Fall 2013

ArcUser

The Magazine for Esri Software Users

esri

SAP Spatial Adds a New Dimension to Business Data

Spatial Processing with SAP HANA, Analytics, Applications, and Mobile

SAP HANA

Achieve high-performance processing of spatial data with the SAP HANA platform

ANALYTICS

Visualize geospatial content with SAP BusinessObjects BI solutions

APPLICATIONS

Enrich SAP Business Suite applications with geographic content

MOBILE

Empower field workers with Esri® ArcGIS® integration with the SAP Mobile Platform for location-based work management

MARKETPLACE

Get access to Esri-enabled solutions on the SAP HANA Marketplace

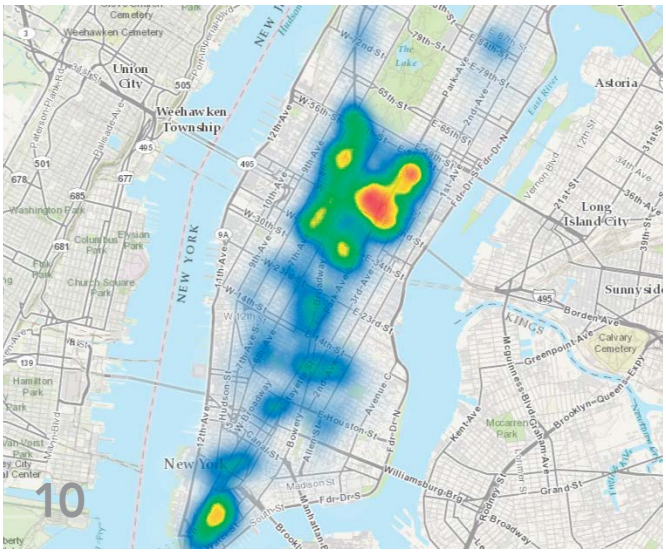
esri Corporate Alliance

SAP®

www.saphana.com/spatial

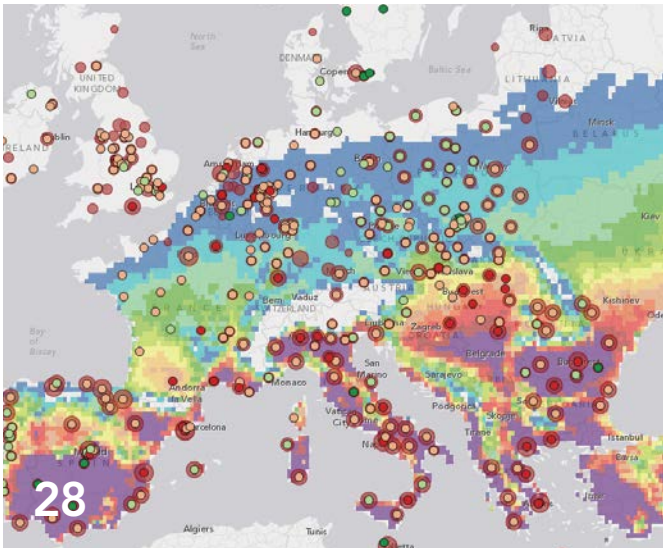
Contents

Fall 2013 Vol. 16 No. 4



Focus

Feature



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.

A Different Kind of GIS

In 2007, with a great deal of fanfare, Apple introduced the iPhone. It wasn't just a better phone; it changed how we communicate and interact with the world and each other.

In 2013, with far less hoopla, Esri introduced ArcGIS 10.2 at the Esri International User Conference. This version of ArcGIS realizes the vision of a web GIS.

Web GIS can integrate virtually everything on the web through dynamic linking of content from multiple sources through visual overlays, distributed spatial analysis, and modeling. It amplifies the power of GIS to identify patterns and relationships and better understand processes while providing more ways to communicate those insights through data visualization.

What does that mean to you?

This new pattern transforms GIS and you, as a GIS professional. Because the full capabilities of ArcGIS Online are automatically available to ArcGIS for Desktop users current on maintenance, its arsenal of online services, data layers, and web maps and apps that can be used on any device are immediately available to you. With this highly integrated system, you can easily view or share maps and apps you create on the desktop with anyone, and you won't have to set up a server, thanks to hosted services. You can securely manage content for your organization. If your business requires it, you can also keep all your content on-premises and access it through Portal for ArcGIS.

What does that mean to the people in your organization?

Instead of having to come to you, staff throughout your organization can help themselves to web maps and apps and data layers you create. They don't have to become GIS-savvy users to unlock the knowledge in your organization's GIS and other resources, and they can use any device to do this. By empowering them to make better-informed decisions, web GIS greatly enhances the value of investments your organization has already made in GIS.

What does that mean to those outside your organization?

The practical effect of web GIS is to make GIS easier and more accessible. By making GIS as pervasive as GPS, we can profoundly change the way we look at problems and arrive at solutions and create a more sustainable future. As Jack Dangermond exclaimed in his User Conference address, "Wow, we suddenly have a different kind of GIS, and a very exciting one."

Monica Pratt
ArcUser Editor

editor's page

ArcUser

Fall 2013 Vol. 16 No. 4

Editorial
Editor Monica Pratt
Contributors Keith Mann, Matthew DeMeritt
Technical Advisers Paul Dodd, Damian Spangrud
Copy Editing Mary Anne Chan

Design
Creative Director James Hitchcock
Graphic Designer Doug Huibregtse
Photographer Eric Laycock
Illustrator Daniel Gill
Print Coordinator Tim Polen

Advisory Board
Corporate Linda Hecht
Corporate Alliances Steve Trammell
Products Dave Scheirer
International Dean Angelides
Marketing Communications Robin Rowe
Industries Lew Nelson

How To Reach Us
Visit the *ArcUser* website (esri.com/arcuser) to download tutorials, read current and past issues, and access additional resources.

Your *ArcUser* Subscription
To subscribe, unsubscribe, or change mailing information online, please go to esri.com/news/publications/index.html; send an e-mail to requests@esri.com; or call 909-793-2853, ext. 2730. F 909-798-0560

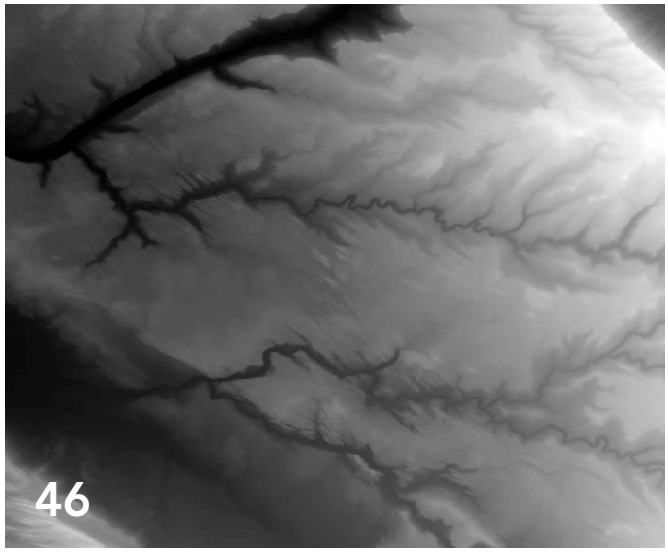
Advertise in *ArcUser*
For information regarding placing an advertisement in *ArcUser* magazine, contact the advertising coordinator at 909-793-2853, ext. 2730, or ads@esri.com.

Editorial Inquiries
Monica Pratt, *ArcUser* Editor
380 New York Street
Redlands, CA 92373-8100 USA
arcuser_editor@esri.com

Visit the *ArcUser Online* web pages (**esri.com/arcuser**) to read the article submission guidelines and copyright policy.

ISSN 1534-5467
ArcUser is published quarterly by Esri at 380 New York Street, Redlands, CA 92373-8100 USA.
ArcUser is written for users of Esri software and distributed free of charge to registered users.

Departments



ArcGIS 10.2 TRANSFORMS GIS

ArcGIS 10.2, a full release of ArcGIS, makes it easier to deploy web GIS, the key component for implementing GIS as a platform.

ArcGIS Online, a collaborative, cloud-based platform, is the key to this new GIS pattern because it lets members of an organization create, share, and access maps, applications, and data across desktop, server, web, and mobile apps both within and between organizations.

With more ready-to-use apps and app templates, ArcGIS 10.2 further enables people to easily build maps that work seamlessly across different devices and reduces the need to create custom applications.

An Integrated System

This release more tightly integrates ArcGIS Online with ArcGIS for Desktop and ArcGIS for Server. ArcGIS Online also provides access to vast collections of ready-to-use maps and GIS services. Its basemaps and other resources are constantly being updated. For example, the World Imagery basemap, last updated in June 2013, provides one-meter or better satellite and aerial imagery in many parts of the world and lower-resolution satellite imagery worldwide.

To ensure that ArcGIS for Desktop users have access to ArcGIS Online capabilities, every customer organization that has ArcGIS for Desktop at any license level—Basic, Standard, or Advanced—and is current on maintenance now receives an ArcGIS Online subscription. The number of named users will be equal to the total number of ArcGIS for Desktop licenses current on maintenance. Maps can be published directly from ArcGIS for Desktop to Portal for ArcGIS and ArcGIS Online.

In addition to better integration with ArcGIS Online, ArcGIS 10.2 brings improvements in performance, security, and functionality: additional tools for working with geodata, new analytical and imagery tools, improved access to 3D capabilities, and better mapping and reporting. Performance has been greatly enhanced with the expansion of parallel processing capabilities and optimized file handling.

This release adds significant analytical capabilities with 16 new geoprocessing tools that include new conversion tools for Microsoft Excel and JSON and 74 new or modified tool parameters. New tools, like the Optimized Hot Spot Analysis, streamline complex, multistep workflows by determining optimal settings and automatically creating a statistically significant analysis.

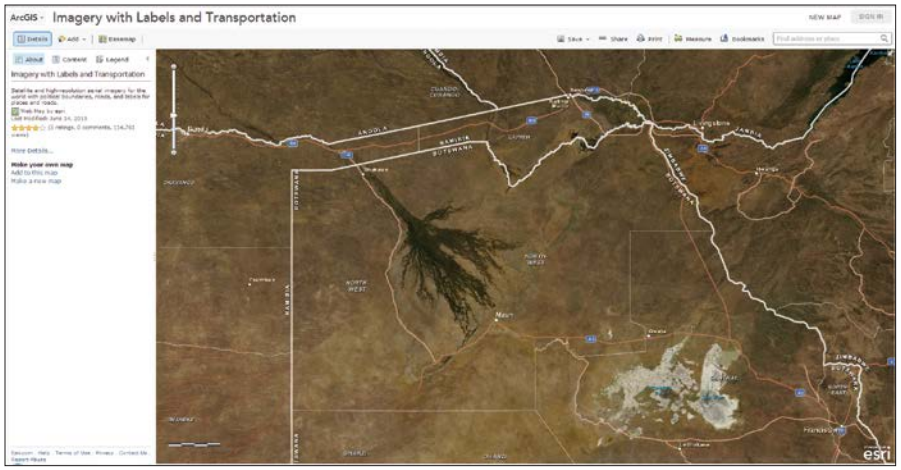
Now a core product, Portal for ArcGIS can be deployed on an internal network to share maps, applications, and other geographic information. The content is delivered through a customizable website. ArcGIS 10.2 for Server can be configured to work with the Portal for ArcGIS so map and feature services hosted on ArcGIS for Server can be made available to users in an organization through the portal. ArcGIS for Server print and geocode services can also support maps and applications users create in Portal for ArcGIS.

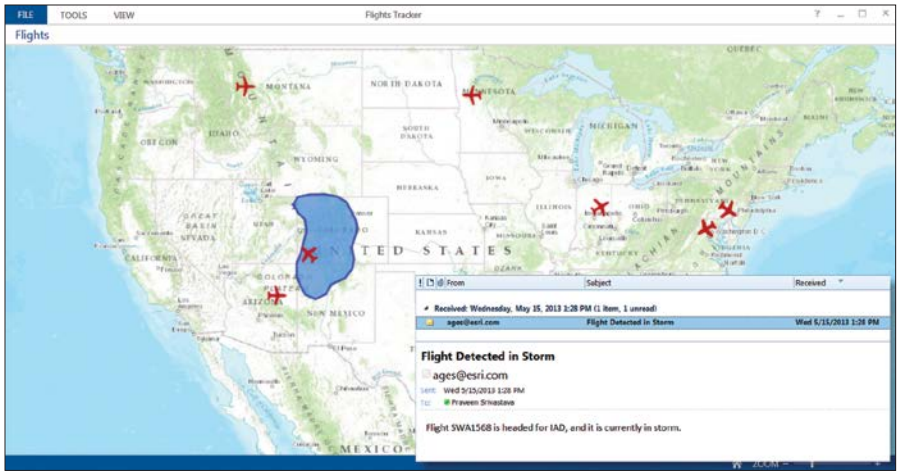
Administer ArcGIS for Server More Easily

Features at 10.2 improve the control administrators have over user behavior that could adversely impact performance, simplify administrative tasks, and make it easier to roll the site back to a previous state.

- Caching Controller, a new geoprocessing service, manages all jobs being processed by the CachingTools service. It is preconfigured in the System folder. The Caching Controller service prevents a server from becoming overwhelmed when multiple publishers submit caching jobs simultaneously. The maximum number of instances (caching jobs) is specified and any additional caching jobs are queued.
- To prevent publishers from automatically copying data to the server when publishing, data copying can be disabled using Manager rather than through the ArcGIS Server Administrator Directory.
- Service Workspaces, a new dialog box in ArcGIS Server Manager, lets an administrator keep track of which folders or databases are being used by site services.

↓ The vast collection of geographic data available from ArcGIS Online can be accessed on the web, desktop, and server in additional to mobile devices. Okavango Delta, Botswana, is shown in the Imagery with Labels and Transportation web map, which uses the World Imagery map service combined with two reference layers.





↑ GeoEvent Processor enables real-time GIS for streaming data. It automatically alerts personnel in real time when specified conditions are met.

New tools in ArcGIS Online include overlay layers that combine two or more layers into a single layer and data enrichment resources for gleaning more information about the people and businesses located within an area, which can be delineated or determined by drive time.

Esri Location Analytics brings ArcGIS tools and methodologies to traditional business analytics systems, combining geographic data on assets, infrastructure, transportation, and the environment with data on an organization's operations and customers. Most business information contains location information. Customers, assets, staff, and suppliers all exist someplace. Considering these aspects of a business in relation to location provides new insights that can help better meet business challenges, solve problems, or identify opportunities.

With the addition of ArcGIS Online, organizations can access Esri apps, such as Esri Maps for Office, Collector for ArcGIS, and Operations Dashboard for ArcGIS, that amplify the benefits of Esri Location Analytics.

- Now administrators can make a backup of the site configuration to a single file. This file can be used to restore site settings using new command line utilities or the ArcGIS Server Administrator API.
- A map service with feature access enabled (i.e., feature service) can be published to ArcGIS for Server from a supported database. Publishing from a geodatabase is no longer required.

Real-Time GIS

ArcGIS GeoEvent Processor for Server, a new optional extension to ArcGIS for Server (Standard and Advanced), enables real-time GIS for streaming data. It ingests GPS from mobile devices, social media, and virtually any other type of streaming data, changing everyday GIS applications into frontline decision apps that speed response.

Multiple, dynamic events can be monitored, automatically updating maps and databases. From the distance of a delivery truck from a warehouse to the location of a plane in relation to a storm, GeoEvent Processor can automatically alert personnel in real time when specified conditions are met. It integrates these capabilities within modern enterprise IT architecture.

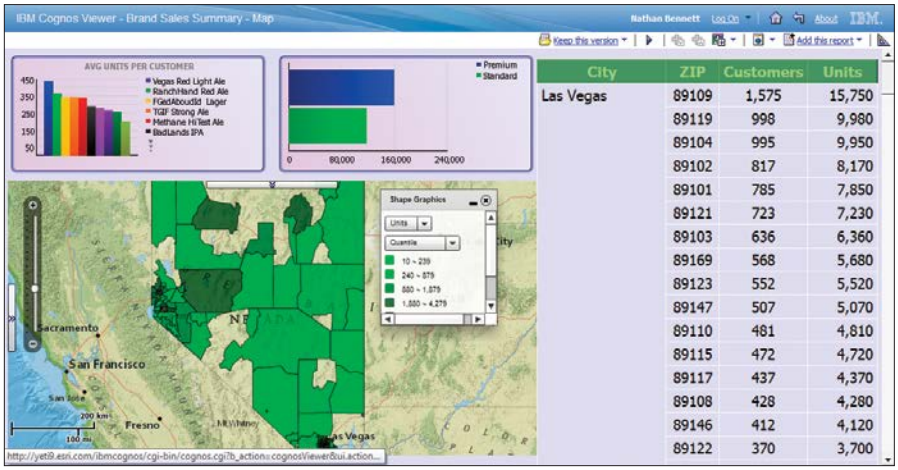
More Secure

Enhanced security for ArcGIS now includes support for Public Key Infrastructure (PKI) and single sign-on authentication. Users can sign in using the user name and password they already use within the organization. With this new authentication capability, ArcGIS Online organizational account administrators no longer need to maintain multiple user credentials for individual application access. This eliminates the need to replicate databases of user credentials for separate applications and systems. Users' personal information remains with the organization, not ArcGIS Online.

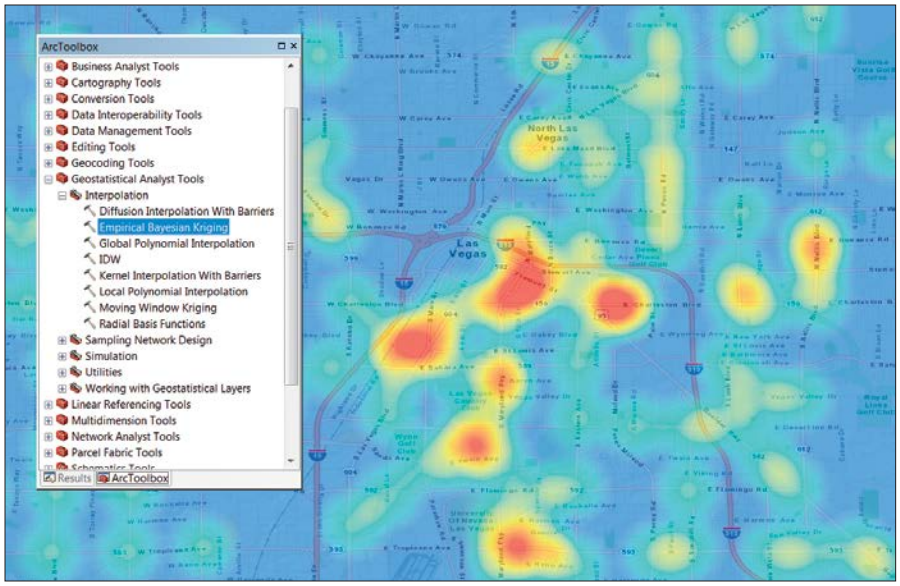
Supporting Better Decisions

Because it makes more analysis tools available, ArcGIS Online extends these capabilities to everyone. Analysis can be performed online and shared as hosted services. Advanced analysis tools have been added to ArcGIS Online, as well as ArcGIS for Desktop, that help investigate geographic relationships, patterns, and trends within data. Premium Content services support more comprehensive analysis with access to large collections of demographic, elevation, and landscape data.

↓ Additional advanced analysis tools for investigating geographic relationships, patterns, and trends within data are available. ArcGIS 10.2 can be integrated with business systems such as MicroStrategy.



City	ZIP	Customers	Units
Las Vegas	89109	1,575	15,750
	89119	998	9,980
	89104	995	9,950
	89102	817	8,170
	89101	785	7,850
	89121	723	7,230
	89103	636	6,360
	89169	568	5,680
	89123	552	5,520
	89147	507	5,070
	89110	481	4,810
	89115	472	4,720
	89117	437	4,370
	89108	428	4,280
	89146	412	4,120
	89122	370	3,700



↑ Additional advanced analysis tools for investigating geographic relationships, patterns, and trends within data are availabale in ArcGIS 10.2.

An ArcGIS Server security option can force developers to use standardized SQL queries when working with map, feature, image, and Web Feature Service (WFS) services through REST or SOAP. This helps prevent SQL injection attacks and also makes it easier for developers and applications to query ArcGIS Server services. Standardized queries are enforced by default but can be disabled by the server administrator.

New Developer Opportunities

ArcGIS Runtime SDKs for Qt, OS X, and Microsoft .NET Framework join the existing collection of developer tools. To more quickly and easily create powerful web apps, these and the recently revamped web APIs have been simplified and improved with extensive support that includes many samples, widgets, and templates. This means less code to write. The documentation answers questions from developers at any level from beginning to advanced.

A Better View

Handling of imagery, and 3D visualization in particular, have been dramatically improved with version 10.2. Content generation capabilities from Esri CityEngine have been integrated with the desktop so ArcGIS 3D Analyst users can generate 3D geometries from existing 2D and 3D input features using rules authored in CityEngine.

A new capability also lets users publish web scenes. Like web maps, web scenes can be shared and viewed by anyone using just a web browser. Viewers can provide feedback about a web scene using the 3D commenting system. Web scenes can also make service-based requests to geocoding or other services.

It is also easier to find imagery. Previously, desktop searches were based on file format. Now searches for imagery can be based on accessible metadata. The search index can be configured to search specified paths for raster products, mosaic datasets, and items within a mosaic dataset. Search results can be added directly to a desktop map or into a mosaic dataset.

Lidar processing is much faster. Better tools, new workflows, and the ability to search imagery improves imagery operations. Cached imagery can be uploaded to ArcGIS Online.

Scaling Up GIS

ArcGIS 10.2 delivers improvements across desktops, devices, servers, and the web that enable the widespread adoption of web GIS. It exploits the cloud and big data and other IT trends. This new pattern makes GIS more pervasive and the work of GIS professionals widely accessible, transforming how organizations operate.

Take Esri Geoportal Server Out for a Spin

Test-drive a live instance of Esri Geoportal Server. This free, open-source product enables the discovery and use of geospatial resources including datasets, rasters, and web services. The newly released Esri Geoportal Server LiveDVD Demo lets you try Geoportal Server without installating and configuring the software.

The LiveDVD Demo provides the perfect test environment for trying out Geoportal Server customizations before implementing them in a production environment. Geoportal is already installed and configured on its own self-contained Linux operating system and can be booted directly by putting it in a computer's DVD drive before turning on the system or booted up using a virtual machine. Either way, the hard drive of the host computer is not touched. The LiveDVD demo was built on the openSUSE (www.opensuse.org) Linux operating system using the SUSE Studio image creation tool.

Alternatively, LiveDVD can be installed on a hard drive to provide a permanent Esri Geoportal Server implementation. Digital and physical media versions of Esri Geoportal Server LiveDVD Demo 2013 can be requested by visiting esri.com/geoportaldemo.

Improve Parcel Workflows

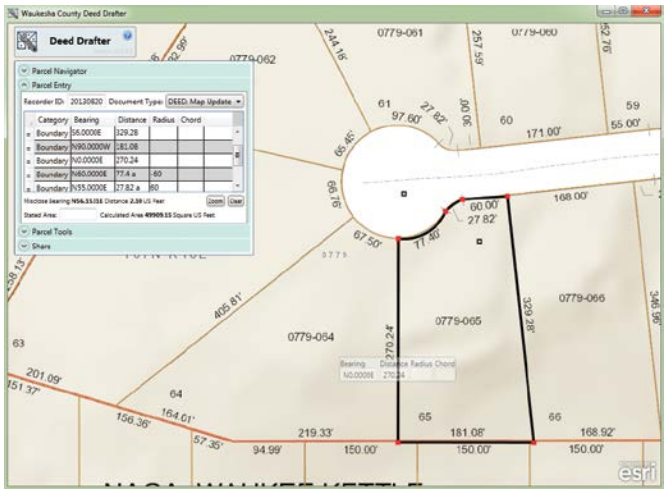
Mapping technicians can more easily enter metes-and-bounds descriptions from deeds and other documents and check for closure errors using a new ArcGIS Runtime application.

