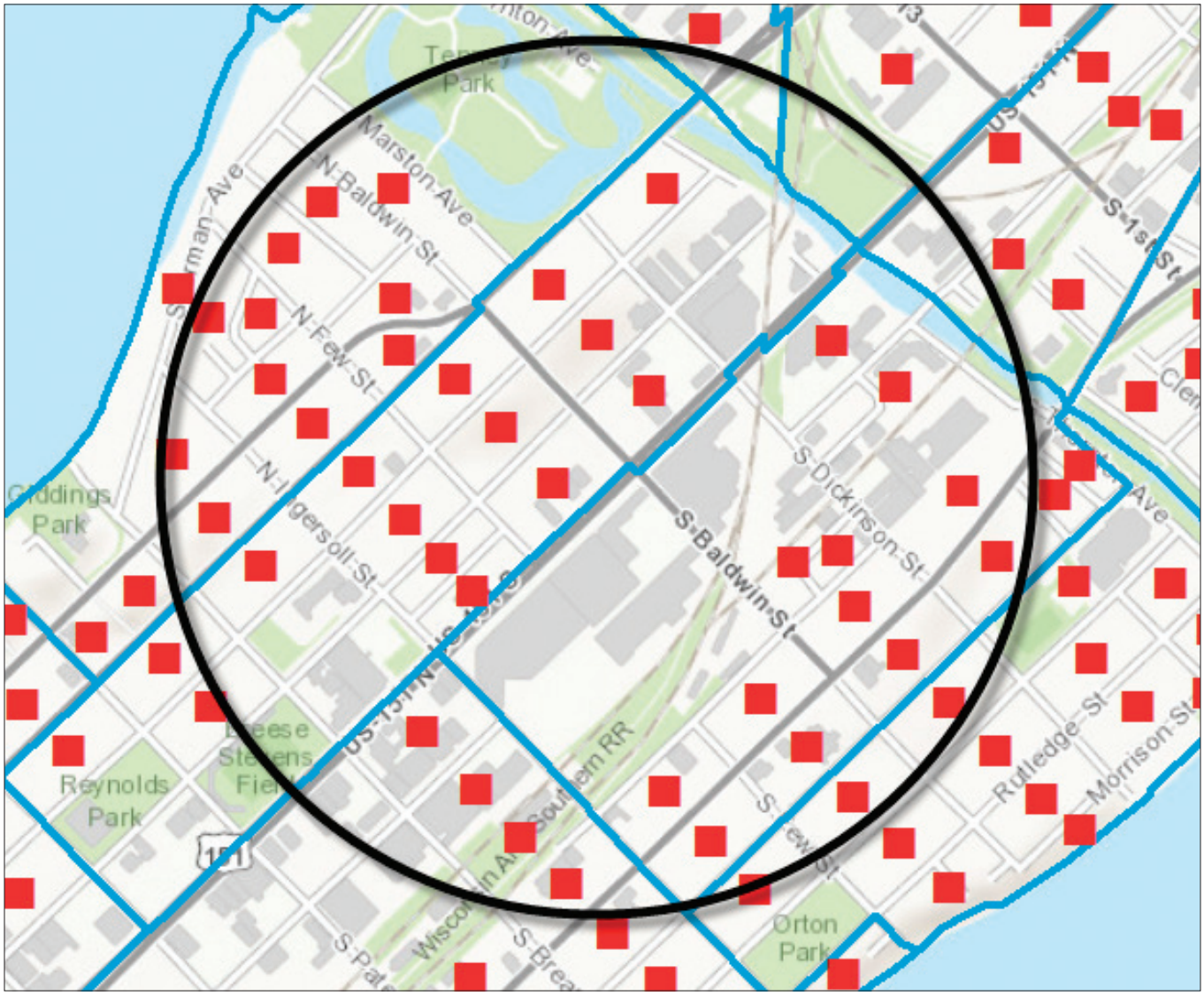
More Than a Pretty Graphic

Sound methodology underpins GeoEnrichment

By Keith Mann, Esri Product Marketing

Simply clicking on a map in the Esri Insights app brings up attractively formatted information on demographics, lifestyles, and even the landscape without requiring any serious analysis on your part. However, when you are using Esri Insights, Esri Maps for Office, or any of the other Esri Location Analytics solutions, you are taking advantage of a sophisticated geodata retrieval methodology called data apportionment.





Data apportionment is a function of the GeoEnrichment service available through the ArcGIS REST API. The GeoEnrichment service uses Weighted Block Centroid geographic retrieval, a special methodology for aggregating data for rings and other polygons. With this methodology, data points within an area of interest are weighted more heavily than points outside that area. When the service aggregates data, the results are statistically adjusted to more accurately reflect the actual statistics within the area of interest.

↑ In this example, the ring touches 12 blocks but completely encompasses only 4 of them. The other 8 blocks are partially inside the ring, although some of their block points are inside.

↖ In an urban setting, most block shapes are defined by streets.

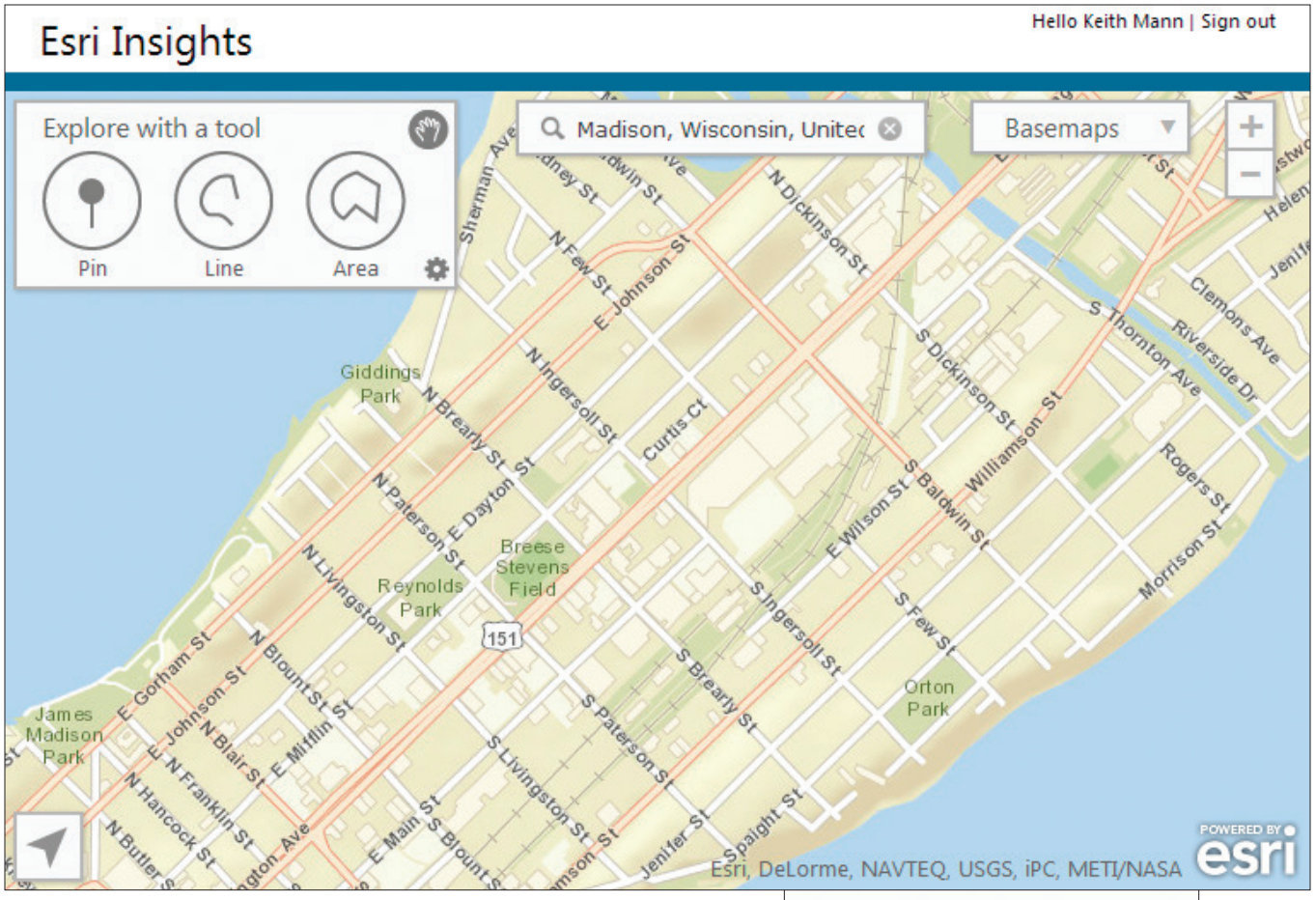
← In rural areas, block shapes are created along streams, streets, and property lines.

It Starts with Census Blocks

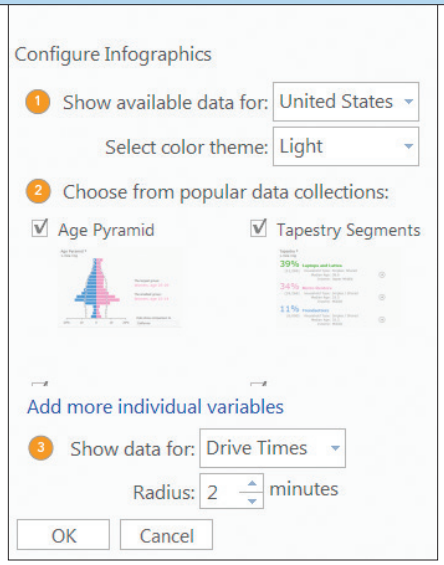
Like Russian dolls, census blocks are nested within census block groups, which in turn are nested within census tracts. The census block groups and the census blocks are the key input for data apportionment. Census blocks are the smallest geographic unit used by the United States Census Bureau.

Every census block has a centroid representing the center of the block that is sometimes called a block point. Think of this geographic point as the hub for all data collected for the census block. The shape of a census block is often determined by physical entities, such as streets or rivers, and administrative boundaries, such as school districts.

An easy-to-understand example of a census block is the city block, which is bounded by four streets. In rural areas, the edges of a census block are more likely to be defined by a combination of physical and political boundaries that result in census blocks with irregular shapes.



↑ Use the Tool and Settings dialog boxes to change extent and type of analysis.



How Data Allocation Works

This example will help you understand how census blocks and block groups are used in data allocation. Imagine you want to get statistics on households by income for a one-mile ring centered on the intersection of two streets. As shown in the example in Figure 2, the ring touches 12 block groups but completely encompasses only 4 of them. The other block groups are only partially inside the ring, though block points for some of those block are in the ring.

For those partially included blocks, the GeoEnrichment service uses data apportionment and the weighted centroid retrieval method to calculate the approximate statistics for those portions of block groups inside the ring. It considers all the block points within each block group touched by the ring but weights the block points inside the ring more heavily. The results are added to the population statistics for the block groups completely inside the ring to provide an aggregated set of statistics on the area of interest encompassed by the ring.

Data apportionment becomes especially important when you're investigating areas that have irregular shapes such as generated drive times, custom areas that you have drawn on the map, or areas that you derived from other data such as fire perimeters or flood zones.

Do It Yourself

You can try this yourself using the Esri Insights app. In this quick tutorial, you'll use Esri Insights to analyze demographics within a ring, a drive-time area, and a custom area. The statistics are calculated for each of these areas using the GeoEnrichment service. All you'll need is an ArcGIS Online account so you can access this online app.

Step 1

Open Esri Insights

1. Sign in to the ArcGIS Marketplace (marketplace.arcgis.com) with your ArcGIS Online user name and password.
2. In the Search box at the top of the page, enter Esri Insights and click the search icon.
3. Click the Esri Insights tile. On the Esri Insights description page, click the View Item button, click the Open button, and click View Application.

Step 2

Find an area of interest and dig deeper

The examples illustrated use Madison, Wisconsin, but you can use any area that interests you.

1. Zoom in a little so that you can easily see street intersections.
2. Click the Pin tool to select it, then click a street intersection. In the infographic pop-up that appears, click the double pop-up icon in the upper right-hand corner to shrink the size of the pop-up.
3. Next click the Zoom To button. You can page through the infographics by clicking the arrow buttons on the left and right of the pop-up.

Although you can't see the census block groups, blocks, and block points, Esri Insights is using that data via GeoEnrichment to calculate statistics and present the results to you as infographics.

Step 3

Change to a drive-time study area

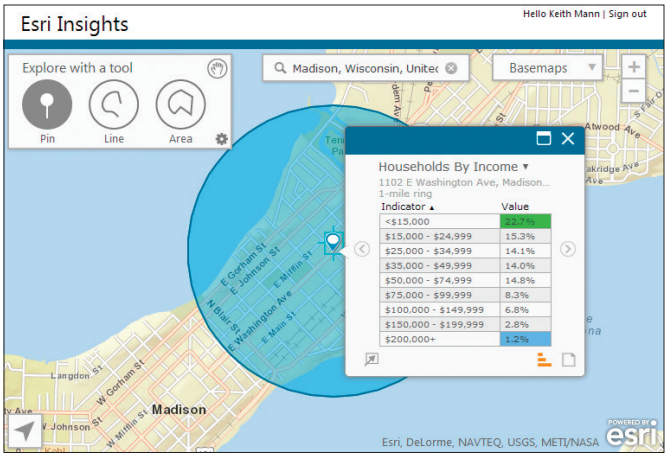
By default, Esri Insights uses a one-mile ring as the initial study area, but it allows you to change the infographic resources, type of area, and size of area.

1. Click the Configure button in the right-hand corner of the Explore with a tool box.
2. In the Configure Infographics panel, change Show data for: to Drive Times and Radius to 2 minutes, then click OK.
3. Page through the infographics again and notice any differences in the statistics. When you're finished, close the pop-up.

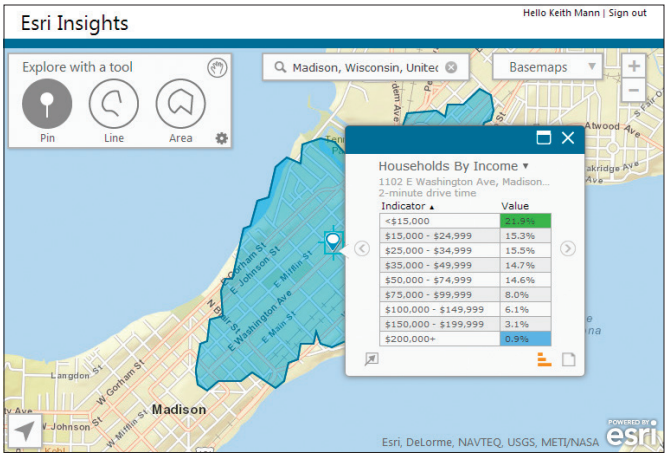
Step 4

Create a custom study area

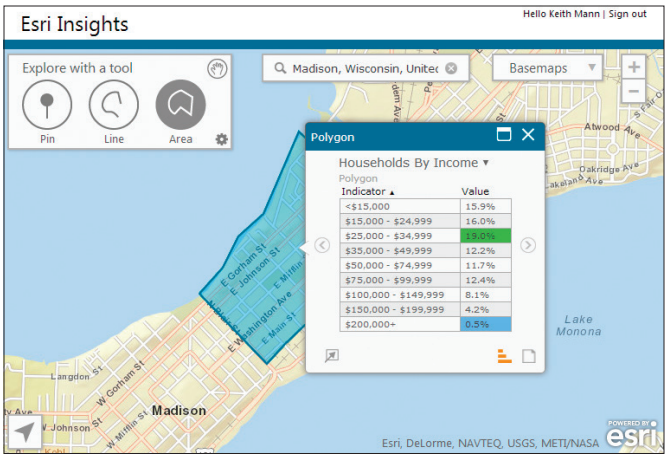
1. This time, click the Area tool. Create a custom area by clicking on the map and stretching out the polygon perimeters.
2. Try defining your area by following physical features like streets or rivers.
3. Once again, page through the infographics and notice any differences in the statistics.
4. When you're ready, sign out of Esri Insights.



↑ The Pin tool creates a one-mile ring, the default initial study area.



↑ Use the Settings dialog box to change the study area to a 2-minute drive time.



↑ Use the Area tool to change the study area to a custom polygon.

Conclusion

Esri Insights and other Esri Location Analytics solutions make troves of useful statistical data for areas you define instantly available using the analytical capabilities of GeoEnrichment service, which lets you answer questions about locations that you can't answer with maps alone.

Your Desktop Just Got a Whole Lot Bigger

If you have a seat of ArcGIS 10.2 for Desktop current on maintenance, you already have a web GIS.

How's that, you say?

Because your desktop license entitles you to one ArcGIS Online named user subscription and a block of credits. That subscription gives you access to world-class content, tools to make you more productive, and a platform for sharing your work and geoenabling your organization by integrating GIS with the operation of your organization via apps for mobile devices and field force management.

Unlocking Web GIS

Web GIS is the best way for sharing maps with people in your organization who are eager to use them, whether or not they know anything about GIS. People now expect that they can take maps with them on a smartphone or tablet. ArcGIS Online and the apps it supplies will let them use maps anywhere. They also can use those maps as a starting point for maps they can customize for their own purposes. Because you can do all these things with the web GIS (enabled by your ArcGIS Online subscription), you can take the lead in your organization, not only creating useful and interesting content but also helping others in your organization be more productive.

Data and Tools for You

An ArcGIS Online subscription gives you access to a world of authoritative content from basemaps with varying levels of cartographic detail to imagery and maps that provide best-in-class data on demographics; real-time traffic and weather; and land-use, terrain, and soils information that can improve your analysis and speed up your projects. This content is constantly updated and expanded.

That same subscription makes tools for working more efficiently available to you directly on the desktop. With the built-in viewer, you can quickly mash up your own data with other specialized layers and basemaps. It also lets you use tools for such tasks as geometric operations, locating addresses, or performing network analysis.

Easy Publication and Sharing

Your ArcGIS Online subscription lets you publish the maps and data you create as web services without installing your own server. You can publish web services either directly from ArcGIS for Desktop or from the ArcGIS Online website using ArcGIS Online hosted services. Published web services can be added to web, desktop, and mobile apps.

In addition to publishing maps and data as web services, ArcGIS Online provides a mechanism for organizing and sharing that content in a controlled manner through the groups you create. Groups can be private so only those involved in a specific activity have access or published so they are available to everyone. Maps can also be shared by embedding them in web pages and blogs, through social media, or by using them to create web applications. ArcGIS Online includes ready-to-use and configurable web application templates that require just a few steps to set up and no programming. Maps can be accessed from mobile devices using Esri's free downloadable apps for smartphones and tables.

Tools for Non-GIS Staff

ArcGIS Online gives you access to plug-ins that let others use your content in Microsoft Office and Microsoft SharePoint, familiar applications they use every day. They can make maps inside Microsoft Excel or PowerPoint using the Esri Maps for Office add-in or map data on SharePoint using Esri Maps for SharePoint.

Field Management Tools

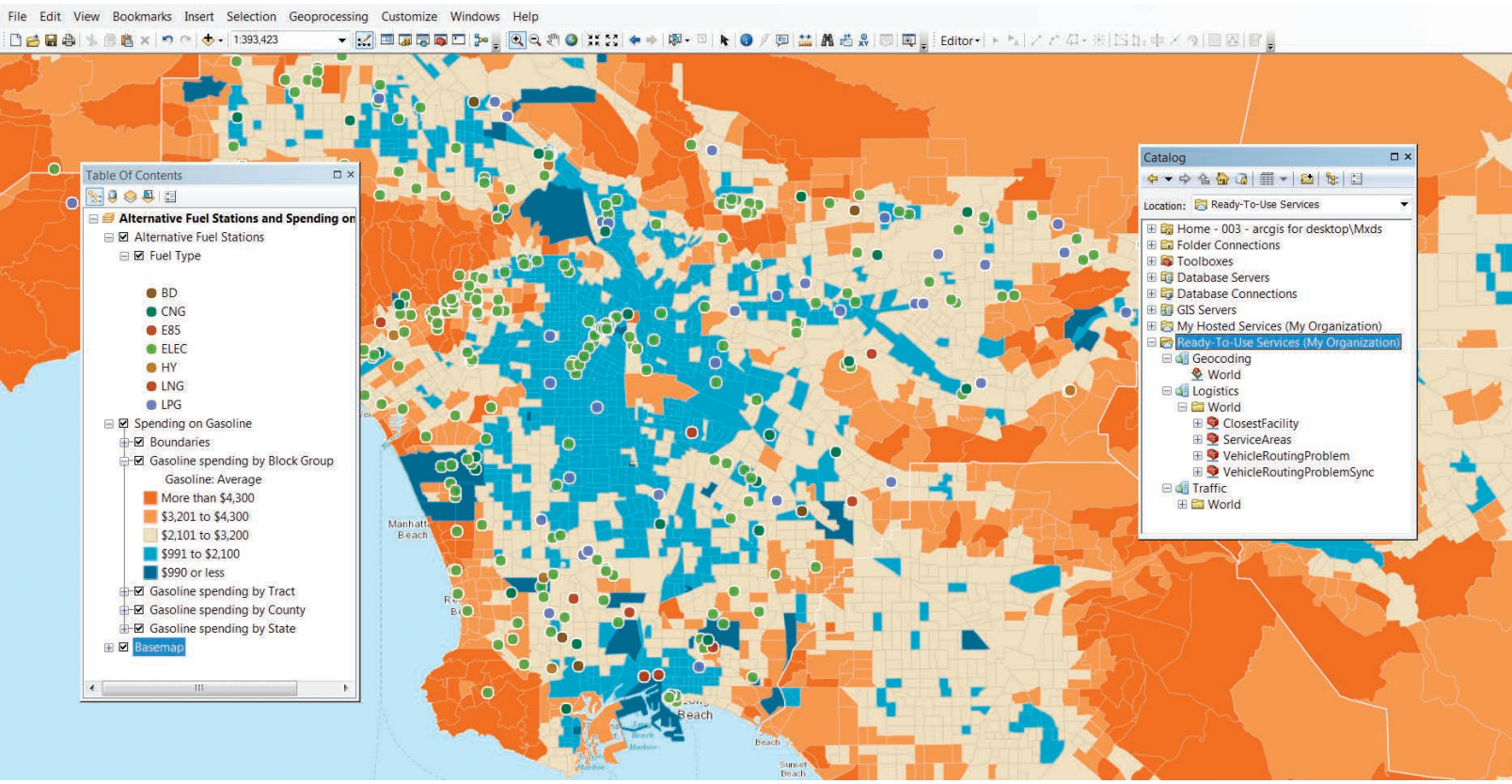
Two additional apps that come with your ArcGIS Online subscription, Collector for ArcGIS and Operations Dashboard for ArcGIS, can help manage field operations. Use the Collector for ArcGIS app on an iPhone or Android smartphone to capture, update, and report spatial and tabular information; plan routes; get directions; and integrate information back into your organization's GIS. Provide a common operating picture for your organization using the Operations Dashboard for ArcGIS app. Use it to monitor activities and events, track your field work force, and access the status of daily operations.

Shortcut to an Enterprise GIS

The inclusion of an ArcGIS Online subscription with ArcGIS 10.2 for Desktop is helping meet Esri's goal to build the most stable and interoperable platform for sharing and understanding geospatial knowledge. Now ArcGIS for Desktop, the premier application for creating authoritative spatial content and conducting spatial analysis, is your key to web GIS. Take advantage of your free named user ArcGIS Online subscription to empower your entire organization.

↗ Use authoritative basemaps with your data to more rapidly develop maps that answer questions or direct policy.

↘ Access online tools for creating service areas via ArcGIS Online.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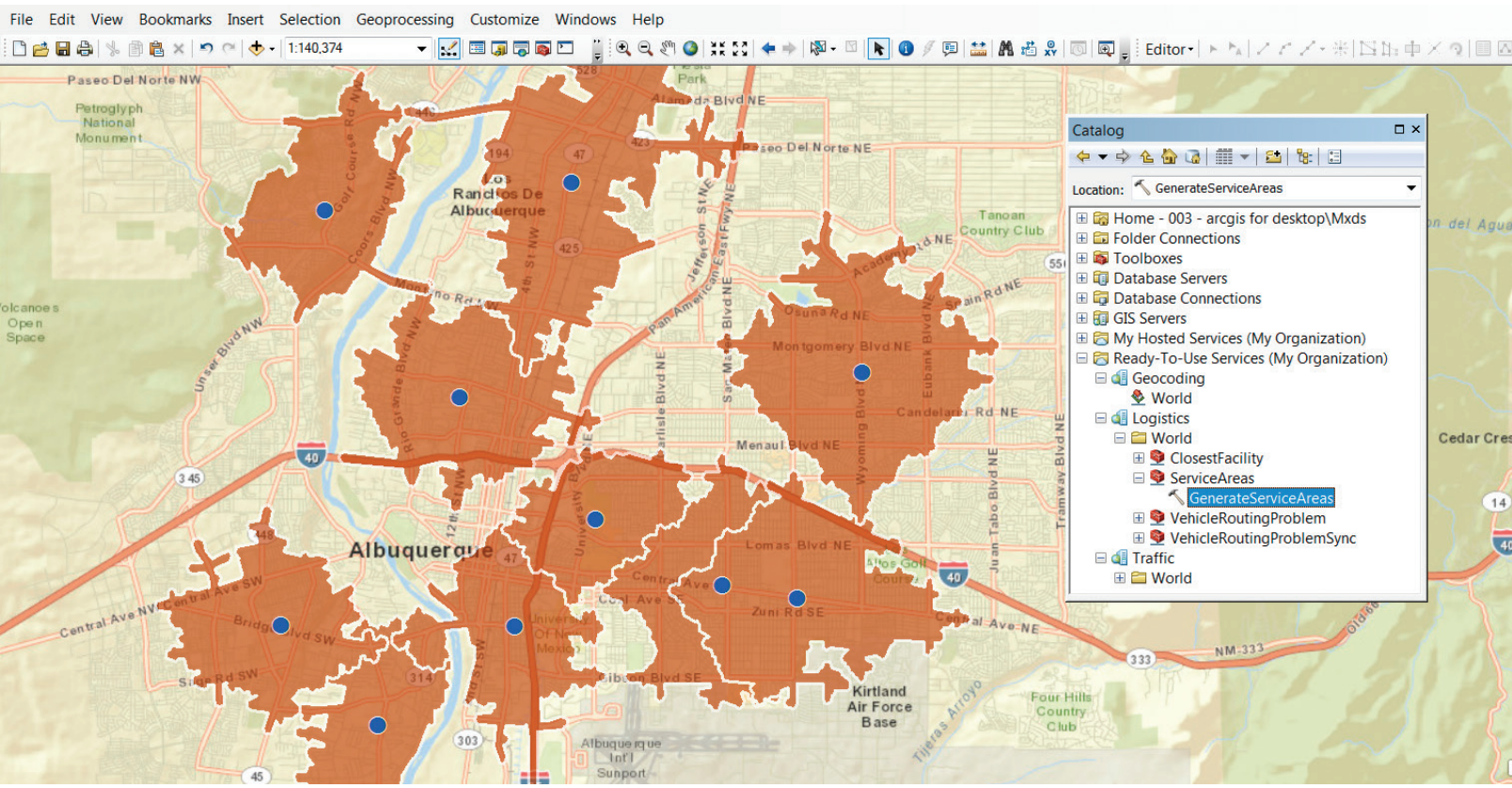
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Riverside County Takes GIS to the Next Level

By Monica Pratt, *ArcUser* Editor

↓ Riverside County uses ArcGIS Online for internally facing web maps like this one showing where bats were trapped and tested for rabies.

Riverside County, located in Southern California, is known for many things. It was the birthplace of the California citrus industry. It is currently the fourth most populous county in the state. And it has been, over the past 50 years, one of the fastest-growing areas in the entire nation.

However, the county's CEO Jay Orr wants Riverside County to be known for something else—for being the best place in America to live. Orr believes that the delivery of "customer-centric public service that is better, faster, and fiscally prudent through technology" is critical to making this vision a reality. To help accomplish this, the county has adopted a new enterprise GIS strategy that makes extensive use of ArcGIS Online.

A GIS Veteran

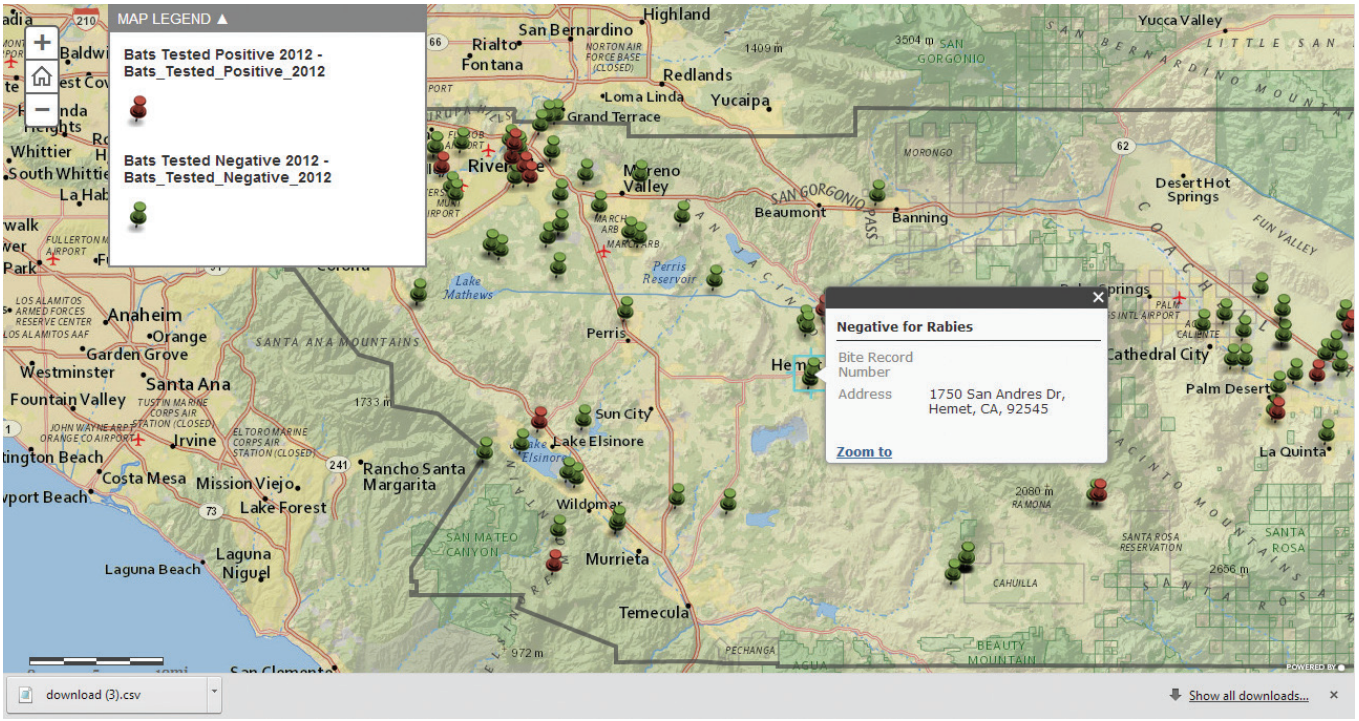
GIS is not new to Riverside County. It was an early adopter of Esri software and began integrating GIS technology into government functions in 1989. The county soon found innovative ways of applying GIS.