Deed Drafter complements the Tax Parcel Editing for Local Governments template and the ArcGIS Parcel Editor solution, helping improve the quality of parcel information for tax assessment offices, registrar or deed offices, private surveyors, title companies, and other similar organizations. It works with ArcGIS 10.2 for Desktop (Standard or Advanced license levels) and ArcGIS 10.2 for Server (Standard or Advanced license levels) or an ArcGIS Online for Organizations account.

As part of ArcGIS for Local Government, Deed Drafter is built on a common information model. ArcGIS for Local Government maps and applications are configured with the ArcGIS platform and help local governments successfully implement GIS in cities, counties, and other government entities. They support functions in departments across local governments. Each map and application covers a core set of the work tasks performed by staff.

Enter a single parcel traverse in the Deed Drafter data entry grid using bearing and distance calls and then save it as a cadastral XML file that can be appended to a new parcel and incorporated in the Parcel Editor workflow. Deed Drafter is deployed using either ArcGIS for Server or an ArcGIS Online for Organizations account.

Download Deed Drafter from the ArcGIS for Local Government gallery at no charge. Developers who want to customize this ArcGIS for Local Government application can access the source on GitHub.



↑ Easily enter metes-and-bounds descriptions from deeds and other documents and check for closure errors using Deed Drafter, a new ArcGIS Runtime application.

The Four Imperatives of Location Analytics

By James Killick, Product Lead, Esri Location Analytics

If you're serious about getting the most from mapping inside your business systems, you need to go beyond the basic mapping offered by consumer mapping apps.

Location analytics combines geographic data on assets, infrastructure, transportation, and the environment with data on an organization's operations and customers to discover powerful answers to any business challenge and share those insights with the rest of the organization.

Esri Location Analytics lets you build complete information and analyses for reaching new customers, markets, and levels of success by bringing the power of ArcGIS tools and methodologies to traditional business analytics systems, like business intelligence (BI), customer relationship management (CRM), enterprise resource planning (ERP), and enterprise asset management (EAM), as well as productivity tools like Microsoft Office and collaboration tools like Microsoft SharePoint.

Organizations create, manage, and analyze vast quantities of data in business systems they use every day. Information about location is pervasive in this data. Customers and constituents have a location. Assets, whether fixed or mobile, have locations, as do staff members and suppliers. With the ubiquitous use of mobile devices and social media, location data is becoming even more pervasive.

By ignoring the location data in your business systems, your organization misses the opportunity to make the most informed decisions and create the best business outcomes. Typically, business analysts, marketing directors, operations managers, and other decision makers lack easy access to spatial tools that visualize and analyze data in a geographic context. Esri Location Analytics provides a transparent connection to GIS that works with the business systems they use every day.

Many business users are completely unaware of the value that location analytics can add even if they do use some form of mapping in these business systems. The common misconception is that mapping is just adding data as "dots on a map."

While putting data on a map will help uncover patterns that graphs and charts won't reveal, the value of location analytics can be much greater. The four imperatives of location analytics outlined in this article will help with those unfamiliar with GIS appreciate the full value of location analytics. For GIS professionals, these imperatives are a yardstick to measure the activities of your organization in terms of its level of sophistication and maturity in the use of location analytics.

Imperative #1

Go Beyond Basic Mapping

Putting your data on a map is simple and easy with many available mapping products. However, the business user dealing with a significant volume of data, say thousands, hundreds of thousands, or even millions of customers, will need the right tools to create value from location data because simply putting lots of data points on a map can quickly obscure it.

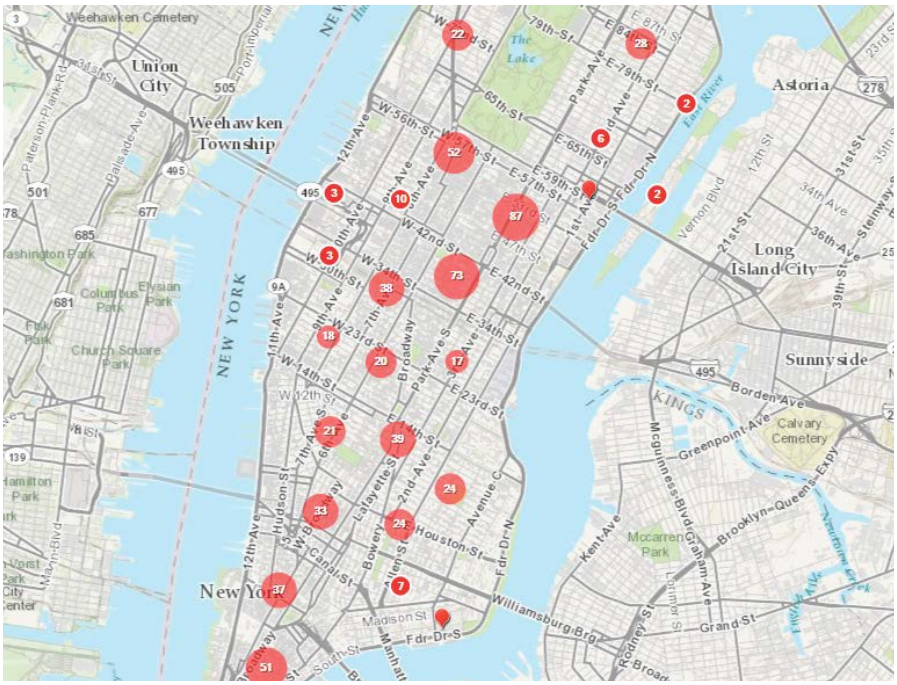
Fortunately, there are better ways to extract information about this data from the map. Not only does Esri Maps for Office make it as easy to make a map as it is to make a chart, it offers tools like automated clustering, heat mapping, data aggregation, and color coding. These strategies reveal more information from data, quickly surpassing the basic dots-on-a-map approach.

With automated clustering, the software automatically groups points that are in close proximity. Each group of points is represented by a symbol, typically a circle. The size of the circle is determined by the number of clustered points it references. A number in the center of the circle represents the number of points clustered. Automated clustering is activated based on how far the user is zoomed in to or out of the map. The circles representing the clusters break apart when the map is zoomed in and coalesce as the map is zoomed out. This is a great way to make viewing large quantities of data manageable.

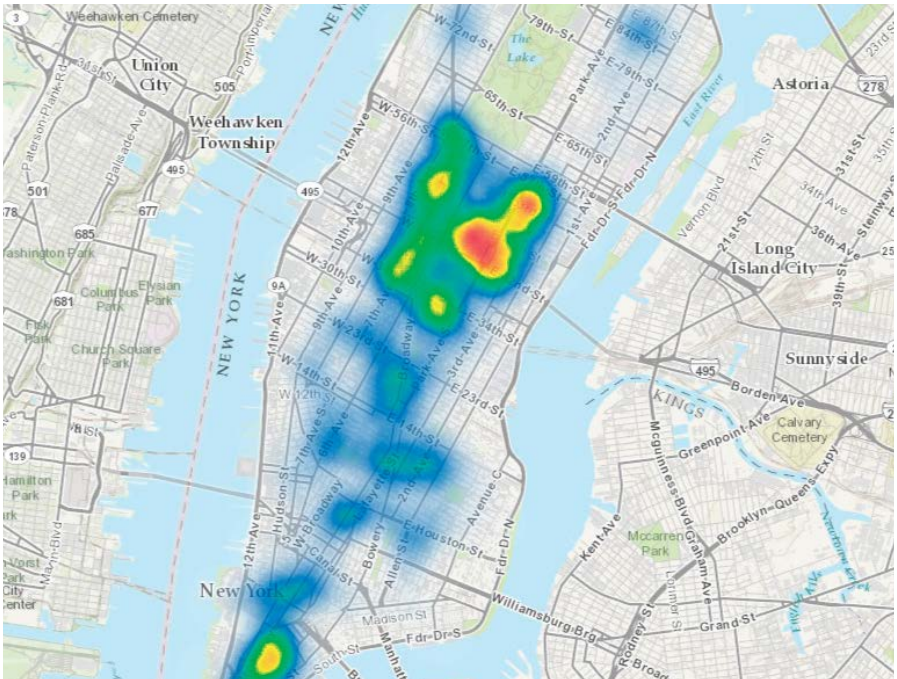
Heat maps, an increasingly common technique, provide a surface that indicates how and where points are clustered. Point density is reflected by the colors used. An area of high density might be colored red, while an area of low density would be colored blue. Although good for showing the density of points, heat maps won't show what is statistically significant in the data.

Aggregating data based on regions and then mapping those regions can provide a much better picture of what's going on. Aggregation can be performed outside mapping software (in an Excel pivot table, for instance) or inside mapping software. For example, sales from individual stores aggregated by postal codes can be mapped by postal code areas, and those areas can be color coded by the mapping software. In addition to well-defined boundaries like post codes, aggregated data can be mapped by organizationally specific boundaries such as sales territories.

↖ Location Analytics goes far beyond just "dots on a map." Without the right tools to interpret it, data can overwhelm a map.



← Clustering is one strategy for understanding your data by making data points in close proximity intelligible.



↙ Heat maps make is easy to perceive data density.

A Good Deal Just Got Better

Now your organization can create and share more interactive maps and apps on ArcGIS Online using fewer credits or at no cost altogether. The popularity of ArcGIS Online has allowed Esri to include some services as part of organizational subscriptions and reduce the cost of other services. These changes went into effect with the July release of ArcGIS Online.

Now unlimited bandwidth usage (outbound data transfer) is included with ArcGIS Online subscriptions. Uploading tile packages from ArcGIS for Desktop is also included in subscriptions.

Significant cost cuts were enacted for popular services. Geocoding costs have been reduced by 50 percent. Routing and geoenrichment costs have been reduced by nearly 65 percent. Infographic costs have been reduced by more than 80 percent.

Esri Updated Demographics and other new data services were also added at the July release.

Imperative #2

Enrich Your View

When you're in the market to buy a house, you don't make your decision based entirely on the information the real estate agent gives you. Your decision is based on more than just the number of bedrooms or the price. Typically, you do some additional research. What is the neighborhood like? What shops are in the area? How long would your commute to work be? All this information helps you make a better, more informed decision.

It's the same situation when you're making decisions about your organization. You're not going to be able to make the most informed decision if you're only looking at your own data. You need to enrich your view by learning more about the geographic areas in which your organization operates. What are the demographics and lifestyles of the people that live in each area? How are they expected to change? Where are competitive or complementary businesses? Is it useful to know more about the surrounding terrain? The acquisition of this information is called geoenrichment. It can add value to your data in two fundamental ways: map enrichment and data enrichment.

Map enrichment means adding new layers of information to the maps you create. These map layers could represent demographics or the locations of certain types of businesses. This data could be administrative boundaries acquired from a third party or real-time data like the path of a storm. Using these map layers with maps of your data can provide a more complete picture.

Data enrichment means adding new columns of information to your own database records so you can slice, dice, and analyze that data in new ways. Although your CRM data might reveal a lot about what products your customers buy and how often they buy them, it won't tell you much (if anything) about the lifestyles or the life stages of those customers. If you can add these dimensions to your data, you can better determine the optimal products and services for your customers and how best to reach them.

Geoenrichment lets you do real research based on location. This is a key component of Esri Location Analytics and the ArcGIS platform. Using geonrichment, you can get to know your customers better and engage with them more effectively.

Imperative #3

Perform Map-Driven Analysis

Mapping your data can uncover many patterns and insights that graphs, charts, and tables simply won't reveal. However, the true value of a map is realized when you can interrogate it. Then it becomes a new analytical tool. Map-driven analysis can range from simply connecting maps to your data to more complex operations using spatial queries with geoenrichment.

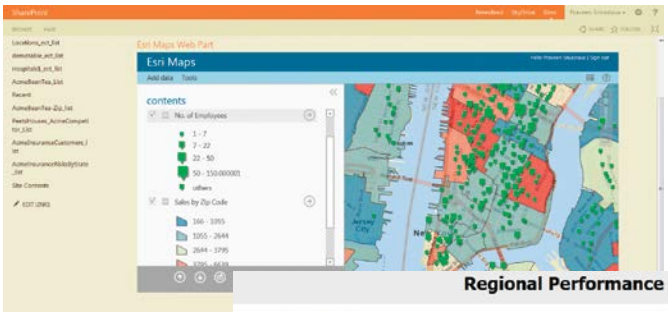
Connect your maps to your data so as you drill into your charts and graphs, the map updates to reflect the changes in unison or, conversely, as you drill into your map, graphs and charts update to reflect the current geographic area.

Use the map to perform spatial queries by selecting areas on the map either by drawing an area of interest or defining a specific region (for example, the area that encompasses a 10-minute drive from a specific location).

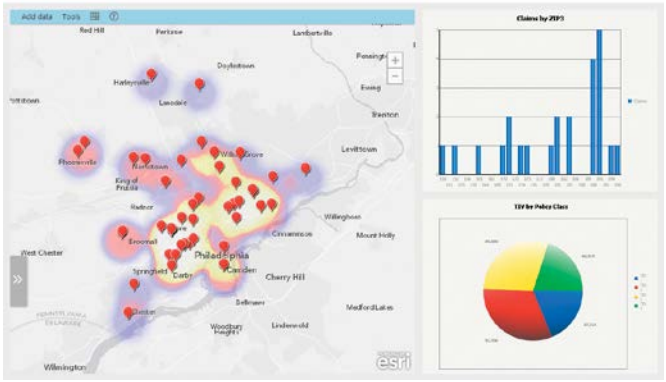
Use spatial queries with geoenrichment to understand the effects more fully. For example, by determining the path of an approaching hurricane and identifying the types of customers or facilities that may be affected, you can estimate vulnerable populations or forecast losses.

Determine statistical anomalies in your data by using hot spot analysis to identify statistical outliers to validate data quality.

Use spatial modeling to predict performance for existing or new locations. It can answer questions such as, What effect will opening a new facility in this location have on sales in existing stores?



↓ Share maps across business systems. Employee locations mapped in Excel are added to MicroStrategy for further analysis.



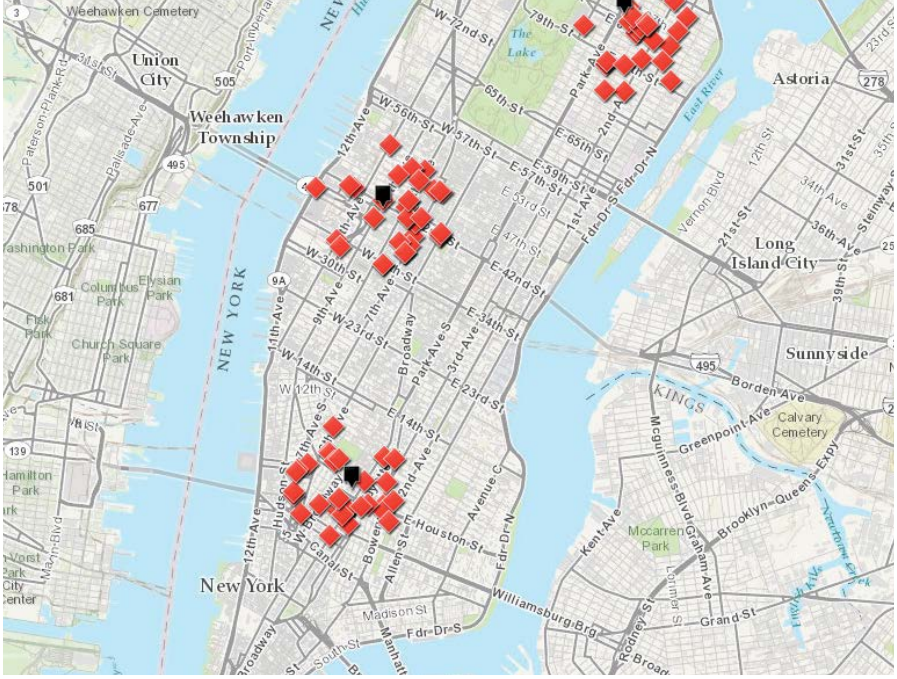
↑ Not only does Esri Maps for Office make it as easy to make a map as it is to make a chart, it offers tools like automated clustering, heat mapping, data aggregation, and color coding.

Imperative #4

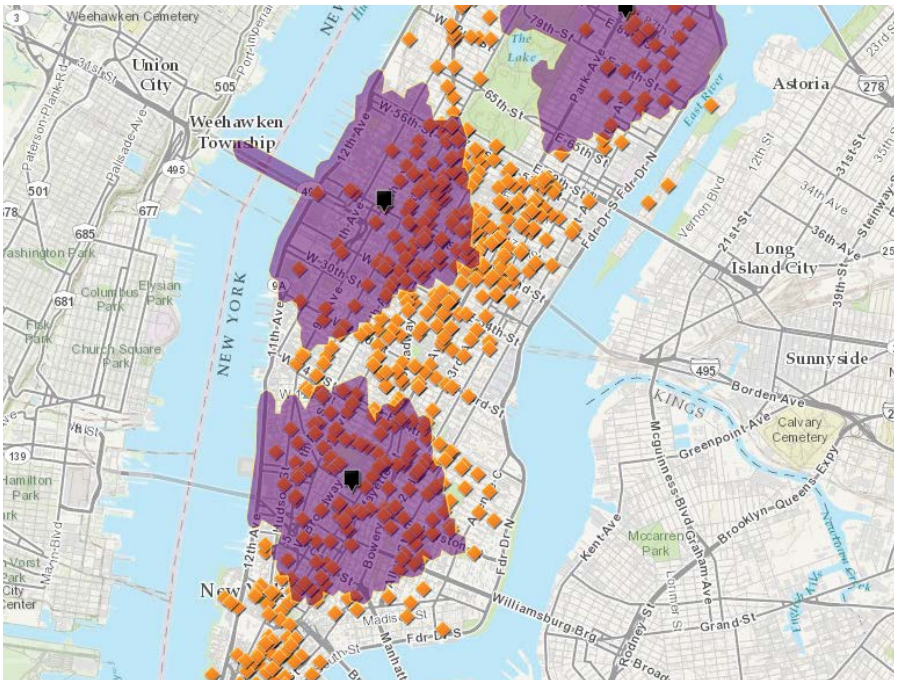
Collaborate with Maps

An enterprise operates more efficiently when everyone is on the same page. Never an easy thing to do, collaboration gets more difficult as a business gets larger. Organizational structures seem to get in the way. Use Esri Location Analytics to create and easily share maps. These maps can become the new information vehicle for breaking down barriers across your organization. Here are four ways to share maps that maximize the value of collaborating with maps:

Share dynamic maps rather than static maps. A dynamic map can be focused on the area that's important to the topic under discussion.



↖ Spatial queries let you analyze area that you define such as areas that are a 10-minute drive from a collection of specific locations.



↙ Nearest-neighbor analysis finds the closest entities of a specific type near a given location.

Share maps across devices so anyone can use them on tablets, smartphones, or desktops and they are available everywhere. For example, a map created in your CRM and available on mobile devices could be valuable to the sales force in the field.

Share maps in presentations as dynamic rather than static maps. Maps created in your business systems can be used in your presentations to make data more comprehensible.

Share maps across business systems and use them as maps or map layers in other business systems. For example, a map of store locations generated in Excel can be used as a backdrop for maps of customers in your CRM.

Share maps securely by controlling who within the organization has access to maps and who can modify them.

Gain a Competitive Edge

Maximize the value of business data by following the four location analytics imperatives: go beyond basic mapping, enrich your view of the world, perform map-driven analysis, and collaborate with maps. Esri Location Analytics products and the ArcGIS platform will help you and your organization apply the four imperatives of location analytics.

Increase the Value of Your Work

Implementing location analytics within an organization results in more demand for and better appreciation of GIS. The requests of non-GIS staff for authoritative datasets and cartographic products that they can use with location analytics tools will drive the demand for GIS. The same staff will see the benefits of having access to geospatial experts who can help them with advanced techniques such as predictive modeling and network analysis as well as application development.

As location analytics is added to fundamental business systems, there is less need to support trivial map-making requests. Location analytics and ArcGIS Online provide self-service mapping and analysis. The result: more people are empowered to create and use their own maps. Ultimately, staff can incorporate mapping into their workflows and decision processes. What does this mean to you? Daily interruptions are reduced so you can focus on the work that is more important to both you and your organization.

Targeting the Right Consumers

Map-based visualization aids green retrofit campaign

By Matthew DeMeritt, Esri Writer

San Francisco's Department of the Environment (SFE) recently completed a successful campaign to improve energy efficiency in city homes with the help of Community Analyst, Esri's web-based mapping and reporting tool. With up-to-date population and segmentation data, Community Analyst gave the department a granular perspective on San Francisco residents that resulted in more effective use of limited marketing funds, resulting in greater participation in the program.

Cast a Big Net

In 2008, the San Francisco Board of Supervisors set a target to reduce greenhouse gas emissions to a level 80 percent below 1990 levels by 2050. With residential housing accounting for 22 percent of the city's greenhouse gas emissions, reducing energy consumption in the home has never been more important. To reach that goal, San Francisco participated in Energy Upgrade California, a statewide energy management initiative with a two-pronged mission to educate California property owners about energy conservation and make energy upgrades more afforable.

To increase the number of energy-efficient homes, SFE developed a program to incentivize the city's homeowners to invest in energy retrofits that would be costly. Because SFE had a very limited marketing budget, it needed a plan to promote the program to those homeowners who would be most likely to undertake such a major commitment. The department decided on a multifaceted outreach campaign that would begin with direct mail and citywide advertising and conclude with old-fashioned door-to-door outreach.

The department achieved widespread awareness of the program through newspaper ads, signage, and leaflets in official city mailings. The city used messaging with seasonal context. Ads declared "It's Outta Here . . ."—a reference not only to San Francisco's World Series champion Giants but also to precious heat escaping from homes during this coastal city's damp winters. The department estimated that at least 250,000 residents would see the ads for Energy Upgrade California. "We needed to introduce Energy Upgrade California to the public," said Luke Easdale, Marketing and Outreach Coordinator for the Energy Program. "We determined the most effective way to initially raise program awareness was through citywide advertising and marketing channels." Although California also offers Energy Upgrade California services to multifamily homes and commercial property owners, the department decided to market to single-family homes to simplify its demographic analysis.

↓ Using Community Analyst Tapestry Segmentation information and census block demographic data, the San Francisco Department of the Environment identified three key population segments that would likely consider purchasing energy upgrade packages.

Find the Niche Market

Since not all residents are homeowners and not all who are homeowners have the means or motivation to retrofit their homes, more targeted marketing was needed to complement the citywide awareness campaign. The department needed to understand San Francisco both geographically and demographically so it could focus efforts on neighborhoods with the highest potential for program participation. This approach enabled the team to allocate its limited financial and volunteer resources more efficiently. Data on demographic and lifestyle characteristics—income, retail spending potential, utility costs, environmental and political group participation, media preferences, and spending patterns—could provide key insights and identify the areas that would be most receptive to the program. "The complexities of Energy Upgrade California—San Francisco are difficult to succinctly summarize in widely distributed collateral," said Easdale. "Ads and bus stop signs should be used to drive overall awareness, but they

must be complemented by informed local outreach methods to ultimately be effective."

Using Esri Community Analyst, which integrates demographics and Esri Tapestry Segmentation data, the team could locate and market the program to the most receptive residents. The Tapestry Segmentation system divides US residential areas into 65 distinct segments based on socioeconomic and demographic characteristics to provide an accurate, detailed description of US neighborhoods. It can help to identify targeted markets, define product and service preferences, and tailor marketing messages to fit specific audiences. Characteristics, such as income, net worth, and spending patterns, can be useful in predicting consumer behavior. Tapestry Segmentation data is available as reports and maps in Community Analyst and other Esri business intelligence products.

↑ Using Community Analyst, the most promising areas were identified, and scripts for door-to-door presentations were crafted to persuade homeowners to invest in energy retrofits.

"From the outset, we wanted a simple visualization and reporting tool that would present the data accurately and help drive our interactive campaign," said Easdale. "A map-based app would give us an overview of the communities that we should visit, which was absolutely essential given our resources."

Applying Insights

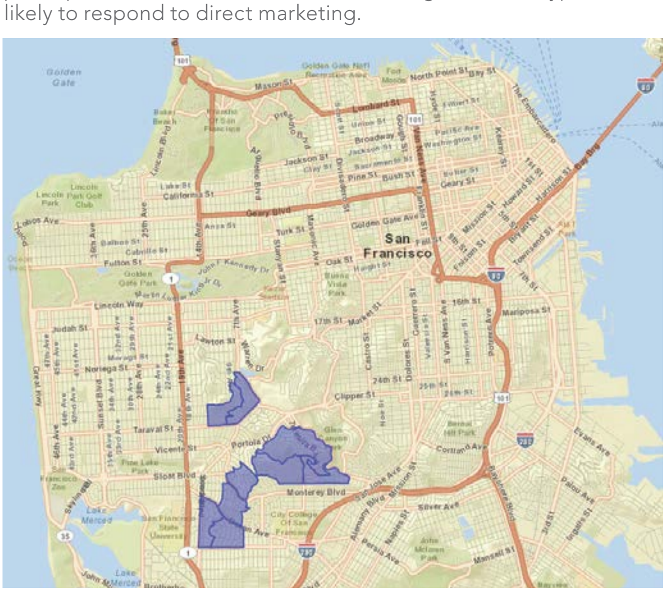
Using Tapestry data in Community Analyst, Easdale identified areas to focus on during the final interactive campaign for Energy Upgrade California. To learn more about the types of people who might be interested in the offer, the team started by plotting the locations of residents who'd bought Energy Upgrade packages in previous years in Community Analyst. Once plotted, Easdale looked for clustering and commonalities shared by these completed projects. Tapestry identified *Connoisseurs* segment neighborhoods as the primary target lifestyle group based on their rate of participation in past programs. Residents in these neighborhoods tend to be wealthy, well-educated, married couples who own their homes and engage in civic activities.

Because Community Analyst displays data geographically, the team was able to see that *Connoisseurs* neighborhoods were concentrated in San Francisco's District 7. Clearly, that was where teams should concentrate the door-to-door campaign. The team used Community Analyst to map individual residential addresses and organized customized walk-sheets so staff could save time and walk continuously from address to address. Community Analyst also revealed potential in *Laptops and Lattes* and *Pacific Heights* neighborhoods. Community Analyst showed concentrations of these segments in five distinct districts, giving even more focus and direction to interactive outreach planning.

Careful crafting of scripts for the door-to-door presentations and the offer of deep discounts for retrofit projects made the final targeted phase of the campaign more effective. Packages consisted of retrofitting insulation and replacing antiquated water heaters; gas furnaces; and other old, inefficient appliances.

The high cost of these modifications meant that even residents of Tapestry targeted neighborhoods who could afford the packages would need incentives. To sweeten the deal, staff offered rebates of up to $5,000 per home. "The high out-of-pocket cost of an energy upgrade was identified as one of the largest barriers to homeowner participation," said Easdale. "Incentives attracted homeowners who didn't have the means to cover an entire upgrade." Besides financial factors, the department's route planning was further refined by considering characteristics such as environmental group participation.

↓ The *Connoisseurs* Tapestry segment (shown in purple), located in San Francisco's District 7, had the highest rate of program participation and was believed to be the segmentation type most likely to respond to direct marketing.



Surpassed Expectations

Map-based demographic and lifestyle research tools facilitate understanding of neighborhoods and are essential in wide-scale marketing campaigns such as Energy Upgrade California—San Francisco. Maps helped the department instantly identify where outreach teams should go.

Thanks to its extensive preliminary research and staggered marketing, the department was able to exceed its expected sales by 81 homes. "Community Analyst, demographics, and Tapestry Segmentation data provided quantifiable reasoning to verify which areas and people to target," said Easdale. "Focused outreach informed by accurate demographic information and authoritative visual evidence proved to be a powerful lead generator for us." Reuben Schwartz, who manages the department's residential energy efficiency programs, added, "Correlating energy consumption to both geographic and demographic traits of our residents is critical to our success. Esri's tools were invaluable tools to help us make those connections. We hope to expand use of these tools to more neighborhoods in the city."

↓ AMC provides global air mobility through airlift and aerial refueling for the United States armed forces. Photo courtesy of US Navy/LTJG Scott Timmester.

Tiny Island, Big Operation

By Andree Swanson, Air Mobility Command Geo Integration Office

In preparation for a presidential visit, the Air Mobility Command (AMC), which supplies airlift and aerial refueling for the US Armed Forces, had to move an enormous amount of cargo, passengers, and aircraft traveling through tiny Ascension Island off the coast of West Africa. The AMC Geo Integration Office (GIO) supported this operation by creating parking plans for large aircraft, such as the 174-foot long C-17 Globemaster III, which had to land on the 34-square-mile island.

↑ Ascension Island off the West African coast

Normally tranquil Ascension Island was transformed into a major military aircraft hub during the month-long operation, moving equipment and passengers to and from Africa in preparation for President Barack Obama's official state visit to the African continent in June 2013.

AMC's global air mission means that at a moment's notice, aircraft and crew can be called to anywhere in the world. GIO staff supported the 18th Air Force planners who were preparing for the presidential visit by providing aircraft parking plans for Ascension Island as a possible mission hub for this event. GIO provides a geospatial picture of possible aircraft parking arrangements by supplying maps that assist in determining ramp space on an airfield. While parking plans make up only a small part of the logistics required to move the president around the world, they play an important role in preparing for operations that require large movements of aircraft, like the Ascension Island operation.

The GIO's primary tool for creating parking plans is Geospatial Expeditionary Planning Tool (GeoExPT). In addition to aircraft beddown, users can create tent city plans, plot airfield damage, or determine the minimum operating strip. Aircraft parking plans might be created for events like the humanitarian airlift support after the earthquake and nuclear incident in Japan, flooding in Grand Forks, North Dakota, or earthquake or hurricane relief support in the Caribbean, as well as for military exercises.

↑ Air Mobility Command's Geo Integration Office develops plans for determining the usability of an airfield for future missions. This image shows an aircraft parking plan for C-17 Globemaster IIIs on the airfield in Iwo Jima, Japan.

Using GeoExPT, a GIS planner lines up aircraft silhouettes that have accurate dimensions, in the order requested, taking into account the limitations of the airfield, established aircraft parking standards, and Air Force Instruction guidelines. When planning for mobility aircraft, which include large aircraft like the KC-10 Extender (an aerial refueling tanker) and the C-17 Globemaster III (a military transport aircraft), these considerations might include ramp weight limits and wingspan. Once completed, the map is provided to the requester, who uses it for decision making and planning.

In the case of Ascension Island, GIO created of a mobility aircraft hub for President Barack Obama's visit to Africa this summer. In mid-June, the first four C-17s arrived from Travis Air Force Base, California; Joint Base McGuire-Dix-Lakehurst, New Jersey; and Joint Base Lewis-McChord; Washington. Nearly 100 C-17 and KC-10 aircraft would use the airfield over the next month. From a generic request for parking plan information, AMC GIO support helped the operation, which became the largest movement of military equipment and personnel through Ascension Island since the Falklands War in 1982.

The demand for the mission-planning aspect of AMC's map system is growing within the command, often outpacing traditional civil engineering needs. "Too many times, we, the integrated geospatial service providers, don't sufficiently question or fully understand the power we have to impact the Air Force mission with the capabilities we provide every day," said Dr. Rick Marshall, a member of the AMC GIO team. *[Marshall is the president and founder of Vertical GeoSolutions, Inc., a company specializing in the collection and integration of geographic information that has worked extensively with AMC using GIS to provide visualization for airfield operations.]*

"Typically, we don't know what we are supporting, we only know that we need to find out how many aircraft can be parked at a location," said Marshall. "By simply sharing geospatial data and capabilities beyond the civil engineering community, we can have far-reaching impacts that pay great dividends to the mission and, in turn, demonstrate value and the mission relevance of the geospatial integration services we provide."

For additional information, contact the Geo Integration Office at 618-229-4360 or amc.maps@us.af.mil.

About the Author

Andree Swanson, a retired Air Force officer, is the communications manager for Air Mobility Command Geo Integration Office. She works to promote awareness of the AMC GIO maps program and also trains and educates new users.

Capt. David Bredesen of the 621st Contingency Response Wing contributed to this article.

↑ KC-10 Extenders and C-17 Globemaster IIIs parked on the Ascension Auxiliary Airfield Ramp at Ascension Island in the southern Atlantic Ocean in June 2013. Photo courtesy of US Air Force/Staff Sgt. Sean Baber

No Ordinary Atlas

By Jan Soucek, ARCDATA PRAHA, s.r.o., and Peter Mackovčin, Palacký University

What is the very first thing you think of when you hear the word *landscape*? Perhaps images of fields, meadows, and forests come to mind. If you think more deeply about this term, you might realize that the landscape unites animate and inanimate nature, and—above all—is the environment for human life.

Geology, geomorphology, hydrography, meteorology, sociology, demography—these and other scientific disciplines study specific aspects of the landscape. Understanding and describing the landscape are not easy tasks and require contextual awareness and deep knowledge that can't be portrayed in an ordinary atlas. To create an atlas about the landscape of the Czech Republic required the efforts of 100 institutions and 300 experts.

In the Heart of Europe

The Czech Republic lies in the middle of Europe, bordered by mountains on three sides. The country includes bare hills, forested highlands, and even warm fertile lowlands where grapes grow well.

Although its modern history begins in the 9th century, human habitation for one million years has been documented by stone artifacts and beautiful prehistoric statuettes. People and landscape have been affecting each other for a very long time.

To understand the country, it is essential to describe every element that influences the landscape. The broad range of themes addressed requires cooperation beween the best specialists. Government organizations (mostly from the Ministry of the Environment and Ministry of Agriculture), universities, and the Academy of Sciences were involved in the creation of this atlas. All faced the challenge of how to manage this complex project and guarantee that every map would be appropriately designed in the same professional manner.

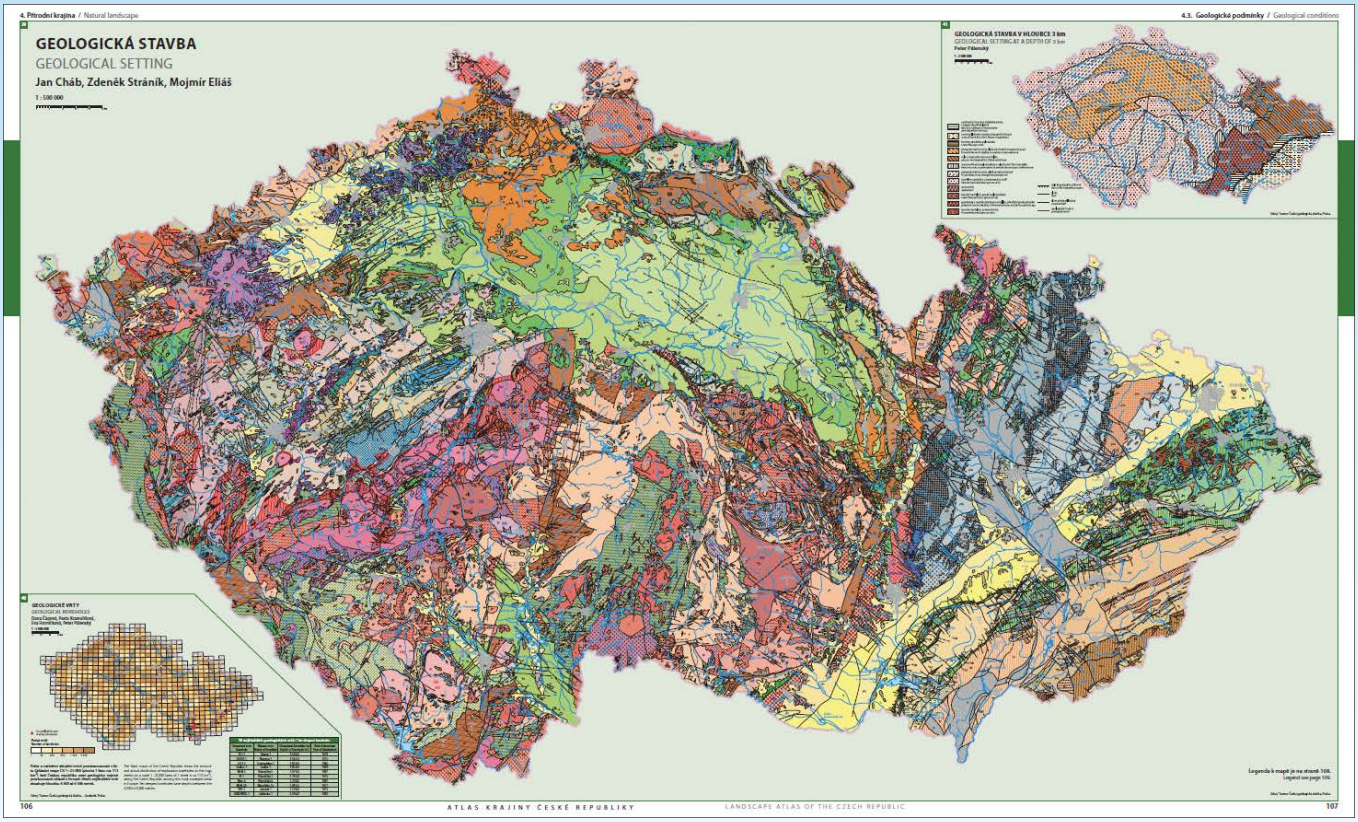
Cooperative Map Creation

Preparing a methodology for creating maps was the first and a fundamental step. The management team created the topographic basemap used by all map authors. This basemap was produced in two versions: physiographic and socioeconomic.

Each version was designed with suppressed symbology and contained only the items needed for visualizing various types of thematic content. These basemaps were created using a geodatabase supplied by ARCDATA PRAHA, s.r.o., the Esri official distributor in the Czech Republic. The team gradually updated this geodatabase with authoritative topographic and administrative content.

Most data management and cartographic processing was done

↓ The countryside in Southern Bohemia. Photo courtesy of Renate Dodell/Flickr.



↑ *Landscape Atlas of the Czech Republic* is a national atlas envisioned as a source of information and knowledge for the central government's policy makers and local governments.

in ArcGIS for Desktop. Databases, spatial data, MXD documents, and Microsoft Excel tables were kept in a structured directory with folders that corresponded to atlas chapters. After peer reviews and revisions, the maps were finalized and exported for prepress.

Map authors followed this methodology as they worked with the geodatabase, supplied metadata, designed layouts, and symbolized the 906 thematic maps compiled for the atlas. This ensured consistent style throughout. All the texts and maps are both in the Czech and English languages. The small number of maps that were not included in the atlas were printed in a later issue of *Acta Pruhoniciana*, a journal for landscape and horticulture.

Consistent and unified map design is one of the most important and challenging aspects of producing a large atlas. Readers should not have to decode different cartographic styles—all the maps should speak in one language.

Final Production

Slovak cartographic company ESPRIT, spol. s r.o., Banská Štiavnica made the final edits to the map book. In the final printed atlas, map scales range from 1:500,000 to 1:2,000,000. The *Landscape Atlas of the Czech Republic* measures 51 × 61 centimeters (approximately 20 by 24 inches) with 331 pages, making it among the largest atlases in the world.

The goal of the project was to create a national atlas that would serve as a source of information and knowledge not only for the central government's policy makers but also for local governments, whose decisions directly influence the lives of citizens.

Because another goal for the project was to provide complex study material for students at the elementary, high school, and university levels, the atlas was not distributed commercially but is supplied to organizations, schools, and scientific departments for free.

The map book has retained a place in this era of information technology by combining the work of hundreds of specialists working on numerous research projects. This way, it became a unique book containing a tremendous amount of information. Besides the provided data, it is also a source of contacts to the participating organizations and map authors. This way, it serves also as a portal that enables the reader to contact the appropriate institution and ask for data.

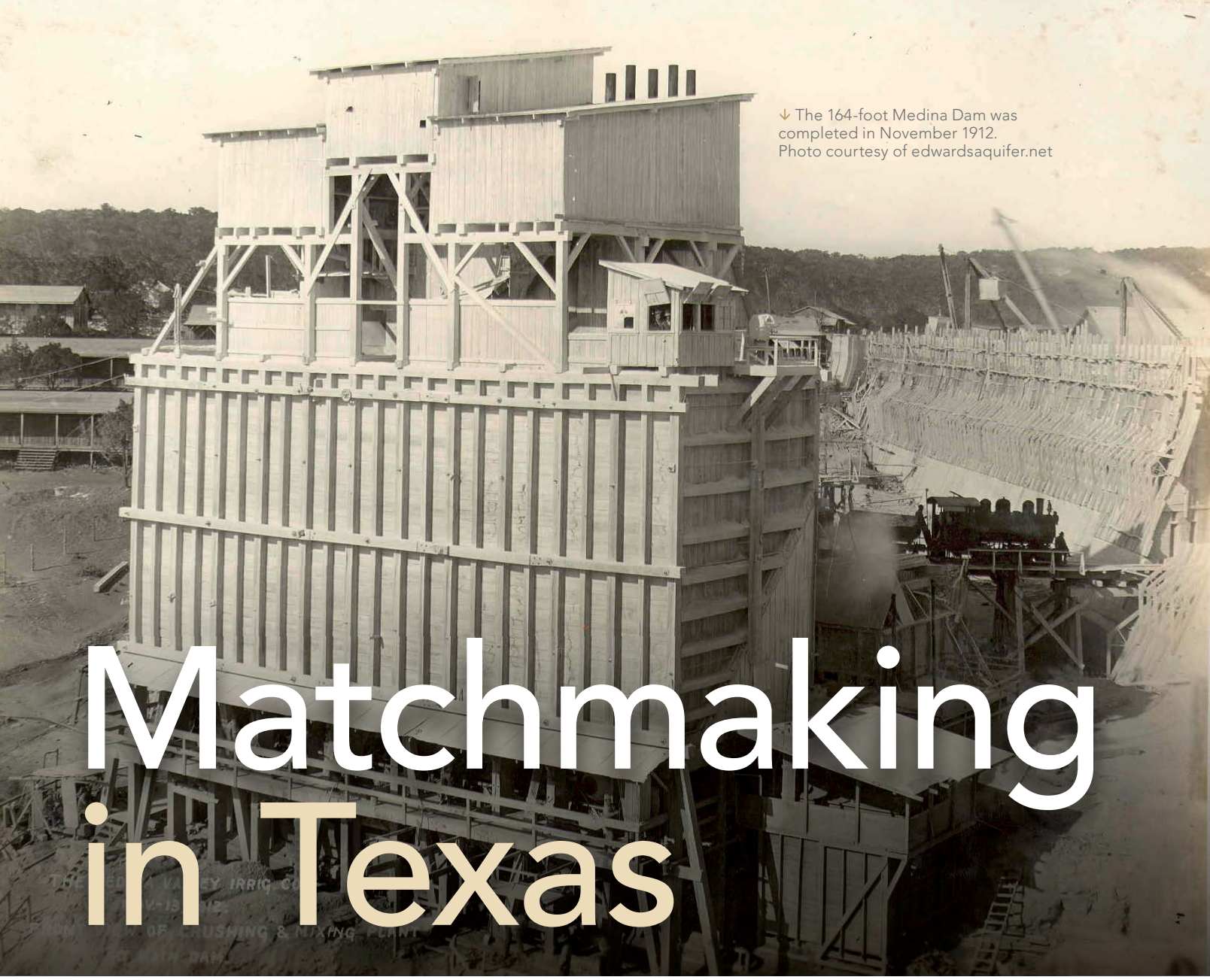
Recognition

Soon after its publication, the *Landscape Atlas of the Czech Republic* received the Map of the Year award of the Czech Republic in the category Atlases from Cartographic Society of the Czech Republic (CSCR). This prize is judged by the academic jury from a number of maps and atlases from the whole country each year.

At the 25th International Cartography Conference in Paris, France, in 2012, the atlas won the first jury's prize in the Atlases category. The atlas also was named the Map of the Month for October 2012 by the International Cartographic Association, proving its merit by international standards.

The *Landscape Atlas of the Czech Republic* is published as a PDF on the web pages of the Ministry of the Environment of the Czech Republic website (www.mzp.cz/cz/atlas_krajiny_cr) and can be perused and appreciated by anyone.

For more information, contact Jan Soucek, jan.soucek@arcdata.cz, or Peter Mackovĉin, peter.mackovcin@upol.cz.



↓ The 164-foot Medina Dam was completed in November 1912. Photo courtesy of edwardsaquifer.net

Matchmaking in Texas

Regional partnership increases efficiency, decreases loss

by Adam Conner and Katherine Tillison, San Antonio Water System

A water improvement district and a public water and wastewater utility in Texas embarked on a parternership that will save water and modernize its delivery.

The Bexar-Medina-Atascosa Water Control & Improvement District No. 1 (BMA) is responsible for providing a reliable water conveyance system from Medina Lake for irrigation purposes. It requires all new customers along the canal to implement efficient irrigation best practices. In 2012, San Antonio Water System (SAWS), a public water and wastewater utility that serves approximately 1.6 million people in Bexar and surrounding counties, became a BMA customer and its largest source of revenue.

Both SAWS and BMA have a stake in increasing the efficiency of BMA's canal system. Immediately after joining BMA, SAWS began finding ways to improve the efficiency of BMA's canal system. The first step was opening lines of communication between SAWS contractors and BMA so BMA would know about upcoming SAWS pipe replacement projects to allow BMA to reuse that pipe in its canal system. At first somewhat piecemeal and uncoordinated, the program improved when SAWS began using ArcGIS to alert BMA of upcoming pipe replacement projects.

Not Alone

Irrigation districts across the nation are embarking on modernizing and optimizing their water delivery systems. According to the United States Department of Agriculture (USDA), irrigated agriculture across the western United States consistently accounts for 80 to 90 percent of

consumptive water use in the United States. Nearly 57 million acres were irrigated in the United States in 2007, an area slightly larger than the state of Minnesota.

Medina Dam, the source of BMA's water, stands 164 feet tall and has a capacity of 254,000 acre-feet. When it was constructed in 1912, it was the largest dam in Texas and the fourth largest in the United States. The extensive 250-mile canal system downstream of Medina Lake, which is entirely gravity fed, was constructed at the same time and was then the largest irrigation project west of the Mississippi River.

Installing pipe (or piping) in a canal system keeps more water (and therefore money). Piping Medina Lake would allow BMA to deliver water faster. Because Medina Lake is one of SAWS's many water sources, more water in the lake means SAWS can rely on it longer during a drought. This is especially crucial after 2011, the single worst meteorological year on record, which has been followed by years in which rainfall seemed to skirt Medina Lake's relatively small 609-square mile watershed. As of August 2013, storage in Medina Lake was at less than 5 percent capacity.

BMA is a relatively small organization with a permanent staff of less than a dozen. Most staff are out in the field. In light of the complexity of its canal system, with many turnouts, gates, and laterals in its canal system, BMA had the foresight to recognize the value of ArcGIS and acquired a license. However, being headquartered in Natalia, Texas, a town of approximately 1,400 residents located 30 miles from San Antonio, made getting ArcGIS training difficult.

SAWS is a utility of more than 1,500 employees with significantly more resources. When SAWS learned of this need for training, it sent staff to Natalia to demonstrate useful ArcGIS applications. During this visit, SAWS discovered that BMA had conducted a preliminary study on canal piping but didn't have a strategy for prioritizing which stretches to pipe first. SAWS decided to use ArcGIS to assist BMA by prioritizing potential problem areas in the canal system.

Canal Efficiency Indicators

After numerous conversations with BMA and other irrigation districts, along with extensive research, SAWS determined there are four main indicators of canal efficiency that could be incorporated into a simple formula. The first and most important variable is the soil type within each stretch, because the canal system is almost entirely open ditch. However, because the main canal above Pearson Lake has a relatively effective clay lining, it was not considered for this piping study. Soil type was given a weight of 40 percent. The agricultural demand within each stretch was also important. Piping these segments would yield discernible benefits, so this was given a weight of 30 percent. Slope and susceptibility to wind and solar evaporation were considered to be of equal importance, and each was given a weight of 15 percent.