For example, in 1993, when fires burned thousands of acres in the county, the GIS team assisted the Emergency Operations Center with its response efforts by identifying the owners of destroyed or damaged properties to speed recovery assistance. Subsequently, GIS also helped determine the boundaries of burned areas so strategies for controlling flooding and mudslides could be developed and damage to environmentally sensitive areas evaluated.

As the cost and operational efficiency benefits of GIS were recognized, individual departments implemented GIS with great success. The county Transportation and Land Management Agency (TLMA) and sheriff and fire departments made extensive use of the technology and worked together to facilitate the creation, maintenance, and use of foundation GIS layers such as parcel, road network, and point locations. Other county departments that have made substantial use of GIS include the Riverside County Department of Public Health, the Riverside County Flood Control and Water Conservation District, and the Assessor Clerk Recorder.

A New Vision

County leaders, who were dealing with the effects of the recent economic recession, began exploring ways that technology could be used to deliver more value for the county. Although it has had a successful history in Riverside County, GIS was identified as a technology with the potential to deliver even greater returns.



The decision was made to move from a collection of individual GIS implementations to a truly enterprise-wide GIS centralized in the Riverside County Information Technology (RCIT) department. The county's enterprise GIS is not designed to be a one-size-fits-all solution. Riverside County CIO Kevin K. Crawford noted that while it transcends departmental interests, enterprise GIS must support departmental and operational requirements. It must serve, not detract from, the business functions of each department and be implemented to meet the varied business requirements of county agencies. The goal is not just sharing automated data but improving business processes.

"The principle purpose is to implement a shared vision for the use of GIS and geographically based data," according to Colby Cataldi, assistant CIO, who oversees enterprise GIS. "The vision represents the crucial outcome of action, direction, purpose, collaboration, and willingness to bring the best thinking into discussion about global issues that may appear to be unique to a department or agency but may also affect departments countywide."

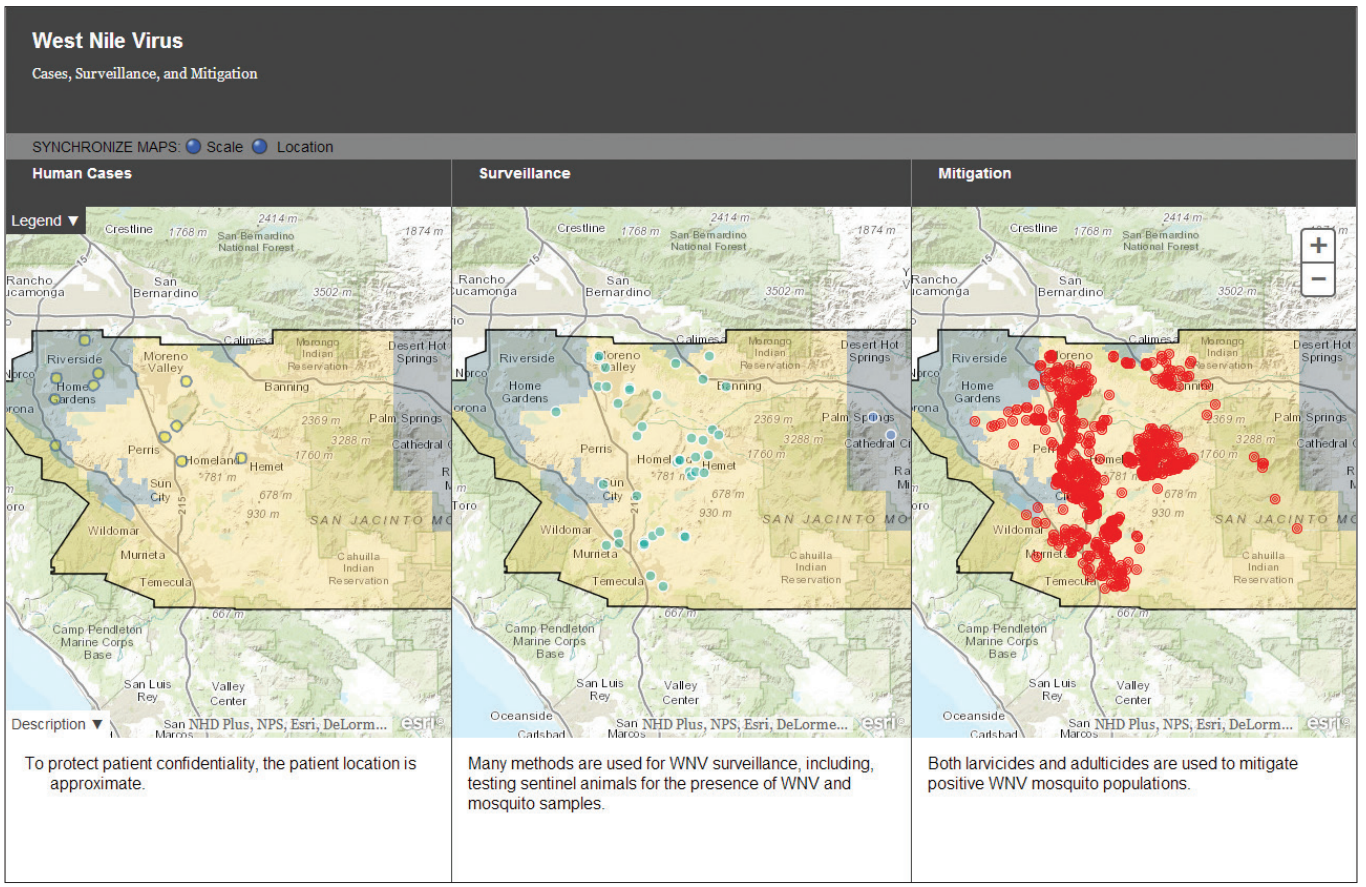
In 2012, the TLMA GIS group moved to RCIT and the county created the Geographic Solutions Division (GSD), which manages the county's enterprise GIS. GSD supplies a variety of geospatial services not only to internal customers but also to the Southern California Association of Governments (SCAG); University of California, Riverside (UCR); the Western Riverside Council of Governments (WRCOG); and the Coachella Valley Association of Governments (CVAG).

In 2011, the county entered into a public safety enterprise license agreement (ELA) with Esri. That experience led the county to evaluate a broader, countywide ELA. With wider access to GIS software, the county could more easily develop a common GIS framework that would improve collaboration within and across departments, make staff more efficient and productive, and enhance customer service. The countywide ELA, signed with Esri in November 2012, has enhanced sharing of GIS information across the organization, with business partners, and the public.

A Dramatic Change

With its ELA, Riverside County gets an ArcGIS Online organizational account that provides a large block of named users and credits. This opens up GIS resources to the entire organization as maps, apps, data layers, and web services, eliminating the learning threshold that had limited access to and benefits from the county's GIS.

With ArcGIS Online, a cloud-based system for creating and sharing maps and geographic information, organizations can upload and easily publish data to create intelligent web maps that can be viewed on any device and embedded in websites, blogs, and applications. ArcGIS Online users have access to ready-to-use, high-quality global basemaps that are constantly updated and data that has been shared by others.



↑ This three-panel map relates the occurrence, surveillance, and mitigation efforts in response to West Nile virus.

Previously, users of the system needed at least some level of GIS knowledge to directly use the system. Often, the value derived by those working directly with the system was dependent on their skill level with the software. Non-GIS staff members obtained maps and reports by making requests to GIS specialists.

The county will still require GIS professionals to perform analysis, create and maintain data, and develop web maps and apps. However, once created, those maps and apps can be made immediately accessible to knowledge workers, decision makers, other non-GIS staff, and the public via ArcGIS Online. Everyone in the organization can be empowered to get the maps and answers they need. They can also contribute back by adding data, refining information, and creating their own maps shared on ArcGIS Online. This helps the entire organization by allowing decisions to be made based on the best available information. This dramatically increases the value the county receives from its GIS.

ArcGIS Online is seen by the county as a key component of its enterprise strategy. Implementing ArcGIS Online "will transform the way we spatially interact with data and information," according to Tom Mullen II, assistant CIO. "The ability for policy makers to spatially see the affected areas of the county and how citizens are cared for, in an interactive map, adds to their depth of knowledge and understanding of the unfolding events and how best to effectively respond to the areas of greatest need in a dynamically changing environment. It provides a department [with] the ability to spatially visualize relationships between services they provide and the communities they serve in an interactive map," said Mullen.

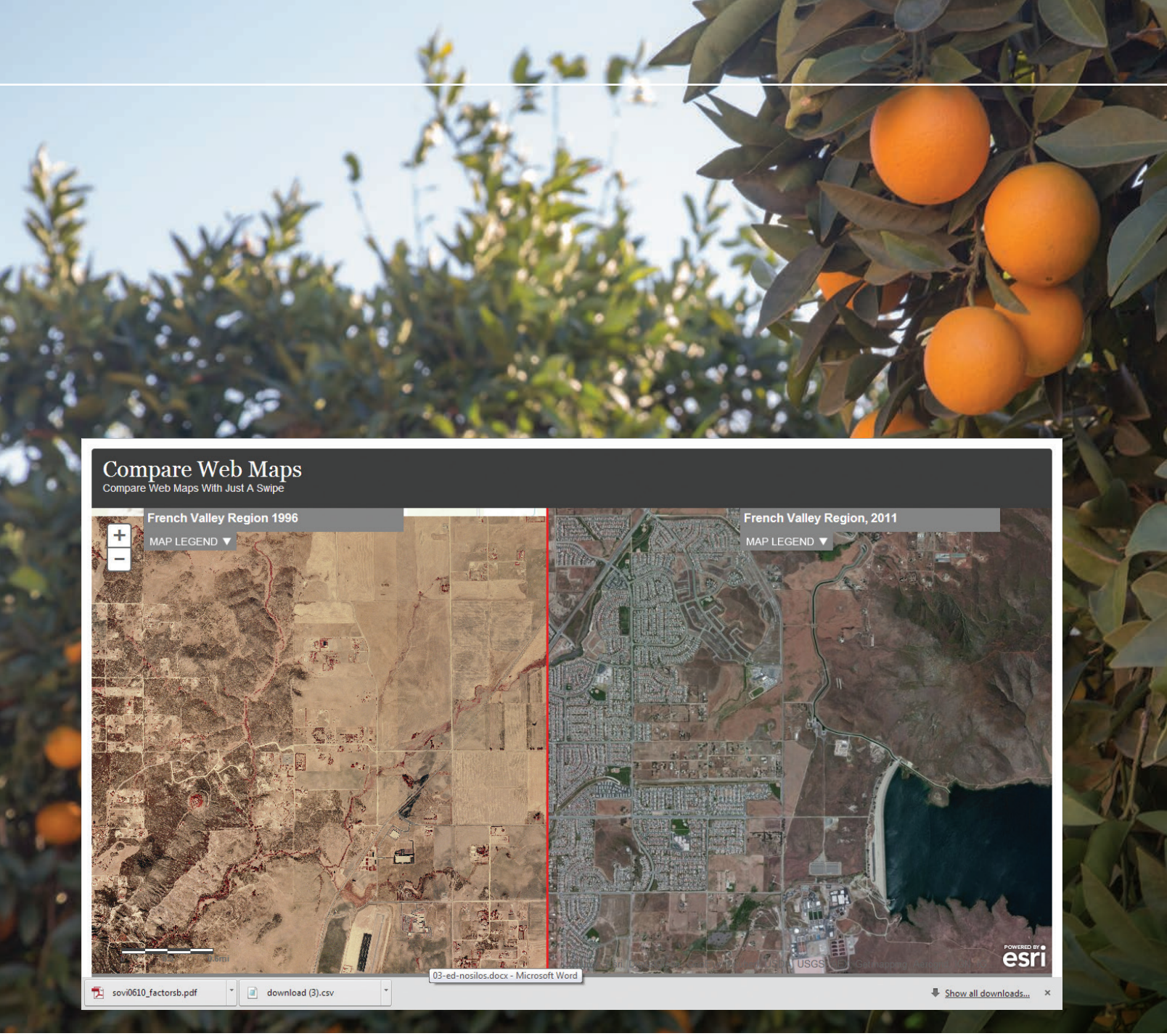
In this cloud-based environment, users can quickly create maps utilizing standard templates and best-practice cartography. Using templates also gives maps on the county website a standard look and feel as well as helps county staff rapidly deploy them.

Reaching a Larger Audience

Shortly after signing the ELA in November 2012, the county started creating web maps and apps. By March 2013, the first ArcGIS Online maps were up.

The county's externally facing sites furnish information to county residents and the general public. These sites also promote government transparency. One of the first sites to take advantage of ArcGIS Online capabilities was the Meet the Supervisors site. Using an Esri story map template, this site introduces each supervisor, indicates the location of the district served by that supervisor, and links directly to individual district websites.

The County of Riverside Ag Trail website leverages ArcGIS Online through a collection of embedded web maps that show the location and give directions and website links to more than 100 businesses and



events related to agriculture in the county. This information is of interest to both residents and tourists. Maps feature farms; wineries; fairs and festivals; and stands and markets that sell organically grown products, fresh fruits, and vegetables.

Because building healthy communities is a top priority for the county, the Riverside County Department of Public Health (DOPH) has used ArcGIS Online to create many kinds of information products, such as the County of Riverside Healthcare Inventory map, which helps residents locate health service providers near them such as hospitals and clinics.

Other county internally facing websites use ArcGIS Online maps to enhance communications within and between county agencies and departments to improve operations. The Department of Animal Services tracks the occurrence of rabies in bats by mapping locations where it has impounded bats and results of tests on those bats.

The West Nile Virus Activity map reports the location and status of surveillance traps, the location of spraying sites, and the boundaries of vector control districts in the county. Information on the occurrence of West Nile virus in the human population, as well as surveillance activities and mitigation efforts, can be compared using a three-paneled web mapping application. (Patient confidentiality is protected by supplying only approximate locations on the map.)

Some ArcGIS Online maps, like the Licensed Healthcare and Social Vulnerability map, help policy makers identify potential problems so they can be mitigated. On this map, care facilities, services,

← Policy makers can easily appreciate the changes over time to an area known as French Valley.

and clinics are mapped against the USA Social Vulnerability Index (SoVI), which measures the vulnerability of US counties to environmental hazards based on factors that may reduce a community's ability to recover from floods and other hazards.

Other maps provide greater perspective for policy makers. A three-panel map shows changes in the population density for the desert community of Mecca. Data for 2000 and 2010 can be compared with projections for 2050. Another map lets the user swipe across the map to compare the dramatic growth that has occurred between 1996 and 2011 in a portion of southwestern Riverside County known as French Valley. Maps like these can help county staff make better decisions regarding where to strategically locate resources to best serve the needs of residents today and tomorrow.

Ingredients for Success

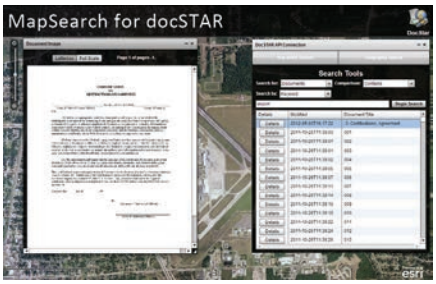
A clearly enunciated vision of the role of GIS in the county and buy-in by the top departmental leadership have contributed to the success and growth of enterprise GIS. By eliminating redundant and competing systems, the county is saving both time and money. ArcGIS Online is making information in the county's GIS directly available to knowledge workers and decision makers in a timely fashion.

The enterprise GIS remains a work in progress according to the county's CIO. The county will focus on the five patterns of GIS business behavior: data management, planning and analysis, field mobility, operational awareness, and citizen engagement. "Moving forward, Riverside County will develop and deploy a common GIS standard and continue to leverage the power of geographic data in an effort to expand the use of shared information; improve the business processes; and promote more timely, informed decisions," said Crawford.

Turning a Requirement into a Benefit

Enterprise GIS helps airport use the data it collects

By Matthew DeMerrit, Esri Writer



↑ MapSearch for docSTAR associates documents to geographic locations. It can search by keyword or by clicking on the map.

The enterprise GIS developed by a Louisiana airport helps not only to meet federal reporting requirements but also to save money and better connect the airport with its customers.

Recently, the Federal Aviation Administration (FAA) began implementing NextGen data requirements for airports. NextGen is an umbrella term for the ongoing transformation of the National Airspace System (NAS) in the United States from a ground-based system of air traffic control to a satellite-based system of air traffic management. The NextGen initiative mandates that airports collect survey-grade datasets, called Airport GIS (A-GIS), so the FAA can manage the spatial data needed to support safe aviation. Although many small- to medium-sized airports without major IT resources are fulfilling the requirements of the FAA, many do not fully benefit from the A-GIS data they collect.

To address that concern, Baton Rouge Metropolitan Airport (BTR), located in the southeast portion of Louisana along the Mississippi, partnered with GEO-Jobe GIS Consulting to extend the reach of its A-GIS data. With some grant money received through ongoing airport projects that can benefit from GIS, the airport was able to implement an enterprise GIS solution that includes Esri's Aeronautical Solution and ArcGIS Online.

Coordination Challenges and Cost Cutting

Like municipalities, airports comprise different departments and interact with various entities. Airports host multiple airlines, fixed-base operators (commercial businesses that provide aeronautical services), and retail tenants. Airports must maintain the highest level of coordination to ensure consistent revenue generation and comply with FAA standards and constantly changing land-use rules. In addition, to stay competitive, airports must execute expensive, multi-year airport improvement projects: runway extensions, obstruction analysis, pavement projects, and terminal improvements.

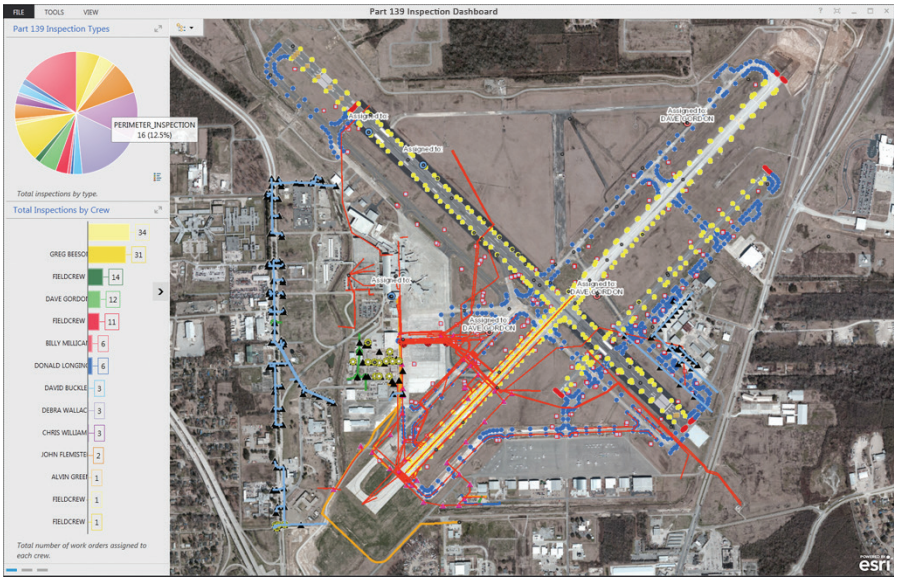
"To confront the rising costs, airport managers sometimes turn to IT consultants to implement 'improved' technology," said Eric Edmonds, vice president of marketing at GEO-Jobe. "However, once installed, many of their investments never actually get used by airport staff. Over time, the glamour and promise of technology wears off and staff just gets cynical."

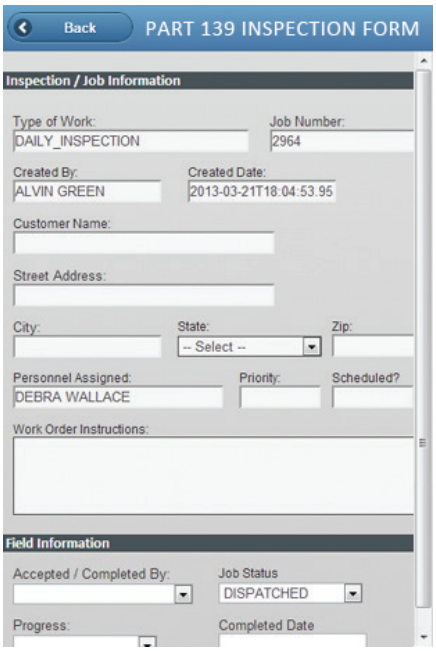
Building Trust

BTR wanted to avoid that situation. In 2010, the airport partnered with GEO-Jobe to perform a health check of its operations. Over the course of a week, GEO-Jobe met with airport personnel and found opportunities for GIS to play a critical role in the decision making and daily operations of the airport.

Enterprise health checks are rarely welcomed by a work force. Like a patient visiting a new doctor, departments can be suspicious of an outsider evaluating the inner workings of a familiar system. "Our initial presentation on basic Airport GIS wasn't well received by several administrators," said Edmonds. However, when GEO-Jobe staff met with department heads individually, managers relaxed and talked openly. Casual conversations with BTR staff revealed operational pain points. These interactions built trust and identified opportunities to make processes more efficient.

↓ The Part 139 Inspection Dashboard provides in-office users with focused inspection information for monitoring activities throughout the day.





↑ Part 139 Inspection Mobile provides a single point for inspection, creation, dispatch, and completion in the field.

Initial Implementation

The solution born from GEO-Jobe's assessment was an enterprise GIS that allowed the airport to push its A-GIS to the FAA. "We started by mining data and installing all the necessary hardware and software to host and serve it," said Edmonds. Collecting existing GIS datasets from local government agencies and adding them to the airport's geodatabase was a crucial first step.

To make all facility information accessible through the platform, Edmonds' team converted BTR's Airport Layout Plan and information, which included CAD drawings and blueprints of construction projects, into a format that could be added to a geodatabase. ArcGIS for Server, ArcGIS Online, and Esri Aeronautical Solution were used to give the airport a central platform for creating and sharing GIS data across departments and with the FAA.

In the first show-and-tell meeting with the airport after the initial implementation, one of the staff members asked GEO-Jobe to calculate the area of a recently acquired parcel adjacent to the airport. The airport had just spent several days surveying the property even though it only needed submeter approximations. To show how even the simplest GIS tools can empower them, one of GEO-Jobe's staff members traced the same parcel using the measuring tool in ArcGIS Online. "It took less than 10 seconds to trace and calculate the area," said Edmonds. "The difference between calculations was only a few feet."

Simplifying Inspections

GEO-Jobe's evaluation of one of the airport's most critical procedures—Part 139 Inspections—came early in the needs assessment. *[The FAA, under Part 139 of Title 14, Code of Federal Regulations, issues Airport Operating Certificates and conducts periodic inspections to ensure airports are meeting the requirements of Part 139.]* Inspections were a major headache for the Operations Department. After carefully canvassing the runway and taking handwritten notes, inspectors would input their notes into a system in the office that generated new work orders. The status of these work orders was tracked on a white board.

GEO-Jobe eliminated that cumbersome process by creating a Part 139 Inspection app that enables field crews to create, dispatch, and complete work orders and inspection reports on the fly. With the app, the operations manager can also track the status of inspections and work orders and locate his field crew at all times.

Sensible Documentation Access

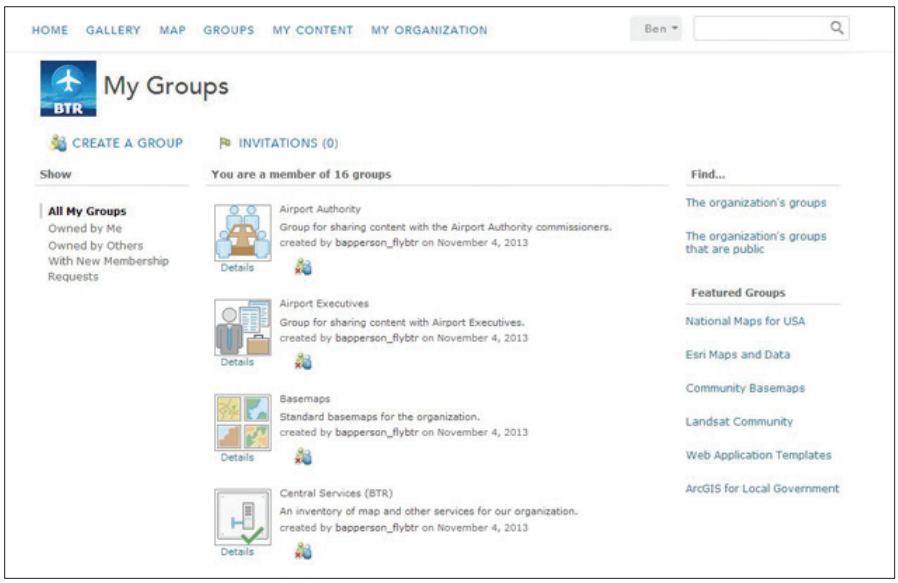
To reduce the generation of paperwork and archiving of paper documents, GEO-Jobe refined the airport's document management process by creating a location-based document management system. The system enabled instant classification of all paperwork, which was fully accessible via a web application to staff who had the necessary security clearances.

The system resembles a typical digital library catalog. All digitized documents are linked to features and areas on the airport's main map viewer. By clicking on specific property, airport staff can quickly pull up documents such as lease agreements, construction bids, architectural drawings, proposals, building footprints, bid acceptance, and repair orders. Correspondence between the airport, its consultants, and the local government is also tracked in the application.

The later stages of the airport's GIS overhaul will involve creating additional apps for both the airport and the public. Several apps that are currently being registered with the airport's ArcGIS Online account include an airport information map, marketing map, construction status map, and noise mitigation status map. Through its partnership with GEO-Jobe, BTR has become a model for small- to medium-sized airports.

"The project has proven that, with the right platform, airports can comply with FAA standards and also use the data to build a full-scale GIS that can be used across airport departments and better serve travelers and the local community," said Edmonds.

↓ BTR is strategically organized within ArcGIS Online through 16 defined groups.



Small Town Makes Big Improvements in Utility Records

A small town in Illinois is documenting its electrical and water distribution infrastructure using ArcGIS Online and mobile devices so that information is current and accessible.

The City of Princeton, located about 100 miles southwest of Chicago, has about 7,700 residents. The city owns and operates its electric utility, water distribution, and wastewater reclamation systems.

The Electric Department, which was purchased by the city in 1900, now serves 4,300 customers. In 2003, the Electric Department expanded its operations by entering the telecommunication business in partnership with Connecting Point/IVNet of Peru, Illinois. The city-built fiber network connects local businesses and is supplemented by broadband over power lines (BPL) providing low-cost Internet access to residents. Connecting Point/IVNet provides services over this network. To support these and electric distribution services, the Electric Department maintains 2,063 poles and 1,107 streetlights.

The Water Department maintains 58 miles of water main and operates the water filtration plant. Over the past 10 years, it has built a new 1.5-million-gallon water tower and three-story treatment facility. Through its decades of operation, the department has kept meticulous paper records of its system in a small sketchbook known as "The Bible." This volume has been handed down from superintendent to superintendent to the present day.

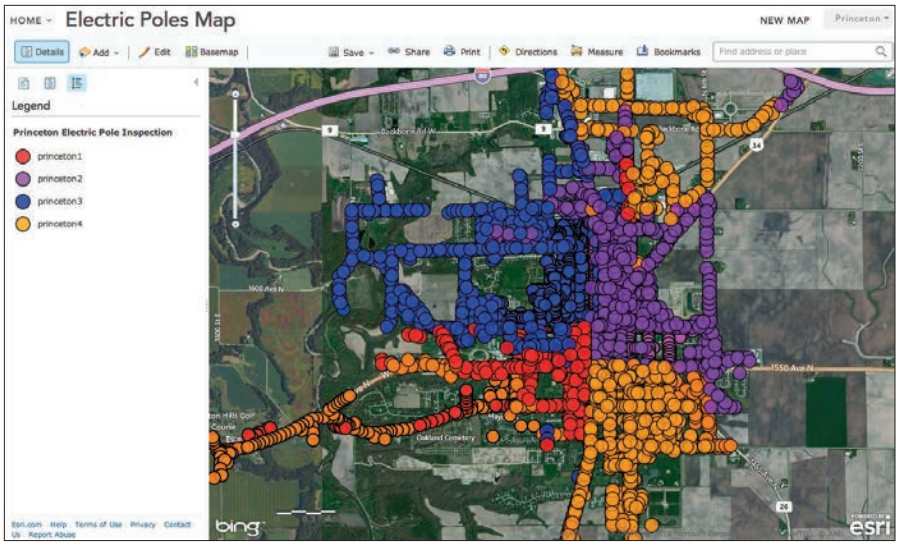
In May 2013, the Electric and Water Departments contracted with Cloudpoint Geographics, Inc., of Roanoke, Illinois, to help create and improve digital records for these two municipal utility systems. Cloudpoint, a recipient of the Esri Specialist designation, chose ArcGIS Online as the primary collection and distribution mechanism for the project. ArcGIS Online is a collaborative, cloud-based platform that lets members of an organization create, share, and access maps, applications, and data, including authoritative basemaps published by Esri.