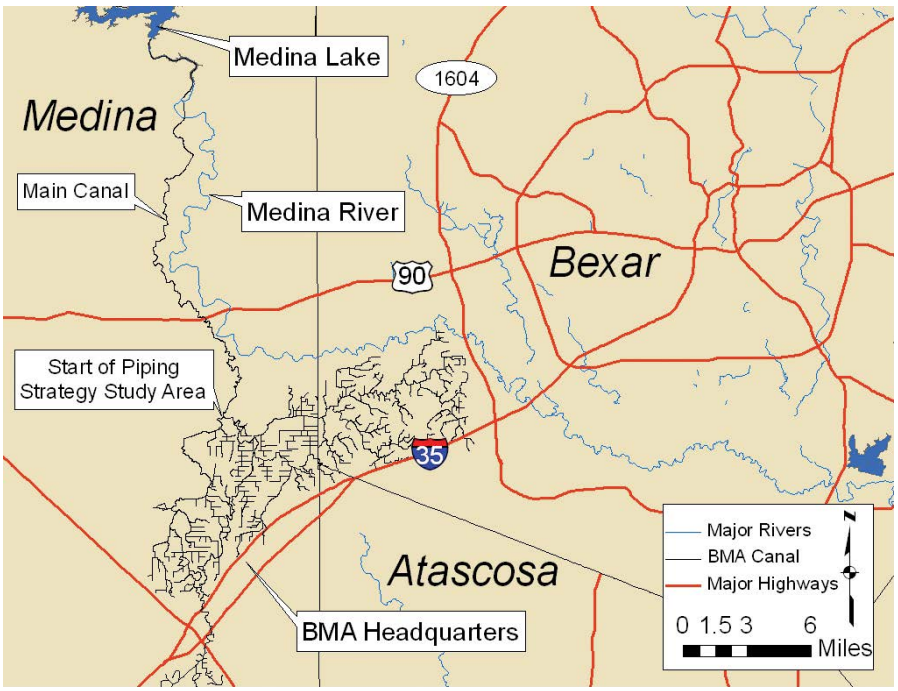
Soil Type

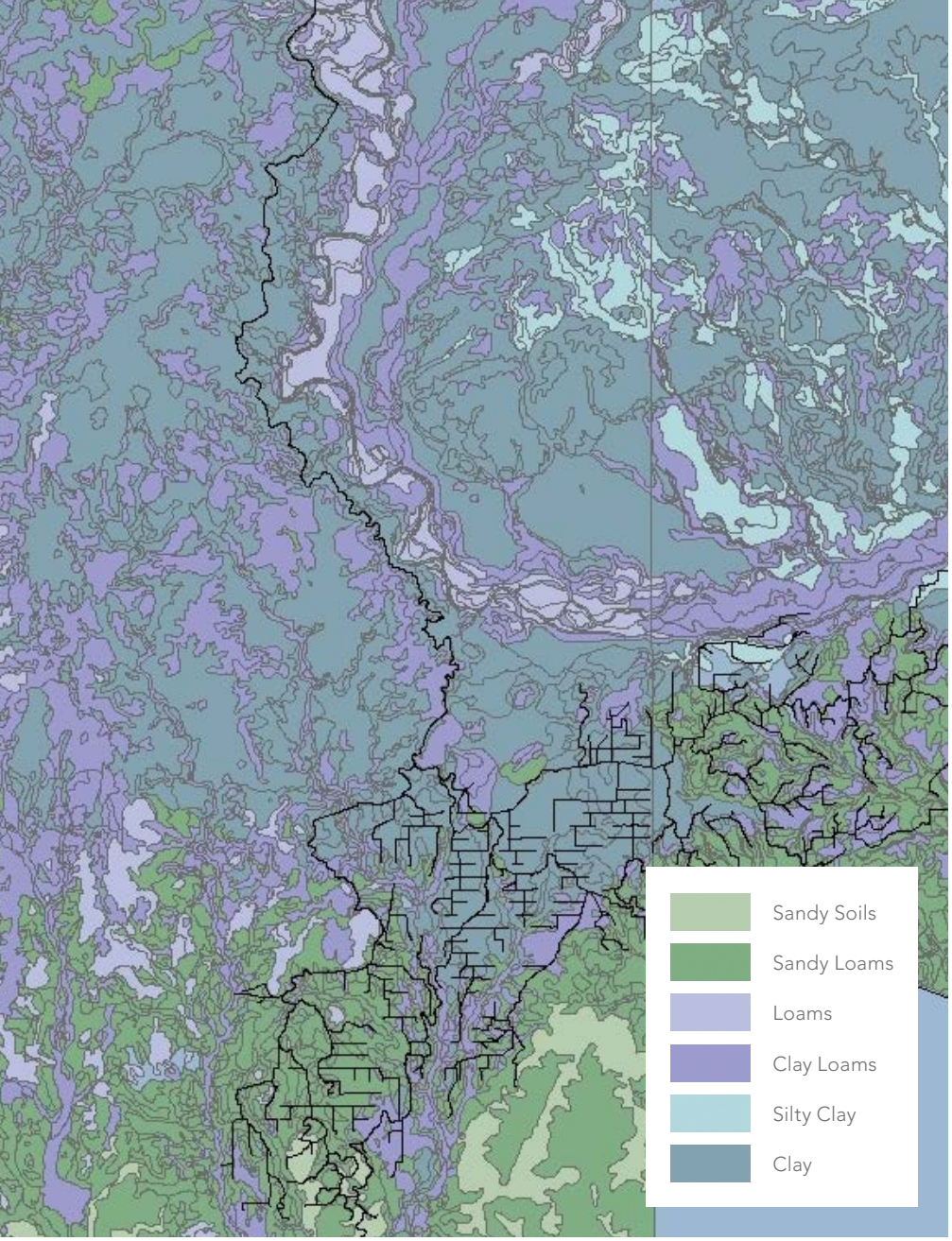
After determining that soil characteristics are the most important variable, SAWS began scouring various databases for soil data that could be used in ArcGIS. The most useful data was downloaded from the United States Department of Agriculture Natural Resource Conservation Service (NRCS) website that identifies dozens of soil classifications and geographically allocates them into thousands of soil parcels. SAWS generalized the dozens of classifications down to six: clay, silty clay, clay loams, loams, sandy loams, and sandy soils. A numerical value was assigned to each soil parcel in the attribute table. Clays were given a value of 50, silty clay 30, clay loams 25, loams 20, sandy loams 10, and sandy soils 5. Finally, this vector shapefile was rasterized to create a raster to input in the Raster Calculator.

Crop Density

BMA's canal system has a significant concentration of agricultural demand that justified a higher priority for piping. SAWS used an image file showing crop locations, obtained from the NRCS website, to digitize vector polygons for each crop type. Subsequently, SAWS assigned values in the shapefile's attribute table to approximate the water demand for each crop. According to the Texas Board of Water Engineers, small grains (wheat and oats) in this region require the most water per acre, followed by cotton, corn, and sorghum. This vector polygon was rasterized to create another raster.

↓ BMA Medina System





↑ Soil characteristics are the most important variable. This map shows regional soil types in relation to the BMA canal system.

Slope

Although BMA's canal system is entirely gravity fed, there certainly are low points prone to losses from ponding, which causes evaporation and infiltration. A digital elevation model (DEM) was downloaded from the NRCS website that was used to create a raster that illustrated slope (i.e., change in elevation). The Slope tool in ArcGIS for Desktop easily converted the DEM to a raster that contained values between 0 and 50. This was the first of five rasters that would later become input for the Raster Calculator in ArcGIS. Since this range (0 to 50) would have been difficult to edit, it served as the range for the other rasters. A slope of 0 represents an area that is extremely flat and therefore an area of high priority, while a slope of 50 signifies an area of low priority.

Evaporation

SAWS determined that susceptibility to evaporation would account for 15 percent of the canal efficiency, allocated between wind evaporation at 10 percent and solar evaporation at 5 percent. To determine which canal segments are most exposed to wind evaporation, SAWS determined that southeast/northwest was the predominant wind direction. SAWS used the Azimuth tool to select only canal segments oriented in two ranges—140–160 and 320–340 degrees—and created a separate polygon shapefile for those segments that were given a high priority. This vector shapefile was rasterized as the fourth raster.

SAWS used the same methodology to determine canal segments with the most exposure to solar evaporation and selected segments oriented east to west. This selection resulted in the creation of the fifth and final raster. Although canopy cover could be seen as a better variable for dictating how much solar evaporation occurs, riparian vegetation results in significant transpiration that negates the reduction in evaporation.

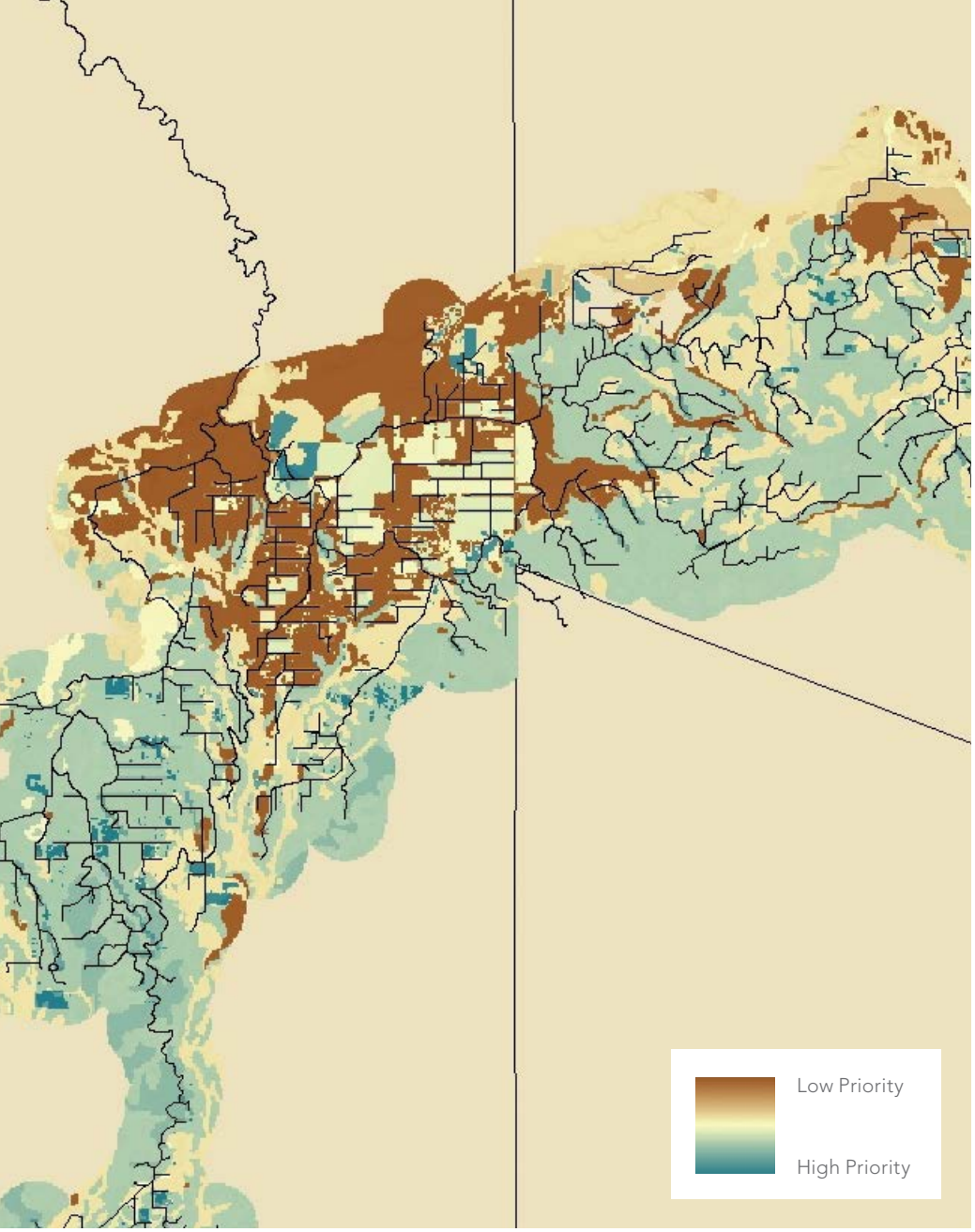
Optimized Canal Piping Strategy

The final step in this multicriteria analysis adds the five rasters to the Raster Calculator tool in ArcGIS for Desktop and plugs in a simple formula that assigned the weights to the four factors considered. The Raster Calculator uses Python syntax in a calculator-like interface that doesn't require coding experience. The output was a raster showing which canal segments to focus on piping first and which were of lower importance and could accommodate used pipes. If at any time these weights need to change, all BMA has to do is add the same five input rasters in the Raster Calculator tool, change the formula, and create a new raster.

This analysis is different from a suitability analysis because, rather than identifying one or two siting locations, this analysis prioritized every foot of the 250-mile canal system. Although a similar analysis could have been done using the Weighted Overlay Analysis tool, preparing the input rasters for the Raster Calculator tool forced SAWS to better understand the data.

Conclusion

In these arrangements, such as the one between BMA and SAWS, partners share experience and learn from each other—both stand to gain. This type of collaboration builds trust among regional players. It differs from regionalization because it brings cost savings associated with having specialized and responsive staff available to assist in the operation of a rural water system.



↑ The SAWS Optimized Canal Piping Strategy

The budding partnership between SAWS and BMA comes at the 100-year anniversary of the Medina Lake system and represents a new era for the region. During the previous century, Medina Lake stakeholders experienced extremes in conditions that ranged from eight years of crippling drought in the 1950s to torrential flooding in 2002. Piping the canal system will make Medina Lake more reliable during droughts. Considering the amount of federal, state, and regional funding currently available, both partners understand that it's better to act now. As the saying goes, "Every time history repeats itself, the price goes up."

For more information, contact Adam Conner at 210-233-3452 or adam.conner@saws.org.

Acknowledgments

SAWS thanks BMA for cooperating in this analysis and hopes the final product is useful in BMA's endeavor to pipe a significant amount of its canal system. The authors are indebted to the USDA for most of the data used in this analysis and the following individuals for their feedback and review: Steven Bereyso (SAWS), Gregg Eckhardt (SAWS), Dan Fulwyler, (Vale Oregon Irrigation District), Rhoda Benson (Roza Irrigation District), Jerry Bryan/Jer Camarata (Farmers Irrigation District), and Justin Harter (Naches-Selah Irrigation District).

About the Authors

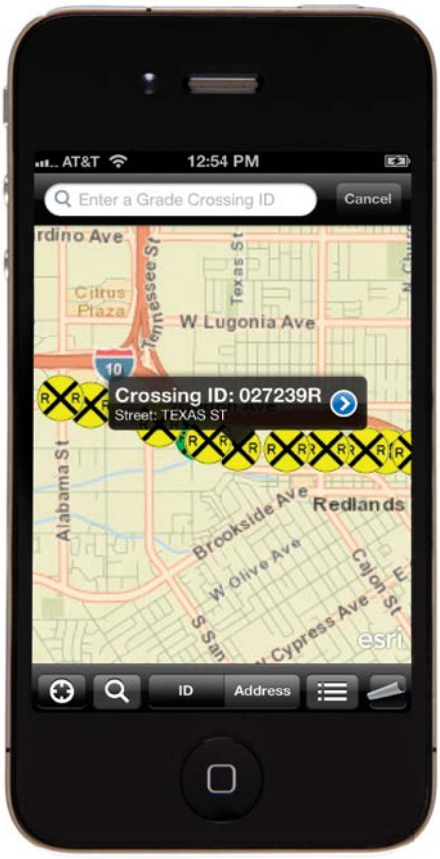
Adam Conner is a water resources planner with SAWS who is responsible for strategic water supply and demand planning as well as surface water asset management. Conner has a bachelor's degree from the University of Texas-Austin, a master's degree in water management from Texas A&M University, and a Project Management Professional (PMP) credential.

Katherine Tillison, an intern with SAWS, is applying ArcGIS to analyze and improve SAWS water resources. She is currently pursuing a bachelor's of science in biological and agricultural engineering at Texas A&M University and eagerly anticipates her graduation in May 2014.

Rail Crossing Locator App

Improving grade crossing safety

By Matthew DeMeritt, Esri Writer



↑ Users can search for rail crossings by ID number or address.

The Federal Railroad Administration (FRA) recently released a free mapping app, available from the Apple App Store, that helps improve highway-rail grade crossing safety. The Railroad Crossing Locator provides transportation and safety agencies with a convenient mobile querying tool and the public an interactive channel to learn about the nation's highway-rail grade crossings.

With 140,000 miles of rail network in the United States, freight and passenger railroads intersect US highways and roads more than 212,000 times. These intersections pose potential hazards for pedestrians, rail travelers, and commuters. Built with Esri's API and SDK for iOS, the app helps locate thousands of rail crossings throughout the United States and displays key safety and descriptive information, including official United States Department of Transportation (USDOT) records.

USDOT assigns unique identification numbers, called crossing IDs, to each grade crossing. States or railroad companies that own grade crossings must provide essential physical and operational information about these crossings that goes into a national inventory maintained by the USDOT and available to the general public and safety and emergency response entities. Making federal datasets easily accessed by the public supports key White House transparency initiatives that recommend that agencies find ways to deliver safety data to the public.

"While we've made significant progress in the reduction of highway-grade crossing incidents over the last decade, much more work remains to be done," said FRA administrator Joseph Szabo. "This technology will be one more tool to help us reach our goal of zero fatalities."

In 2008, the FRA GIS team launched its first publicly available grade crossing mapping application. Called the Pop-Up Viewer, this simple mapping utility used Esri server technology integrated with a records search tool on the FRA's safety data website. Although highly successful compared to paper record search methods, the viewer was optimized for web browsers on desktop computers. Typically using a laptop in the field, transportation and safety personnel would have to go through a multistep process to access the location and related records for an individual crossing. Five years later, agencies and the public have come to expect faster and more convenient ways of getting information.

In 2012, the FRA decided to modernize the grade crossing mapping application. Its GIS team worked with regional safety staff, state department of transportation officials, and others, to determine the core functionality needed to upgrade the application. The consensus was that the mobile application should have an intuitive, simple-to-use interface. Rather than replace the desktop information resource available at FRA's website, this new tool would complement the FRA's collection of investigative tools for professionals and the public.

A few years ago, Esri released its iOS API and SDK for creating apps that run on Apple mobile devices. FRA saw that this could provide a better method for getting rail crossing information to relevant personnel and the public. After gathering user input and discussing the project with the IT and Public Affairs office, the GIS team came up with interface and functionality requirements and decided to work with Esri Professional Services to build the Rail Crossing Locator, a native iOS app.

↑ The details page gives basic crossing attributes.

This app consumes FRA's ArcGIS for Server map services, allowing users to perform queries on the FRA Grade Crossings spatial database. That database contains an inventory of all highway-rail crossings with accurate spatial locations throughout the United States and information about the crossing owners; crossing locations; and the highway, traffic control, and physical characteristics of the crossing. The app also allows users to access official USDOT Inventory Record and Accident/Incident records for each crossing.

The app initially pinpoints the user's location and shows nearby crossings. The aerial basemap is the default, but three other basemaps are available. The crossings symbols are color coded to denote whether the intersection is at grade, above grade, or below grade. Selecting the crossing displays a pop-up with the crossing ID number and address of the intersection and provides access to an additional page that shows a selection of the main attributes (e.g., operating railroad, road name, county) and links to the crossing's official USDOT Inventory Record and Incident Report. A convenient reporting option allows the user to send an e-mail to the FRA regarding a nonemergency issue at a specific crossing, which is automatically populated with the specific crossing ID. Besides finding crossings near their location, users can search for crossings by unique USDOT crossing ID or street address. Using the embedded filter tool, users can also find grade crossings by selected characteristics.

The Railroad Crossing Locator app gives easy access to information that improves investigative and reporting processes. Citizens can also use the tool to modify travel plans to avoid potential delays at crossings and be more informed about safety issues.

Inaugural UC Hackathon

Fun, food, and CODING

At 1:00 p.m. the doors to Ballroom 20A at the San Diego Convention Center opened to 17 avowed geogeeks. Their mission: build a usable software solution for the good people of San Diego, California, using the ArcGIS platform and complementary third-party tools. The contest would be over and the winners announced in just 24 hours.

Esri and DigitalGlobe partnered for the inaugural Esri UC Hackathon. During the contest orientation, San Diego council member Mark Kersey summarized San Diego's challenges in creating an Open Data Initiative and suggested issues in the region that could be addressed using the technology.

Teams, composed of one to five members, were required to use one of Esri's ArcGIS APIs (JavaScript, Flex, Silverlight, iOS, Android, and Windows Phone) and San Diego data in their solutions. To be eligible for the DigitalGlobe prize, teams also had to use the DigitalGlobe ArcGIS Online Services.

In addition to the new beta ArcGIS Developer Subscription, teams had access to DigitalGlobe 8-band WorldView-2 satellite imagery and data from the San Diego Data Library, Open San Diego, San Diego Association of Governments (SANDAG), San Diego Geographic Information Source (SANGIS), and the San Diego Apps Challenge data.

Final hacks were due and presentations began on July 7 at 11:30 a.m. followed by judging and the awards presentation at 1:00 p.m.

Brad Hellyar, Jack Reed, and Ari Isaak created Notify 311, which captured first place in both the Esri and DigitalGlobe contests. The app lets San Diego citizens report civic issues, from abandoned shopping carts to flooded areas, and sends notifications to the appropriate council member and any residents who subscribe. Notify 311 avoids the contract issues and maintenance downtime associated with the city's existing proprietary 311 systems by using the city's GIS infrastructure.

"San Diego seemed to need a better way for citizens to report 311 issues in the city. We also wanted to utilize the existing GIS infrastructure that the city had in place. So this app came together with those two ideas in mind for a spatially aware 311 app," said Reed, who has been developing apps that use GIS for three years.

For their efforts, Hellyar, Reed, and Isaak received three Esri Developer Summit (DevSummit) seats, three Esri Developer Network (EDN) Standard licenses with ArcGIS for Desktop Basic, and a poster of a high-resolution satellite location chosen by the winners.

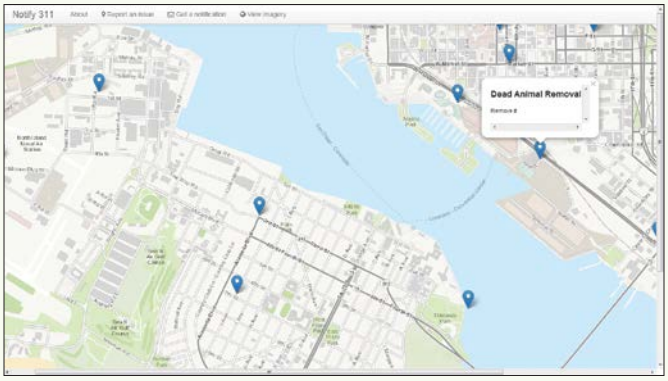
The second-place app, My Farmer's Market Today, addresses access to locally grown food, a trend that has been increasing in San Diego. Olmo Zavala Romero, Yazmin Valdez, and Elena Osorio-Tai, all students working on advanced degrees, had worked together before but had not previously created an app before collaborating on My Farmer's Market Today.

The app maps all the farmer's markets in San Diego and surrounding areas and provides market addresses, hours of operation, and websites along with turn-by-turn directions to them. It can also filter results by day of the week.

"We love challenges," said Osorio-Tai. Although they got little sleep, time flew by, and they had a great time working on the app. For their second-place finish, the team received three EDN Standard licenses with ArcGIS for Desktop Basic.