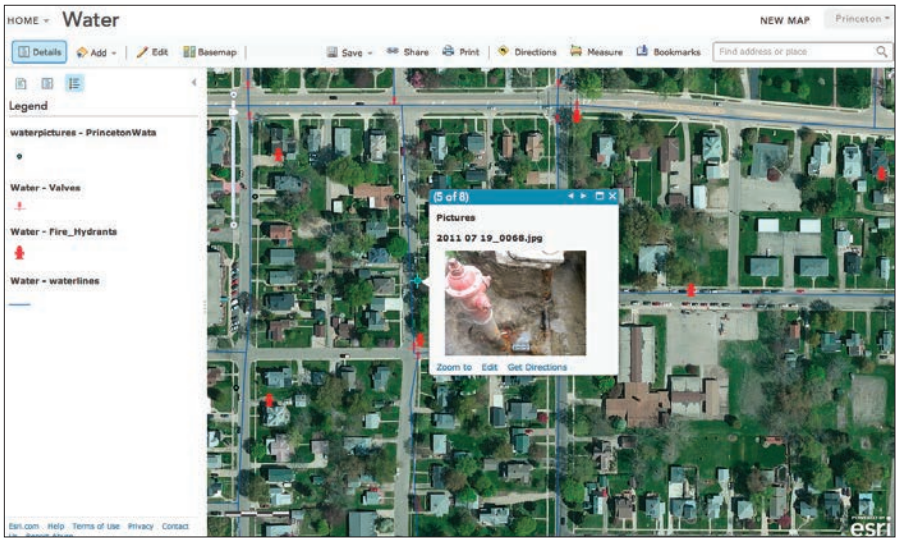
Rather than purchasing iPads to conduct

← Historic Main Street in downtown Princeton, Illinois

↗ After completing the inventory of 2,500 utility poles in just two and a half months, Princeton has comprehensive information on the number, condition, and types of electric poles in its system.

↘ Photographs of the water system's components were geocoded and uploaded to ArcGIS Online.





the fieldwork for the project, the city rented four preconfigured iPads as mobile data collection devices from Cloudpoint. Using the iPads in kiosk mode with the Collector for ArcGIS app from Esri, four teams from the Electric Department inventoried and photographed more than 2,500 utility poles in just two and a half months. This inventory provides the city—for the first time—with comprehensive information on the number, condition, and types of electric poles in its system.

Cloudpoint Geographics is currently migrating the Electric Department data into the ArcGIS Data Model for MultiSpeak, a ready-to-use geodatabase template that conforms to industry-standard MultiSpeak specification and is endorsed by the National Rural Electric Cooperative Association (NRECA). Eventually, the department's CAD information will supplement the model and provide a clear picture of the entire electrical distribution system.

To aid in digitizing the city's water system, Cloudpoint was allowed to scan pages from the Water Department's Bible but required to return the book each day. In keeping with the city's tradition of meticulous record keeping, each of the approximately 4,600 photographs (both digital and scanned) collected was given an approximate address by department staff. That metadata was stored in the exchangeable image file format (Exif). Cloudpoint extracted this information, geocoded it, and linked it to each image before publishing it to ArcGIS Online for use in the field by Water Department staff.

A copy of the original sketchbook and these photographs are now available on ArcGIS Online. Because the Esri Local Government Information model was used, information about main breaks and other projects can be included so that important information, as well as the Bible and photographs, is now readily accessible to field crews responding to water main breaks.

The Electric and Water Departments' projects are just the beginning. The City of Princeton, with Cloudpoint's help, plans to use ArcGIS Online to increase the locational accuracy of the city's data, make some data publicly available, and expand the use of GIS into other city departments. The city's ArcGIS Online subscription makes all these projects possible and affordable.

Mapping Your Field Data

By Joseph J. Kerski, Esri Education Industry Curriculum Development Manager

Mapping your field data has never been easier—or more powerful. Mapping field data has been a major activity for research and exploration for centuries. More recently, it has been viewed as a valuable activity in education.

Why should you collect and analyze field data? Why should you use ArcGIS for these tasks? How can you collect and analyze field data in ArcGIS Online? What are some resources that you can use to continue to learn more about fieldwork? This article covers these topics in a way that is accessible even if you are new to fieldwork and mapping. Resources provided at the end of the document will help you dig deeper into these topics.

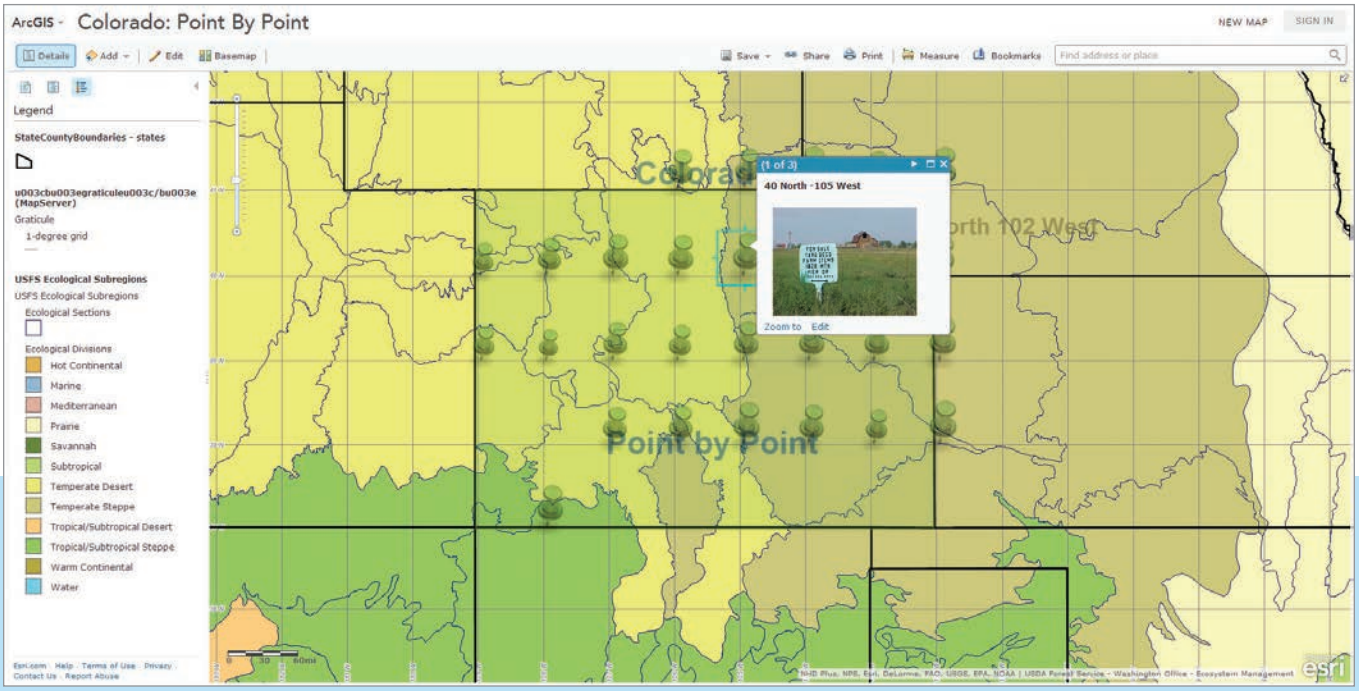
Why Do Field Mapping?

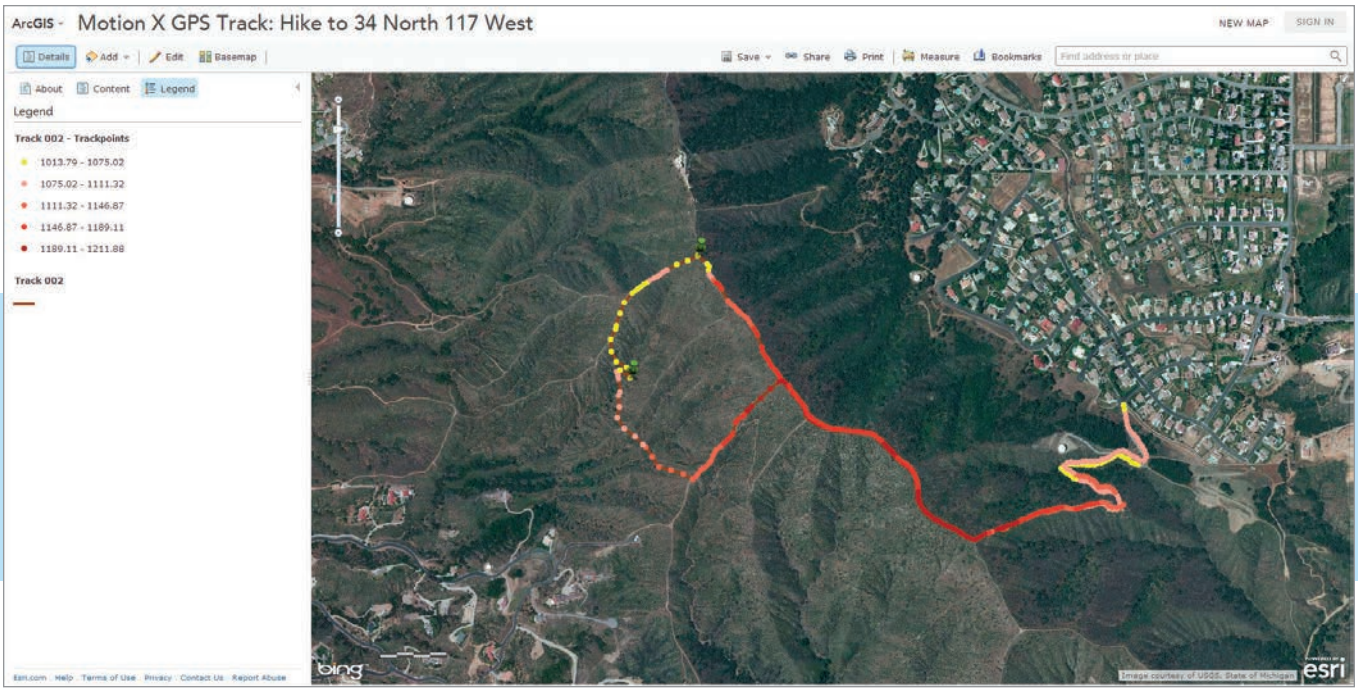
Why should you map field data in the first place? According to the National Research Council *Learning to Think Spatially* report (2006), spatial thinking and uncovering spatial patterns are fundamental to understanding. GIS provides the technology to map and visualize information. Indeed, ArcGIS provides a complete platform for mapping via a wide variety of file formats and data gathering devices. In addition, every issue critical to the 21st century has a spatial component—energy, water quality and availability, biodiversity loss, climate, sustainable agriculture, human health, ocean acidification, population change, natural hazards, just to name a few. It is vital that we understand each of these complex issues. They are global concerns, but they also affect our everyday lives. Each of these issues requires field investigation.

Analytical mapping also has value in and of itself. It is a fundamental part of the scientific and geographic inquiry process. This process includes asking geographic questions, acquiring geographic data, exploring geographic data, analyzing geographic information, and acting on geographic knowledge. Despite the geographic words used to describe this inquiry process, it is important to note that the process can and should occur in any discipline asking the *where* question—not only in geography, but in epidemiology, planning, business, and many other fields.

Fieldwork empowers people to get involved in community issues. It builds essential critical thinking and work force skills, such as understanding spatial and tabular

↓ Map notes in an ArcGIS Online map





↑ A GPX track mapped inside ArcGIS Online and symbolized by elevation

data types, assessing data quality, how to collect data, how to construct databases, how to bring data from the field into a GIS environment, classifying and symbolizing data, and analyzing data. In fact, David Orr's words from *Earth In Mind—On Education, Environment, and the Human Prospect* (1994) are particularly relevant here: "Now more than ever, we need people who think broadly and who understand systems, connections, patterns, and root causes...how to think in whole systems, how to find connections, how to ask big questions, and how to separate the trivial from the important."

I believe that effective spatial thinkers need to be conversant in three main areas—content knowledge, the geographic perspective, and skills. These skills include technical, communications, and other skills that are identified in the Geospatial Technology Competency Model published by the US Department of Labor, Employment and Training Administration. Planning and conducting fieldwork and analyzing the results of that fieldwork depend on all three of these areas, whether that field data comes from biology, epidemiology, transportation, law enforcement, defense, history, archaeology, energy, natural resources, administration, geography, business, or another field.

Why Use ArcGIS?

ArcGIS isn't just a set of web maps and some desktop tools. It is an integrated *system*—a platform—for making wise decisions. ArcGIS makes it easy to map many types of field data. A variety of georeferenced basemaps is available from ArcGIS Online as well as thousands of thematic layers, with more continually being added. ArcGIS makes it easy to analyze field data, both on the desktop and in the cloud. You can symbolize and classify your data, perform spatial analysis, present your results online as live web maps, embed your maps in web pages, and use them to create story maps.

↓ The author, Joseph J. Kerski, believes that using the geographic perspective can transform education and society through better decision making.

Requisite Skills

Some core skills are required when considering fieldwork: creating databases; capturing the location; collecting attribute data; creating maps; and classifying, analyzing, and symbolizing data. One must evaluate the project goals, the time and equipment available, terrain, and other factors when preparing to go into the field. Planning is essential for efficient field collection that contributes to meeting project goals.

Many Ways to Add Field Data

Adding field data to your GIS environment can be accomplished from databases, social media feeds, sensor networks, imagery, services, spreadsheets, probes, smartphones, GPS receivers, and many more means. Let's consider just five of the many ways you can add field data.

Add Map Notes

Probably the simplest way to add field data to a web map on ArcGIS Online is to create map notes. You can add map notes to indicate where you collected field data by clicking on the map at that location on the map. To find a specific location, you can input coordinates in the geographic search box at the upper right of the map. Coordinates have to be entered as x,y (in other words, longitude, latitude) and entered in decimal degrees. Don't forget that negative numbers are needed for locations in the western and southern hemispheres. The Location tool, under the Measure menu, will allow you to check the location of your cursor's latitude-longitude coordinates.

Import GPX Files

You can import a GPX file from a GPS receiver, from a device such as a scientific probe (those from Vernier or PASCO, for example), or from a smartphone. GPX is an open file format in XML used to describe waypoints, tracks, or routes. You can easily collect location data in GPX using one of the many apps available for smartphones (My Tracks or Motion X GPS). The GPX file can be added directly into ArcGIS Online; symbolized by elevation, time, or another attribute; and the resultant map saved and shared.

Create Table and Import It

You can create a table of data and import that table into ArcGIS Online. Tables can be created in Microsoft Excel or a text editor and saved as a CSV file. You can also use Esri Maps for Office and create ArcGIS Online maps directly inside Excel, generate heat maps and enriched data products, and share those maps.

Add an Online Table

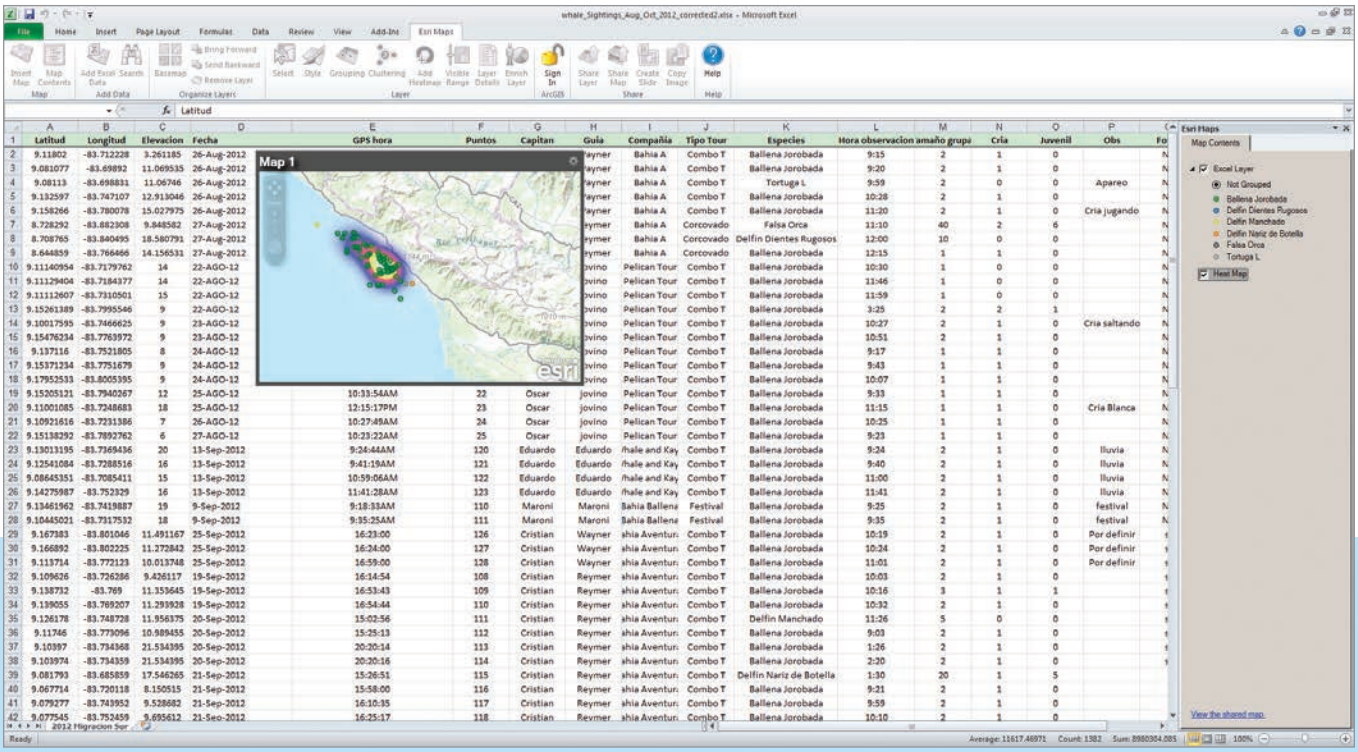
You can add a table that is already online, such as the tables of recent earthquakes from the US Geological Survey. This is helpful when mapping data that has already been formatted for use in a GIS.

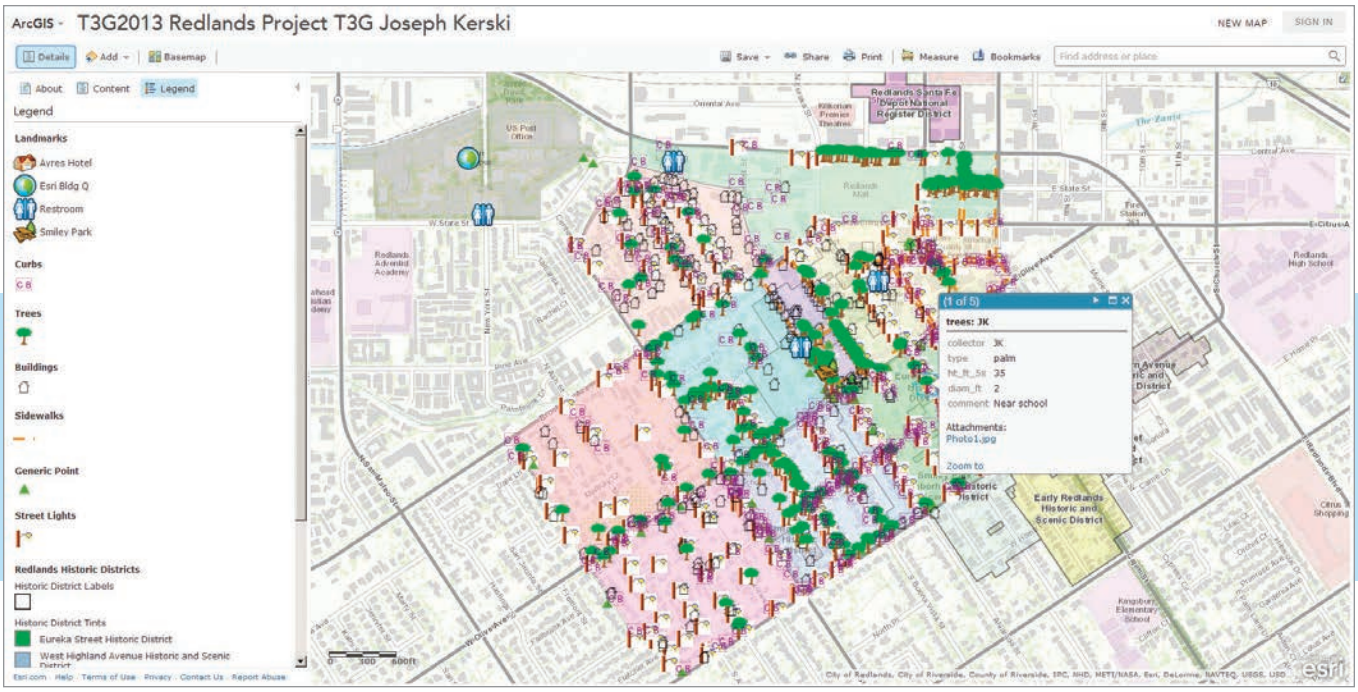
Share as a Feature Service

You can create a geodatabase in ArcGIS for Desktop or add content directly to My Content on your ArcGIS Online site and share it as a feature service. A feature service is more powerful than map layers generated using the previous strategies because you can perform richer analysis on feature services, add them to any ArcGIS Online map as a stand-alone layer, and make them editable.

An *editable* feature service can be used

↓ Whale data in Costa Rica mapped from a spreadsheet in Esri Maps for Office





↑ A map created from data describing a variety of features that was collected in just 90 minutes by a group of 100 people using smartphones

for citizen science projects. With an editable feature service, all the participants in your project (students in your class or members of your organization) can add data to a single common web map. Editing is controlled by the owner of the service. One characteristic of an editable feature service is that it can have domains that specify what data types are allowed and the value range for each field. When editing the data on mobile devices, domain values appear as items in pull-down menus. This minimizes manual keying of data in the field, speeding up the field collection process and minimizing data input error.

With these five techniques for easily using ArcGIS Online for field mapping, how might you use them in your own work?

Additional Field Collection Resources

For more information about collecting and mapping your field data, search for these topics on the video collection on video.arcgis.com. In addition, over 1,500 videos exist on GIS in education, including several playlists on fieldwork on www.youtube.com/geographyuberalles. Several relevant courses exist on the Esri Training site on training.esri.com. The Esri education team also frequently writes about this topic on edcommunity.esri.com/blog.

About the Author

Joseph J. Kerski, PhD, believes that spatial analysis with mapping and GIS technologies can transform education and society through better decision making using the geographic perspective. He holds three degrees in geography. For 22 years, he served as geographer and cartographer at three US federal agencies including the National Oceanic and Atmospheric Administration (NOAA), the US Census Bureau, and the US Geological Survey. Since 2000, he has served as an instructor in GIS at the University of Denver. In 2006, he joined Esri as an education manager focusing on thought leadership in geospatial technologies and education. His areas of interest include GIS-based curriculum development, research in the implementation and effectiveness of GIS in education, teaching professional development institutes for educators, and fostering partnerships and communication that promote and support GIS internationally in both formal and informal education and at all levels.

No GIS Experience Required

Format supports decision makers and better outcomes

By John Stewart, Jared Shoultz, Ana Lòpez-De Fede, and Kathy Mayfield-Smith,
University of South Carolina Institute for Families in Society

An institute at the University of South Carolina is using an interactive format for distributing health-related data that characterizes the communities served, their needs, and the resources available so decision makers and other stakeholders can explore this data at various levels of geography.

The Institute for Families in Society (IFS) conducts research with various partners to reduce child abuse, strengthen and engage families and communities, and improve the health of vulnerable populations. IFS, in collaboration with the South Carolina Department of Health and Human Services, is developing dynamic Adobe PDF environmental scans containing extensive demographic, population health, and health services data at regional, county, and ZIP Code Tabulation Area levels. These interactive, embedded PDF products effectively organize and distribute relevant, spatially referenced information for use by health care providers, administrators, patient groups, and others working to improve access to care and health outcomes for vulnerable populations across the state.

Complex spatial decision-making processes typically require large volumes of data from wide-ranging sources at multiple geographic scales. Effective decision making may also necessitate data sharing, exploration, and interpretation by diverse stakeholder groups. Dynamic PDFs, organized by geography, provides greater context for these end users.

Enabling Interactive Discovery

When developing a geographic information product for widespread distribution, IFS faced a number of challenges. End users needed not only to access but also explore an extensive set of data that characterizes the population, health needs, and health resource environment of South Carolina at regional, county, and local levels.

To allow for interactive discovery of critical geographic distributions and patterns, most data elements had to be dynamically mapped. Mapped data, as well as supplemental data, had to appear in easily navigated, georeferenced tables. Detailed metadata was required to identify data sources, highlight data currency, and define terms and the data transformation methods. User-defined maps, data tables, and metadata all had to be preformatted and printer ready.

End users had little or no experience with GIS software and often had no access to commonly used GIS resources. Some lacked administrative rights on their machines and could not install software. Lack of Internet connectivity for several key users and restricted Internet access for others precluded a general web-based information dissemination strategy. Instead, they needed an easy-to-use, stand-alone, encapsulated geographic information product that could be easily distributed via e-mail, USB flash drive, or DVD.

Accessible, Interactive Format

Building on the native capability in ArcGIS for Desktop to export to the familiar and widely used Adobe PDF file format, IFS developed a GIS-based environmental scan tool that met all end-user requirements. This product provides data-rich, interactive mapping capabilities with georeferenced data tables and extensive metadata all in a single embedded PDF document of less than 15 MB.

Separate county- and ZIP Code Tabulation Area (ZCTA)-level maps permit users to visually analyze dozens of spatial data layers providing the location of critical health care facilities such as hospitals, federally qualified health centers (FQHC), rural health clinics (RHC), and free medical clinics (FMC). These maps also supplied access to demographic data from the American Community Survey indicators of socioeconomic disadvantage; population characteristics and projections from Esri updated demographics; and data on disease prevalence rates, disease cluster hot spots, and measures of health care accessibility.

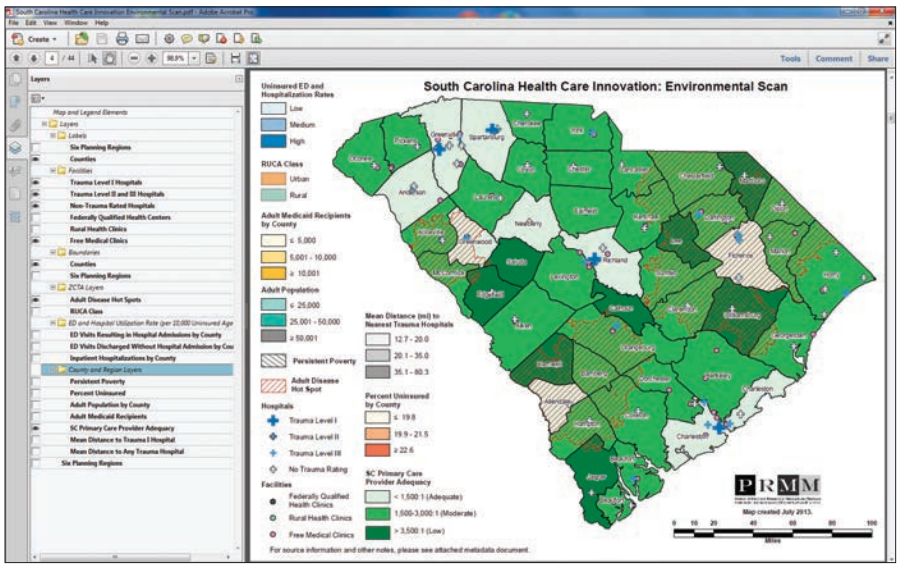
Each of these layers can be turned on and off, allowing users to explore individual data elements of interest and overlay multiple layers. The maps also contain dynamic label sets and regional, county, and ZCTA boundaries. PDF bookmarks organize map layers into logical thematic categories facilitating navigation of this extensive spatial data content. Dynamic titles and legend headings automatically reflect user selection of one or more spatial data elements in preformatted map layouts.

The dynamic PDF allows users with no cartographic training or experience to create and share customized, high-quality maps that reflect stakeholder-specific perspectives, objectives, and needs. Mapped and nonmapped (supplemental) data appear in geographically organized and referenced tables. Comprehensive metadata, bundled into the dynamic PDF, ensures ready access to important underlying information about data and methods used in the scan. The PDF format prevents users from inadvertently altering data and ensures environmental scan data integrity. Users can print selected pages of the scan (customized map views, for instance) or the entire pre-formatted document.

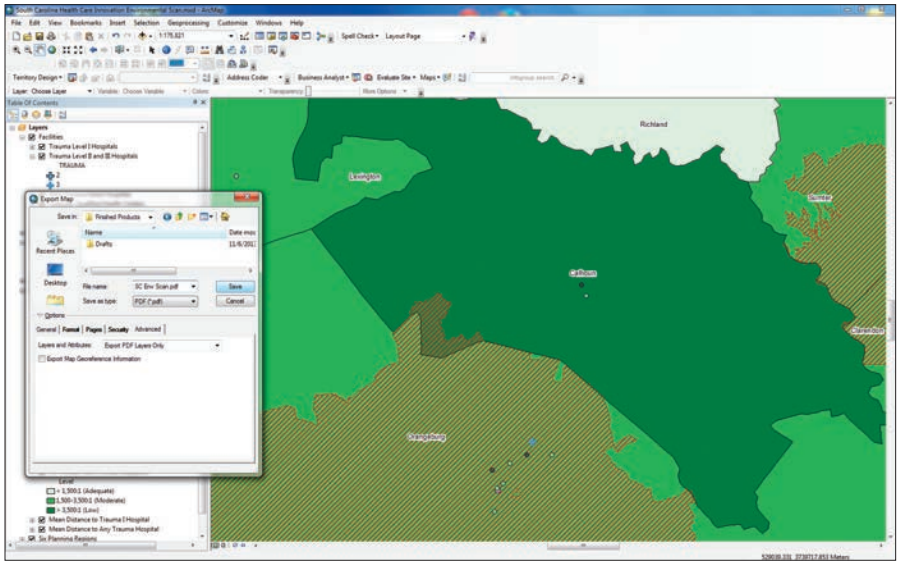
Creating Environmental Scans

A variety of software was used to develop the dynamic PDF environmental scan. Numeric processing and database management operations were performed using ArcGIS 10.1 for Desktop, Microsoft SQL Server, and SAS statistical software.

ArcGIS also was used to geocode health care provider and population locations as well as conduct network (Origin-Destination Cost Matrix) and spatial statistical



↖ Dynamic PDF map and layer list showing provider adequacy, disease hot spots, hospitals, and free medical clinics



↙ ArcGIS for Desktop project export to PDF with layers

(Getis-Ord Gi* Hot Spot) analyses to derive additional scan data elements. All cartographic content was developed using ArcGIS. Maps were exported from ArcGIS using the Export to PDF with Layers function.

Data tables and metadata were formatted in and exported from Microsoft Excel. Adobe Creative Suite applications were used to design cover and data usage pages and to enhance key graphics. Finally, all input files were consolidated and organized in Adobe Acrobat Pro to create a single PDF document. Despite the relative sophistication of this development strategy, end users require only Adobe Reader to interactively explore a complex array of georeferenced data that can be turned off and on to build customized printed maps.

Uses beyond Health Care

To date, IFS has developed and distributed interactive PDF environmental scans to promote innovative local health care provider collaborations, target high-risk populations for community health worker interventions, and strengthen state and local efforts to improve birth and maternal health outcomes.

While clearly useful for population health and health services planning and evaluation, these same dynamic PDF methods can facilitate more general needs and resource assessments, as well as strengths, weaknesses, opportunities, and threats (SWOT) analyses. They may prove equally valuable areas as varied as education, social welfare, criminal justice, urban development, environmental justice, and natural resource management for site selection, resource allocation, prevention, and intervention efforts.

By engaging diverse stakeholder groups with a shared information product, an interactive GIS-based PDF can increase stakeholder involvement and consensus, foster broader data sharing arrangements, and prompt context-relevant questions for subsequent investigation. Some of the questions raised by dynamic PDF users may be more thoroughly examined using desktop, server, or web-based GIS tools. In this way, dynamic PDFs complement existing GIS resources and may encourage more widespread community utilization of GIS-based strategies to support collaborative, data-driven decision-making processes at state and local levels.

For more information, visit the IFS website (www.ifs.sc.edu) or contact Ana Lòpez-De Fede at adefede@mailbox.sc.edu.

Acknowledgments

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Revealing the Health Care Landscape

Californians will require comprehensive information about their local and regional health care delivery systems more than ever as a result of health care reform. The Office of Statewide Health Planning and Development (OSHPD) has a powerful tool for making the content of data more transparent: the highly interactive *California Healthcare Atlas*.

The most recent version of the *California Healthcare Atlas* offers a variety of health care-related maps that use Esri technology. The *California Healthcare Atlas* website was first launched in 2005 with a relatively small set of data. The current and third iteration of the website provides access to much more data and improves information transparency, usability, and content discovery.

According to Michael O'Neill, GISP, senior geospatial architect for OSHPD, "This website presents and integrates OSHPD patient, financial, facility, health professions work force, and geographic data into one easy-to-use open-data portal." The interactive Internet GIS mapping application provides users with a large and growing data warehouse and geospatial database containing detailed information on licensing, finances, and utilization of hospitals and health care facilities, as well as annual patient summary reports.

> "Without that essential automation using the Esri tools, we could not ever keep up with the data maintenance."
>
> Michael O'Neill, GISP, Senior Geospatial Architect for OSHPD

Opening Up Data

The atlas serves a diverse set of users. Before the first version of the atlas was released, OSHPD produced data and data products for policy makers, researchers, and facility administrators, and these continue to be OSHPD's core consumers. Previously, multiple files or systems had to be located and data synthesized to get answers, a daunting task for all but the most determined.

With the altas, data compilation and cross-referencing has been done and published in OSHPD's search engine-optimized platform so that information is searchable. What might have previously taken hours now can be accessed in minutes by most people. The newest version of the atlas lets users dig deeper into this information by interactively mapping financial, licensing, health professions work force, and in-patient discharge data summaries. The atlas provides wide-ranging analysis capabilities through dynamic charts, graphs, and responsive maps.

The site logically organizes and cross-references more than 16,000 geographic places with a myriad of health care facts (from numerous state and federal sources) into a cohesive, friendly, searchable, and cross-referenced atlas of health care information. For example, users can geobrowse hospitals in any part of California and discover information about any of those facilities such as special designations, number of beds, common surgery costs, service utilizations, and payer reimbursement rates.

"But what the atlas does so elegantly is connect a wealth of once-disparate data and then make those relationships easily found and understood," said O'Neill. "This makes current data users happier, and new data consumers feel well-served." The trick to opening data, which many miss, he said, is putting out lots of data in accessible ways for the variety of users and in appropriate contexts.

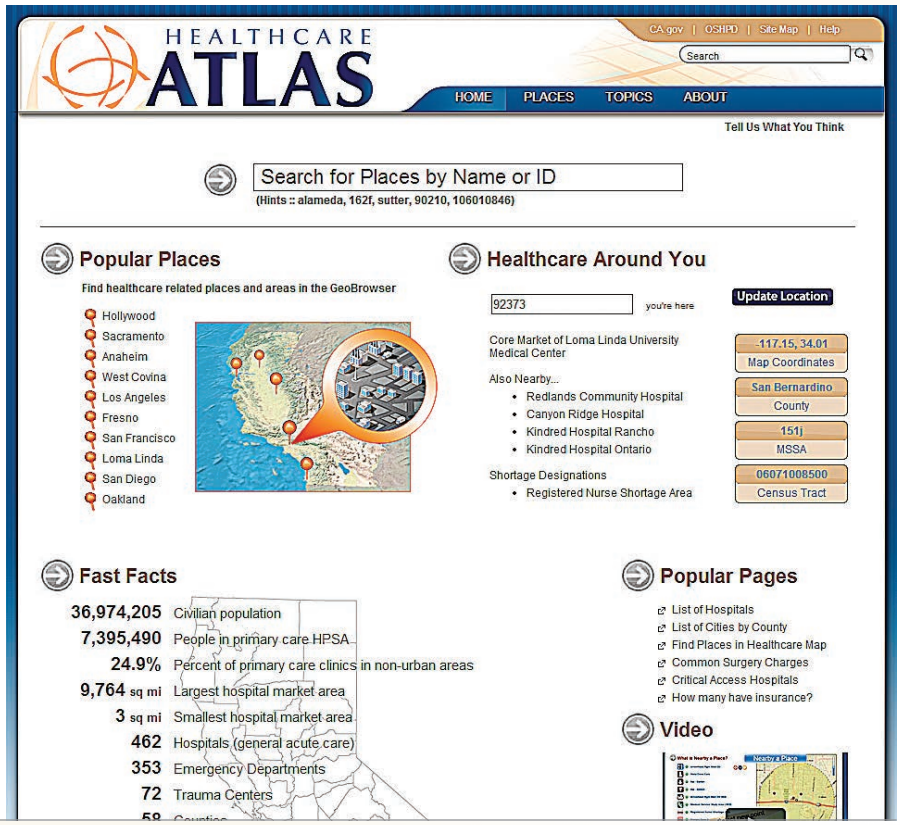
Evaluating Unmet Needs

As health care reform continues to unfold, hospital market content available from the atlas is proving valuable for growth planning. The in-patient-based market maps are "critical for evaluating our growth strategies and have enabled us to have more informed conversations with potential affiliate and partner organizations," said Alfio Levy, senior associate at Alameda Health System (AHS). "The tool has been very thoughtfully developed; it saves us money and time," said Levy. AHS marketing, communications, and strategy teams are frequent users.

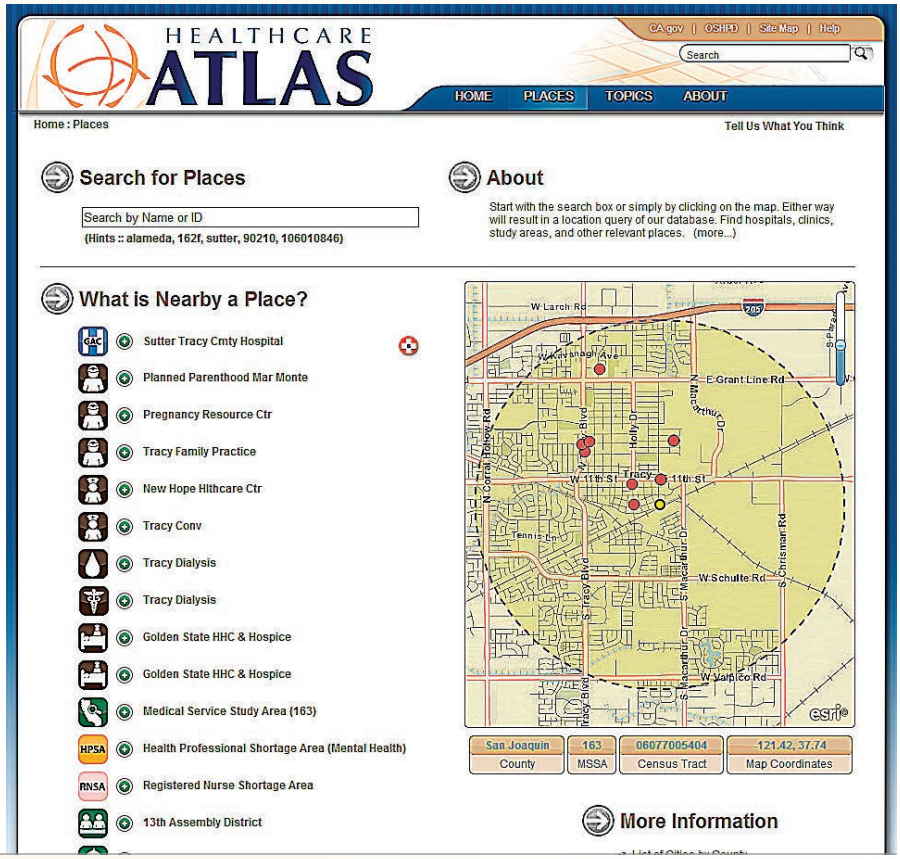
Other site visitors seek information on areas that have one or more of the seven work force shortage designations administered by OSHPD. For example, the Health Professions Education Foundation (HPEF) is awarding $32 million this fiscal year as financial incentives to attract or retain health care professionals in areas of unmet need. Using the atlas, individuals can quickly and easily locate where these special designations exist and learn about hospitals and clinics located in these areas.

"The workload burden on staff, grant applicants, and awardees was, in the past, unnecessarily cumbersome," said Charlene Almazan, lead program officer for HPEF. The website makes their work so much easier and quicker. "I love telling our grant applicants and awardees to use my GIS," said Almazan (who is not a GIS staff member).

According to Arsenio Mataka, assistant secretary at California Environmental Protection Agency, "having the geographic and demographic information about which areas in California lack sufficient health care professionals provides executives and other decision makers with meaningful insights as they move to improve the health and economic vitality of our state's most impacted communities."



↑ The *California Healthcare Atlas* is a powerful tool for making data comprehensible.



↑ The attractive interfaces, search engines, search boxes, and especially the logical information architecture make the site's more than 16,000 pages accesssible.

"It's such a simple thing—connecting the geographic dots—and yet the simplicity belies an essential step in connecting people needing services with enough health professionals to provide those services," O'Neill said.

Evolution of the Atlas

Health care in California is a complex landscape of practitioners, hospitals, clinics, patients, businesses, insurance, diagnosis, treatments, research, and more. In practice, the data reflects that landscape's complexity. Using, managing, and planning health care is neither simple nor easy for anyone. High on any list of challenges has to be information access and transparency.

In many ways, OSHPD faced an "open data" challenge 12 years ago. There were virtual mountains of ethereal bits and bytes stacking up within the walls at OSHPD. The challenge back then—and today—has been to harness the many unwieldy data silos so that they churn raw data into information in a tangible, inviting way, he said.

Michael Kassis, former CIO and deputy director at OSHPD, remembers that in the late 1990s to 2000 a small number of OSHPD staff knew how to use GIS in the common desktop workstation environment. Maps were made. Data was processed. Information was created. "It was business as usual like throughout countless organizations. If you had the skills, software, data, time, and knowledge to put it all together, you could turn mere data into information," said Kassis. Both staff and management recognized the value GIS technology brought to the table with its powerful visualizations and geographic analysis. Nonetheless, there were problems:

- There was too much data, period.
- That data was too complex and nuanced.
- Too few staff had sufficient GIS knowledge and skills.
- There were many data silos.
- It was too difficult to find data.
- It was also too difficult to combine disparate datasets.
- Publication media was too limited.

Having recognized the value of GIS and openly acknowledging these issues,

management moved on multiple fronts to deal with challenges such as insufficient funding and resources. A feasibility study report was produced to make the case for funding a new enterprise-level GIS program and a large, complex data warehouse. That lengthy endeavor began in 2000. By 2004, programs were funded, contracts were executed, and OSHPD had the beginnings of a fledgling enterprise GIS and data warehouse.

"That big step was difficult and yet essential to having the atlas today," O'Neill said. "Thanks to what management began in 2000, a foundation of information technology and organizational infrastructure was laid that ultimately made possible all that the atlas has become."

Technology Today

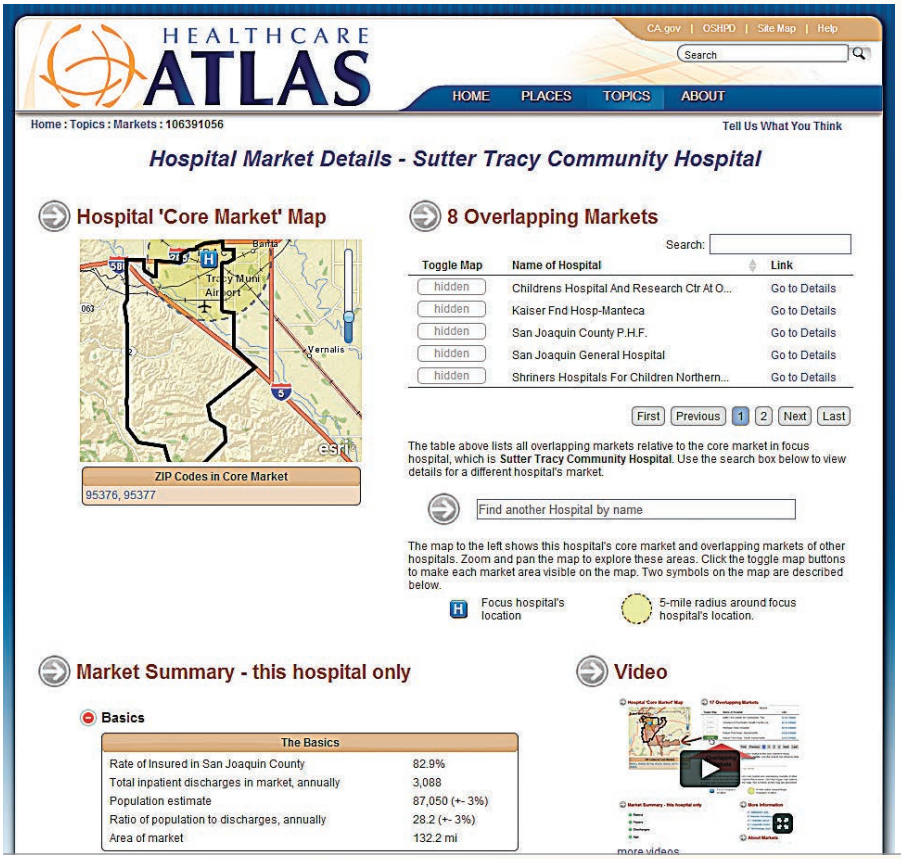
According to O'Neill, Esri has been a vital technology and solutions partner from the start. The first incarnation of the website published a smaller range of data and debuted as OSHPD's initial public offering of online mapping combined with data from the new patient data warehouse. The site featured a cutting-edge web query system—California's first-ever interactive mapping of health care data that provided access to financials, licensing, facilities, and in-patient discharge summaries. More new data types, new functionality, new workflows, and new technology were subsequently added.

Today, the atlas uses ArcGIS 10.0 for Server, ArcGIS API for JavaScript, Microsoft MVC .NET, and SQL Server combined with a few other programming libraries. "Esri provides us with a comprehensive suite of GIS software," O'Neill said.

"We blend in a variety of small and large technology products, but we are an Esri shop for our geospatial solutions. We consume all the major Esri products ranging from the desktop ArcGIS software to ArcGIS for Server for mapping and geodatabase management. Having that consistent and complete set of GIS offerings from the industry leader has been valuable."

He noted that the Representational State Transfer (REST) map services are easy to manage, and consuming them is equally easy—expedited by the robust JavaScript

↑ The site uses geography to make a wealth of data about the health care landscape discoverable.



↑ Users can geobrowse hospitals in any part of California and discover information about any of those facilities.

API. "JavaScript is easy for us to support. The Esri API makes getting it done easier than other alternatives," he said. "Using the JavaScript API was a no-brainer decision."

The OSHPD GIS team authors and maintains its geographic datasets for the atlas with the same software used for regular cartographic production, which allows publishing map services easily on ArcGIS for Server. From a staffing and resource perspective, O'Neill and colleagues find this setup ideal because it allows them to efficiently pair tasks with available staff skills. GIS tasks are assigned to GIS professionals, and website development is accomplished by programmers.

"Managing the geographic datasets is actually a huge and complex undertaking made easier with Esri tools," said O'Neill. Some of the secret sauce found in the atlas flows from a cookbook-like library of over 100 custom ModelBuilder models that encapsulate approximately 1,800 processing steps. "Without that essential automation using the Esri tools, we could not ever keep up with the data maintenance," he said.

Latest Phase

Having several years of experience and user feedback under its belt, OSHPD realized that things had to change in order to keep up with quickly evolving expectations for the user experience. The new third-generation version of the *California Healthcare Atlas* modernizes the platform on which it runs, improves usability, increases data transparency, and adds new data.

"The site's layout is reorganized to better hold the huge and diverse content presented now and to allow for adding new content going forward," O'Neill said. "Everything relates to something and—oft-times—to many things at once. This reflects reality and real geography where hospitals, people, and administrative boundaries are interconnected."

The threads or pathways through the site's more than 16,000 pages are seemingly limitless. It's a formidable mountain of data made tangible by attractive interfaces, search engines, search boxes, logical information architecture, and gobs of cross-referencing.

"This generation of the website marks a new beginning for information transparency, site usability, and content discovery offerings by OSHPD," he said.

Looking Forward

California is the only state in the nation to host such a collection of geographic and health care data that is fully searchable, cross-referenced, indexed, discoverable, and yet still user-friendly. Much of what this latest version was about revolved around resetting the foundation to support new capabilities and to create room for adding new content. Plans for the next few years include the addition of new health care quality measures and expansion of the hospital market content, as well as the creation of more ways for people and systems to consume the data.

"We've not perfected the atlas by any means. That would take resources we simply don't have today," said O'Neill. "But what we have done so far is to open data silos—wrapped in an inviting package—thus allowing many more would-be information consumers access to authoritative content. We will continue to improve upon our report-like managed content and also improve upon freeing the data in new ways to put the power of information into peoples' hands," he said. "We have been wrestling with how to connect more people to our data for years and think we've had a breakthrough with this latest version of our atlas product. Nobody has a platform like this."

For More Information

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oshpd.ca.gov/atlas

Creating the Liveable City

Unlocking the hidden potential of urban environments

By Greg King, Arup Group Limited

The world's population is becoming more urbanized, which means creating sustainable urban environments is increasingly important. The current design of urban environments has huge potential to benefit from urban retrofit that would achieve more sustainable outcomes.

The project described here focuses on implementing active transport infrastructure within the urban environment to reduce the reliance on private vehicles. The analysis processes used in this project can easily be applied to other aspects of urban retrofit.

Project Context

The Moreton Bay Regional Council (MBRC), a local government area in Queensland located north of Brisbane, is Australia's third-largest council, with an area of 206,944 hectares (ha), or 511,369 acres. With approximately 400,000 people (per 2011 Censuses of Population and Housing), it also has one of the fastest-growing populations in Australia. The MBRC population is estimated to grow to 516,000 people in 2031.

The MBRC Community Plan 2011–2021 states, "By 2021, our region will consist of well-connected places and residents will embrace more sustainable travel and behaviour." In line with the MBRC community plan, the council wants to target investment in active transport (walking and cycling).

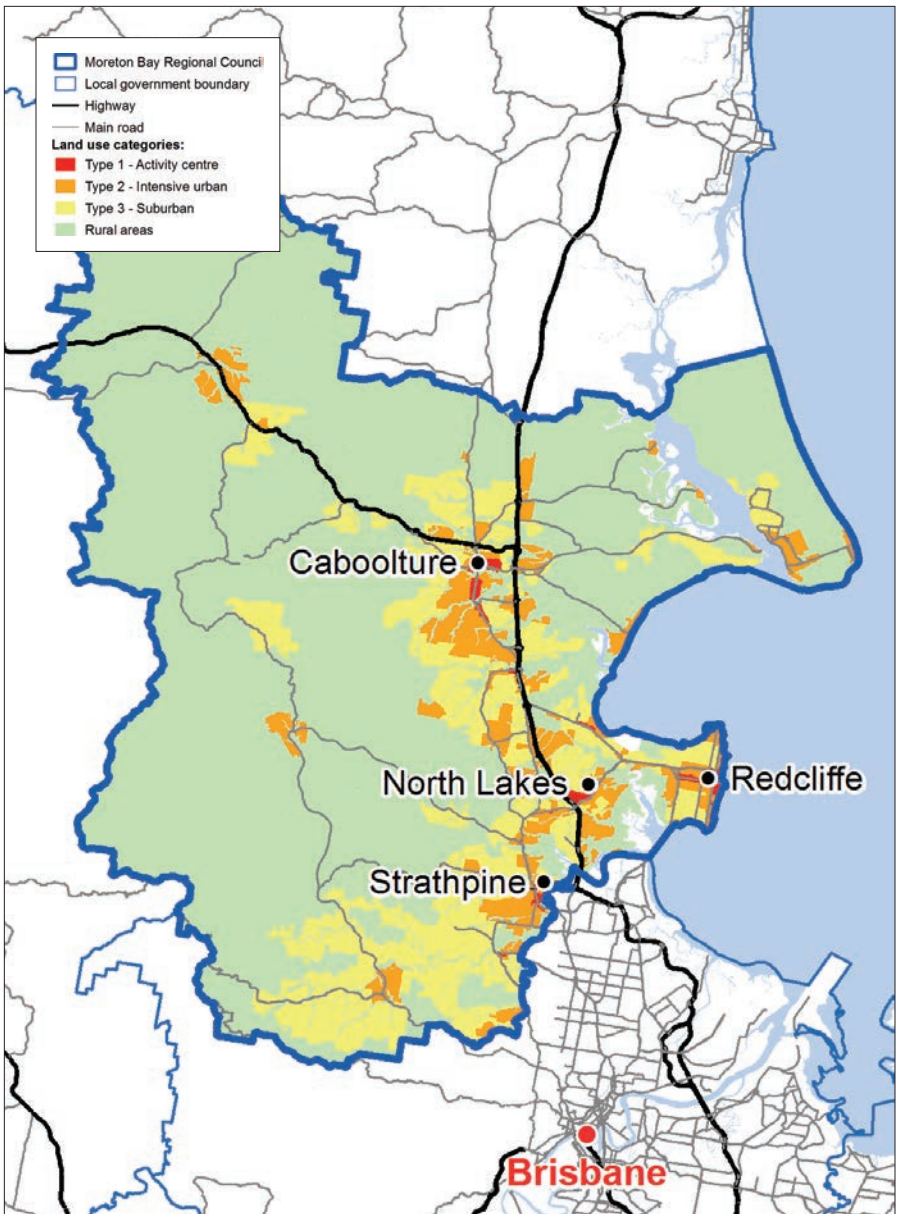
Implementing a high-quality infrastructure network encourages local residents to become more active. Encouraging active transport modes will also help achieve the council's wider objective of creating well-connected and vibrant local neighborhoods and moving away from typical suburban and urban sprawl.

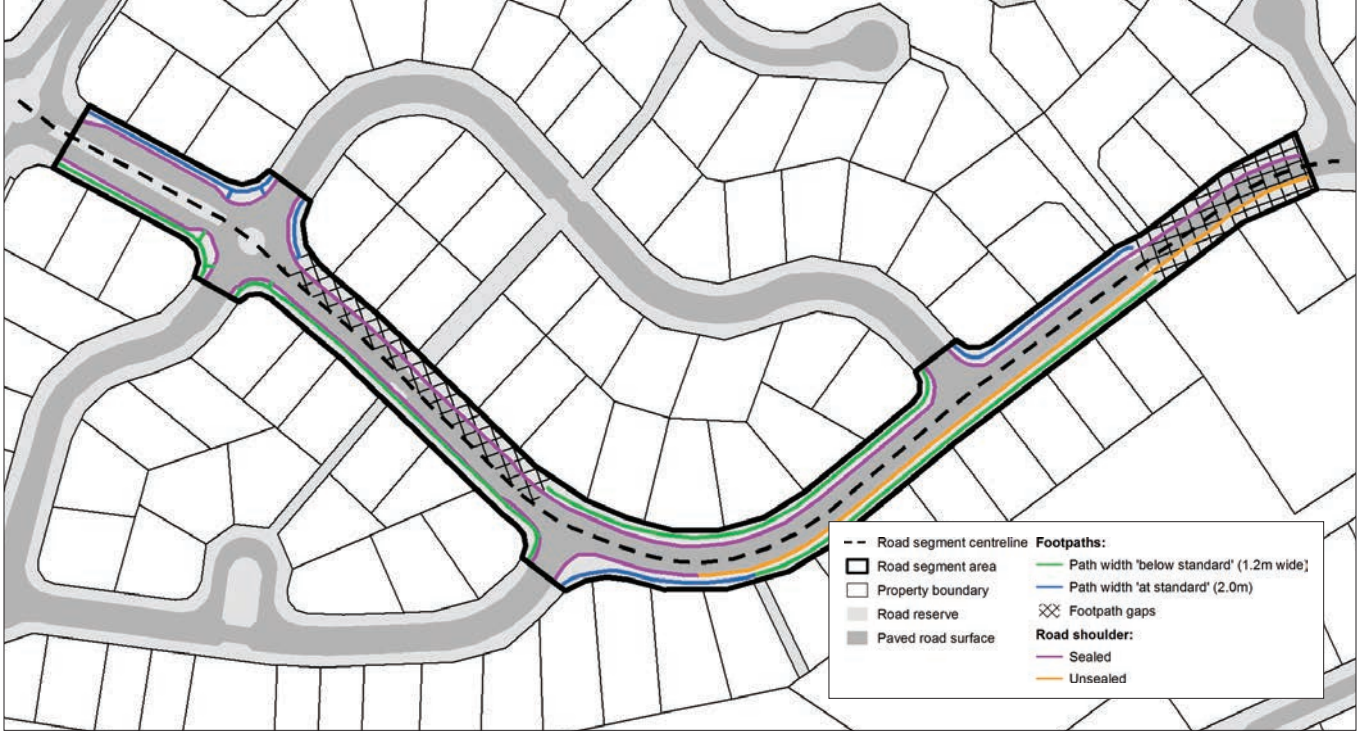
Previous investment focused on road capacity infrastructure. However, the more holistic approach now being applied focuses on active transport. Consequently, MBRC embarked on a project to quantify and prioritize the upgrades required to the network to achieve this objective in the community plan. This project, the Moreton Bay Network and Corridor Study, ran from April 2012 until June 2013 and focused on the main road network encompassing all arterial, subarterial, and collector roads. These roads have a combined length of almost 1,200 kilometers (km) (or about 730 miles).

This led to a couple of questions. How do you assess the existing condition of the active transport networks? How do you then prioritize these upgrades to provide the best value to the community?

The answers to these questions required considering which was the best approach to upgrading the network to meet the council's standards while taking into account the finite financial resources available. To

↓ Moreton Bay Regional Council is a local government area located to the north of Brisbane experiencing strong urban growth.





↑ The crux of this work is assessing road corridors for their potential to be upgraded/retrofitted. Making efficient use of these areas can have a significant benefit to urban environments and the communities that live and work in them. In the context of active transport networks, this image gives an example of how road segments are defined and how the features within each segment are assessed to meet desired standards.

assess and prioritize its active transport network upgrades, MBRC partnered with Arup Group Limited, an independent firm of designers, planners, engineers, consultants, and technical specialists. Because of its powerful analysis capability, GIS was chosen as the platform to complete this project.

The Analysis Process

Active transport infrastructure consists of facilities for walking and cycling. The individual elements include footpaths (pedestrian only or shared), pedestrian crossings, street vegetation, and cycle lanes. The analysis identified gaps in the active transport network and explored the potential for new infrastructure based on available space in the road reserve.

The project also evaluated existing active transport infrastructure against MBRC standards to determine where the existing network required upgrading. Finally, when looking to prioritize upgrade works, the surrounding land use, road hierarchy, and proximity to nodes such as commercial centers and community facilities were included to ensure that funding was being invested in the right areas.

Combining these elements was a complex undertaking. Without the use of GIS, it would have been time-consuming to go through each road segment manually. With GIS, the project team could process all active transport elements and produce results in a timely manner.

This project was divided into three main phases:

- Network audit
- Gaps analysis (based on agreed standards)
- Upgrade prioritization

Network Audit

The first step in determining the required upgrades of the active transport network was to audit the existing network. This involved dividing the road network into 1,690 individual segments. Using the road reserve polygons in the cadastral database, each road segment was given an area. All features within this area were classified as part of that road segment. Features outside the road reserve were excluded.

Once the segments and extents were determined, the network audit calculations gave summary figures for the existing network. Using the Analysis Tools geoprocessing tools in ArcGIS Toolbox, the active transport networks were documented for each road segment. This resulted in 80 separate attributes that documented the active transport network for each of the 1,690 road segments. For each road segment, all 189 attribute values were collated or calculated to create a comprehensive database of information on the active transport network for the Moreton Bay Region. Creating this database provided the basis for performing the network analysis.