TapAMap Watersheds is an iPad/iPhone app designed by Scott A. Smith that lets students explore locations and update information about a place. It offers links to Wikipedia articles about nearby locations. US Geological Survey watershed data, used to prototype the app, supplies information on the region, basin, subbasin, watershed, and subwatershed for a location. For his efforts, Smith received a certificate for merchandise at the Spatial Outlet at the conference.

Although Esri has been involved in other hackathons and held two hackathons at the DevSummit this year, this was the first hackathon held in conjunction with the Esri International User Conference. Esri is promoting hackathons as a great way for developers to meet others with similar interests, learn new things, and get their hands on the newest Esri technology.



↑ Notify 311, the first-place winner in the Esri UC Hackathon, lets San Diego residents report problems in the city.

GIVE IT A TRY

New flexible developer subscriptions for ArcGIS Online

Esri invites developers to build, test, and push the boundaries of geo-enabling applications with a new plan that gives them free subscriptions for its web, mobile, and online tools and services. The plan includes access to powerful geoservices as well as the ability to host data in the Esri cloud as RESTful web services that can be consumed by a wide variety of client-side apps and APIs.

Developers can subscribe at the free level or upgrade to one of the paid levels that provide more storage and services and the ability to deploy commercial applications with no extra fees or royalties. This is a flexible and cost-effective way to build apps for both the GIS user community and consumers on a variety of devices.

The new developer subscription to ArcGIS Online includes improved documentation, better samples, and usage monitoring tools that enable apps and services to be quickly and easily deployed and managed. Build apps using popular web and mobile development technologies, such as JavaScript, iOS, Android, Flex, Silverlight, Windows Phone, and Windows Mobile, as well as REST APIs. The APIs and SDKs are well-documented and come with many samples.

Developers can create and edit new feature services through a web interface. Use the geocoding service to convert addresses to and from geographic coordinates. Search for places within a region and get locations that match your search.

Get routes and directions between locations using tools for JavaScript, Android, and iOS. Find the optimal route between multiple locations and simulate traffic conditions. Use the Esri cloud to store and create RESTful web services. Create custom REST endpoints to store and query geographic data such as points, lines, and polygons.

Create maps for any mobile platform and turn spreadsheets and data into map features. Display markers, icons, and pop-ups to customize maps, or choose from special maps styled for different uses.

Developers who are interested in getting started today can subscribe to a developer plan of ArcGIS Online at developers.arcgis.com. Check out Esri on GitHub and contribute to more than 100 repositories of apps, templates, utilities, and developer quick starters.

Transformation AND Opportunity

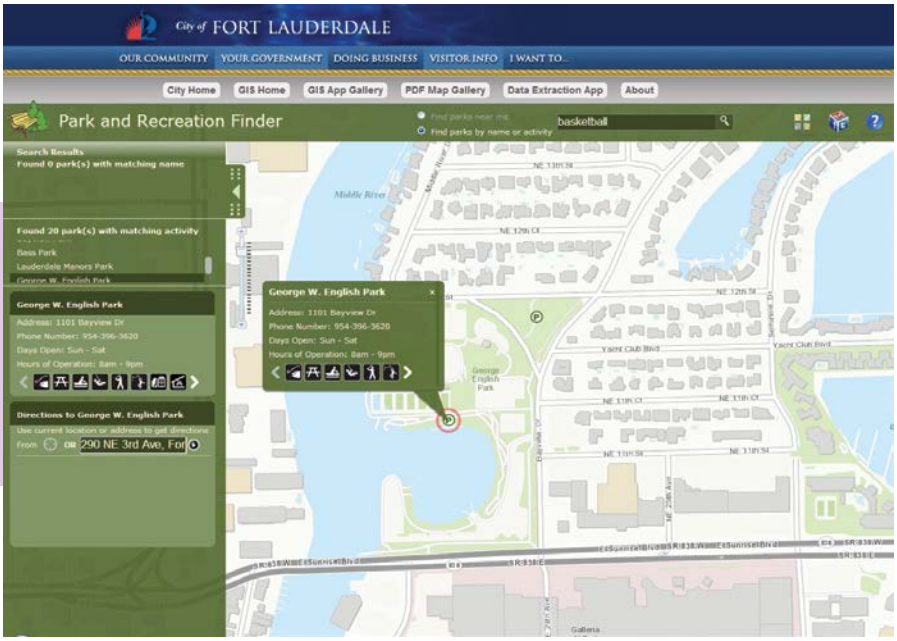
It's a good time to be a GIS professional

Not only has the demand for your skills remained strong in government, utilities, and natural resources organizations, but the commercial real estate, insurance, marketing, and logistics industries are discovering the value of GIS and are providing new opportunities for GIS professionals. As positive as this situation is, the future is even brighter.

Why?

Because GIS is undergoing a profound transformation. It is becoming web GIS.

↓ GIS manager Ian Wint discovered he could rapidly expand the City of Ft. Lauderdale's collection of mapping applications in a fraction of the time by configuring the templates from Esri like this Park Finder application.



What Is Web GIS?

It is a new pattern for delivering GIS capabilities that lets people everywhere access and use geographic information on desktops, the web, tablets, and smartphones. Web GIS is the centerpiece of Esri's strategy for implementing GIS as a platform

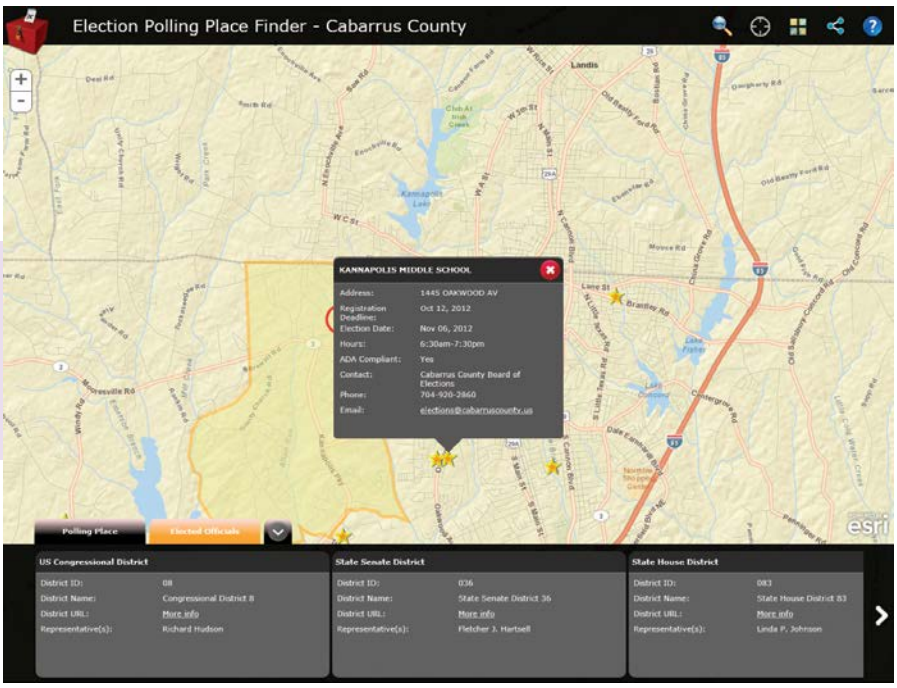
Conceptually, web GIS is agnostic with regard to how it gets implemented. It can run on a local network on-premises using ArcGIS for Server and Portal for ArcGIS or on ArcGIS Online in the cloud hosted by Esri or some combination of these strategies.

Web GIS expands, rather than replaces, existing GIS in organizations. With web GIS, people can not only access maps and apps on consumer devices and the web but easily build maps that work everywhere. With the wide variety of ready-to-use applications and application templates, there is far less need for creating custom applications.

What Can You Do with Web GIS?

The web GIS pattern also provides a new pattern for integration. Maps and apps can bring in all kinds of data from tables, enterprise systems, and spreadsheets and integrate it with social media and sensor networks.

With ArcGIS GeoEvent Processor for Server, an extension to ArcGIS for Server,



↑ Cabarrus County, North Carolina, GIS administrator Zachary Woolard implemented Esri's Polling Place Locator template. "Within a week of discussing how we could improve our service, we were demonstrating the completed application to our Board of Elections," said Woolard.

your organization can take advantage of the vast quantities of data being captured in this increasingly instrumented world by ingesting streams from social media, in-vehicle GPS devices, and many sensor sources in real time and performing continuous analysis and processing as the data is received.

Through dynamic linking from distributed services using web services and web maps, almost any data source can be integrated. This sidesteps the process of carefully restructuring data using data models that was previously required.

Integrating GIS with other business systems, previously a formidable task, is now much simpler. Because web GIS is based on simple protocols like REST and other web standards, it can effectively embed GIS into existing enterprise systems like IBM Cognos, MicroStrategy, and SAP.

Easy map creation and integration with business systems build cross-organizational collaboration, enhancing communication, and optimizing access to information. Web GIS makes it possible to tap into information from outside the organization by using the vast collections of ready-to-use maps and GIS services, including geocoding, routing, and geoenrichment accessed through ArcGIS Online. Whether web GIS is implemented through ArcGIS Online or Portal for ArcGIS, sharing maps and other resources is secure so web GIS can be used as a mapcentric content management system.

Why Does It Matter to You?

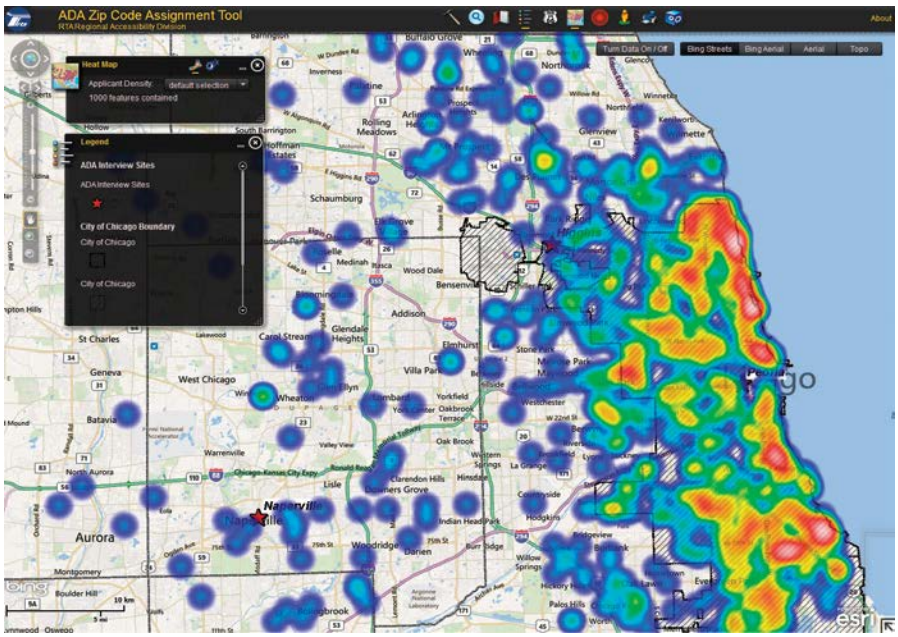
Because GIS is tranforming, so is your job. GIS professionals will be essential to this transformation.

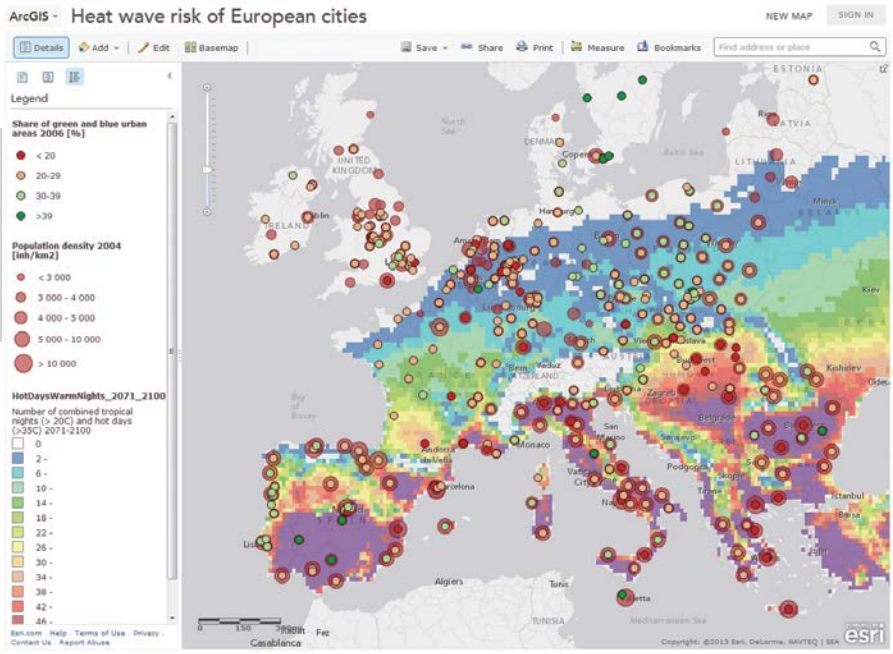
In the last few years, GIS departments have dealt with less of some things (fewer staff members, less time, and smaller budgets) and a lot more of other things (end users to support, technologies and platforms to implement and maintain, and new data types). It's now time to let go of a few things. Let go of the search for that monolithic killer that will meet all your organization's needs. Let go of making endless one-off paper maps. Let go of PDFs on your website that are nearly obsolete as soon as they are created.

These things should not be your focus.

The world moves too fast, and your time is too valuable to be spent on lower-level tasks. Embrace web GIS and the multiplier effect it can have on your impact on the organization. As a GIS professional, web GIS is the best way to increase the value of your work by sharing it with non-GIS staff. People in your organization who are eager to use maps can now do that on their own consumer devices.

↓ Instead of taking a month to fullfill each request for a hard-copy map, the Regional Transportation Authority (RTA) directs internal and external customers to an online map where they can interactively select a dataset, transit service, or jurisdiction and view it and run analyses on it in a matter of minutes.





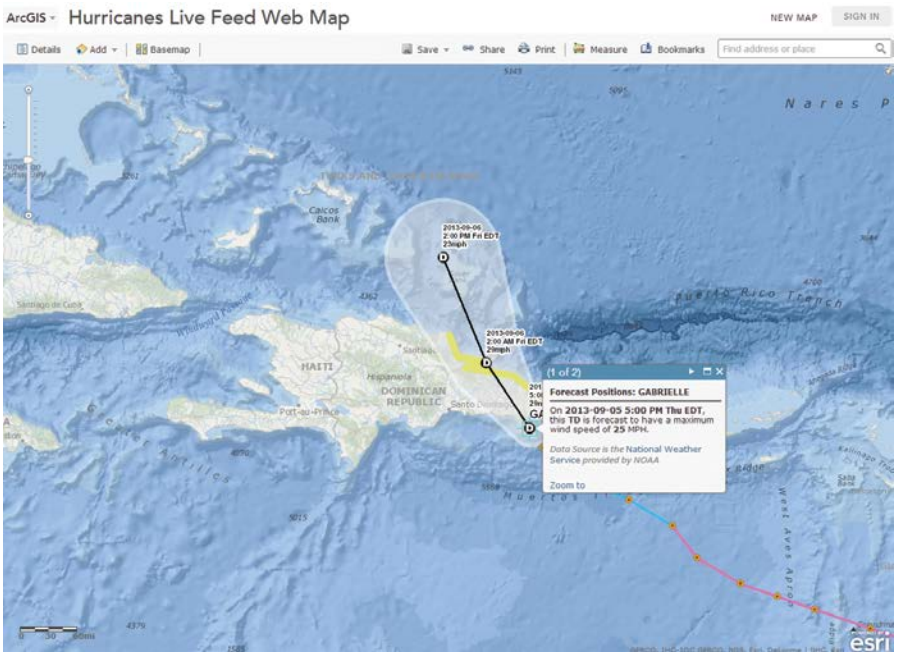
↑ With Web GIS, you and your users can incorporate information from outside the organization by using the vast collections of ready-to-use maps and other resources shared on ArcGIS Online such as this map created by the European Environmental Agency showing the heat wave in Europe during the summer months of 2013.

ArcGIS for Desktop remains the primary tool for creating authoritative data and high-quality maps. A library of useful maps and resources built using desktop GIS is the foundation of web GIS. In recent years, map publishing workflows have been reengineered to make it simpler to move work from the desktop to the web. Desktop users can contribute maps and make them available to as many people as desired almost instantaneously from literally any device or client.

Beginning with ArcGIS 10.2, more GIS services will be available from ArcGIS Online, including analytical services such as routing with live traffic data, terrain analysis, and enhanced worldwide geocoding. ArcGIS 10.2 also introduces a new ArcGIS for Server extension called Portal for ArcGIS that delivers mapcentric content management and web maps tools like ArcGIS Online but is designed for users who host ArcGIS completely within their own infrastructure.

ArcGIS Online and Portal for ArcGIS multiply the value of ArcGIS for Server investments by transforming ArcGIS for Server services into information products that are easily available to anyone in the organization, solving the challenge of providing information quickly in a usable format. Organizational users can use maps and layers as is, add local data, or include data and services from ArcGIS Online to answer their own questions and create new information that can be shared back. With ArcGIS for Server and ArcGIS for Desktop, both servers and desktops can be connected with ArcGIS Online to create a fully integrated web GIS.

↓ Because web GIS is based on simple protocols like REST, it can integrate data from many sources such as the live data feeds of current and recent tropical storm locations obtained from the National Hurricane Center and the Joint Typhoon Warning Center.

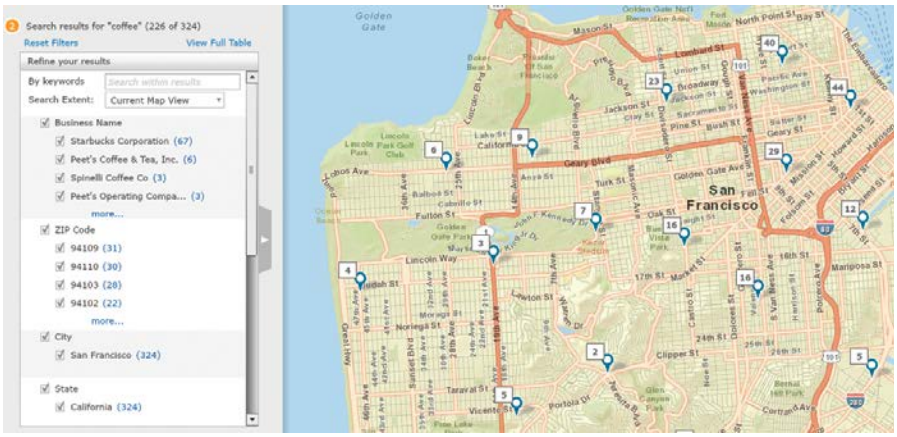


Web GIS Increases the Demand for GIS Professionals

Many GIS departments are using web GIS to carry out their traditional activities more effectively by enabling users to benefit from the powerful visualization and analytic tools available from ArcGIS Online. Other GIS departments are expanding the vision and role of mapping and GIS by involving all parts of their organizations.

In either case, web GIS is being implemented as single-topic self-service maps and apps that don't require training or tutorials. Want to know where parks are in your city? Web GIS has an app for that—specifically, the Park and Recreation Finder app available from the AcGIS for Local Government Resource page. These and the many other map apps and templates are constantly developed and released by Esri.

These apps let users help themselves to answers using your organization's most



↑ GIS professionals with a strategic mindset speed implementation and limit cost by using cloud-based solutions like Esri Business Analyst Online that require no infrastructure.

current data. They solve common problems and require only configuration to get them up and running, eliminating the long (and expensive) development cycles associated with traditional monolithic, "do it all" applications. Using this approach lets GIS departments get a greater return on existing investments in GIS.

In a world increasingly transformed by geospatial information, there is an increasing demand for GIS professionals who possess knowledge and skills that include

- Organizing and managing geographic data
- Designing maps as effective information products for decision makers and the public
- Understanding GIS system configurations and architecture
- Engineering workflows for systematically collecting and updating geographic data layers
- Working with institutions to integrate GIS and geographic data with other systems
- Managing policies for data sharing and collaboration
- Designing and building applications and apps that support organizations in the use of geographic information
- Advocating the use of geographic thinking in problem solving across organizations
- Ensuring continuity of information management
- Creating decision support applications
- Integrating geographic data with enterprise computing and other enterprise-focused IT technologies
- Integrating remote-sensing data with GIS
- Developing collaborative relationships with other information providers
- Finding and acquiring the best commercial data sources
- Performing geospatial modeling
- Applying geodesign techniques

However, to be successful in this new environment will require more than just a diverse skill set. It will require GIS professionals who have a strategic mindset and use a business-oriented approach to implementing GIS. They will succeed by seizing opportunities for combining existing data in new ways with data and services available from ArcGIS Online and always favoring configuration over customization when choosing solutions. When possible, they will speed implementation and limit cost by using cloud-based solutions like Esri Community Analyst and Esri Business Analyst Online that require no infrastructure. GIS professionals also need to see users as customers. They need to be GIS evangelists and sell GIS by exceeding user expectations.

Self-serve apps don't replace GIS professionals. Freed from rote tasks by self-serve web apps, GIS professionals can concentrate on high-value activities like the creation of authoritative datasets and spatial analyses that yield actionable information for the organization. By embracing the new capabilities of web GIS, the benefits of GIS can be spread across organizations.

A New Chapter

By any measure, this is an exciting time for GIS professionals. Web GIS is opening the world's eyes to the power of spatial visualization of information, and this change in perception is transforming how people understand the world. Nevertheless, the fundamental mission of the GIS professional—helping streamline processes, inform decision making, and improve communication by incorporating a geographic perspective—remains the same.

Just for GIS Professionals

A new website, ArcGIS for Professionals (pro.arcgis.com), provides a central location for resources for applying the new web GIS pattern. This website has been designed to help GIS professionals maximize their effectiveness and success with this new approach to GIS.

Site content spans experience levels from those just starting GIS careers to administrators and developers. Beginning with common tasks, such as compiling and analyzing data, mapping, and organizing projects, pro.arcgis.com also provides extensive information and tips on using new tools and applications available with ArcGIS 10.2. Now tasks that were previously more complex and time-consuming on the desktop can be handled using tools, services, and apps, and GIS use can be expanded across the organization. The site directly links to support, tutorials, training, documentation, and information on administering GIS.

Mirror, Mirror

A self examination for GIS managers

Do you want to ensure your GIS survives any imminent or future reorganization of your organization? Adam Carnow assembled the following questions to help you identify areas for improvement (and perhaps even growth) that can make your GIS an indispensable part of your organization's operation. Carnow, a GIS professional for more than 21 years, is an account executive in Esri's southeast regional office in Charlotte, North Carolina, where he helps local governments use GIS more effectively. These questions address not only your processes and goals but also what you and others in the organization think about your GIS program.

What do you think about your GIS program?

Can you justify your GIS budget?

Are you prepared for change?

Are you proactive or reactive?

Are you innovative?

What plans do you have for your GIS?

How do you measure success for your GIS?

Are you proud of your GIS?

What do others think about your GIS program?

Is there a bottleneck in your organization for access to GIS?

Do you have management support?

Is your GIS a mission critical enterprise IT system?

Does your annual GIS budget include funding for software, hardware, training, services, and data?

Are you using the latest technology?

Are you using shapefiles?

Are you using ArcGIS 10.1? Have you made plans to move to 10.2?

Do you have IMS or Web ADF applications in production? If so, when will they be replaced?

Are you using ArcGIS Online?

Do you provide easy-to-use, focused apps available on any device?

Do you prioritize Commercial Off-The-Shelf (COTS) applications over custom solutions?

Do you favor solutions you configure over those you code?

Have you implemented GIS across all five business patterns (e.g., apps that help manage data, transform data into actionable information, get information in and out of the field, disseminate knowledge where and when its needed, and engage constituents?

Are you participating in the Community Maps program?

Are you using ArcGIS for Local Government?

Are you using Community Analyst?

Do you follow IT, GIS and Esri best practices in your implementation of GIS?

How do you run your GIS program?

Do you know your customer's needs?