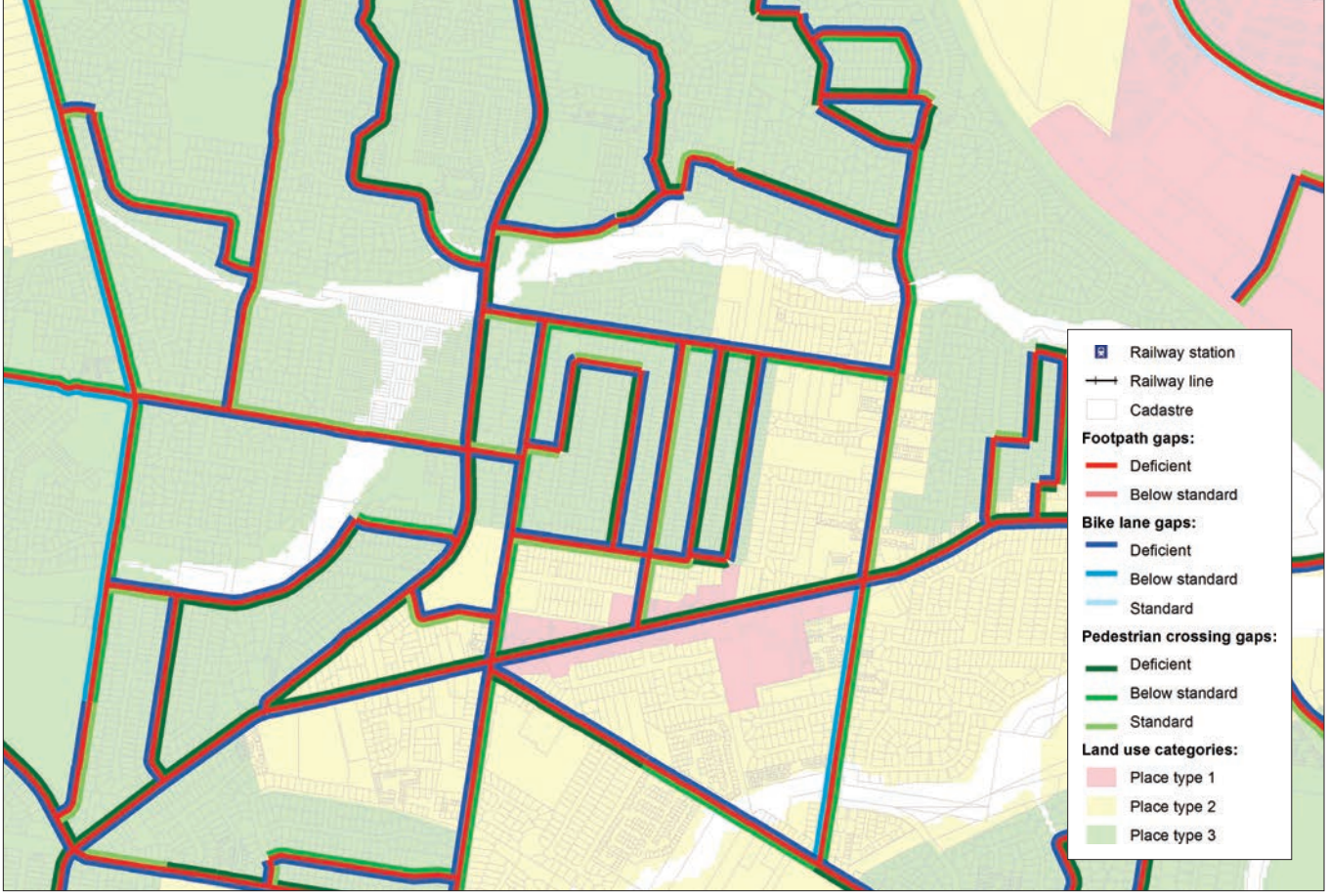
Gap Analysis

When identifying potential deficiencies in the active transport network, the desired level of service needed to be determined. MBRC and Arup held a workshop that produced a clear set of guidelines for all elements of the active transport network.

To create realistic standards, urban land uses were divided into three categories: type 1 (activity centers), type 2 (intensive urban), and type 3 (suburban). Standards were developed for each category. This step allowed the analysis to produce realistic results based on the intensity of the land use.

The gap analysis involved comparing the results of the network audit with the desired standards to determine the quantity of each active transport element. Areas were classified as follows: those that met the standards were deemed at standard, those with active transport elements that did not comply with standards were classified as below standard, and those with no active transport infrastructure were deemed deficient.

The results revealed that most of the active transport network would benefit from upgrading. The active transport facility benchmarks set for desired levels of service would ultimately create a more active and connected community.



↑ Once the active transport network has been assessed against the desired standards, each road segment is categorized based on its level of provision for footpaths, bike lanes, and pedestrian crossings.

Upgrade Prioritization

After comparing the existing active transport network to the standards, the final step was to prioritize the network upgrade to ensure the funds spent would provide the most benefit to the community. To do this, upgrades for these deficiencies were divided into two categories: short term and longer term. Within the road reserve, existing conditions play a key role in what is possible. Each road segment was evaluated to determine if upgrading the active transport network was an easier short-term task or a complex and longer-term project.

Study results were fed into MBRC's new Priority Infrastructure Plan (PIP), which manages the direction of infrastructure investment in the region until 2031. It divides the MBRC area into 21 priority areas for investment allocation. To provide more detail, each priority area is further divided by the three land-use categories to create 57 separate areas.

All the active transport network data was aggregated by these 57 areas to give a summary of active transport infrastructure provision. As well as documenting the level of service, unit costs were applied to give MBRC cost estimates for upgrading the network within each priority area. This information allowed MBRC to prioritize resource allocations based on where the need was greatest. Because the base data for each road segment was available, a more detailed approach could have been taken. Prioritizing upgrades for individual road segments could be based on the current level of infrastructure provision, whether it was in an area of short- versus longer-term upgrades, surrounding land use, and proximity to key destinations and public transport nodes.

Implementation of Analysis

Road reserves account for a significant amount of land. However, the traditional urban fabric doesn't make adequate use of these areas. In the MBRC region, unpaved areas of the road reserve (i.e., portions of the road reserve not covered by the actual roadway) account for 3.75 percent of the total land area. This equates to approximately 7,750 ha (~19,000 acres). This is a substantial amount of land and could provide significant benefits to the community and environment if used effectively.

In addition to implementing active transport infrastructure and facilities, road reserves could be used for environmental features such as biofiltration beds, garden beds, and fauna crossing facilities.

Biofiltration beds improve the quality of storm water runoff. These beds use plants, garden beds, and the soil profile to naturally filter physical, chemical, and biological contaminants from storm water runoff. This results in significantly cleaner runoff flows and healthier waterways.

Garden beds and vegetation can provide urban habitat for fauna. Installing gardens with local plant species provides shelter and food for local animal species, and vegetation can contribute to the amenity of the road corridor by providing shade for pedestrians and cyclists, helping keep the otherwise hot urban environment cooler and maintaining the connection of green spaces.

Implementing fauna crossing facilities would help animals navigate through urban environments to maintain important linkages between habitat areas that would otherwise be cut off by urban development.

Road reserve areas could also be used to improve the usability of urban areas with the provision of street furniture such as benches, bike racks, drinking fountains, bins, and awnings. Adding acoustic and visual barriers that mitigate against adverse conditions of surrounding activities would improve the aesthetics of these areas for residents.

Around public transport nodes, road reserve space could contain facilities that support public transport services such as public safety and shelter facilities, storage facilities, and interfaces with other types of transport to make public transport more attractive to prospective users and increase patronage.

A Business Case

In addition to environmental benefits, investing in public urban spaces can have financial benefits. Investing in active transport networks has the potential to change people's transportation choices.

Moving to more active transport can have a beneficial effect on the health of local communities and reduce spending on health care.

Creating a comprehensive active transport network can reduce private vehicle trips. Along with investing in public transport facilities to increase patronage, this can reduce investments in road capacity upgrades, especially to handle peak-hour commuter travel in areas where road networks are at or near full capacity. Finally, investment in urban areas can contribute to raising property values.

An urban retrofit project is a large undertaking but it can create many economic opportunities for local businesses and employment opportunities for local residents. When these scenarios are considered in the long term, their return on investment in urban areas can be significant for both the public and private sectors.

Summary

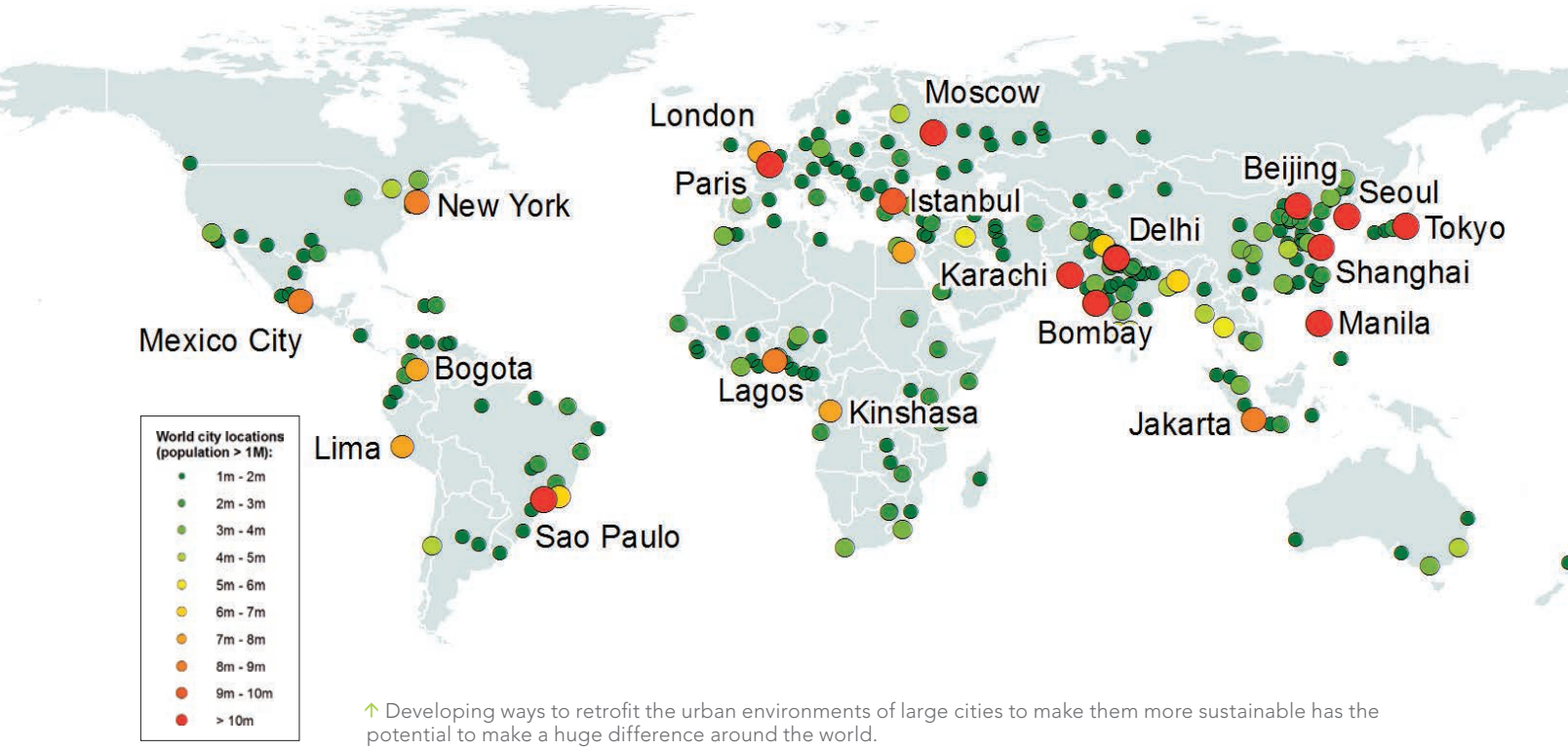
Historically, urban areas have been designed to separate people from the surrounding natural environment. This goal needs to be reconsidered. Existing urban areas need to be retrofitted so they are more in line with natural environmental systems.

Significant work has been done to make individual buildings more sustainable, but there is a need for a holistic citywide approach to making urban areas more sustainable. Conducting this type of spatial analysis will give urban planners and elected officials the information they need to make the big decisions that will improve cities. Using GIS in this way can access the potential for retrofitting urban areas and take the idea of sustainable urban development from concept to reality.

For more information, contact Greg King (greg.king@arup.com, g_king@tpg.com.au).

About the Author

Greg King is the GIS consultant in Arup's Brisbane office. He has a background in urban planning and is a member of the Geospatial Information and Technology Association (Australian and New Zealand chapter). He graduated from the University of Queensland with a degree in regional and town planning. He has worked at several large multidisciplinary engineering firms before joining Arup Group Limited in 2008. At Arup, he has worked on projects in a variety of areas: community engagement, environmental, geotechnical, road and rail corridor studies, and maritime. However, his passion is using GIS for analyzing urban environments. Because cities are some of the most complex environments on earth, he believes they provide many opportunities to use the full potential of the analytical functionality in GIS.



↑ Developing ways to retrofit the urban environments of large cities to make them more sustainable has the potential to make a huge difference around the world.

Sell an App for That

Apply to become an ArcGIS Marketplace publisher. This new destination site allows ArcGIS Online subscribers to search, discover, and get apps and data from qualified providers for use within their organization. The services listed on the Marketplace are intended to serve all market segments that Esri serves, worldwide.

Authorized Esri partners (as well as Esri distributors and Esri staff) publish listings for apps and data services that are registered with the ArcGIS platform. Anyone can browse the listings on the ArcGIS Marketplace, but they must be an ArcGIS Online subscriber to get free trials or make purchases. Any named user of the ArcGIS system can have apps and data services provisioned to their organization.

Here are some apps that have been developed by partners and are available on the Marketplace.

Gas HCA Online by Eagle Information Mapping

Natural gas pipelines must be located where they pose minimal threats to people, the environment, and personal or commercial properties. Gas pipeline operators must comply with federal rules that regulate where pipelines can be located by performing a calculation of high-consequence areas (HCAs). Eagle Information Mapping has developed a way to quickly and accurately perform this analysis. Simply supply your pipeline centerline, building locations, and identified sites. The app will then run a complete HCA analysis for you.

Land Use Editor by GEO-Jobe

Proposed land annexations or zoning changes must go through a governmental submission and approval process. The Land Use Editor app gives you a streamlined way to track zoning and annexation changes during the entire submission process. The app is designed to work with the ArcGIS Local Government Information Model, but you can configure it to work with other data models too.

GeoLynx Mobile by GeoComm

If you are a police, fire, or emergency medical services responder, you can use this app as an in-vehicle mapping and navigation system. It has built-in emergency incident mapping and hazardous materials (hazmat) mapping capabilities, as well as audible driving directions, a night mode map display, and support for marking up and drawing on the map.

For apps and data service providers, ArcGIS Marketplace delivers a mechanism to generate leads, provide free trials, grant access to listings, and manage subscriptions. To find out what it takes to become an ArcGIS Marketplace provider, visit esri.com/partners/partner-network/marketplaceprovider.

New Runtime SDKs Include Mac OS X and Qt

Sign up for a free ArcGIS developer subscription on the ArcGIS for Developers website and get the new ArcGIS 10.2 Runtime SDKs for iOS, Android, Java, Mac OS X, Windows Presentation Foundation (WPF), and Qt.

ArcGIS Runtime SDKs provide a set of powerful tools for developers to embed dynamic mapping and geospatial technology into existing applications or build native, focused client applications for desktop, mobile, and embedded devices. These SDKs use the ArcGIS platform by integrating mapping, geocoding, and advanced geoprocessing models so you can create rich, highly functional GIS apps. They can consume content and services from your own on-premises ArcGIS servers or ArcGIS Online, including hosted services, available as part of an ArcGIS for Organizations subscription.

These SDKs add new capabilities and improve the performance of many tasks. The beta version of offline capabilities for routing, geocoding, and data editing are included with each Runtime SDK. The APIs have been improved to simplify the coding model for commonly performed tasks such as geocoding and assigning basemaps. For more accurate display and distance calculations, geometry libraries have been enhanced to support geodesic buffering and geodesic offsets. Apps built with the 10.2 Runtime SDKs also include support for OAuth for seamless integration with the security models built in ArcGIS Online and Portal for ArcGIS.

Esri's first SDK releases for Qt and Mac OS X are included with this 10.2 release. ArcGIS Runtime SDK for Qt helps C++ developers use the Digia Qt framework to create GIS applications that use local services and bypass the requirement for an ArcGIS for Server connection. Users can build ArcGIS applications with the new Runtime Qt SDK on 32- and 64-bit Windows and Linux platforms.

The new ArcGIS Runtime SDK for OS X provides an Objective-C API for developers to add mapping and GIS functionality to Mac applications. The API leverages services from ArcGIS Online and ArcGIS for Server through the REST interface. The SDK supports the Mac OS X Mavericks (10.9) operating system and can either be installed on any Mac or distributed using the Apple Mac App Store. ArcGIS Runtime SDK for iOS also supports iOS 7, allowing users to deploy apps to the widest possible audience.

Also included in each of the 10.2 Runtime SDKs (except WPF) is a beta version of offline capabilities, available via a new API. Developers can create apps that take data offline, edit it, and immediately sync changes back to the server as well as receive changes others have synced to the server. Users will be able to provision devices with the data, basemaps, and editable layers they need to work completely offline. Functionality in the beta 10.2 version of the offline API includes downloading features and tile caches and offline routing, geocoding, and editing. The official release of the offline API is expected in Q1 2014.

For more information on ArcGIS Runtime, visit esri.com/runtime.

Create Location-Aware Apps for iPhone and Android

With the Geotrigger Service, developers can easily create location-aware apps for iPhone and Android without compromising battery life.

The Geotrigger Service works by executing an action only when a mobile device enters or leaves a trigger zone (geofenced area). It works via the cloud to push a location-based message to that device or to a remote server. Date and time ranges can be applied to triggers so they are only active during certain time periods.

With the Geotrigger Service, apps built on the Esri location platform can quickly gather business intelligence by locating where people are and when the app was used. Developers can also design apps that send messages to users when they enter or leave an area defined by a geofence. Developers can use the Geotrigger Service for developing apps across all industries.

Retail and Loyalty: Engage customers with personalized content and deals the moment they enter a store.

Real Estate: Send messages to prospective home buyers when their search criterion matches a nearby home.

Energy Management: Use location to automatically manage power consumption at home or in the office.

Tourism: Bring public attractions to life by informing tourists of interesting locations as they explore a city.

Public Alerts: Notify citizens about events such as road closures or civic emergencies based on past locations.

The Geotrigger Service will be free during beta until the final version is released in 2014. Feedback from the beta will be used to shape the official release.

For more information, visit esriurl.com/geotrigger.

The Key to a New Wave of Enterprise GIS Users

By Christopher Thomas, Director, Esri Government Markets—Federal, State, and Local

In my early days as a GIS administrator, one of my number-one priorities was to build an enterprise, or organization-wide, GIS program.

I worked hard to figure out how to get GIS software directly into the hands of people in fire, planning, building and safety, engineering, public works, finance, parks and recreation, economic development, airports, code enforcement, housing, and any other discipline who would take a moment to listen to the benefits of GIS. As the Esri tools and supporting technologies progressed, the GIS team was able to achieve a vision of "no department left behind."

We went from mainframe applications, extended through emulation software on dumb terminals, to stand-alone and networked desktop software, and eventually to Internet and mobile devices. My team and I moved closer and closer to this vision each and every day. And along the way came a lot of firsts: from GIS use on fire trucks to nonsurvey uses of GPS for public works asset data collection, from public access to GIS via the public library to the use of GIS for 3D statistical modeling, and from using GIS for revenue auditing to being one of the first local governments to use GIS on the Internet. The journey we took led us to a greater understanding of the return on investment of GIS, and we realized a lot of innovation by becoming creative as we sought to reinvent government.

Some of my peers in information systems and GIS, both inside and outside the organization, openly and critically questioned why I would want to encourage others to use the technology themselves. I was puzzled by this question. These peers would go on to ask, If everyone else was able to use the power of GIS, what would we do?

These were the same peers who could not understand why the GIS profession could not gain significant traction inside their own organizations. I simply did not see the logic in this line of thought. After all, there were so many other things we could work on: creating new datasets, developing data repositories, integrating GIS into mainstream applications like 911 and permitting systems, building kiosks and front counter applications, building citizen engagement websites, increasing operational efficiency through in-vehicle and mobile applications, and developing regional cooperatives, to name a few. There was just so much more to do.

And the more GIS was embraced by the various departments and the public, the more GIS became mission critical to the organization, and the more important we became to the organization. While the question my peers asked so many years ago still exists, we have been presented with an even greater opportunity to extend the power of GIS to every discipline in government.

More important, there's an opportunity for GIS personnel to become even more mission critical to their organizations. The key today just might be Microsoft Office 2010. Think about the number of individuals who use Excel spreadsheets and PowerPoint presentations in your organization. There are millions of Microsoft Office users worldwide. What if you could harness their work to extend GIS through a tool they are already familiar with? With respect to Microsoft Excel, what if instead of performing analysis through pie charts or scatter diagrams, people could show their information on a map by clicking an Esri Map button on the toolbar?

Well, that's exactly what your users can do with Esri Maps for Office, a simple plug-in for Microsoft Office. The power of mapping comes through an ArcGIS Online subscription extended through the add-in. Microsoft Office draws from basemaps and leverages the data you and your colleagues have been developing and maintaining for decades.

Public works professionals could take spreadsheets of capital projects and create interactive maps of the locations of those projects ranked by cost, time to completion, or any other factor and perform their own analyses. Finance directors could take spreadsheets of delinquent payments by billing route or by month and build heat maps of the patterns to better understand their businesses and citizens' payment habits and set course corrections. Or the same department could show where money was being allocated across a community. These maps and analyses could be used for internal review or, with the click of a button, turned into web maps that could be embedded in public-facing accountability and transparency websites.

Consider the hundreds of PowerPoint presentations created each year. While these presentations are impactful and professional, what do you do if someone asks a question about the information in a map image and the map itself doesn't contain the answer? You may come off as unprepared, or you may have to have another meeting. With Esri Maps for Office and ArcGIS Online, you can create presentations with live maps embedded in them. When an elected official raises a question, you simply click the live map inserted into the PowerPoint to navigate to the answer. You move from presentation to interaction.

If everyone else was able to use the power of GIS, what would we do?

These are simple routines that GIS professionals have performed on behalf of other disciplines for years. Now everyone can make his own maps. Try ArcGIS Online and Esri Maps for Office yourself—or better yet, show them to the finance director. See esri.com/maps4office.

Follow Christopher Thomas on Twitter at @GIS_Advocate.

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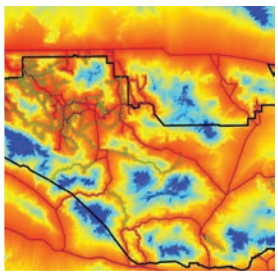

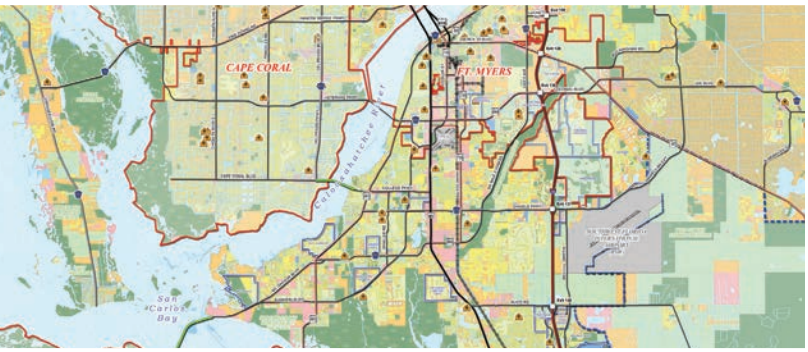

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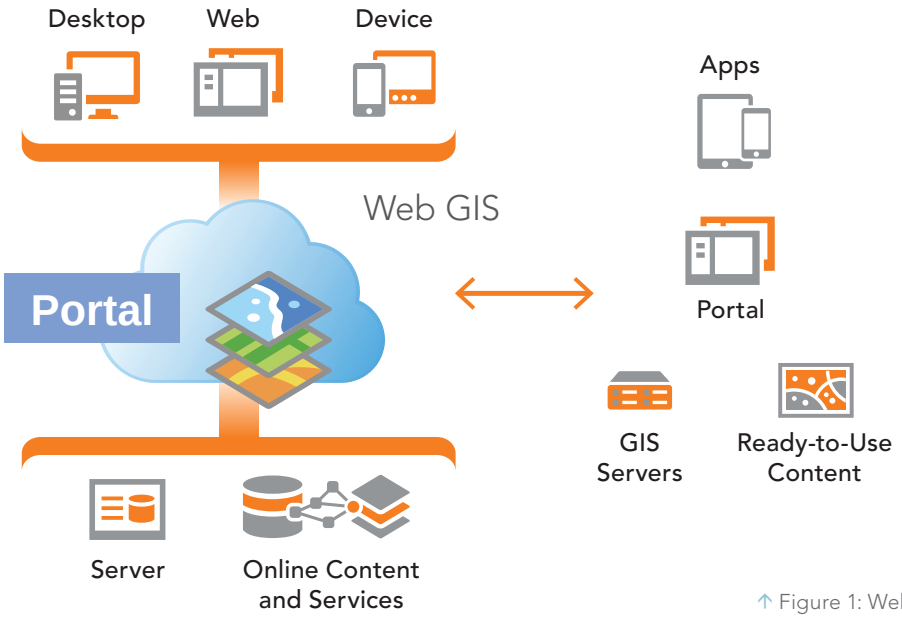
Portal for ArcGIS 101

By Derek Law, Esri Product Manager



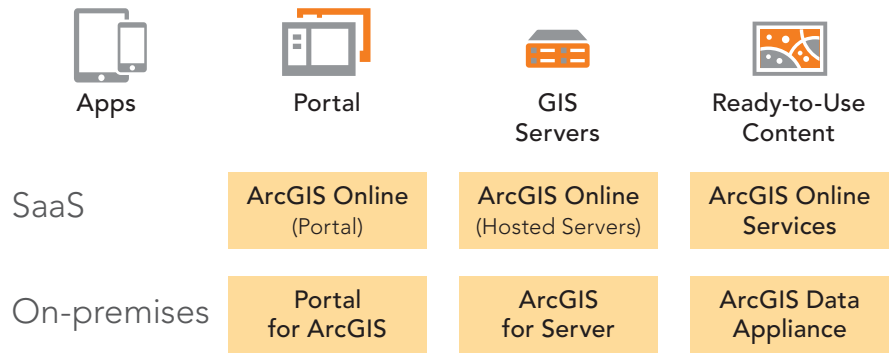
↑ Figure 1: Web GIS concept diagram

This article provides GIS managers and analysts with an understanding of the fundamental concepts of Portal for ArcGIS and its capabilities. It presents a general overview of Portal for ArcGIS; discusses its key features, architecture, and implementation; and highlights the ArcGIS platform client applications that are available with Portal for ArcGIS.

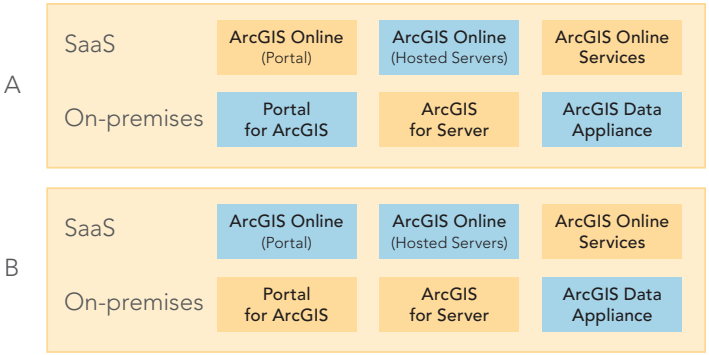
Traditionally, GIS has been a technology used by analysts to perform spatial analysis and generate custom map products that meet the specific needs of their organizations. Although it was considered a niche technology, in recent years the concept and importance of spatial location have become more mainstream, and GIS awareness is now becoming more prominent in many organizations.

Web GIS is a pattern for delivering GIS capabilities. It is at the center of Esri's strategic direction for implementing GIS as a platform. The key concept behind web GIS is that all members of an organization can easily access and use geographic information within a collaborative environment. Analysts still provide technical GIS expertise in the traditional sense, but other staff in the organization with little or no GIS knowledge can also benefit from and contribute to the organization's GIS platform. Web GIS leverages existing GIS investments and makes them discoverable and more accessible. It provides a platform for integrating GIS with other business systems and promotes cross-organizational collaboration. Consequently, web GIS extends the reach of GIS to everyone in an organization, enabling better decision making.

At the center of the web GIS pattern in the ArcGIS platform is the generic concept of a *portal* that represents a gateway for accessing all spatial products in an organization. The portal helps organize, secure, and facilitate access to geographic information products. Client applications on desktops, web apps, tablets, and smartphones interact with the portal to search, discover, and access maps and



↑ Figure 2: Web GIS deployment models



↑ Figure 3: Web GIS hybrid deployment models

other spatial content. In the back-office infrastructure, the portal is powered by two components: GIS servers and ready-to-use content.

The ArcGIS platform offers two deployment models for web GIS. ArcGIS Online, the cloud-based offering, has a software-as-a-service (SaaS) deployment model. All components are hosted in the cloud. There is no hardware infrastructure for an organization to maintain because Esri manages and maintains ArcGIS Online. Alternatively, there is an on-premises model that includes Portal for ArcGIS. Portal for ArcGIS is deployed with ArcGIS for Server and optionally with the ArcGIS Data Appliance. In the on-premises model, an organization manages the hardware infrastructure to operate the ArcGIS platform.

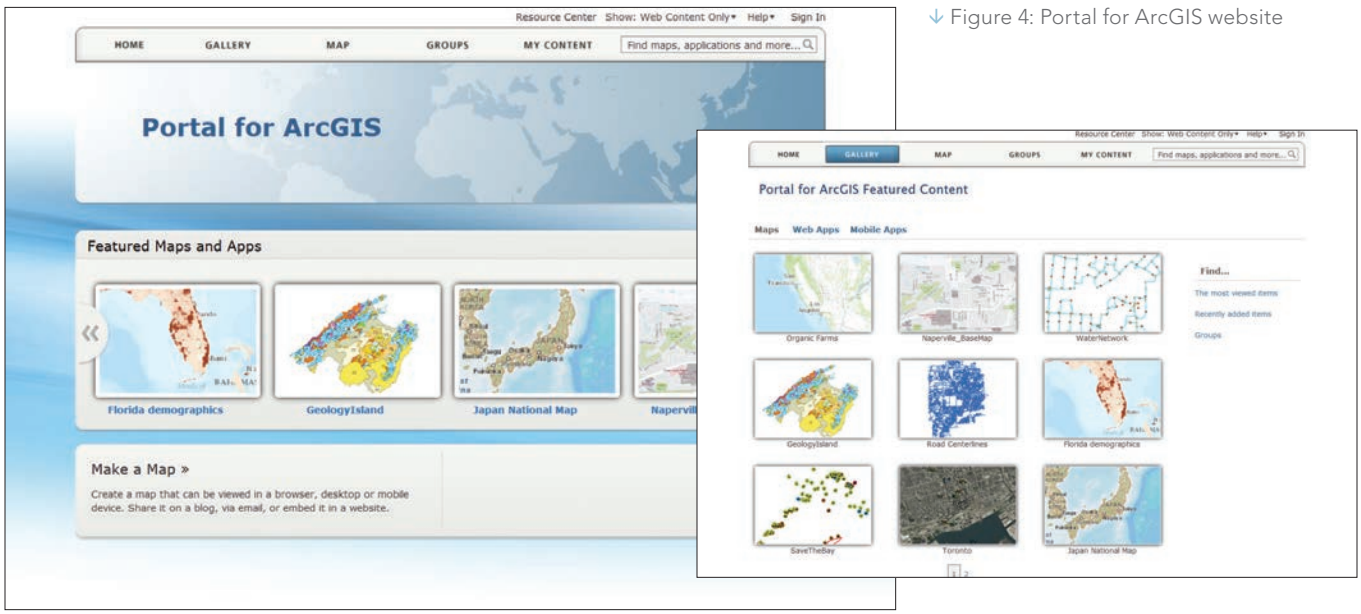
Although there are two separate web GIS deployment models, hybrid deployments that combine parts of the cloud-based model with parts of the on-premises model are not only possible but very popular. These two common hybrid deployments are: ArcGIS Online + ArcGIS for Server + ArcGIS Online content and Portal for ArcGIS + ArcGIS for Server + ArcGIS Online content. Selecting the appropriate web GIS deployment model—SaaS, on-premises, or a hybrid variation—will depend on an organization's business workflows and security requirements. Organizations can use one or several deployment models of the ArcGIS platform to enable web GIS to support their different lines of business.

What Is Portal for ArcGIS?

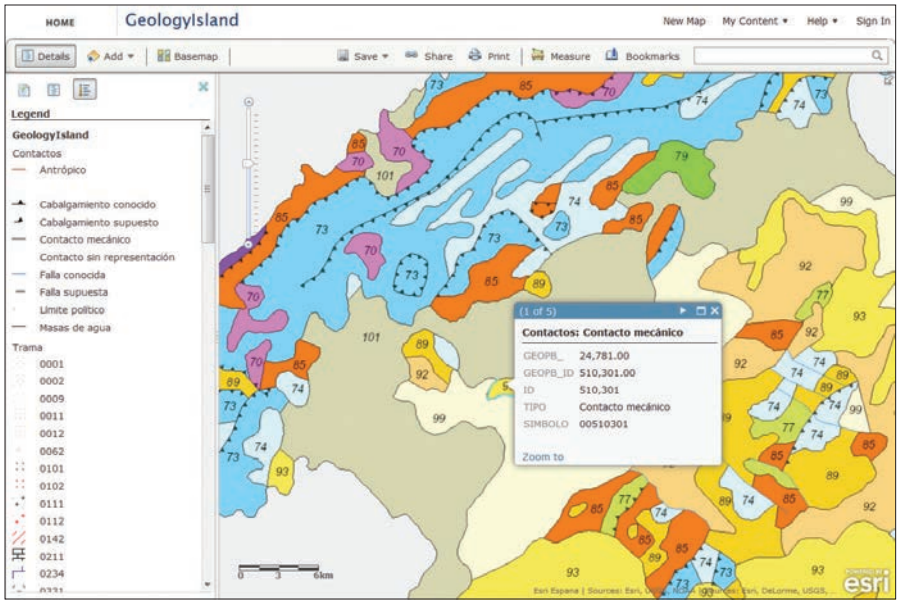
Portal for ArcGIS is a mapcentric content management system that an organization can host within its own infrastructure. Portal can be deployed on Windows or Linux operating systems and installed on an organization's physical machines or in the cloud. It is software that enables an organization to deploy the portal concept of the web GIS pattern. An organization that installs Portal for ArcGIS would typically already be using ArcGIS for Server as part of its GIS operations and is responsible for the setup, configuration, and management of the portal.

Why Choose Portal for ArcGIS

There are several reasons why an organization chooses to implement Portal for ArcGIS instead of using ArcGIS Online for its web GIS portal. An organization may have sensitive data that cannot be uploaded and stored in the cloud. Perhaps the organization



↓ Figure 4: Portal for ArcGIS website



↑ Figure 5: Portal for ArcGIS map viewer

has unique security constraints and IT policies that can only be addressed by running the ArcGIS platform within the organization's IT infrastructure. There may be requirements to honor strict service-level agreements that cannot be currently met with ArcGIS Online. The organization may work in an isolated/disconnected network environment that does not have Internet access. While Portal for ArcGIS offers many capabilities available in ArcGIS Online, some functionality may not yet be available because its development and release schedule follows that of ArcGIS Online.

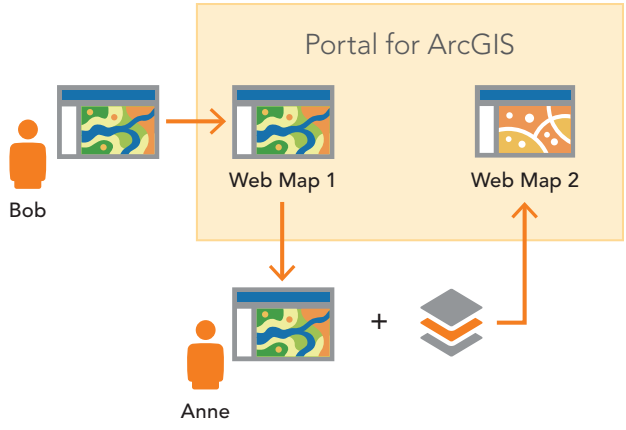
Key Features

A common misperception is that Portal for ArcGIS simply provides a website for displaying GIS content that facilitates the search and discovery of spatial assets. It is much more than a website. While the website is the primary interface for Portal, it is actually a mapcentric content management system that provides a framework for the management of GIS content and promotes collaboration between staff within an organization. As a content management system, Portal for ArcGIS can register and store many common types of GIS content associated with ArcGIS such as web services, web applications, map documents, layer files, layer packages, geoprocessing packages, and shapefiles. It also supports many standard file formats such as comma-separated values (CSV); Adobe PDF; and Microsoft Word, Excel, or PowerPoint files.

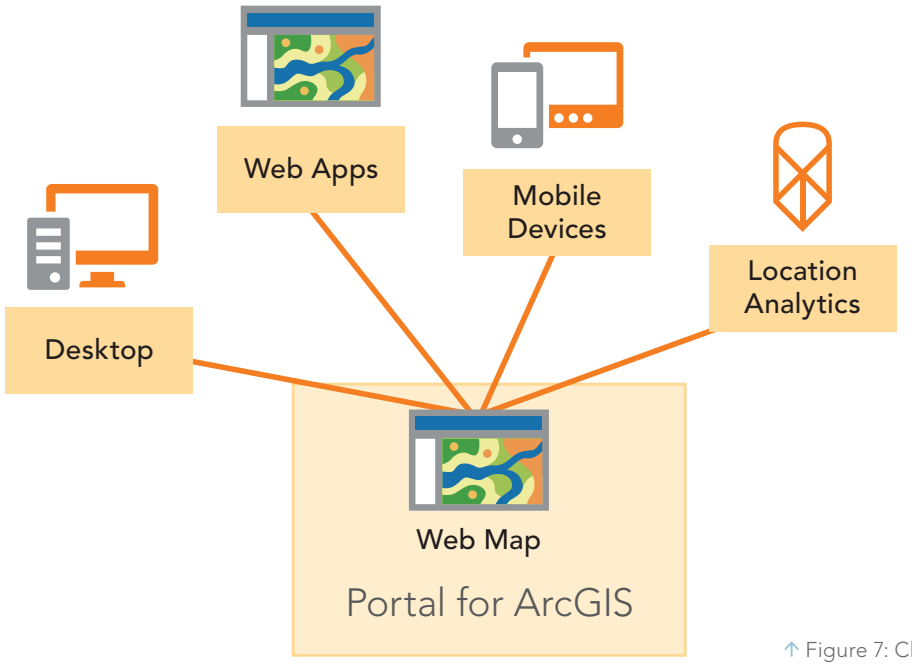
When a web service, web application, or data file is registered or created in Portal for ArcGIS, it becomes a Portal item. An item defines a unique searchable element in the portal that has descriptive information associated with it and must be tagged with keyword(s). Depending on the type of GIS content added, in some instances, the GIS resource is simply being referenced and not physically moved into Portal. For example, items could be referenced to an online resource such as a web service or web application, or they can contain actual data such as a tile package or PDF document. Portal for ArcGIS can aggregate all of an organization's GIS assets and related data files into a central location. It is a content management system for GIS resources that is easily searchable and accessible through the user-friendly Portal website.

Items in Portal for ArcGIS can be organized into Groups. Conceptually, a Group is like a folder containing a collection of items. A Group can also be empty and have no items (e.g., when a group is first created). Groups can categorize items for organizational purposes and be leveraged to control access to items. When an item is first created, it is private by default. Only the item owner can see and access it. The item owner determines if the item will be shared with a specific group or groups, with the organization, or with everyone (i.e., publicly accessible).

For example, item A is a registered web service, and item B is a PDF document that has been uploaded into Portal. Item A has been shared with the organization, but item B is only shared with the Survey group. Only members who belong to the Survey group are able to see and access item B, but all Portal members are able to see



↑ Figure 6: Web map sharing workflow in Portal for ArcGIS



↑ Figure 7: Clients for the web map

and access item A. Groups can be used to promote sharing and collaboration for specific items among certain staff in the organization and can be created for different departments, teams, business units, projects, organizational themes, or used to replicate the internal structure of the organization.

Portal for ArcGIS Map Viewer

A key aspect of the Portal for ArcGIS website is the map viewer. It provides an interactive means to perform mapping and visualization of GIS data. A user first selects a basemap, then searches for GIS content (typically web services) and adds them as operational layers (i.e., business information) onto the basemap. Optionally, the display properties of the operational layers can be configured such as setting transparency and symbology and activating and customizing pop-ups and attribute tables. Users can also add and display their own data, such as CSV, TXT, and shapefiles, on the map. The map viewer offers a simple and user-friendly mapping experience that makes it easy to find, assemble, and create map information products. It empowers those without GIS expertise to leverage GIS technology with their organization's GIS assets in a very accessible manner that extends GIS technology to a broader user base.

Web Maps

After creating a map in the map viewer, a Portal member can save it as a web map. A web map is a container that stores map definition (e.g., layers, visibility, and extent) and behaviors (e.g., pop-up windows). The web map concept is an important part of the web GIS pattern and the ArcGIS platform. A web map is one of the mechanisms that promotes and facilitates sharing and collaboration in Portal for ArcGIS.

For example, a member named Bob creates a new web map in the map viewer, saves it, and shares it, making it available to other Portal members. Anne, a coworker, can open Bob's web map in the map viewer and use it as a starting point for her own mapping visualization. She may add or modify the map contents, save it as a new web map, and share it with other members. Anne leverages Bob's work, and they have both extended the organization's GIS content by contributing back their data and analysis.

This workflow can continue and allow many Portal members to interact with and leverage the web maps stored in Portal. In effect, this is collaboration of spatial content based on maps. It is recommended that groups be used to help organize, filter, and govern the overall collection of web maps and other GIS content within Portal for ArcGIS. Portal members can also make web maps available to people outside Portal for ArcGIS by sharing with everyone and embedding web maps in HTML pages or directly sharing URL links to web maps with others.

Web maps work with all ArcGIS platform client applications: ArcGIS for Desktop, the ArcGIS web mapping APIs and viewers (JavaScript, Flex, and Silverlight), the ArcGIS mobile apps and

	With an ArcGIS organizational account			Without account
	User role	Publisher role	Administrator role	
Search and use public items	✓	✓	✓	✓
Search and use private items	✓	✓	✓	
Create and share items	✓	✓	✓	
Publish new content as tiled or feature services		✓	✓	
Administer the ArcGIS organization			✓	
Manage users and their privileges			✓	
Manage items created by others			✓	
Use Esri Maps for Office and SharePoint, Collector for ArcGIS, or Operations Dashboard for ArcGIS	✓	✓	✓	

↑ Table 1: Types of roles in Portal for ArcGIS

APIs (iOS, Android, and Windows Phone), ArcGIS Runtime SDKs, and Esri Location Analytics products (e.g., Esri Maps for Office, Esri Maps for SharePoint, and Esri Maps for IBM Cognos). Web maps with custom map definitions and behaviors will all be honored in the ArcGIS platform client applications. The web map is an interactive display of geographic information that can be used to tell stories and answer questions across multiple platforms and devices and within many enterprise business systems. This further extends the reach of GIS assets within an organization.

Application Templates

Portal for ArcGIS members can also build web applications for their web maps using the application templates included with Portal. With these templates, members can create and deploy new web mapping applications for a web map without any programming. Once a web map is saved and shared, a Portal member can select an application template, and the map's data content populates the template to create a new web application. The web application can be hosted within Portal for ArcGIS, or its code can be downloaded onto a local machine and then hosted on an organization's web server. Portal for ArcGIS includes many different application templates, and some can be further configured and customized. Each template is designed for a specific use case such as telling a story or answering questions.

Hosted Services

Portal for ArcGIS members can also add their own data to Portal to create a hosted web service. Two types of hosted web services are available: tiled map services and feature services. Tiled map services are typically used for static data. Feature services are typically used for dynamic data. A Portal member can add data to Portal to create a hosted web service under the My Contents section of the Portal website. ArcGIS for Desktop and Esri Maps for Office users can also connect to Portal for ArcGIS and publish GIS content to Portal as a hosted web service.

ArcGIS Online Content

Portal for ArcGIS also provides access to all nine basemaps available from ArcGIS Online: Imagery, Imagery with Labels, Streets, Topographic, Terrain with Labels, Light Gray Canvas, National Geographic, Oceans, and OpenStreetMap. Optionally, premium content from ArcGIS Online can also be used with Portal.

Architecture

Portal for ArcGIS, an optional extension included with the ArcGIS for Server Advanced edition (Workgroup and Enterprise levels), is a different and separate installation from ArcGIS for Server. It requires installation of the ArcGIS Web Adaptor, which is included with ArcGIS for Server. The Web Adaptor integrates Portal with an organization's web server architecture, enabling Portal to use an organization's identity store and security policies at the web-tier level. Portal for ArcGIS includes its own identity store but also supports both Integrated Windows Authentication (IWA) and Public Key Infrastructure (PKI) authentication for logging into the Portal website and accessing its content. Portal for ArcGIS and ArcGIS for Server can be installed on the same machine or on separate machines. Optionally, they can share the same Web Adaptor.

A Portal for ArcGIS instance includes:

- The Portal website with map viewer
- A repository that contains the Portal content and index files
- Application templates that can be used to deploy web applications

for web maps
- The Portal Sharing API, which exposes Portal for ArcGIS functionality as a REST endpoint and enables access to the ArcGIS Portal Directory

When installing and setting up Portal for ArcGIS, the first time you attempt to access the Portal website, you will need to specify an initial administrator account. You create this account when you initially log into and configure Portal for ArcGIS. This is not an operating system account. It only exists in the Portal for ArcGIS instance. After the initial configuration of your Portal instance, you can specify other accounts as administrators, demote the initial administrator account to a different role, or delete it.

Portal for ArcGIS can be accessed with or without an ArcGIS organizational account. When you access Portal with an ArcGIS organizational account, you become a Portal member and can be assigned into one of three role types: Administrator, Publisher, or User. Portal for ArcGIS administrators control which role is assigned to a Portal member.

Portal for ArcGIS administrators can customize and configure many different properties of the Portal website and determine the functionality available. They can change the look and feel of the website home page, change gallery page settings, set featured groups, define the basemaps available in the map viewer, choose application templates, and set utility services. Utility services are the web services that power specific functionality in Portal such as printing maps, locating addresses, calculating area, and routing. Portal for ArcGIS includes some default web services from ArcGIS Online for utility services, but you can optionally use your organization's web services to enable the utility services.

Integration with ArcGIS for Server

Portal for ArcGIS complements ArcGIS for Server because it provides an attractive front-end user experience for web services from an ArcGIS Server site. In addition, you can use ArcGIS Server web services to power Portal's utility services such as geocoding, high-quality printing, and routing. Portal for ArcGIS can be integrated with ArcGIS for Server in three ways.

Portal for ArcGIS with Registered Web Services

You can register web services from an ArcGIS Server site with Portal by simply adding the web services as Portal items. The items reference the URL addresses of the web services. You can register both public and secured web services with Portal. For secured web services, you can optionally save the authentication credentials with the item or have users submit authentication credentials when they access it. Portal for ArcGIS and ArcGIS for Server are two separate entities, each with its own identity stores. Conceptually with this integration, Portal for ArcGIS and ArcGIS for Server are loosely coupled. Portal can have many registered web services from many different ArcGIS Server sites.

Portal for ArcGIS with a Federated Server

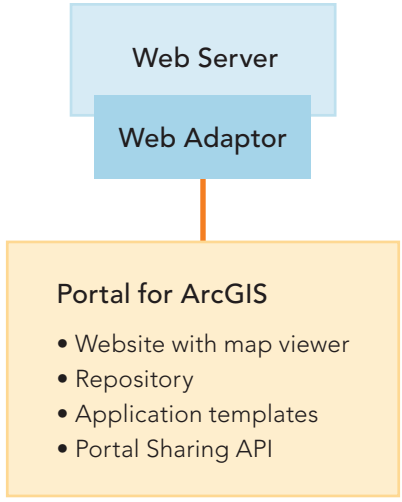
In this configuration, Portal for ArcGIS and ArcGIS for Server are more closely integrated. When you federate an ArcGIS Server site with Portal, it uses Portal's identity store. This means that all Portal for ArcGIS members are now the only valid logins to the ArcGIS Server site. The ArcGIS Server site's identity store is no longer used. Any web services that are published to the ArcGIS Server site will automatically be available as an item in Portal, and when users try to access the item, they will have a single sign-on user experience. Portal can be federated with multiple ArcGIS Server sites.

↓ Figure 8: Application templates in Portal for ArcGIS

Portal for ArcGIS with a Hosted Server

In this option, you can configure a federated ArcGIS Server site to be a hosting server for Portal. This enables Portal members who are publishers to publish tiled map services and feature services to Portal. They can publish hosted web services directly in Portal, ArcGIS for Desktop, and Esri Maps for Office. The web services are hosted by ArcGIS Server on the back end. This option requires a multiuser geodatabase that is registered as a managed geodatabase data store for the federated ArcGIS Server site. Portal can only have one ArcGIS Server site as a hosted server.

A Portal for ArcGIS instance can use one or all of these integration options with ArcGIS for Server and with multiple ArcGIS Server sites. Selecting which integration option(s) to use will depend on your organization's business workflows.

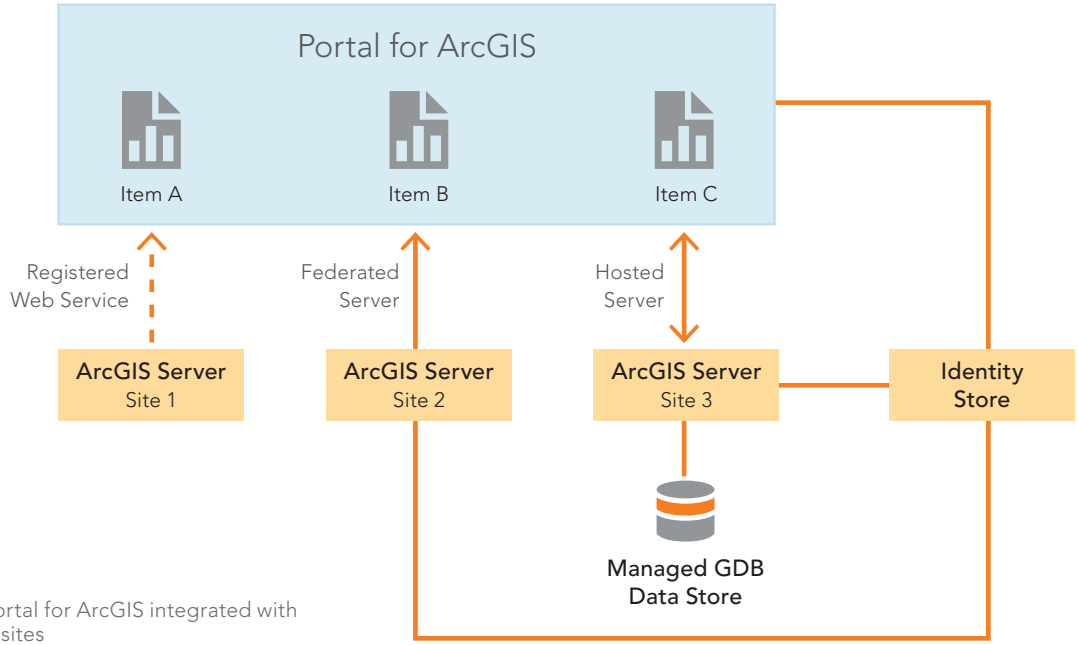


↑ Figure 9: Portal for ArcGIS architecture

Clients to Portal for ArcGIS

All ArcGIS platform client applications work with web maps from Portal for ArcGIS. ArcGIS for Desktop and both the ArcGIS viewer applications (Flex and Silverlight) are good examples of clients that fully support web maps. Portal for ArcGIS leverages your existing GIS investments because you can register all your existing GIS web applications as Portal items. Several ArcGIS client applications have been designed specifically to work with Portal for ArcGIS (and ArcGIS Online).

- Esri Maps for Office provides mapping capabilities in Microsoft Office through an add-in. You can use this add-in with Microsoft Excel to create web maps in Portal that show data from Excel spreadsheets. Additionally, an add-in for Microsoft PowerPoint lets you embed these web maps into your presentations.
- Esri Maps for SharePoint provides mapping capabilities in Microsoft SharePoint through a map Web Part for SharePoint pages. You can use this to display content from Portal for ArcGIS in your SharePoint pages. It also includes a locate workflow that



↑ Figure 10: Portal for ArcGIS integrated with ArcGIS Server sites

spatially enables SharePoint lists containing address data.

- Collector for ArcGIS is a field data collection and editing app for smartphones and tablets designed to help field staff rapidly collect and update data in the field using web maps from Portal for ArcGIS.
- Operations Dashboard for ArcGIS allows decision makers, operations managers, and section leaders to monitor activities and events; track their field work force; and assess the status of daily operations. The Operations Dashboard app creates and manages operation views within Portal. When members open an operation view in Portal, it downloads and installs the app on their computer.

These ArcGIS client applications extend the reach of your organization's GIS assets in Portal for ArcGIS to a broader user base.

Summary

Web GIS is a pattern for delivering GIS capabilities and a key concept of implementing GIS as a platform. Portal for ArcGIS is a mapcentric content management system that enables an organization to deploy the portal concept of the web GIS pattern in its own infrastructure. Portal for ArcGIS is more than a website. It is a framework for the management of GIS content and promotes collaboration between users within an organization. Portal leverages existing GIS investments by making them discoverable and more accessible. By empowering people to use and create maps accessed from many client apps and platforms, it extends the reach of GIS to everyone in the organization, enabling better decision making.

About the Author

Derek Law works on the ArcGIS for Server product management team. He is involved with requirements gathering, software development, and product evangelism. His technical expertise is focused on ArcGIS for Server, Portal for ArcGIS, and web mapping technologies. He has an MSc in remote sensing from the University of Victoria, British Columbia, Canada.

Looking Good Part 2

Making cool contours with reprojected elevation rasters

By Mike Price, Entrada/San Juan, Inc.

This tutorial takes a raster reprojected in the previous article and uses it to create a hillshade, model a slope, and create high-quality contours using a reprojected elevation raster.

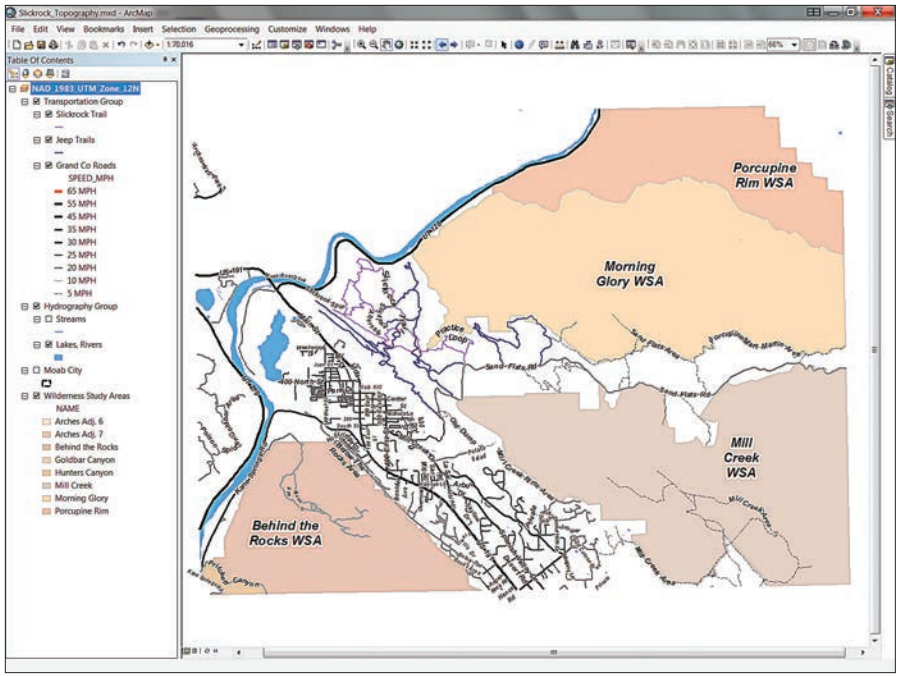
In "Looking Good: Properly reprojecting elevation rasters," an article in the fall 2013 issue of *ArcUser* magazine, I presented several methods for effectively reprojecting elevation and other rasters using the Nearest Neighbor technique, bilinear resampling, and cubic convolution. That exercise showed how to reproject a digital elevation model (DEM) from geographic to projected coordinates.

In this exercise, you will generate three related products: a hillshade, a slope raster, and high-quality contours. The hillshade and slope will help assess the quality of the raster by revealing herringbone patterns, tile seams, or other unnatural artifacts in the raster. In addition, slope rasters can be used to evaluate travel impedance when modeling search and rescue response. After evaluating the reprojected DEM, it will be used to generate contours.

Getting Started

Like the previous article, this exercise uses a small piece of a US Geological Survey 10-meter DEM that shows the famous Slickrock Bike Trail, located just outside Moab, Utah. Download the sample dataset from the *ArcUser* website (esri.com/arcuser) and unzip it on a local drive. Start ArcGIS for Desktop and open Slickrock_Topography.mxd (located in the \Slickrock_Topography folder) in ArcMap. The map includes the Slickrock trail, several jeep trails, Grand County roads, and Wilderness Study Area boundaries. Much of this vector data is available on the Utah Automated Geographic Reference System (AGRC) site.

↑ The data for this exercise describes the famous Slickrock Bike Trail, located just outside Moab, Utah.



↑ When you open the map, you will see it includes the Slickrock trail, several jeep trails, Grand County roads, and Wilderness Study Area boundaries.

Setting Up the Model

1. In the text menu area, choose Customize > Extensions and enable the Spatial Analyst extension. Choose File > Map Document Properties and set the Default Geodatabase to \Slickrock_Topography\Geodatabase\UTM83Z12\SR_Topography.gdb. This step is very important if you have completed the previous exercise.
2. Still in the Map Document Properties dialog box, check Pathnames Store relative paths, and complete other fields to provide metadata for the map. Click OK and save the project.
3. Next, add the reprojected elevation raster by clicking the Add Data button, navigating to \Slickrock_Topography\Geodatabase\UTM83Z12\SR_Topography.gdb. Add topo_10_utmc. This is an expanded version of the 10-meter topography raster that was reprojected in the previous exercise from geographic coordinates to UTM Zone 12N using the North American Datum of 1983 (NAD83) datum. After careful comparison of the results of the bilinear and cubic resampling techniques, the cubic technique works best in the highly irregular Slickrock terrain. The "c" in the file name indicates cubic resampling was used to reproject this DEM.
4. Topo_10 should load at the bottom of the Table of Contents (TOC), and it shows the full extent of the model's area. To view the entire model area, choose Bookmarks > Slickrock Topography 1:60,000.
5. Add ArcToolbox to the ArcMap window and locate the Spatial Analyst Tools. Open the Surface toolset and inspect it.

Before using any tools, update the Geoprocessing Environment. These settings are very important. Right-click in an open Toolbox area and select Environments. In the Environment Settings window, verify that the Current and Scratch workspaces are set to SR_Topography.gdb. (This setting should have been carried over from the Map Document Properties dialog box.)

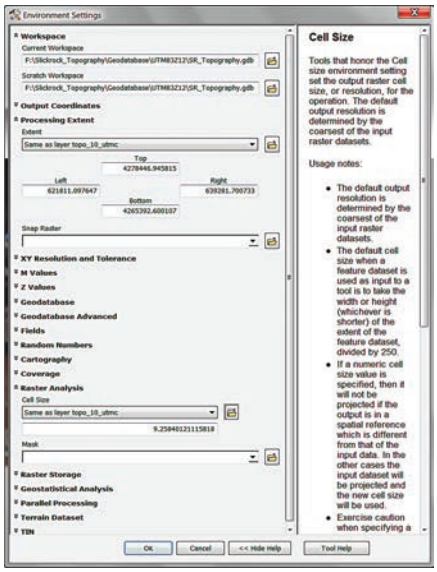
Scroll down the Environment Settings dialog box and set the Processing Extent to Same as topo_10_utmc. Continue scrolling, open Raster Analysis, and set the Cell Size to Same as layer topo_10_utmc. Click OK and save the project.