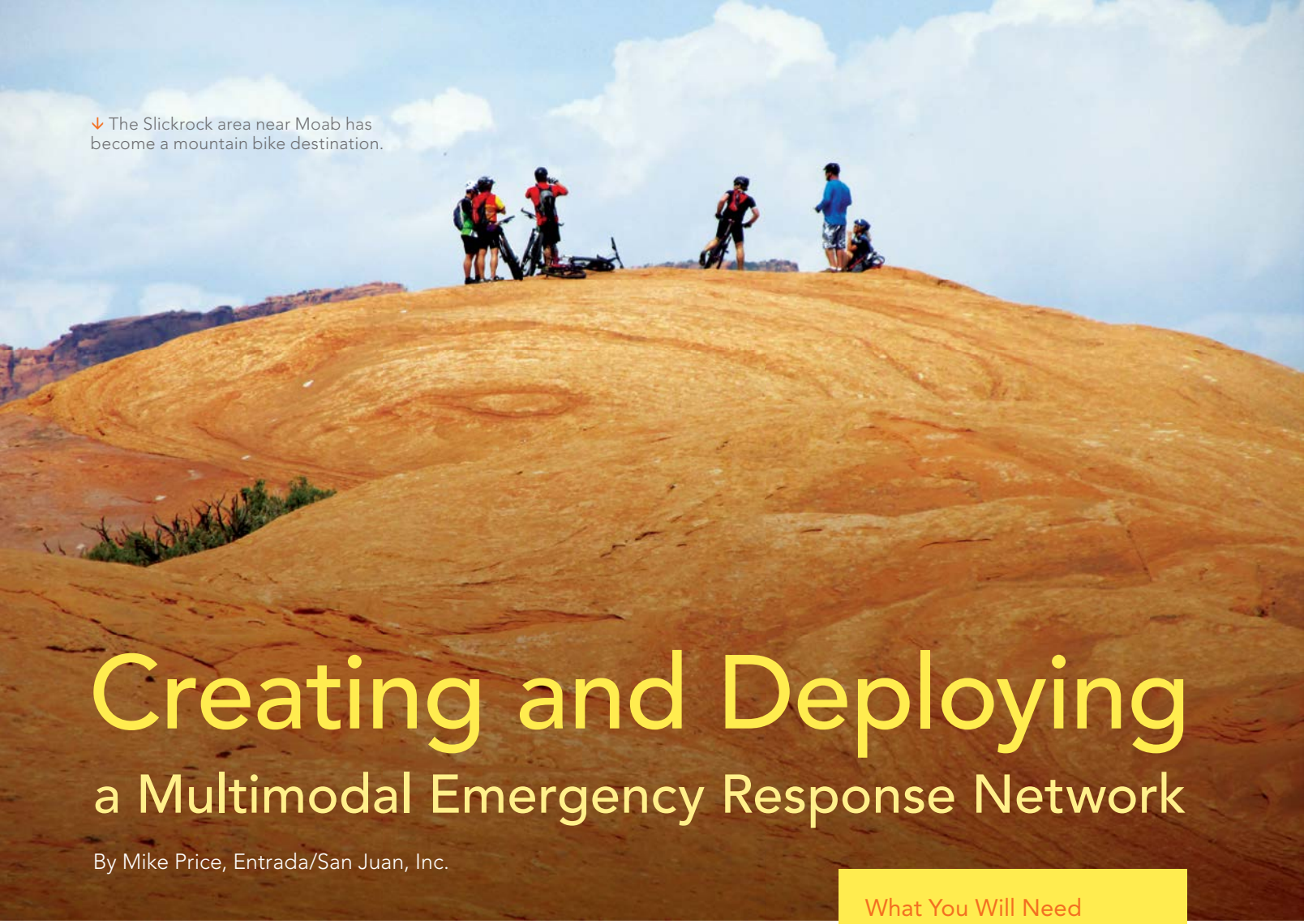
Do you run your GIS like it is a private business, eliminating competition, increasing your customer base by exceeding their expectations, and generating a profit?

Is your GIS integrated with enterprise IT systems?

Do you sell your GIS to your management?

To be an effective enterprise-wide GIS, it should be woven into the fabric of daily operations. It should be the core technology of a business. If it's not, something needs to be fixed. Create a system everyone needs and can use. Make GIS an indispensible technology platform for your organization.

Adam Carnow can be reached at acarnow@esri.com or followed on Twitter at @AdamCarnowEsri.



↓ The Slickrock area near Moab has become a mountain bike destination.

Creating and Deploying a Multimodal Emergency Response Network

By Mike Price, Entrada/San Juan, Inc.

In addition to expertise in GIS and data modeling, author Mike Price has extensive experience as a first responder and has been a volunteer fire fighter in Moab, Utah, for several decades. Approximately six years ago, he began experimenting with a multimodal response network, combining data on nearby trails and county roads into a single complex network. To predict travel times on various trail segments, he modeled slope using a US Geological Survey 10-meter digital elevation model and has field tested travel times by foot, bike, and motorized vehicle.

What You Will Need

- ArcGIS for Desktop (Basic, Standard, or Advanced license) 10.1 or 10.2
- ArcGIS Network Analyst extension
- Sample dataset downloaded from *ArcUser* website
- Unzipping utility such as WinZip
- Intermediate skills with ArcGIS for Desktop
- A good understanding of ArcGIS Network Analyst

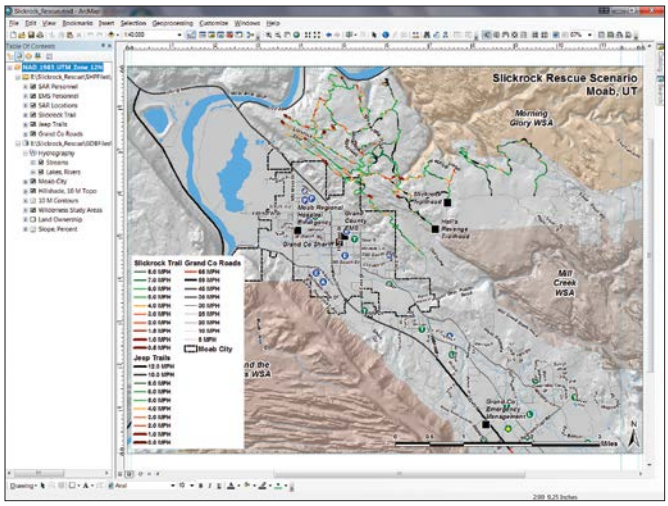
In the exercise scenario, an off-duty emergency medical technician (EMT) who is hiking on a mountain bike trail in Moab, Utah, encounters a cycling accident. A cyclist has taken a tumble and appears to have broken his collarbone and sustained abrasions but is conscious and coherent. The EMT calls 911, reports the victim's location and condition, and awaits emergency personnel.

Response to this incident will require identification and routing of emergency medical and search and rescue (SAR) responders to their base facilities in and near Moab as quickly and efficiently as possible. The exercise describes how to create a multimodal network dataset to accomplish this. It ends with queuing these resources for deployment.

Preparing Data for a Multimodal Network

This portion of the exercise will consist of creating a Transportation geodatabase, building a new feature dataset, importing the transportation shapefiles into it, and calculating distance and time fields for those layers. To begin this exercise, go to the *ArcUser* website and download the Slickrock Rescue training set. Unzip it to a local drive.

1. Start ArcMap 10.1 and choose Customize > Extension to verify that a Network Analyst extension is available and active. Choose Customize > Toolbars to make the toolbar visible.
2. Open \Slickrock_Rescue\Slickrock_Rescue.mxd and inspect the data layers and their sources. Basemap data resides in a file geodatabase, and all transportation layers are shapefiles.



↑ The sample dataset for this exercise comes from the Slickrock area of Moab, Utah, which is a popular destination for mountain bikers.

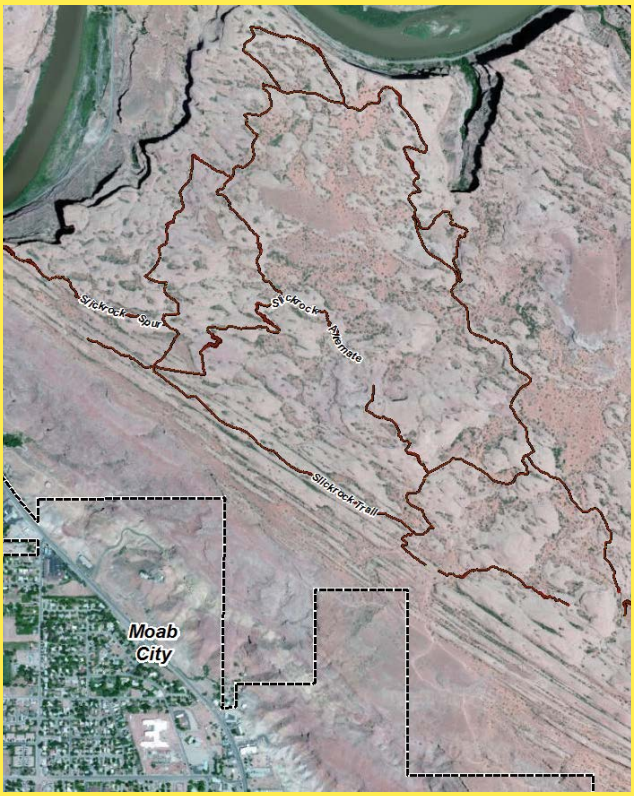
3. Close ArcMap and open ArcCatalog. Navigate to \Slickrock_Rescue_GDBFiles, right-click the UTM83Z12 folder, and create a new file geodatabase named GC_Transportation.
4. Right-click GC_Transportation and choose New > Feature Dataset. Name it SR_Response. Set the coordinate system to NAD 1983 UTM Zone 12N and accept the defaults for the rest of the parameters.
5. To import roads and trails into this feature dataset, right-click SR_Response and select Import > Import Feature Class (single). In the ArcCatalog window, select Slickrock Trail from the SHPFILE folder them to the Import wizard. To ensure that the entire shapefile is imported, click the Environments button at the bottom of the Import wizard and set the Processing Extent to Union of All. *This is a very important step.* Click OK. Repeat the process for Jeep Trails, and Grand Co Roads shapefiles.
6. After all transportation feature layers are imported, close ArcCatalog and open ArcMap. Create a new Group Layer in the TOC called SR_Response and drag the new layers to it.
7. To reuse thematic mapping that already exists for shapefiles, change the data pointer from each source shapefile in Transportation Group to its corresponding Feature Class in SR_Response. Begin by double-clicking Slickrock Trail to open its Properties, click the Source tab, and click the Set Data Source button. Choose Transportation_Group_Slickrock_Trail as the data source. Repeat this step for Jeep Trails and Grand Co Roads. Once this is done, remove the SR_Response group from the TOC and save the map.
8. Right-click the Slickrock Trails shapefile and open its attribute table. Notice that slope-adjusted speeds are already posted, but the segment distances in miles (MILES) and travel times in decimal minutes (MINUTES) are set to zero.
9. Right-click the MILES header and select Calculate Geometry. Calculate the Length in Miles US.

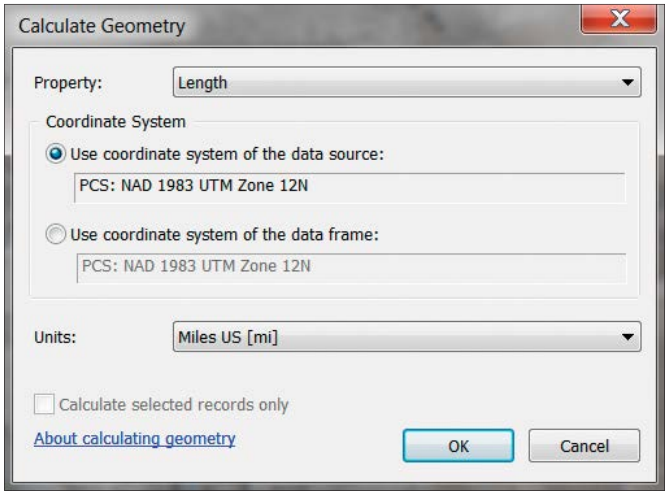
A Little about Slickrock

In 1969, a motorcycle trail was established on barren, weathered Navajo Sandstone less than two miles northeast of Moab. Occasionally, motorcycle riders and hikers used the trail during the 1970s but in the early 1980s, it was discovered by mountain bikers. Since then, it has developed into a leading destination that attracts thousands of mountain bike riders each year.

With increased recreational use, accidents, injuries, and rescues have become very common. The Grand County Search and Rescue (GCSAR) group is often the busiest SAR agency in Utah, locating and extricating injured or lost bikers, hikers, rafters, and others, from dangerous situations throughout southeast Utah. Because of its popularity, the Slickrock Trail is often the most frequent response location. Fortunately, its trailhead is less than two miles from downtown Moab. The terrain is very open, and the trail is well marked. Unfortunately, for rapid response and victim extrication, it presents some of the most rugged terrain in the Four Corners region

The Slickrock Trail is crisscrossed by the rugged and very popular Hell's Revenge Jeep trail. The trail was established in 1980 by Moab's Red Rock Four Wheelers. Hell's Revenge follows old jeep and seismographic trails and provides viable options for travel by emergency responders using small four- and six-wheeled vehicles. Both trails connect to the Grand County road system just two miles from Moab.





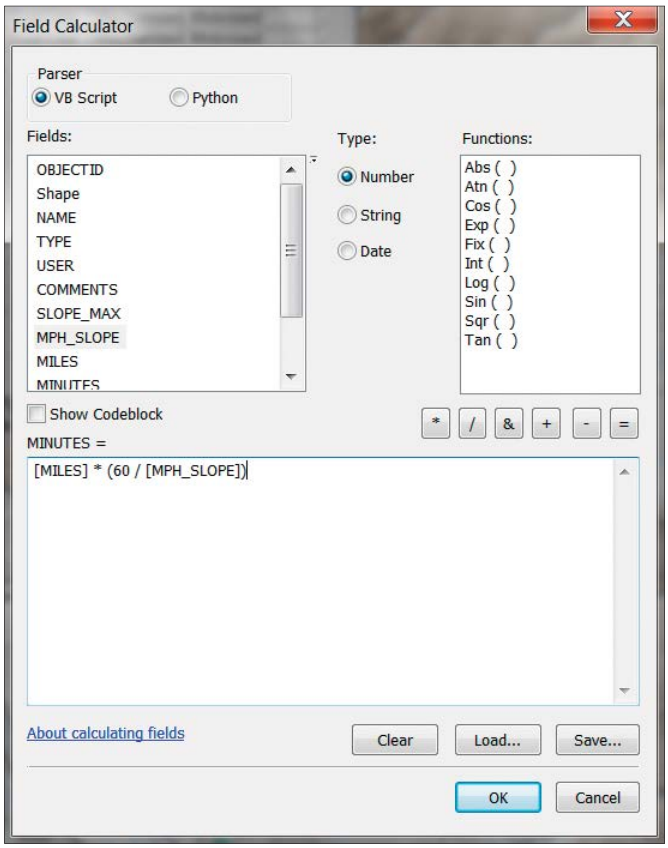
↑ Calculate the Miles field by Calculate Geometry, a content menu choice available when the header for the Miles field is right-clicked.

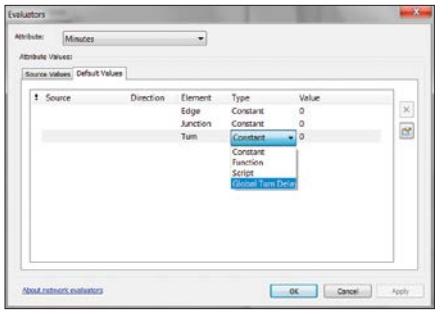
10. Once MILES are calculated, the travel time MINUTES for each segment can be calculated using its length and slope-adjusted speed. Right-click the MINUTES field header, open the Field Calculator, and use this formula:
    MINUTES = MILES * (60 / MPH_SLOPE).
    Carefully check the expression before clicking OK.
11. Perform the same operations on Jeep Trails. For Grand Co Roads, calculate length in miles for the MILES field. For the MINUTES field, use
    MINUTES = MILES * (60 / SPEED_MPH)
    as the expression.
12. Save the map and close ArcMap and reopen ArcCatalog. When creating and building a network dataset, data locks are often problematic. To avoid possible locks, create and build SR_Response in ArcCatalog with ArcMap closed.

Creating a Network Dataset in ArcCatalog

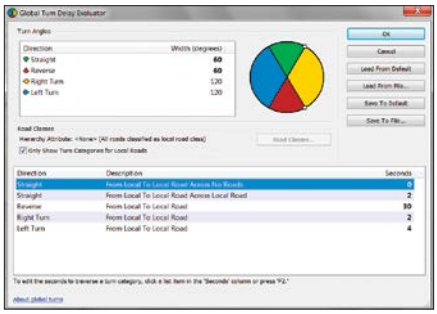
1. Open ArcCatalog and choose Customize > Extension and verify that a license for the Network Analyst extension is available and is active.
2. Navigate to Slickrock_Rescue\GDBFiles\UTM83Z12\GC_Transportation\SR_Response and right-click the SR_Response dataset. Select New > Network Dataset. Click Next.
3. Accept the default name and specify a 10.1 network dataset. (Note that while 10.0 is an alternate version, 9.x is not.) Click Next and, in the next window, click the radio button next to Select all feature classes. Click Next.
4. Click Yes for Global Turns for all network participants and click Next. Click the Connectivity button and check the Connectivity Policy for network participant. They are designed to perform with endpoint connectivity, so verify that End Point has been specified. For some networks, Any Vertex might be considered, but these are very carefully constructed, and End Point is a very safe, stable choice. Click OK to close this window and click Next.
5. The Grand County roads and trails are quite simple, with no one-way streets or limited access, so this network will not use elevations to modify connectivity. Click the None button and click Next.

↓ Use the Field Calculator and a simple expression to calculate the MINUTES field.

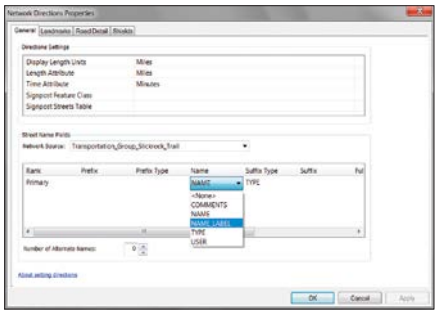




↑ When creating the Network Dataset in ArcCatalog, use the Evaluators dialog box to set the Global Turn Delay.



↑ Make routing realistic by refining the parameters for global turn delays.



↑ For each of the feature datasets, change the Street Name Fields section.

6. Now to add to the global turn rules. Minutes is the default evaluator, but Miles is also available. Select Minutes, click the Evaluator button, and click the Default Values tab. On the Turns line, click Constant and change Turns to Global Turn Delays. To define directional turns, press the F12 key to open the Global Turn Delay Evaluator. In this dialog box, set Straight Across No Roads to zero (0), Straight Across Local Road to 1, Reverse to 30, right Turn to 2, and Left Turn to 4. Click OK twice and then click Next.
7. Now for the tricky part. Setting Directions will require reassigning the Name field to a predefined field in each dataset called NAME_LABEL and click the Direction button. For each network source (Slickrock Trail, Jeep Trails, Grand Co Roads), click the NAME header and select NAME_LABEL from the drop-down. Click OK, then Next, one more time.
8. Review the New Network Dataset Summary and click Finish. When asked to build the new network dataset, click Yes. Close ArcCatalog when processing has finished.

Rounding up Resources

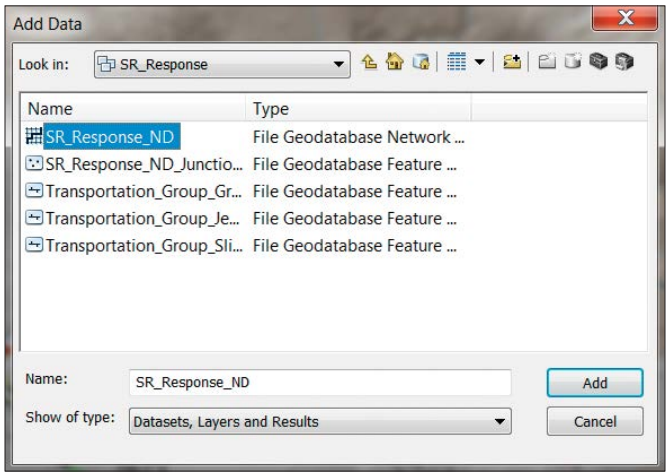
1. Restart ArcMap and open the Slickrock_Rescue map. Click Add Data, navigate to the Slickrock_Rescue\GBDFiles\UTM83Z12\GC_Transportation\SR_Response feature dataset, and add SR_Response_ND. When prompted to add other participating feature clases, click No. *Do not add other participating feature classes because the necessary ones are already in the map.*
2. Right-click on an open area of the Standard toolbar and open the Network Analyst toolbar. This toolbar will be used to perform most of the rescue mapping tasks. Dock the Toolbar in the upper left, above the TOC.
3. Using the Network Analyst toolbar, open the Network Analyst window and park it to the right of your TOC. If you wish, you can use the toolbar's Route function to test the network's performance by dropping two or more points anywhere on the map, including the Bike Trail, and routing between them. Now formally test the network by using the Network Analyst Closest Facility (CF) function to locate emergency responders and route them to appropriate assembly points.

Running Closest Facility Backward

The training data includes the locations of 14 fictional Grand County SAR members who live throughout the Moab Valley. They are symbolized by rank inside green circles. The SAR operations base, symbolized with a black square, is 2.5 miles south of Moab at the Grand County Emergency Operations Center (EOC) on US Highway 191. The commander lives "just across the road." To route SAR

Agency/Facility	Minimum Personnel	Activation Time, Minutes	Travel Time, Minutes	Deploy Time, Minutes	Response Time, Minutes
Grand Co SAR	4	2	2	3	7
	6	2	3	3	8
	8	2	4	3	9
Grand Co EMS	2	1	2	2	5
	4	1	3	2	6
	6	1	3	2	6
Grand Co Sheriff	1	1	0	1	2

↑ Table 1: Response times for agencies in Grand County

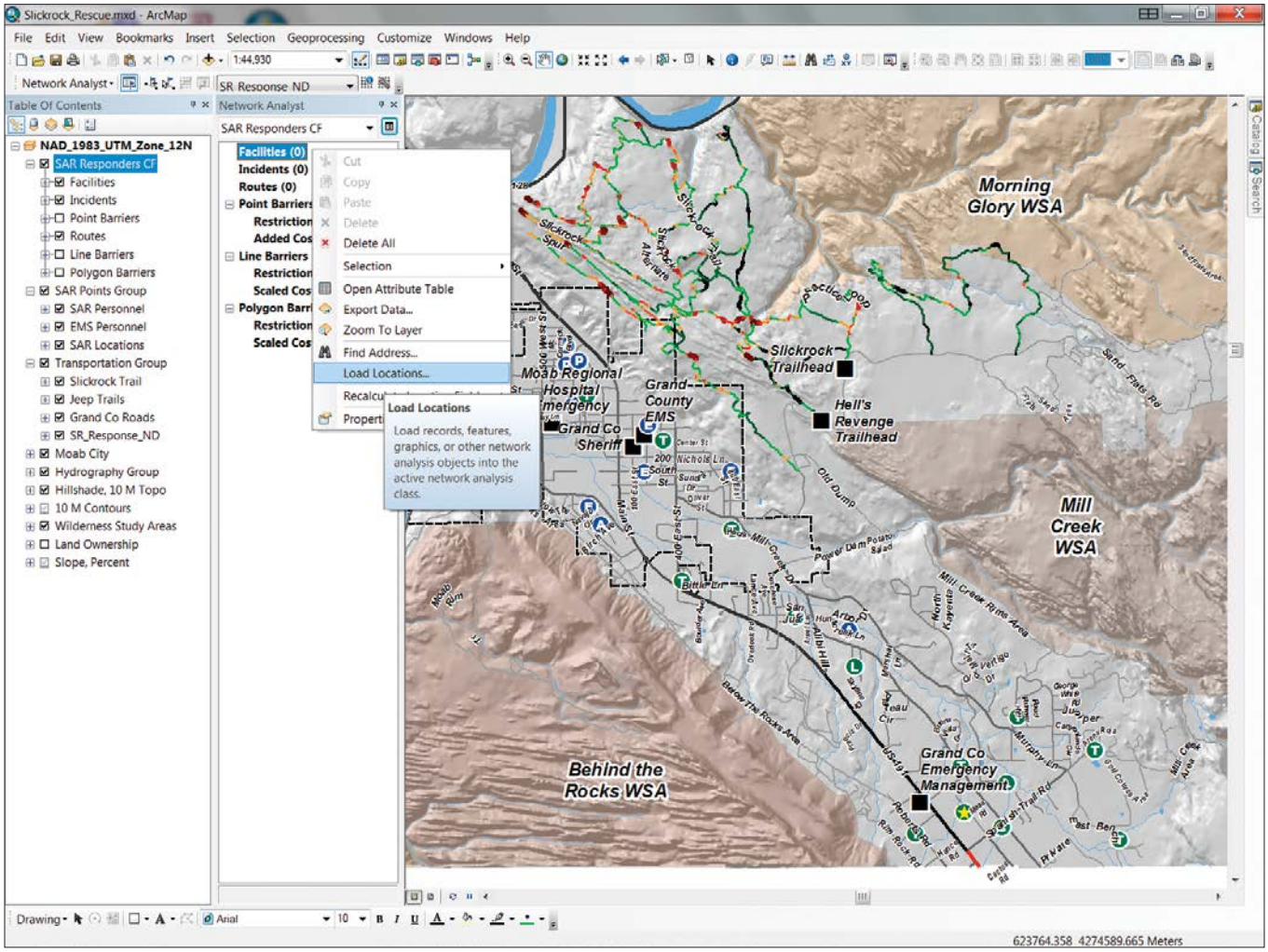


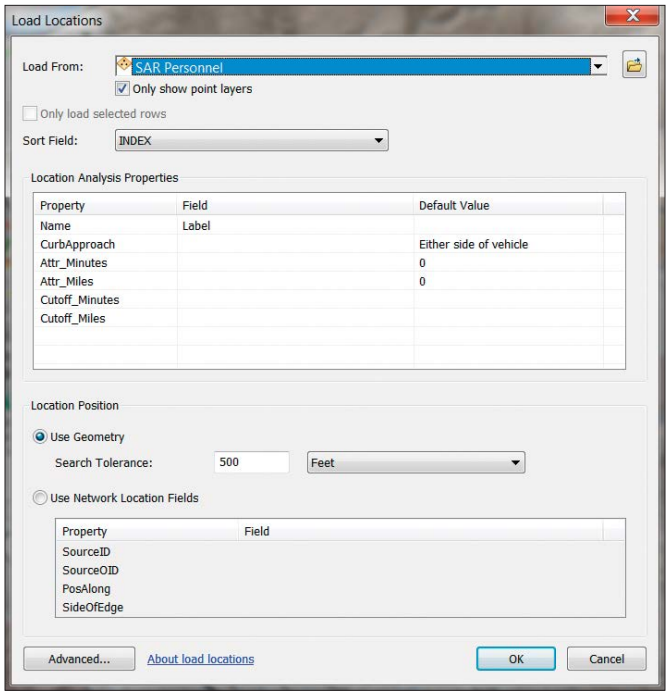
↑ After closing ArcCatalog, open ArcMap and add SR_Response_ND.

personnel from their homes to the EOC, we will reverse the typical Closest Facility workflow. This process will accumulate an effective response force and estimate the typical lead time required to assemble responders.

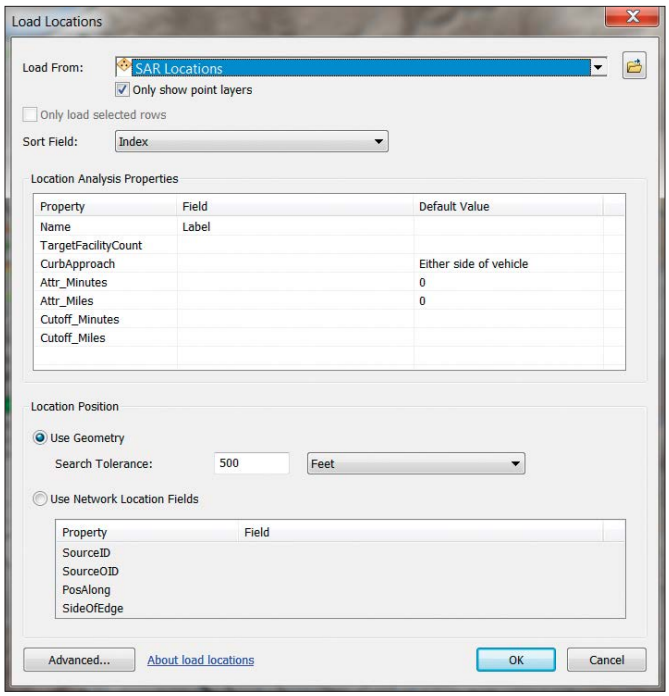
1. In the Network Analyst toolbar, click the drop-down and select the Closest Facility solver. The empty CF solver will load at the top of the TOC and appears in the Network Analyst window. Double-click Closest Facility in the TOC and open its Properties. Change the Layer Name to SAR Responders CF and close the Properties window.
2. In the Network Analyst window, right-click Facilities. (Yes, Facilities is correct because this CF analysis is being run backwards.) Select Load Locations. In the Load Locations window, choose Load From to SAR Personnel. Set the Sort Field to Index, the Name to Label, and the Search Tolerance to 500 Feet. Click OK and watch the 14 personnel points load.
3. Right-click Incidents > Load Locations. In the dialog box, set Load From to SAR Locations and set Sort Field to Index and

↓ To route SAR personnel from their homes to the emergency center, reverse the typical Closest Facility workflow and load SAR Personnel as Facilities.





↑ When loading locations into the SAR Response CF, set the Sort Field to INDEX and the Search Tolerance to 500 Feet.

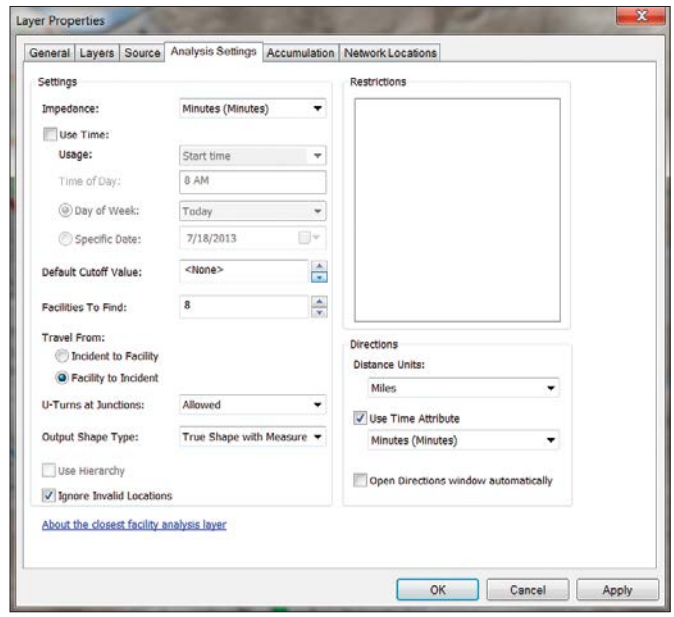


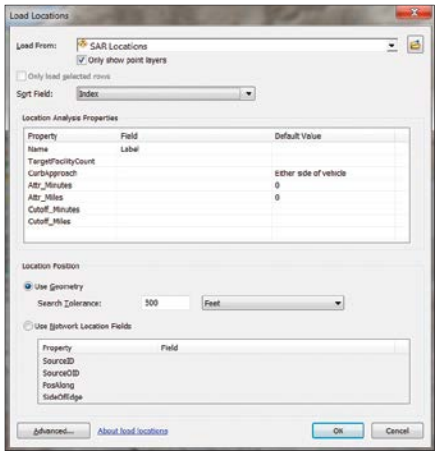
↑ Load SAR Locations as the Incidents and delete all but the Grand County Emergency Center.

→ In the Layer Properties for the SAR Responders CF, set Travel From to Facility to Incident and set Facilities to Find to 8.

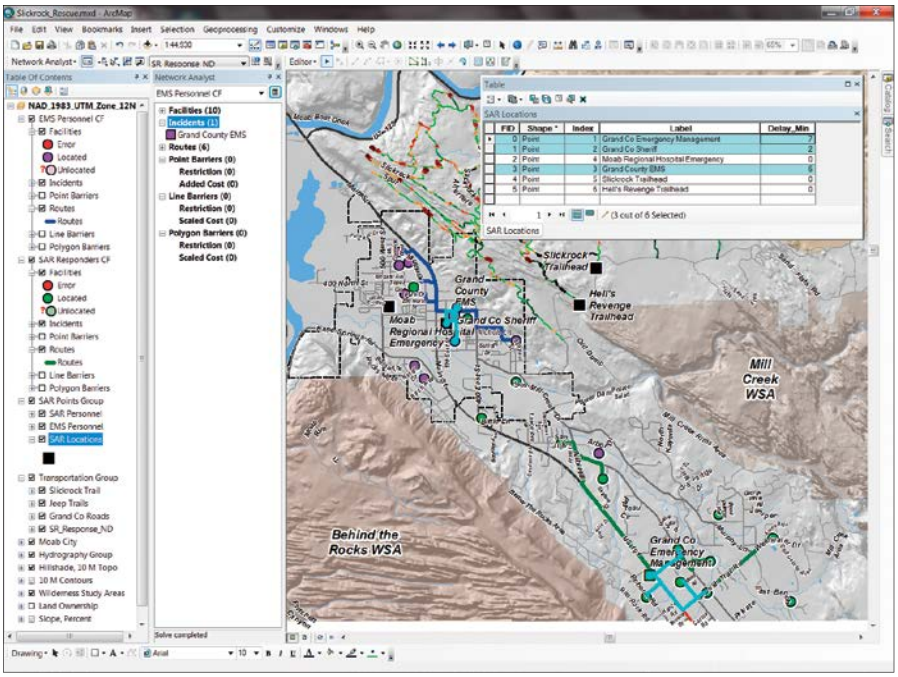
Name to Label. Click OK, and six incidents will load.

4. To retain only the Grand Co Emergency Management incident, open the Incidents set in the Network Analyst window, select all records except Grand Co Emergency Management, and delete them. Deleting unwanted records makes the IncidentID field much more functional.
5. Double-click on SAR Responders CF to open its properties and select the Analysis Settings tab. Click the radio button next to Travel From to Facility to Incident and set Facilities To Find to 8. Keep the other defaults. (Hint: You may change the Output Shape Type from the default True Shape with Measure to True Shape; Straight Line, creating a traditional spider diagram; or to None, which is sometimes useful for very large CF routines.) Click the Accumulation tab and select both Miles and Minutes. Click OK to close Properties.
6. Now to route SAR responders. In the TOC, right-click SAR Responders CF and click Solve. The solver should quickly execute and create eight polyline routes from SAR residences to the Grand Co Emergency Management.
7. In the SAR Responders CF, right-click Routes, open its table, and position it at the top of the canvas and resize fields as necessary to make all of each record visible. (This is when a second monitor is helpful.) Be certain that the records are sorted by FacilityRank in ascending order.
8. Inspect the TotalMinutes field and notice that four responders can be routed to the EOC in under two minutes and six responders in less than three and all eight responders should arrive in less than four minutes. These are travel times to the facility only. Remember them and close the Routes table. Now use the Closest Facility routing procedure for EMS Personnel.





↑ Set similar parameters when loading Incidents into the EMS Personnel CF. After loading SAR Locations as the Incidents, again delete all but the Grand County Emergency Center.



↑ Modeling travel times for SAR and EMS personnel and a county sheriff, all traveling from their homes to base facilities allows the arrival times of reponse personnel at a staging area to be coordinated.

Routing EMTs to the Ambulance

The residences of 10 fictional Grand County EMTs, symbolized with blue circles, are located throughout Moab Valley. Most live within the city limits, so their travel time to the ambulance downtown garage should be minimal. The ambulance garage is labeled Grand County EMS.

1. To route EMS responders, create a second Closest Facility solver. In the Network Analyst toolbar, click the drop-down and select the Closest Facility solver. Double-click on the empty CF solver at the top of the TOC to open its properties and change its name to EMS Personnel CF.
2. In the Network Analyst window, right-click Facilities, select Load Locations, and choose EMS Personnel. Set the Sort Field to Index, the Name to Label, and the Search Tolerance to 500 Feet. Click OK.
3. Use the same procedure to load the Incident locations using SAR Locations. Delete all incident locations except Grand County EMS.
4. Open EMS Personnel CF, click the Analysis Settings tab, specify Facility to Incident, and set Facilities To Find to 6. Close Properties, right-click EMS Personnel CF, and choose Solve.
5. Open the Routes table and select two EMTs, who will make up the first team to reach the ambulance. Note that their travel times are less than two minutes. If additional EMTs are required for a multiple casualty incident, additional personnel will require slightly more travel time to reach a second or third ambulance.

Staging

Running the Network Analyst Closest Facility in reverse modeled travel times for SAR and EMS personnel traveling from their homes to base facilities. When modeling an actual response to a SAR incident, the arrival times of reponse personnel at the trailhead or other staging area must be coordinated so they will arrive at appropriate times. Knowing how long it takes SAR and EMS responders to drive to their base will allow determination of reasonable minimum total response times to each facility.

Table 1 lists response times for three county agencies, with options for several personnel counts. Total Response Time represents the time required for a responder to grab their gear and get out the door (Activation), drive to the facility (Travel), and prepare their vehicles for deployment (Deploy). A Grand County sheriff's deputy, also added to the mix, quickly responds directly from the sheriff's Office.

Lag times for minimal deployments can be entered into the attribute table for SAR Locations. Right-click SAR locations, select Edit Features > Start Editing, and open the attribute table. In the Delay_Min field, enter 7 for Emergency Management, 2 for the Sheriff, and 5 for EMS. When finished, choose Stop Editing from the Editing Toolbar. Save the map.

Summary and Acknowledgments

This tutorial teaches an intermediate-level user of the ArcGIS Network Analyst extension how to define and build a multimodal network dataset that models time and distance-based travel throughout the Slickrock area of Moab, Utah.

Special thanks to the Grand County, Utah, agencies that have supported the development of this response scenario and training set. Participating Grand County agencies include the Grand County Sheriff's Office (especially Search and Rescue), Emergency Management, Emergency Medical Services, the Sand Flats Recreation Area team, and the Road Department. I could not have created this exercise without their excellent technical assistance and support.

Wayfinding • Kiosks • Menu Boards
Advertising • Reception • Employee Communications
Emergency Notification • Entertainment • Schedules

One Solution. Many Applications.

Learn more at www.omnivex.com

Looking at Temporal Changes

Use this Python tool for creating ring maps

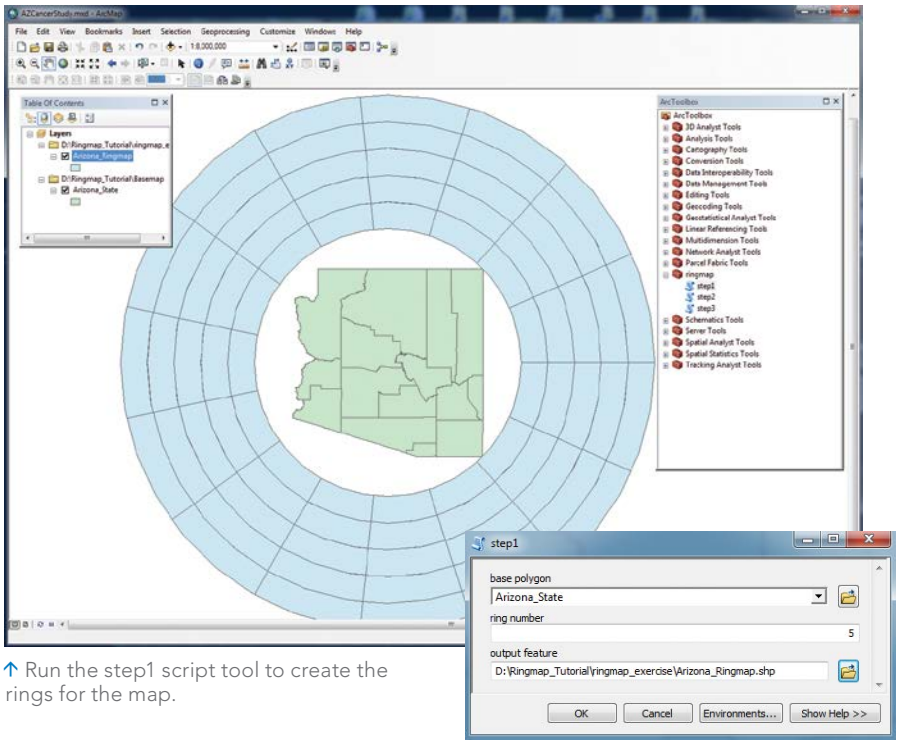
By Ta-Chien Chan, Chien-Min Wang, and Yung-Mei Lee, Center for Geographic Information Science, Research Center for Humanities and Social Sciences, Academia Sinica, Taiwan

The authors have developed a Python tool that steps users through the process of creating a ring map. They have provided this tool in a toolbox along with some sample data that can be used to create a ring map.

The multitemporal dimensions of attribute data are difficult to display in a single map. Traditionally, users either make the multiple line graphs for presenting the temporal trends in different locations or create bar charts on a GIS map. However, multiple line graphs cannot visualize the spatiotemporal correlation together, and bar charts are sometimes problematic because charts may overlap.

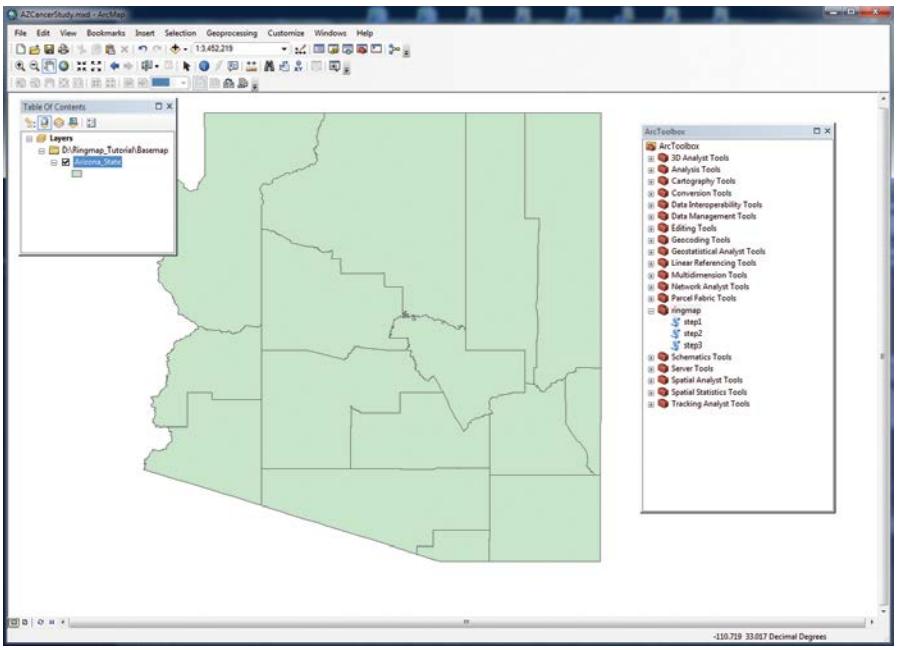
In 2008, researchers at the Georgetown University Medical Center in Washington, DC, proposed using ring maps to integrate the multidimensions or multiattributes data into one simple map. *[This work by Guilan Huang, Sergio Govoni, Jae Choi, David M. Harley, and James M. Wilson was described in "Geovisualizing Data with Ring Maps: Improves comprehension when mapping many variables," which appeared in the Spring 2008 issue of* ArcUser.*]* Ring maps use a basemap as the central feature, and surrounding rings represent the corresponding attributes in each location. Data that varies over time, such as weekly disease surveillance counts, annual cancer incidence/mortality, or monthly crime rates, can all be visualized using ring maps. Other data can be joined and used for exploring the potential contextual associations among the attributes.

Although a ring map is a powerful tool, there was no step-by-step tutorial describing how to make one. The authors developed a tool for creating a ring map in ArcGIS 10.1 using



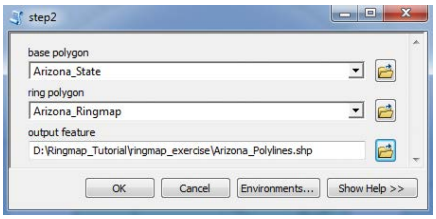
↑ Run the step1 script tool to create the rings for the map.

↓ Open a new map document and add the Arizona.shp file and the ringmap toolbox.

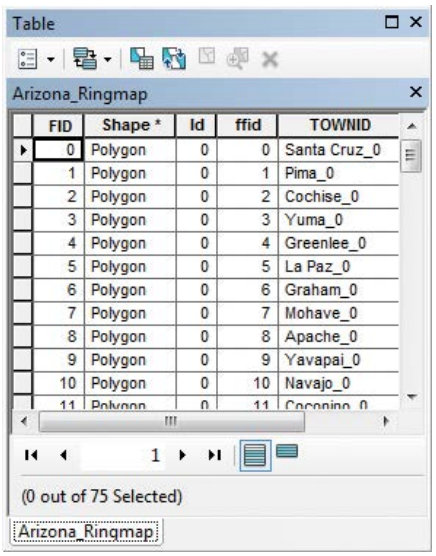


What You Will Need

- ArcGIS 10.2 for Desktop (Basic, Standard, or Advanced license)
- RingMap toolbox and sample dataset from *ArcUser* website
- A zipping utility such as WinZip



↑ Run the step2 script tool to create the lines linking the basemap to the rings.



↑ Open the Arizona_Ringmap attribute table to make sure the TOWNID column was created.

ArcPy and the Python language that can be accessed from ArcToolbox. The tool creates a ring map using a three-step process. The first step creates the number of rings specified by the user. The second step generates polylines that link the rings and the centroids of corresponding locations on the basemap. The third step creates an indexed column so that the attribute table for the ring map can be joined with another table, in this case cancer incidence data in a Microsoft Excel spreadsheet. As the number of rings increases, so does the computation time required.

Getting Started

This exercise uses a sample dataset, containing both training data and the RingMap toolbox, which can both be downloaded from the *ArcUser* website. The data describes age-adjusted female breast cancer incidence from 2006 to 2010 for the 15 counties in the state of Arizona. It was obtained from the Arizona Department of Health Services. The five rings created correspond to the number of years considered in the study data. A shapefile of the administrative boundaries, downloaded for free from a public domain spatial database, Global Administrative Areas (www.gadm.org), is also included in the sample dataset.

After downloading the sample dataset and the RingMap toolbox, unzip it at or near the root directory of a local drive where it will create a folder called Ringmap_Tutorial.

Start ArcMap and load the shapefile named Arizona_State.shp from the Basemap folder. Open ArcToolbox, right-click ArcToolbox in the ArcToolbox window, choose Add Toolbox, and select the toolbox named ringmap from the Ringmap_toolbox folder. The toolbox contains three scripts named step1, step2, and step3.

Click the step1 script to open it. In the script dialog box, choose Arizona_State from the drop-down for basepolygon. Enter 5 for the ring number. Set the output to the ringmap_exercise folder and name it Arizona_Ringmap.shp. *[Make sure to type in the .shp file extension.]* Click OK to create the five-ring polygon.

Click the step2 script. In the script dialog box, select Arizona_State from the basepolygon drop-down. Choose Arizona_Ringmap from the input ring polygon drop-down. Set the output location for line features that will be created to the ringmap_exercise folder and save it as Arizona_Polylines.shp. Click OK to run the script tool and create the lines that will link the ring map to the basemap.