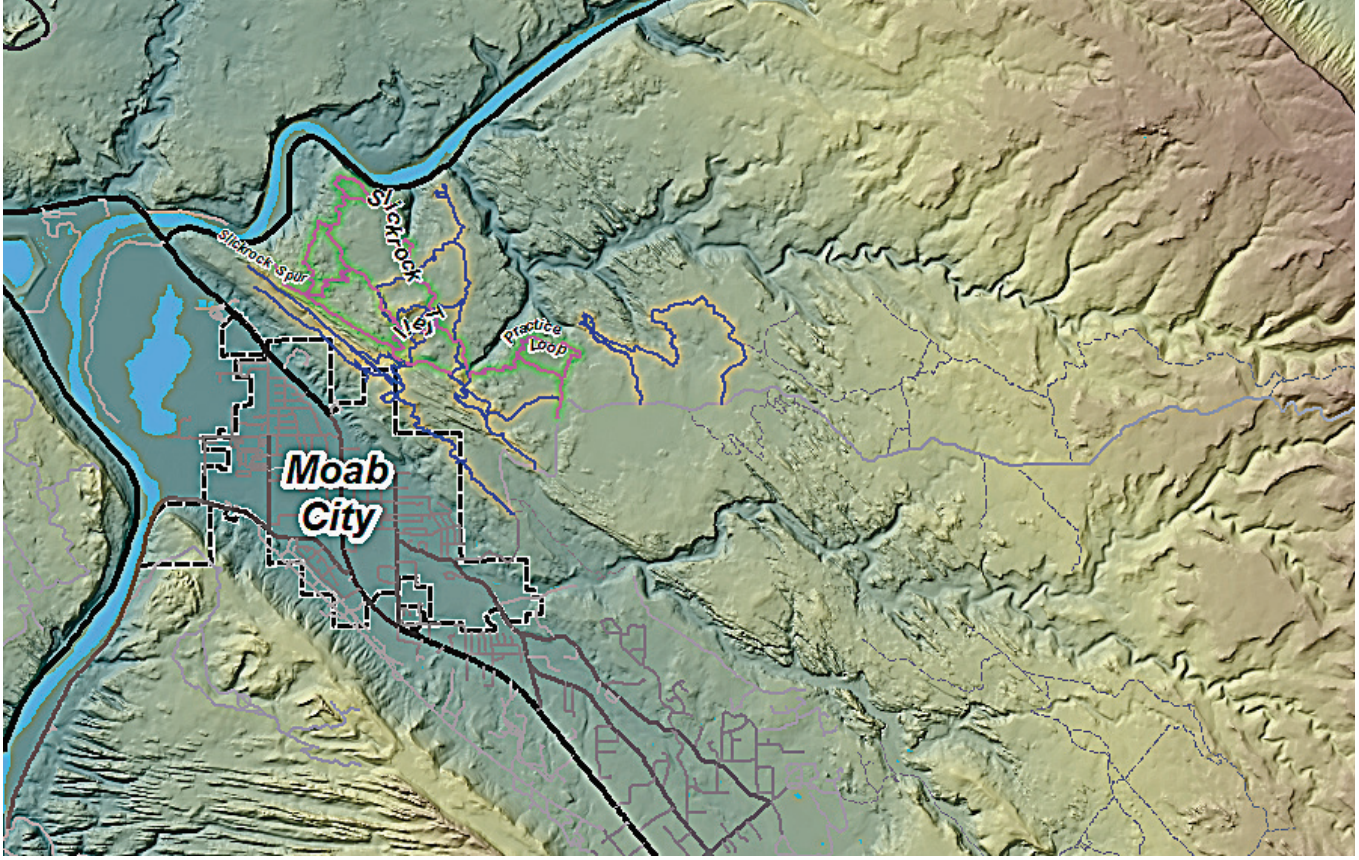
Modeling the Hillshade

The first task will be to create a hillshade of the DEM.

1. Select the Hillshade tool from the Spatial Analyst Surface toolset.
2. In the tool's dialog box, choose topo_10_utmc, located in the SR_Topography geodatabase, as the Input raster.
3. Name the Output raster hlsh_10_utmc and save it to the SR_Topography geodatabase.
4. Since the elevation horizontal and vertical units for this raster are in meters, a Z factor of 1 is appropriate.

↓ Before working on the map, make sure to set the geoprocessing environment. Set the Current and Scratch workspaces, Processing Extent, and Raster Analysis cell size.





↑ After creating the hillshade, symbolize it using the select Brown to Blue Green Diverging, Bright color ramp.

5. Accept the Hillshade tool default parameters and click OK. The hillshade layer will appear near the bottom of the TOC.

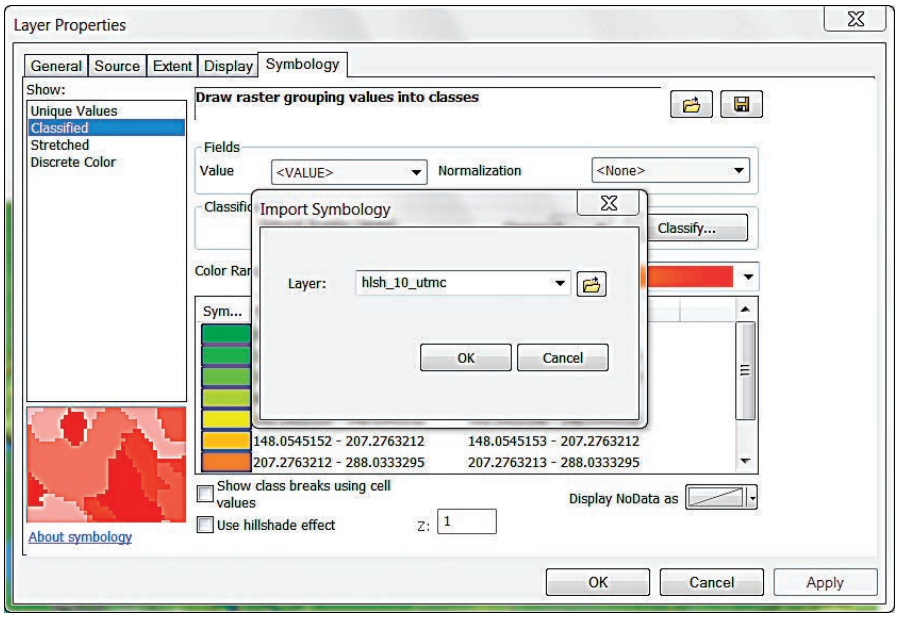
Organizing the Map

To enhance and organize the map, move topo_10_utmc to the bottom of the layers in the TOC, just below hlsh_10_utmc.

In the TOC, open the Properties for hlsh_10_utmc, select the Display tab, and set Transparency to 50 percent.

Open the Properties for topo_10_utmc. On the Symbology tab, right-click the current color ramp and click Graphic View to uncheck it. This will turn off the color bar and show the names of color ramps instead. Scroll down the list of color ramps and select Brown to Blue Green Diverging, Bright. Also check the Invert box and click OK.

Turn off the Wilderness Study Areas layer.

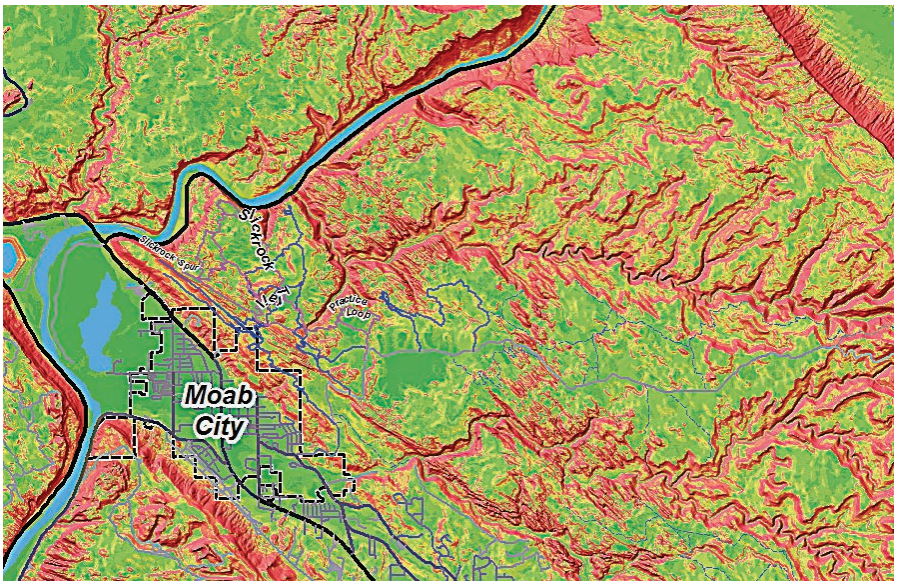


↑ Use a layer file, Slope Percent.lyr, to apply a standardized classified legend for the percent slope raster.

Investigating Irregular Topographic Slope

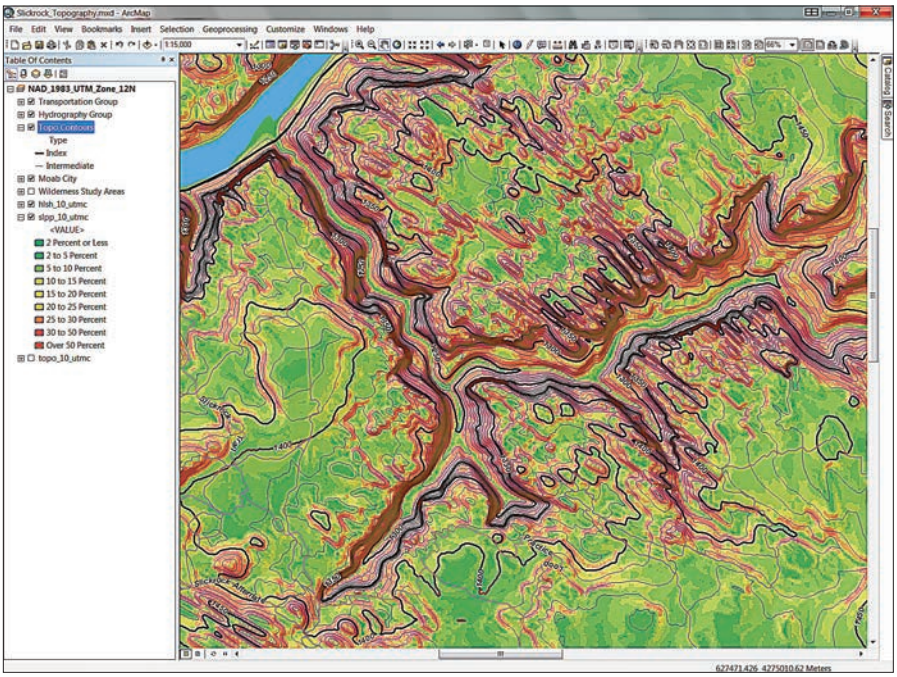
Next, model Slickrock slope to see the ruggedness of this country. Since mountain bikers must battle gravity to go up (and down) the Slickrock trail, modeling the slope in percent will help visualize the effort required to climb these hills. Remember that percent slope is essentially rise over run. In this model, a slope of 10 represents 10 meters of rise for every 100 meters traveled horizontally.

1. In the Surface toolset, open the Slope tool and set the Input raster to topo_10_utmc. Change the Output measurement to PERCENT RISE. Name the Output raster slpp_10_utmc (p for percent). A Z factor of 1 is again appropriate. Click OK to the model slope.
2. After slpp_10_utmc loads in the TOC, move it to a position just below hlsh_10_utmc. Turn off topo_10_utmc.
3. In the TOC, right-click slpp_10_utmc and open the Symbology tab. In the upper right corner of the Layer Properties window, click the Import (file folder) button and navigate to



↑ Once the Slope Percent. lyr is applied, use the Slickrock Detail bookmark to zoom in and study the degree of slope for various portions of the bike and jeep trails.

↓ Use the Contour With Barriers tool to create contours at 10-meter intervals.



\Slickrock_Topography\Utility. Select Slope Percent.lyr, a layer file that will apply a standardized classified legend for the percent slope raster. Click Add, then OK, and OK again.

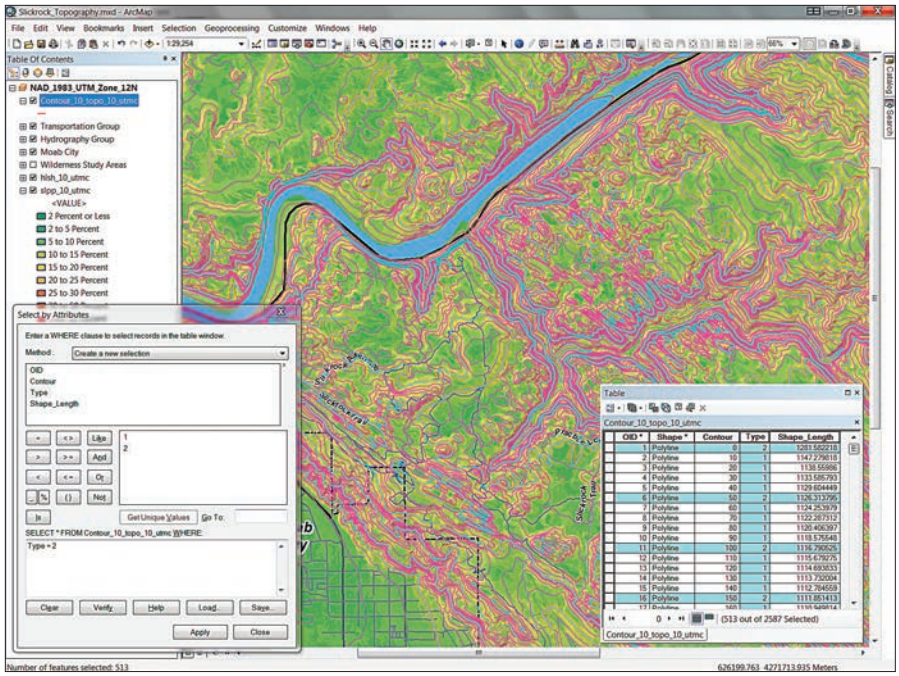
4. In the TOC, open the Properties for slpp_10_utmc and select the Display tab, and set Transparency to 50 percent.
5. If the legend does not load, check Show and verify that it is set to Classified.
6. Use the Slickrock Detail bookmark to zoom in and study relationships between bike trails, jeep trails, and slope. If you have biked in rugged terrain, you will recognized that slopes below 10 percent, shown in shades of green, are usually not too difficult to navigate and that slopes between 10 and 20 percent (yellow shades) are tough. Slopes over 20 percent (shades of red) are typically very dangerous. Fortunately, most of the trails are on green slopes.
7. Find a few trail segments that traverse steeper terrain. Notice that the Slickrock Trail is sometimes steeper than the jeep trails, especially in northern areas. These are the slopes I use to set network impedance and calculate travel times when modeling time-based travel on these trails. When finished, save the project.

Creating Contours

The final task will be creating, mapping, and labeling topographic contours. The 10-meter DEM in the sample dataset is of sufficient quality to create contours using a 10-meter interval. Mapping one index contour for every five stacked contour lines will generate an index interval of 50 meters. Wouldn't it be nice if ArcGIS would flag these 50-meter lines for us? Actually, the Contour With Barriers tool will do just that.

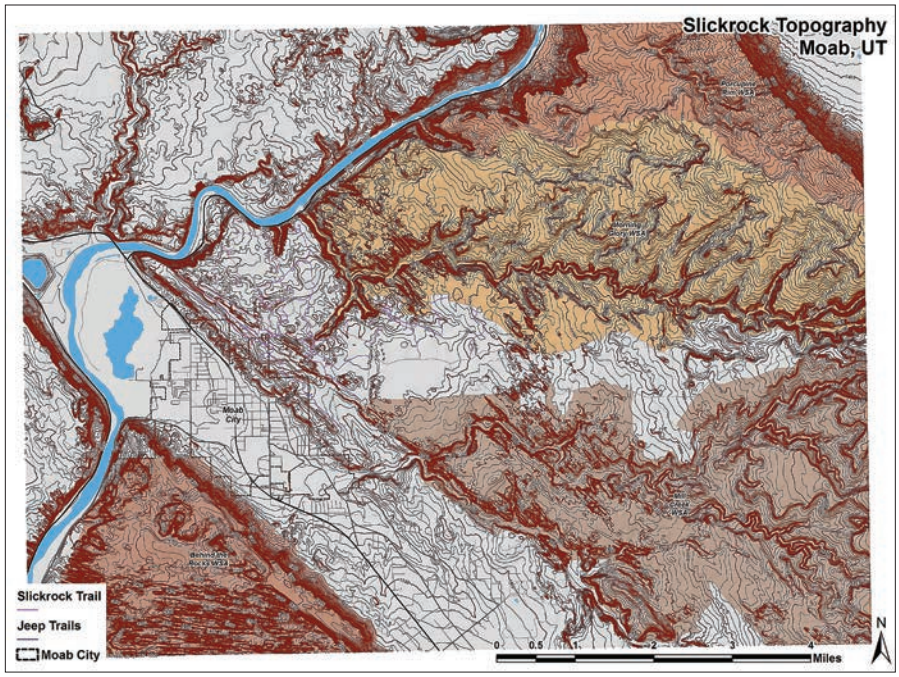
The Contour With Barriers tool has been around for a while but is often underutilized. Initially, it was used primarily by geologists to contour structural surfaces dissected by faulting. Contour With Barriers is now the primary contouring utility for ArcGIS that often replaces both the Contour and Contour List tools.

1. In ArcToolbox, select the Contour With Barriers tool from the Surface toolset.
2. In the tools wizard, select topo_10_utmc as the Input Raster.
3. Set the Output Contour Features destination to \SR_Topography\



↑ Use Select by Attribute to select contour lines of type 2.

↓ Make a few refinements. then change to Layout view to inspect the completed map.



and name the output feature class Contour_topo_10_umtc.

4. Retain POLYLINES as Type of Contours.
5. In the next wizard pane, set Contour Interval to 10 and Index Contour Interval to 50.
6. Leave other parameters unchanged. Click OK and watch the contours appear on the map. Move Contour_topo_10_umtc just below the Transportation Group in the TOC.

Displaying Contours

The Contour With Barriers tool adds the Type field and codes index contours with a value of 2. Intermediate contours are coded 1. To simplify thematic mapping and labeling of contours, the sample dataset contains a layer file for symbolizing the contours.

1. Open the attribute table for Contour_topo_10_utmc and locate the Type field. Use Select by Attribute to select all records for which Type = 2.
2. Click the Add Data button, navigate to \Utility, and select Topographic Contours.lyr. When the layer file loads, note that the data link is broken. You will repair this link by pointing the layer file to Contours_topo_10_utmc file.
3. In the TOC, open Properties for Topographic Contours.lyr, click the Source tab, and click the Set Data Source button and navigate to Contour_topo_10_utmc as the data source.
4. Remove Contour_topo_10 from the TOC and save again. Cool contours, and they were so easy.

Mapping Contours

Finally, make a presentation map from these rasters.

1. Close ArcToolbox to increase the active mapping area and zoom to Bookmark Slickrock Topography 1:60,000.
2. Open the Properties for data frame name, click on the General tab, and set the Reference Scale to 1:20,000. Rename hlsh_10_utmc to Hillshade, 10 M Topo; slpp_10_utmc to Slope 10 M Topo; and topo_10_utmc to 10 M Topo.
3. Switch to Layout View and look over the map. Turn Slope and Topo layers off; move Hillshade, 10 M Topo above the Wilderness Areas layer; and turn Wilderness Areas back on.

Experiment with zoom scale, reference scale, and label fonts to make the map more attractive and readable. Save once more. You are finished.

Summary

In this exercise, you modeled a reprojected Slickrock DEM and created a topographic hillshade, modeled the slope in percent, and created and posted high-quality topographic contours.

Acknowledgments

The exercise data was obtained from the US National Map and the Utah AGRC, Grand County. I also used files from personal field studies. Esri Spatial Analyst product managers also provided input regarding design and use of tools, especially Contour With Barriers.

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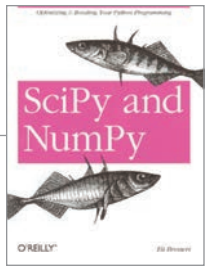
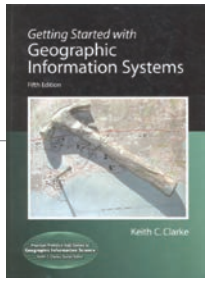
GIS Bookshelf



SciPy and NumPy

By Eli Bressert

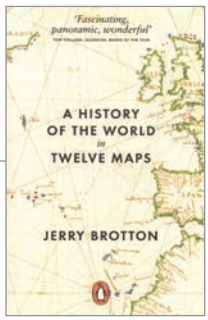
The goal of this slender, illustrated book is to get the reader using SciPy and NumPy quickly. NumPy has been part of the ArcGIS software installation since 9.2. This package for scientific computing in Python includes support for an N-dimensional array object. Many existing Python functions have been created to process NumPy arrays, most notably those contained in the SciPy scientific computing package for Python. In its 82 pages, *SciPy and NumPy* covers installing and using both Python libraries as well as add-on SciKits packages. O'Reilly Media, 2012, 82 pp., ISBN: 978-1449305468



Getting Started with Geographic Information Systems, Fifth Edition

By Keith C. Clarke

Since it was first published 14 years ago, this introductory text has continued to change as GIS has evolved. The fifth edition features revised chapters on spatial analysis, functionality, and the future of GIS along with a new chapter on terrain analysis. Each chapter includes a study guide and glossary. The People in GIS sections, new with this edition, contain interviews with GIS professionals from around the world. Additional teaching resources are available online. While current with the technology, this text provides the fundamental concepts needed to intelligently use this powerful tool. This volume is part of the Pearson Prentice Hall Series in Geographic Information Science that is edited by the author. Prentice Hall, 2010, 384 pp., ISBN: 978-0131494985



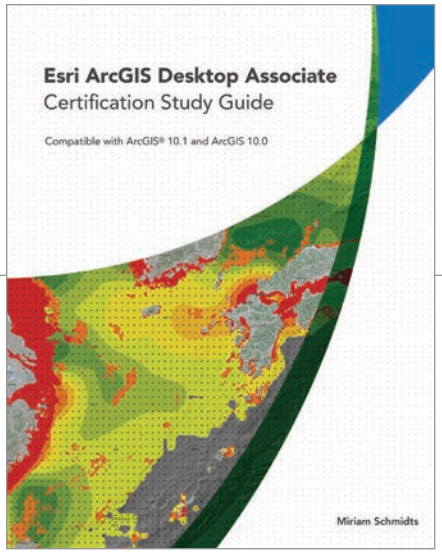
A History of the World in Twelve Maps

By Jerry Brotton

The author chose 12 maps of the world that illuminate aspects of the circumstances and mindset of the cultures that created them. While the creators of these maps faced the same problems of scale, perspective, orientation, and projection, the approaches they employed were strongly influenced by not only cartographic technology but also by religious, political, financial, and even personal considerations. In providing context for each map, Brotton has written a brief history of the world through cartography that is enthralling. He concludes with the inescapable truth that "There is simply no such thing as an accurate map of the world, and there never will be one. The paradox is that we can never know the world without a map, nor definitively represent it with one." Penguin Books, 2012, 514 pp., ISBN: 978-0141034935

Prepare for Success

A guide for those seeking associate certification



Make sure you are well prepared for the Esri ArcGIS for Desktop Associate certification test with this study guide. The Esri Technical Certification Program, open to Esri users worldwide, recognizes individuals who are knowledgeable about and proficient in best practices for using Esri software. This practical workbook features a comprehensive review of the GIS skills and knowledge measured by the exam. It provides overviews of essential ArcGIS for Desktop tools and workflows, step-by-step exercises, and practice questions that will prepare you for the exam. Each chapter includes chapter and challenge questions (with answers), key terms, and a list of additional resources. *Esri ArcGIS Desktop Associate Certification Study Guide* comes with access to a 180-day version of ArcGIS for Desktop software (version 10 or 10.1) and a DVD containing data for working through the exercises. The author, Miriam Schmidts, teaches GIS classes and develops course materials for the Esri educational services team. She is an experienced instructor who is a CompTIA Certified Technical Trainer (CTT+) and an Esri Certified ArcGIS for Desktop Professional. Esri Press, 2013, 392 pp., ISBN: 9781589483514

Saving the Blue Stuff

The first Ocean GIS Forum

By Monica Pratt, *ArcUser* Editor

Esri chief scientist Dawn Wright invited those attending the Ocean GIS Forum to accompany her on a "hero's journey across the ocean to move from what is to what can be."

This year's event, the first of what is expected to be many ocean GIS conferences, showcased the multitude of ways the ocean community uses GIS to better understand and protect the ocean. Speakers at the conference emphasized the importance of enlisting the public's support in saving the world's oceans from the adverse impacts of human activity. The event also gave Esri an opportunity to unveil new tools and enhancements to existing tools for handling multidimensional data.

The conference, held November 5–7, 2013, on the Esri campus in Redlands, California, drew 150 attendees from academic and research institutes, government agencies, nonprofit organizations, consulting firms, and ocean-related businesses that use GIS in the marine environment. While most were from the United States, some attendees traveled from Spain, the Russian Federation, Brazil, Canada, Pakistan, and the United Kingdom. The event was sponsored by Oceaneering, ExactEarth, QPS, Amazon Web Services, and RPS/ASA.

The groundwork for this event was laid last year at the first—and only—Esri Oceans Summit. Fifty leaders in the oceans community invited to the Redlands campus were joined by an almost equal number of Esri staff to establish a community of GIS ocean interests, identify challenges to using GIS in the ocean environment, and guide the development of GIS tools for that community.

The summit was one of the first steps outlined in the Esri Oceans Initiative. Announced in 2012, it is an organization-wide effort to enhance Esri's capabilities to support GIS in both coastal and open

ocean applications. Esri has been involved in ocean conservation efforts since it first developed a marine spill analysis system in 1989. Efforts in this area continued with digital nautical charting projects with National Imagery and Mapping Agency (NIMA) [former name of the US National Geospatial-Intelligence Agency] and hydro information systems for Finland and Sweden. This work highlighted the need for handling more than two dimensions and resulted in the development of a data model for the marine environment.

Exploration and Understanding

Keynote speaker Dave Gallo, an oceanographer and the director of special projects at the Woods Hole Oceanographic Institute, was one of the first scientists to use both robots and submarines to explore the deep sea floor. Recently, he has become more widely known for his work with the film director James Cameron and for his wildly popular Technology, Entertainment, Design (TED) Talks.

At the beginning of his address, Understanding Precedes Action, Gallo displayed an image of the earth as seen from space. It emphasized one of the challenges facing the ocean community: the misconception that "since we can see it all we know it all." The reality is that only a small percentage of the ocean has been studied. But even that limited exploration has revealed the ocean as a place of vast diversity, esoteric creatures, and geological features that dwarf terrestrial mountains and valleys.

"Oceanography, to me, has always had these two parts. There is the excitement of exploration and discovery," said Gallo. "The other part is the importance of understanding it for the sake of the planet." Gallo has been using GIS as a tool for increasing his understanding since the 1980s when he traded his colored pencils in for ARC/INFO when drawing bathymetry contours.

He observed that the lack of a holistic view of the ocean is the underlying cause of the poor response to events like the Deepwater Horizon oil spill in the Gulf of Mexico. Years of studying the ocean have impressed on Gallo the critical importance of the ocean to everyone and the need for the public to support the work of the ocean community.

↓ Oceanographer and keynote speaker Dave Gallo is concerned that lack of a holistic view of the ocean underlies the poor response to events like the Deepwater Horizon oil spill.

Enlisting the Public

In the panel discussion that followed Gallo's keynote, Sylvia Earle reenforced Gallo's message that "protecting the blue part of the planet that keeps us alive" should be our first priority. Earle is a renowned oceanographer, author, and National Geographic explorer-in-residence. She was joined by Dr. Jerry Schubel, president and CEO of the Aquarium of the Pacific; David McKinnie, senior adviser for the National Oceanic and Atmospheric Administration (NOAA) Ocean Exploration Research; Gallo; and Wright.

Schubel talked about the importance of getting "the public interested in, commited to, and caring about the ocean. You're all involved with data but the public and the policy makers don't want data," he said. "They want information. Data has to be converted into information, and that is one of the powerful things that GIS can do." GIS aids collaboration and helps the ocean community tell powerful stories to the public. Schubel's Aquarium of the Pacific has effectively used story maps to translate science to the public.

Data sharing, public engagement, and technology were three of the major components of a national program for exploring the ocean discussed at Ocean Exploration 20/20: A National Forum, held July 19–21, 2013, in Long Beach, California, at the Aquarium of the Pacific. McKinnie, in speaking about the 20/20 event, noted that the need for good data has contributed to a blurring of the line between exploration and research with the advent of privately funded researchers and citizen explorers. This means more data users and more data providers, resulting in more data but also a more complex landscape that requires some agreement on priorities, partnerships, platforms, and technology development.

Pushing the Limits of GIS

During the afternoon on both days, Lightning Talks by an assortment of researchers, people in marine-related

↑ The Aquarium of the Pacific has effectively used story maps, like this one on its penguins, to engage the public.

businesses, and government agencies gave a quick overview of the many ways the ocean community is exploiting the latest GIS capabilities for collecting, managing, and analyzing large, complex datasets and collaborating and communicating using web mapping and the ArcGIS Online platform.

One of the Lightning Talks given on the first day aptly illustrated how GIS is enabling crowdsourced ocean science. Lei Lani Stelle, an associate professor of biology at the University of Redlands in California, described a smartphone app that helps gather data on marine mammal sightings. She maps mammal distributions to identify and find ways to mitigate potential human-marine mammal conflicts.

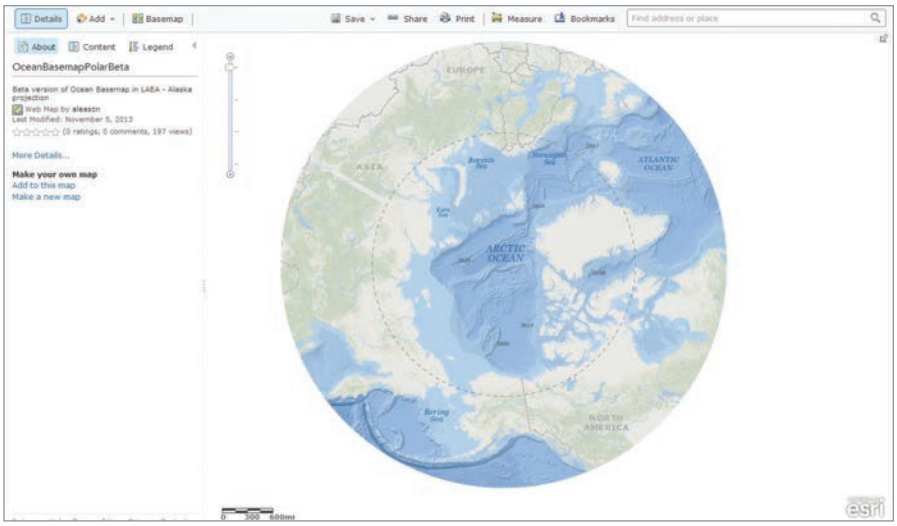
The app lets her obtain data in a usable format from a previously untapped source: companies that offer whale watching tours. The app uses the device's GPS capabilites to supply location information, user accounts qualify who is submitting the data, and drop-down selections in the interface speed the input of species and activity

↓ Senior NOAA adviser David McKinnie, renowned oceanographer Sylvia Earle, Aquarium of the Pacific president and CEO Jerry Schubel, Esri chief scientist Dawn Wright, and Woods Hole Oceanographic Institute special projects director David Gallo discussed the role of GIS in ocean study and preservation.

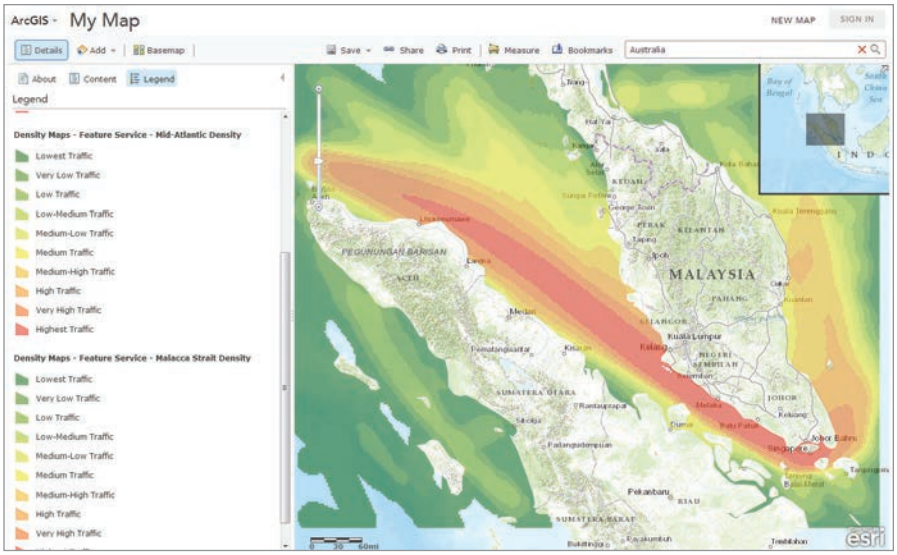
information. A photo can also be included. Observations are uploaded by syncing to an online geodatabase.

Another presentation demonstrated how GIS is helping oil and gas companies operate in the marine environment more safely. In just five minutes, Mark Stevens described how GIS helps his company, Oceaneering, provide a common operationing platform (COP) for intelligently and rapidly responding to incidents and disaster and coordinating drills. Oceaneering, a sponsor of the Ocean GIS Forum, supplies engineered services and products to the offshore oil and gas industry and specializes in deepwater applications.

The company creates COP interfaces for clients that use ArcGIS Online to create mapcentric, GIS-based dashboards that integrate information about a site with all types of data on current conditions and operations including the deployment of vessels, remotely operated vehicles (ROVs), other special equipment, and staff. Oceaneering works with companies to define and prebuild bathymetry, environmental, and other layers that support a COP and inform response efforts.



↑ The newly released Arctic Ocean Basemap—Beta



↑ ExactEarth, a conference sponsor, has released layers showing cargo vessel density on ArcGIS Online.

Improved Tools for Ocean GIS

The second day began with the technical plenary session delivered by Kevin Butler, a member of the Esri product development team. He demonstrated how the ArcGIS platform can serve as a basis for e-science and highlighted ongoing development efforts to improve support for multidimensional scientific data—specifically support for Network Common Data Form (netCDF), GRIdded Binary (GRIB), and Hierarchical Data Format (HDF) data in the mosaic dataset and rendering rasters as vector fields. This work was inspired by feedback gathered at the Ocean Summit last year.

Many of these development efforts have been delivered in the Multidimension Supplemental toolbox Version 1.1, a collection of nine tools that extend the functionality of the Multidimension toolbox. The tools, developed in response to requests for better support of the OPeNDAP protocol and netCDF files, can be used as-is or modified to handle specific use cases. Additional tools, new with this version of the toolbox, perform statistical operations on multidimensional data. (Download this toolbox for free at esriurl.com/MultidimensionSupplementalTools. Note that the samples included are designed for ArcGIS 10.2 and higher.)

Existing GIS tools have also been enhanced with the capabilities requested at last year's Ocean Summit. Mosaic dataset functionality has been expanded to allow the storage of netCDF data so that it can be temporally and spatially aggregated.

Esri software engineer Shaun Walbridge introduced a new version of the Benthic Terrain Modeler (BTM). This set of Python scripts in a custom toolbox lets ocean researchers extract more value from bathymetric data by classifying surficial seafloor characteristics for use in studying benthic habitat, geomorphology, the prediction of benthic fish species, and other aspects of oceanography. BTM can create grids of bathymetric position index (BPI), standardized BPIs, slope, and terrain ruggedness from an input bathymetric dataset. Two terrain classification tools let users create zone and structure classifications and define the relationships that characterize them. BTM is open source, and the code is available on GitHub.

↑ First Ocean GIS Forum attendees

More Data Resources

Caitlyn Raines, Esri project manager for database services, announced some structural changes to the Ocean Basemap that was released last year. The new version, the New Ocean Basemap—Beta Version, covers 36 million square miles in high resolution and will comprise two feature services. The first feature service provides hydrographic and terrestrial cartography, and the second feature service contains reference information and labels. By allowing the reference layer to be turned off, this change provides more flexibility in using the basemap with other data. In addition, the NoData tiles will no longer display when the map is zoomed in beyond the resolution available in an area. Instead, the closest available resolution will be resampled. When the official updates are published on ArcGIS Online, the beta version will be removed, although the previous version of the Ocean Basemap will be supported until the end of 2014.

In addition to changes in the Ocean Basemap, Raines also announced the release of the Arctic Ocean Basemap—Beta. It will use a Lambert Azimuthal Equal Area projection centered over Alaska to allow the Arctic Ocean Basemap to interface seamlessly with other Esri software products.

The Journey Continues

With the feedback from this year's conference, Esri will continue moving the Esri Oceans Initiative forward and developing the GIS tools and data that enable the ocean community to better understand and work in the complex marine environment. GIS can be especially valuable in capturing the public's interest in the fate of the ocean by delivering scientific information as maps that make a compelling case for changing human behavior.

Moving from "what is"—limited knowledge of the ocean and abusive practices toward it—to a "what could be" future of greater understanding and widely held appreciation of the critical role of the ocean is a challenging goal. In his closing remarks, Esri ocean solutions manager Drew Stephens proposed enlisting the help of members of the ports community, offshore energy and shipping industries, and atmospheric research field who could provide additional information and insights. The situation is urgent, and the task is great. As Gallo noted, quoting Cameron, "The oceans are changing faster than we can understand them."

Penn State Opens Up GIS Education to the World

By Jim Baumann, Esri Writer

This past July, Coursera hosted the first Massive Open Online Course (MOOC) that explored the fundamentals of mapping using GIS. It was developed by a member of the Pennsylvania State University (Penn State) faculty.

While online education is at the cutting edge of classroom initiatives, the original concept of distance learning dates back nearly 300 years. In 1728, Caleb Phillips advertised shorthand lessons by mail in the *Boston Gazette*, allowing formal study outside the traditional classroom setting.

With the World Wide Web's seemingly limitless potential for interactive learning activities and its ability to instantly deliver course materials to thousands of students throughout the world, distance learning has grown exponentially. The Babson Survey Research Group reports that during the fall 2010 school term, more than 6.1 million university students in the United States were taking at least one online course.

The latest development in distance learning is the MOOC, which stimulates large-scale participation among class enrollees. The term *MOOC* was coined by researchers Dave Cormier and Bryan Alexander at an extended education class at the University of Manitoba in 2008.

Various companies, including Coursera, Udacity, and EdX, provide administrative and technical support to those who have developed MOOCs (normally professors and their respective universities) and want to launch their courses. Created in 2012, Coursera attracted approximately four million students during its first year of operation.

A MOOC for GIS Education

Dr. Anthony Robinson, lead faculty of online geospatial education at Penn State, developed the course lectures and wrote content for the MOOC. The accompanying lab exercises, which use ArcGIS Online, were developed in cooperation with Esri's education industry curriculum development manager Joseph Kerski. Esri provided special support for the software so that the thousands of students enrolled in the class could use it whenever needed.

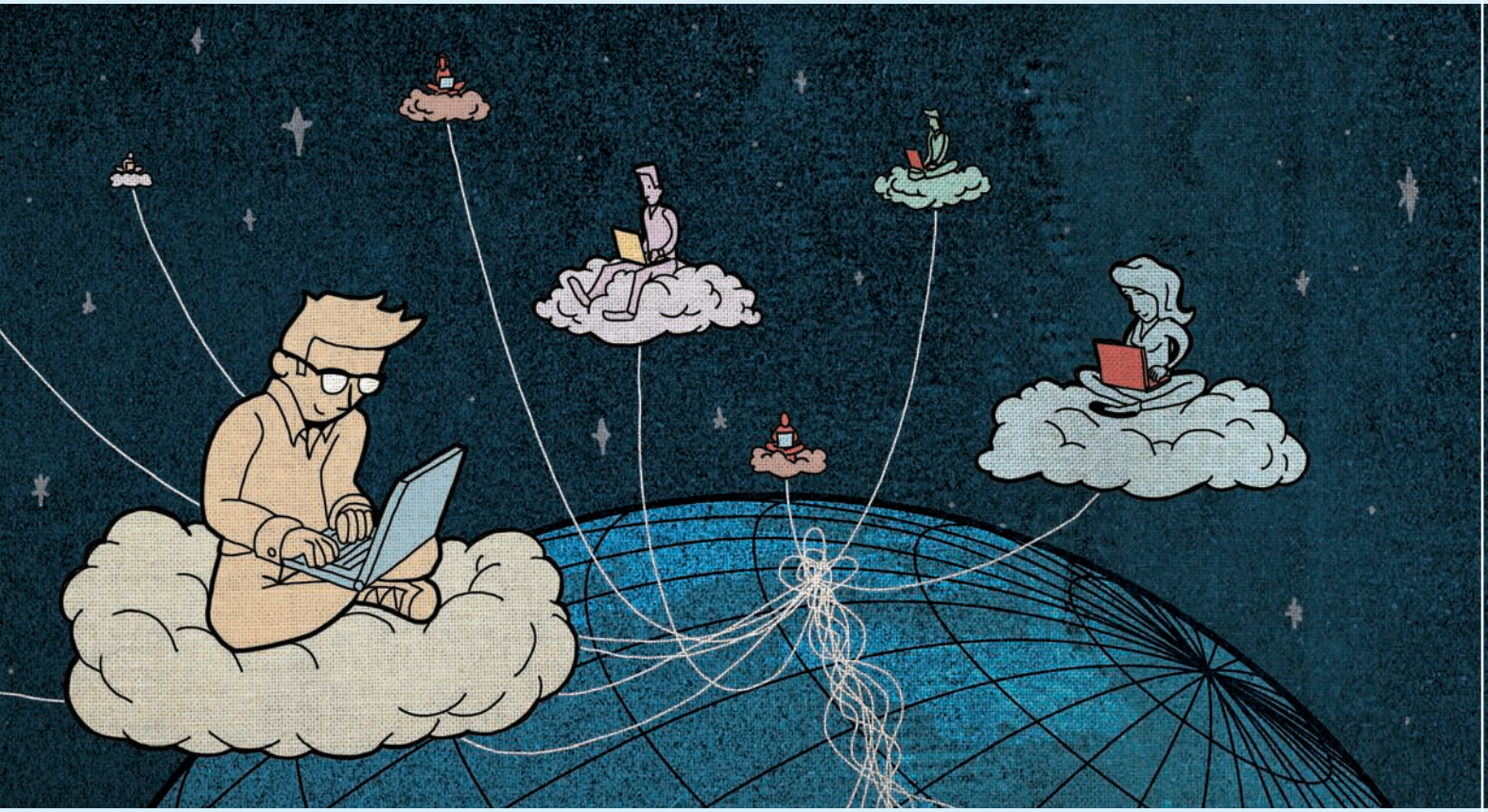
Though experienced in teaching GIS courses online, Robinson was initially uncertain about how to develop coursework for a MOOC and sustain his students' interest in the class. Because MOOCs commonly attract tens of thousands of students (computer science courses with more than 100,000 enrollees are not unusual), the traditional teacher/student relationship is fundamentally changed.

One of Robinson's major goals was to reach as many students as possible. He realized that even though the course was free, it would not be equally accessible in all parts of the world because of technical limitations, such as Internet speed that would make it difficult for some to access and download files. To minimize this problem, his class didn't require downloads. "Students just used their web browser," said Robinson. "I really wanted to keep the technology threshold as low as possible."

Initial Success

On July 17, the more than 40,000 students who had enrolled in the course automatically received an e-mail indicating that they could begin work on the course materials for lesson 1. Each week of the five-week course featured a different lesson, which included lecture videos, written content, explanatory graphics, video assignments, discussion activities, and hands-on mapping activities. Students were evaluated in the course through weekly quizzes, a final exam, discussion participation, and a peer review of their final mapping assignment.

"After the course launched, a



transformation occurred and the students really took over the class," said Robinson. "They created their own study groups, online communities, and forum threads in support of their coursework, most of which was outside my instruction. It's incredible to see how a global audience has engaged with the science and art of mapping."

The number of students in a MOOC can make evaluating student lab work challenging. Robinson relied on peer assessment to evaluate the maps created for the final assignment. "I designed a scoring rubric that allowed students to review the maps by their classmates using storytelling and map design criteria that I defined," said Robinson.

Once a student sent in a completed lab assignment, he or she automatically received three assignments submitted by other students. Each student reviewed the work of other classmates' work based on the rubric. The number of peer reviews for each map was large enough to average out extreme or disinterested students, but not so large that peer reviews took students away from their own work significantly.

By the final week of the course, nearly 9,000 students were still participating. The scope of the final story map projects submitted reinforced a belief about modern mapmaking held by Robinson and other digital cartographers: virtually any subject can be visually and intellectually enriched through the use of maps and mapping techniques.

At the end of the class, final grades were calculated. A Statement of Accomplishment was issued to those students who passed the course. This is the generally recognized certification for completing a MOOC because most MOOCs do not provide university credit.

The Future of MOOCs

According to Robinson, MOOCs may become more central to university education in the future because they have the potential to reduce student and university costs while providing a flexible schedule for completing course requirements. He thinks they will be particularly attractive to mature students who often have more time constraints than younger students as well as lifetime learners like his grandfather, who enrolled in the course.

Robinson also says that MOOCs tend to attract large international audiences. In most Coursera classes, 60–75 percent of the students are from outside the United States. "This is probably because the courses are free and offered by a recognized institution of higher education," stated Robinson. "Basically, all you need is an Internet connection."

The Maps and the Geospatial Revolution MOOC provided Penn State with visibility to students throughout the world who may have been previously unaware of the university. Some of these students may consider taking other online classes or applying to the university based on their positive experience with this class.

A-Maizing Sales

Managing fund-raising with ArcGIS Online

By Skye Perry, SSP Innovations, LLC

With the advent of ArcGIS Online, GIS can scale down as well as up and improve outcomes for even modest tasks. The author, a GIS professional, and his son applied ArcGIS Online to a fund-raising activity to get the job done not only efficiently but enjoyably.

My nine-year-old son Joshua is in Cub Scouts in Parker, Colorado. Every year, troops sell popcorn to raise money to pay for scout activities. At the sales kickoff meeting, the leader of our group said that he often prints a map of the neighborhoods where his boys are selling popcorn. That way, they can check off which households they sold to, where no sales were made, and where no one was home. He also talked about transposing the paper order sheet into an Microsoft Excel spreadsheet.

Like any good GIS geek, when I hear the words "map" and "spreadsheet" together, bells go off. Add collecting data in a mobile environment and this quickly became a great opportunity to teach Joshua about what I do every day.

Managing the Sales Territory

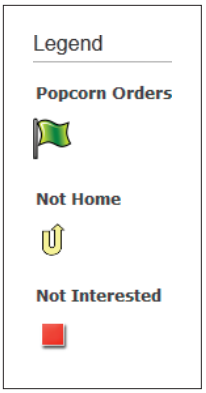
So Joshua and I headed home to create an ArcGIS Online web map to keep track of where he collected his popcorn orders. We started by creating template comma-separated value (CSV) files for the three categories of events he wanted to enter: Successful Sale; No One Home, Potential Revisit; and Not Interested.

For the Successful Sale CSV file, we created fields for name, address, order date, each type of popcorn product, payment type, and a flag to eventually track the

↓ The author and his son, Joshua, created a web map on ArcGIS Online and used Collector for ArcGIS to manage popcorn sales for Cub Scouts fund-raising.

deliveries of the product. The goal was for Joshua to be able to capture all the information he needed for each sale and then use that data when delivery time rolled around. This would allow him to cover more ground quickly while capturing the details about each house he visited.

We uploaded each CSV file to ArcGIS Online and then created a quick web map. We customized the field aliases to include the prices of products. We also set up some cool symbols, such as bags of popcorn, and then published the map. The entire process took about an hour.



↑ The popcorn sales map featured cool marker symbols.

The next day, armed with my iPhone, Joshua hit the streets to begin selling popcorn. To collect information in the field and add it to the map we created in ArcGIS Online, I had him use the free Collector for ArcGIS app instead of the basic mobile Esri app because Collector is geared to collecting data in the field and works with ArcGIS Online or Portal for ArcGIS. After downloading Collector for ArcGIS, the app just asks you to sign in to your ArcGIS Online account or a portal.

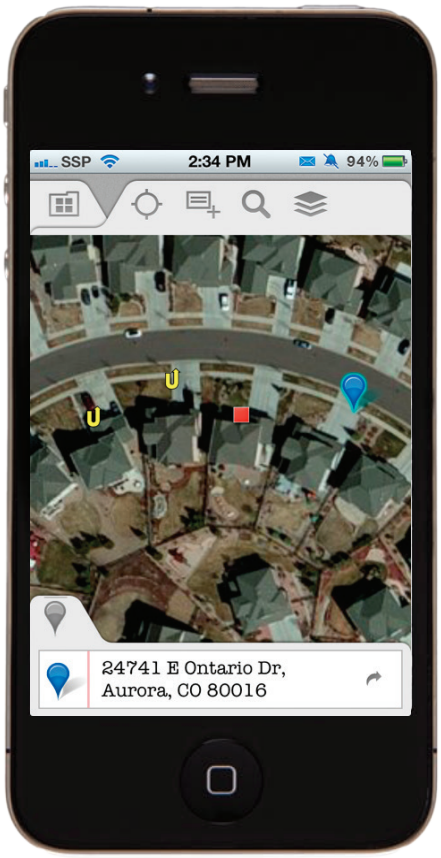
Joshua learned how to use this app more quickly than most adults. We didn't have any of the change management issues sometimes encountered with older workers. The GPS functionality worked well. The app showed him immediately where he was located. As he reached each house, he dropped a pin on the map, and Collector for ArcGIS provided a reverse-geocoded address. This address could be copied into a new record, which was much easier than typing it in. The geocoding worked pretty well but occasionally pulled up a neighbor's address, so we validated the addresses as we went along. Entering a new sale was very easy. Joshua entered the name, date, address, product quantities, and payment details into the form in the app.

As Joshua made each entry, the web map was populated with quality data—point features categorized as a Successful Sale, Not Home, or Not Interested. The best part of this quick project was that I got to sit in my comfy, air-conditioned car as Joshua entered the data. I watched his progress in real time via my iPad. As the point data automatically appeared, I was able to do quick quality assurance/quality control (QA/QC) of the entries as needed. At one point, I lost Joshua, but I was able to quickly find him by driving a block over to his last entered point.

Finally, to have just a bit more fun, I decided to mash up our targeted sales area with some Esri data available on ArcGIS Online. I pulled up median income for the targeted neighborhood and overlaid it with our initial sales locations. We found that we were in a good area to make sales, as the median income in the neighborhood was greater than $113,000 per year. I'm sure there's some psychological study on the best median income for successful popcorn sales, but that's a bit beyond my expertise. We will certainly use this layer to target Josh's next sales drive.

Takeaways

This project makes a pretty strong case for managing data entry from the back office, another mobile location, or really anywhere at all. The Collector for ArcGIS app was

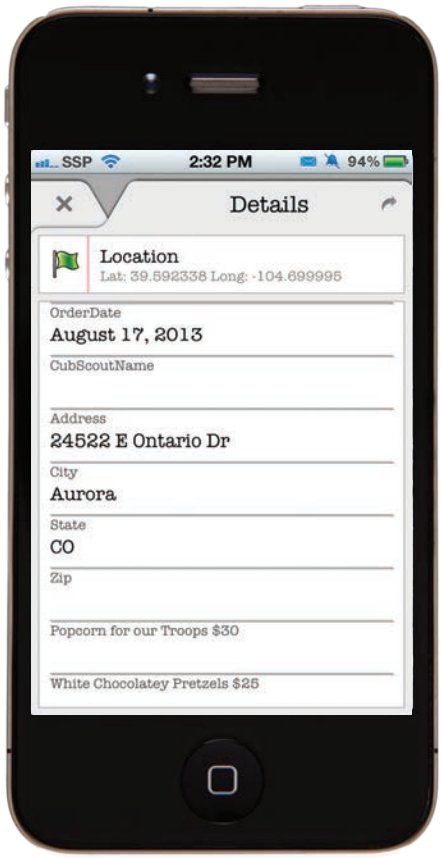


↑ As Joshua reached each house, he dropped a pin on the map, and Collector for ArcGIS provided a reverse-geocoded address.

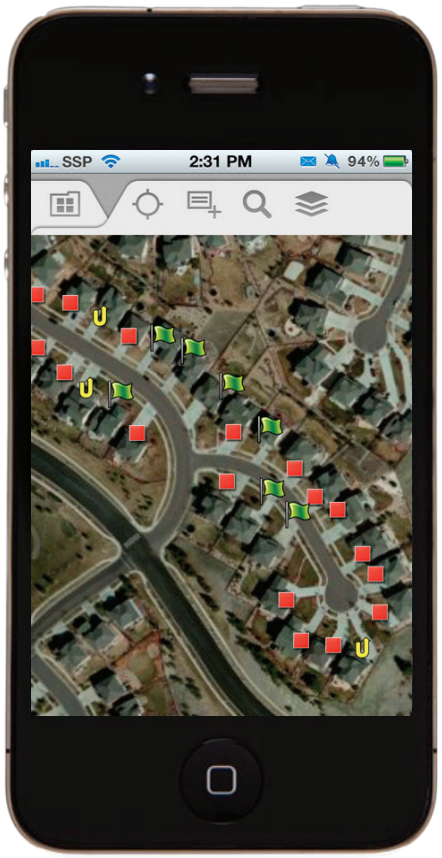
a success. It was easy enough for a nine-year-old to use and, based on watching how kids play games, I'd bet kids much younger could become GIS whizzes too.

What was great about working with Esri ArcGIS Online? It gave us a new way to collect, analyze, organize, and empower spatial data that we could deploy on any common mobile device platform. This makes implementation easy and limits change management because just about everyone knows how to use a smartphone these days, even children.

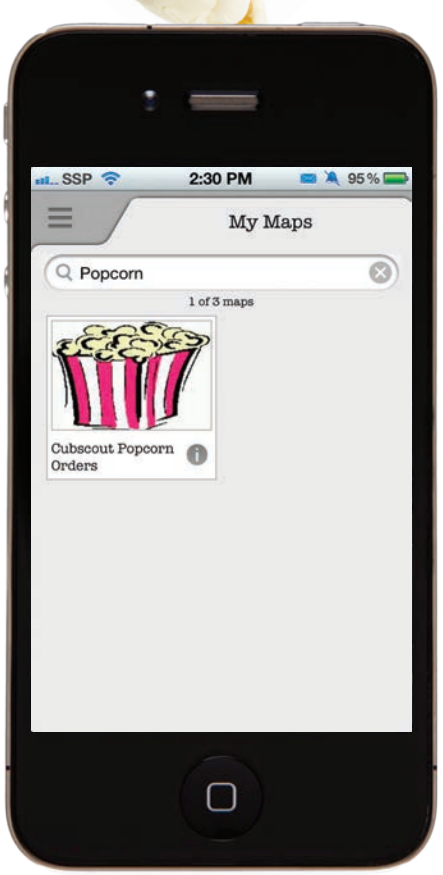
By the end of the day, this experience had offered a great opportunity to teach Joshua a bit about GIS. ArcGIS Online was a natural fit, and we had a lot of fun creating and using the Collector for ArcGIS app with it. We wrapped up the popcorn sales drive this month and will use the Collector for ArcGIS app again to track our delivery progress when the popcorn and other products



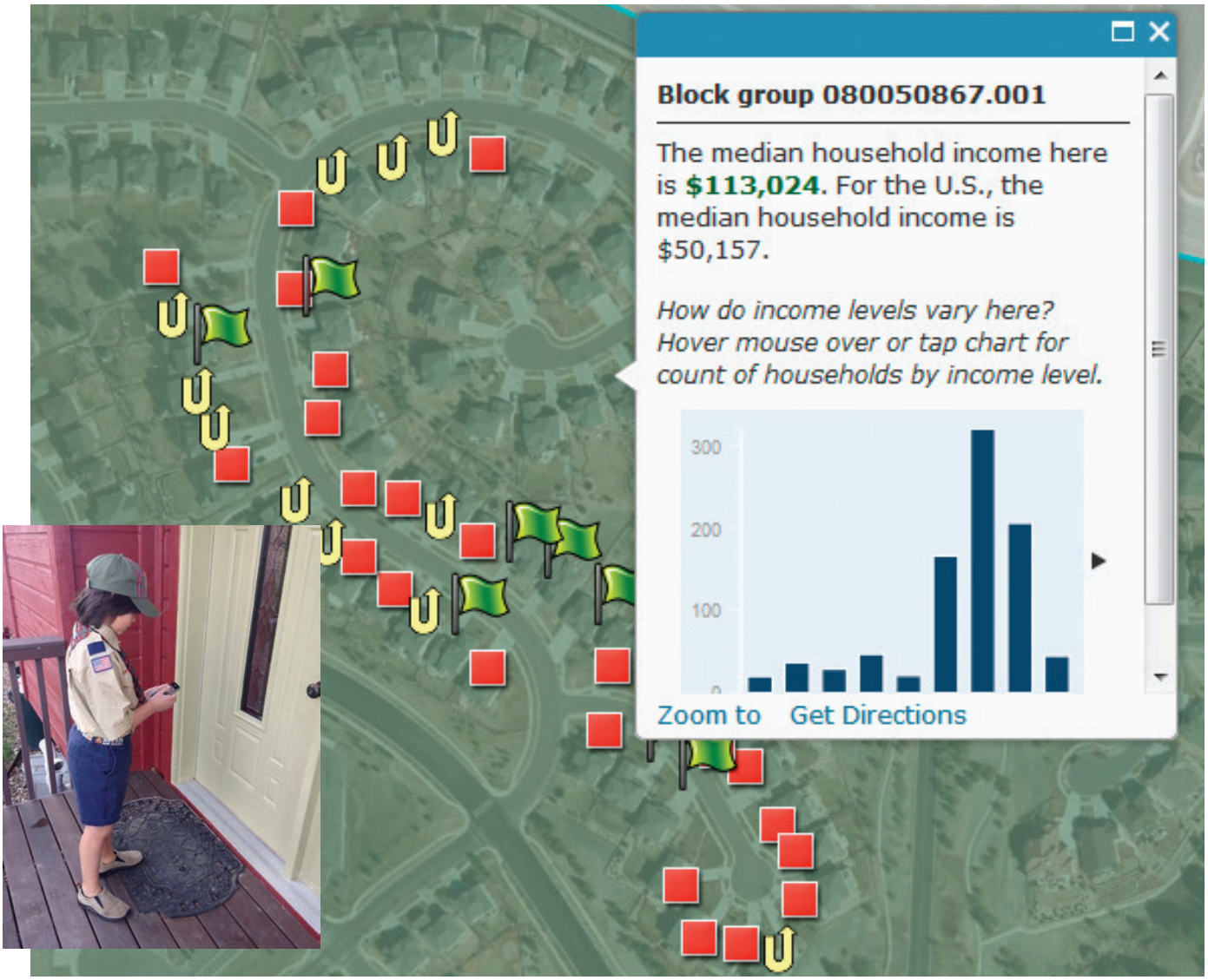
↑ The geocoded address was then copied into a new record.



↑ The resultant web map showed houses where orders were placed, houses where no one was at home, and houses where residents did not want popcorn.



↑ The quick setup left time to create some cool symbols for the map.



↑ To add another dimension, the sales data was mashed up with demographic data from ArcGIS Online, revealing the median income for the targeted neighborhood greater than $113,000 per year.

arrive in a few weeks. We will create a new web map for that using symbols based on the delivery flag for each sale record.

ArcGIS Online provided Joshua with a great first GIS experience and made the collection, analysis, and reporting of the popcorn sales data quick, easy, and—dare I say—outright fun.

About the Author

Skye Perry is the principal consultant for Esri partner SSP Innovations, LLC, based in Englewood, Colorado. SSP Innovations provides implementation and integration of the full line of Esri software from setting up comprehensive, ground-up solutions to optimizing and expanding existing investment in GIS.

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