Click the step3 script. In the script dialog box, select Arizona_State from the basepolygon drop-down. Choose NAME_2 (i.e., the county name) for the town field and choose Arizona_Ringmap as the ring polygon. This step creates the indexed column for joining attribute data. Click OK.

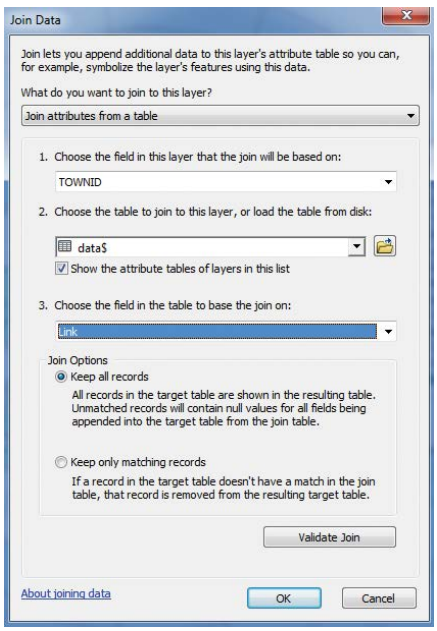
Once step3 has run, open the attribute table for Arizona_Ringmap in ArcMap. The TOWNID is composed of the county name and the order of the ring. Ring numbering begins with zero, so the index named Santa Cruz_0 is the first inner ring of the Santa Cruz county.

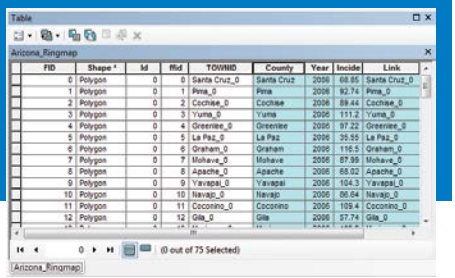
Add cancerdata.xls, the Excel spreadsheet containing cancer incidence data located in the Ringmap_Tutorial folder, to the map. Choose the table named data$.

In the table of contents for ArcMap, right-click on Arizona_Ringmap and choose Joins and Relates > Joins. Join Arizona_Ringmap with cancerdata.xls by choosing TOWNID as the field the join will be based on, choosing data$ as the table to join and Link as the field in the table to use for the join. Click OK.

Reopen the attribute table for Arizona_Ringmap to verify that Arizona_Ringmap and cancerdata.xls have been successfully joined.

↓ Use the TOWNID field to join cancerdata.xls.





↑ Reopen the Arizona_Ringmap attribute tabel to verify that the join was successful.

Double-click Arizona_Ringmap in the table of contents and choose the Symbology tab of the Properties dialog box. Choose Quantities > Graduated colors and set the number of classes to five and method to Quantile. Edit labels and apply a color ramp to symbolize female breast cancer incidence in Arizona for 2006–2010. The inner ring displays data from 2006, and the outer ring displays data from 2010. Apply county name labels and a pleasing color to Arizona_State.

For more information, contact
Dr. Ta-Chien Chan
Center for Geographic Information Science,
Research Center for Humanities and Social Sciences,
Academia Sinica, Taiwan
E-mail: tachien@ sinica.edu.tw

About the Authors

Ta-Chien Chan is an assistant research fellow at the Center for GIS, Research Center for Humanities and Social Sciences, Academia Sinica, Taiwan. His major research interests focus on spatial epidemiology and infectious disease surveillance.

Chien-Min Wang is a part-time research assistant at the Center for GIS who is interested in developing GIS applications.

Yung-Mei Lee is a full-time GIS analyst at Chan's laboratory who is interested in GIS education.

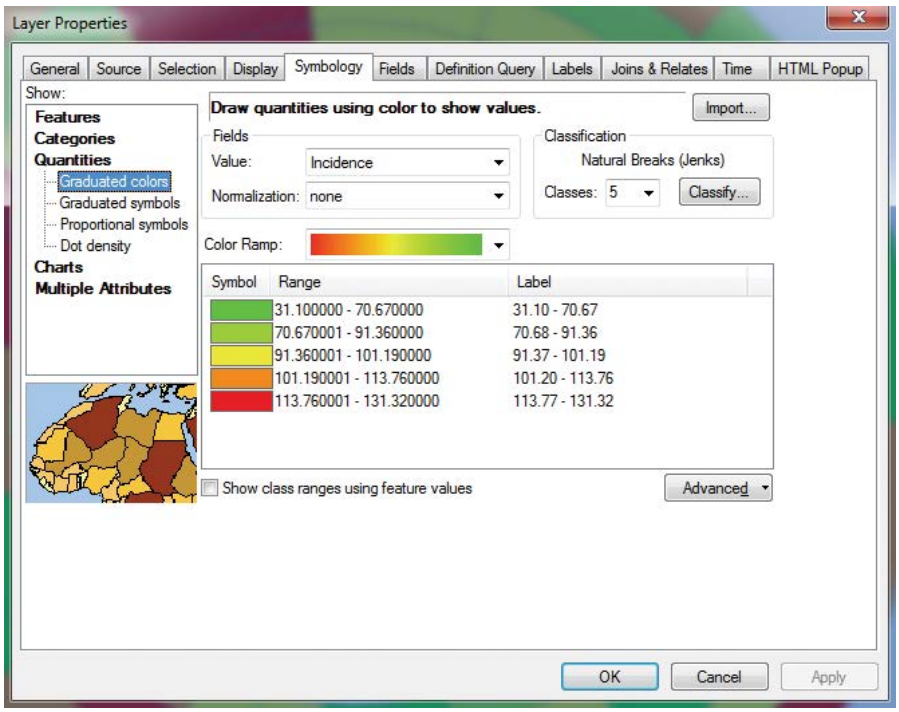
References

Huang, Guilan, Sergio Govoni, Jae Choi, David M. Hartley, James M. Wilson, "Geovisualizing Data with Ring Maps," *ArcUser* vol. 10 no. 2, 2008: pp. 54–55.

Stewart, J. E., S. E. Battersby, A. Lopez-De Fede, K. C. Remington, J. W. Hardin, K. Mayfield-Smith. "Diabetes and the socioeconomic and built environment: geovisualization of disease prevalence and potential contextual associations using ring maps," *International Journal of Health Geography* 2011, vol. 10, no. 18, 2011.

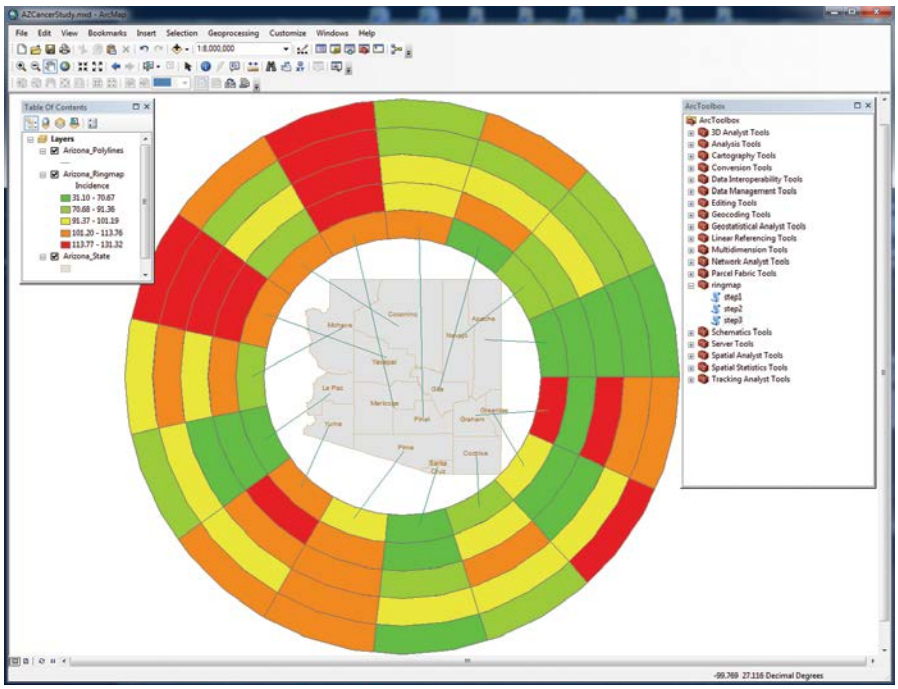
Zandbergen, Paul A., *Python Scripting for ArcGIS*, Esri Press, 2013.

Arizona Cancer Registry Database Query Module Set Selection [http://healthdata.az.gov/query/module_selection/azcr/AzCRSelection.html].



↑ Symbolize the incidence data for each county using graduated colors and add labels to the basemap.

↓ The final map presents cancer incidence data in a compelling manner.



10 cm or better. Everywhere.
Without a base station.
Interfaced to ArcGIS® for Windows® Mobile & ArcPad®

from

ALTUS
POSITIONING
SYSTEMS

with
TERRASTAR™

20725 Western Avenue | Suite 100,Torrance | California 90501 | USA
T: 310-541-8139 | Fax: 310-541-8257 www.altus-ps.com

Looking Good

Properly reprojecting elevation rasters

By Mike Price, Entrada/San Juan, Inc.

Until recently, it was not easy to reproject a digital elevation model (DEM) from geographic coordinates to another coordinate system without introducing significant artifacts.

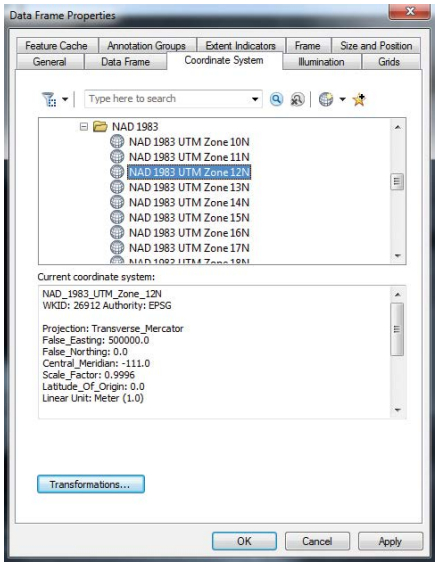
This tutorial presents a workflow for reprojecting a US Geological Survey (USGS) DEM in decimal degrees from geographic to universal transverse Mercator (UTM) coordinates. The sample dataset is the same elevation raster used to calculate slope impedance for "Creating and Deploying a Multimodal Emergency Response Network," a companion tutorial in this issue of *ArcUser*.

In this exercise, you will learn how to reproject the source USGS data into a standard projected system and experiment with two slightly different resampling techniques. When you have looked at both methods, you can decide which you prefer.

The USGS and other federal and state elevation data providers often post DEM data in an ArcGIS grid format, applying geographic (decimal degrees or longitude-latitude) coordinates. The preferred datum is North American Datum of 1983 (NAD83). Elevation is typically reported in meters.

To analyze raster elevation data and display digital topography in three dimensions, it may be desirable (or even necessary) to reproject data to a local projected coordinate system such as UTM or state plane. Occasionally, a significant datum transformation is also required.

For many years, ArcGIS users have "reprojected" elevation and other rasters by assigning the desired coordinate system to a data frame and exporting the raster using the data frame's coordinate system instead of the source raster's coordinate system.

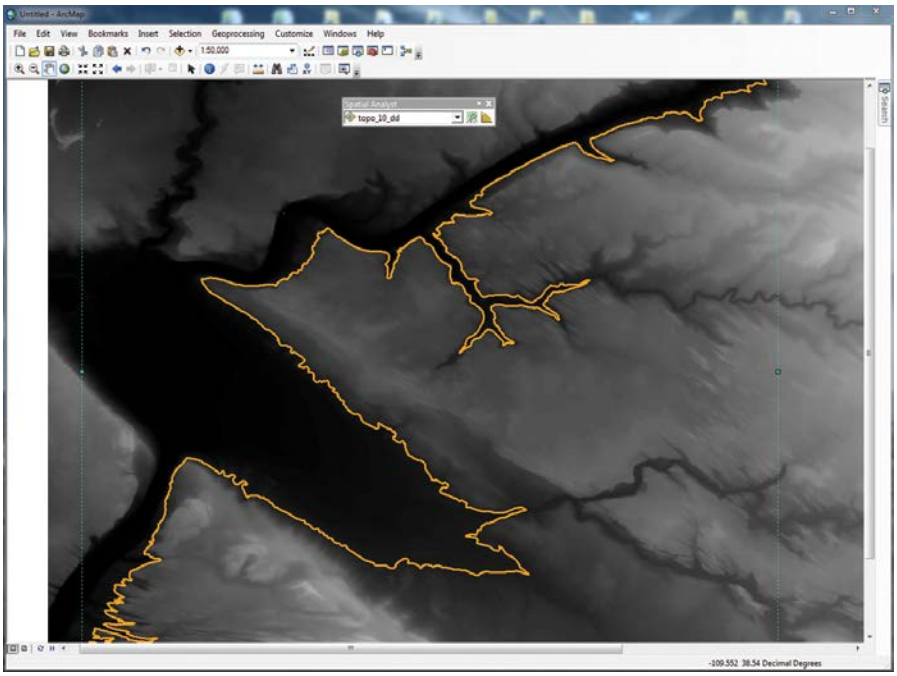


↑ Open the Data Frame Properties dialog box and change the coordinate system to NAD 1983 UTM Zone 12N.

↓ Moab Valley, Utah
(Photo by David Iliff, License: CC-BY-SA 3.0)

What You Will Need

- ArcGIS 10.1 for Desktop (Basic, Standard, or Advanced license)
- ArcGIS 10.1 for Desktop Spatial Analyst extension
- An unzipping utility such as WinZIP
- Sample dataset downloaded from the website (esri.com/arcuser)
- A basic understanding of ArcGIS for Desktop



↑ Use the Create Contour tool from the Spatial Analyst toolbar to create a single sample contour line.

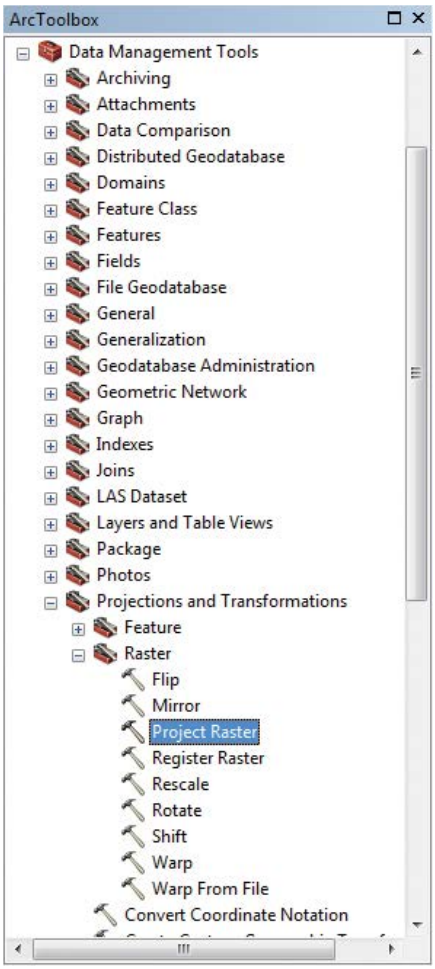
Quick and Dirty: Traditional Raster Projection

Specifying a non-geographic method for the coordinate system and exporting this raster as a new dataset to apply the data frame's coordinate system was often ineffective, especially if the reprojection involved noticeable rotation or shearing. It applied a Nearest Neighbor resampling algorithm. Because topographic data was often inadequately resampled, a significant "herringbone tweed" artifact was created in the reprojected raster that was especially noticeable in hillshades, hydrologic flow networks, or image drapes generated from that raster. For years, the fallback strategy was to keep the source DEM in its original geographic coordinate system as long as possible. However, the raster reprojection tools in ArcToolbox allow users to accurately transform elevation rasters and other grids into a new coordinate system.

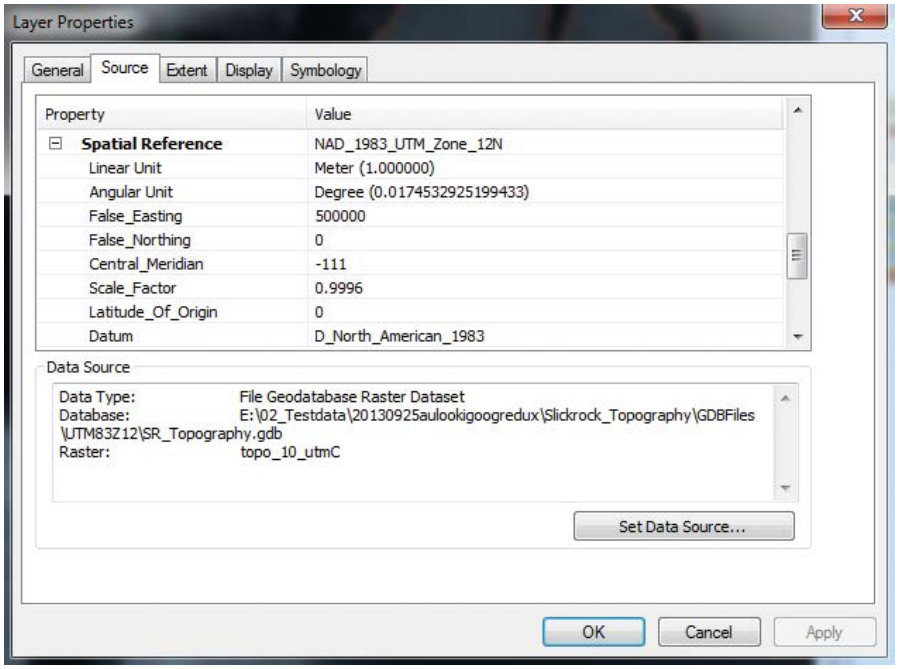
Creating a Sample Contour

Begin by downloading the sample dataset for this tutorial from the *ArcUser* website (esri.com/arcuser). Place the sample dataset archive in a local folder and unzip it.

1. Start ArcMap and open a new map document. In the Standard toolbar, choose Customize > Extensions and verify that the Spatial Analyst extension is available. Choose Customize > Toolbar and select the Spatial Analyst toolbar to display it. Notice that this toolbar has fewer functions than it had in previous versions of ArcGIS.
2. Click the Add Data button, go to the folder where you unzipped the sample dataset, and navigate to the \Slickrock_Topography\GRDFiles\LonLat83 folder. Add the raster DEM named topo_10_dd. This elevation raster was clipped from a larger 10-meter DEM downloaded from the *National Map* website. As its name suggests, the data is registered in decimal degrees. After it loads, note the coordinate system used (shown in the lower right corner of the map canvas). It should show decimal degrees.
3. Open the Data Frame Properties dialog box and the coordinate system to NAD 1983 UTM Zone 12N. Because both datasets use the NAD83 datum, no datum transformation is required. Click the General tab and change the Units Display to Meters and the data frame name to NAD_1983_UTM_Zone_12N to remind you of the destination coordinate system. Close the Data Frame Properties dialog box.
4. The Create Contour tool from the Spatial Analyst toolbar will be used to create a single sample contour line to validate the elevation data. First, verify that the Spatial Analyst toolbar shows topo_10_dd as the current raster. The dark northwest trending area in the DEM is Moab Valley. Select the Create Contour tool and click the rim to

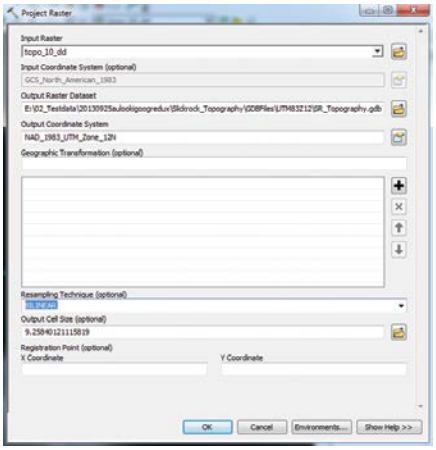


↑ Navigate to Data Management Tools > Projections and Transformations > Raster. Open the Project Raster tool. Stretch the dialog box out completely so all fields are visible.



↑ After topo_utmB has processed, open its properties to verify that it was reprojected.

↓ Click the Resampling Technique drop-down and choose BILINEAR to create the topo_utmB raster. This step is not optional.



the right of the valley floor. A sample contour should appear shortly. If necessary, change the contour line's color for maximum visibility by right-clicking on the contour and choosing Properties.

5. This contour line graphic uses geographic coordinates in NAD83. Leave this line graphic in your map and save the map as SR_Topography.mxd.

Reprojecting the Right Way: Reprojecting Rasters with ArcToolbox

The ArcGIS toolbox provides a much better method for projecting rasters into a new coordinate system. In previous versions of ArcGIS, when raster topographic data was exported to a new coordinate system, the NEAREST (Nearest Neighbor) technique was used by default, which often caused problems. ArcGIS now provides four choices: BILINEAR (bilinear resampling), CUBIC (cubic convolution), NEAREST, and MAJORITY (majority algorithm). The BILINEAR option and the CUBIC option are most appropriate for continuous data, such as this floating-point topography raster. The NEAREST and MAJORITY options are used for categorical data such as a classified integer grid. ArcGIS help provides additional information on these sampling techniques.

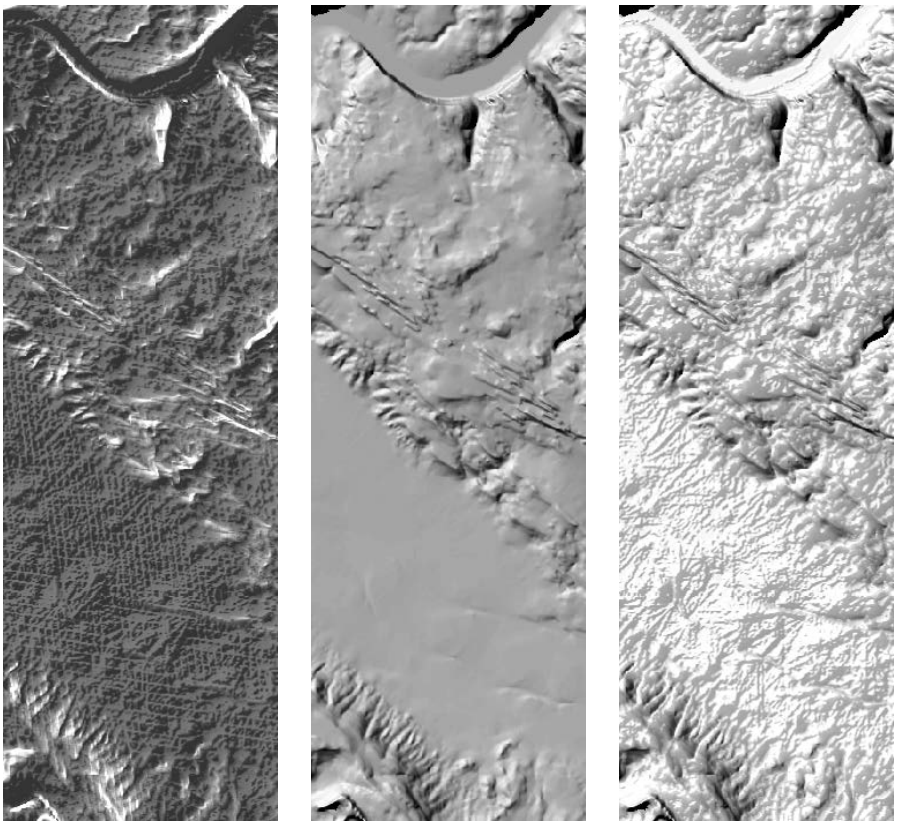
Which technique to use, BILINEAR or CUBIC? After consulting Esri Technical Support, I learned that the bilinear resampling algorithm will smooth the continuous raster within the pixel range without extrapolating values. The CUBIC (cubic convolution) algorithm will follow a curve method and might interpolate pixels slightly above or below their source values.

Try both techniques and name each output raster accordingly. The BILINEAR output will be named utmB, and the CUBIC output will be named utmC. By trying both, you can assess just how much smoothing is acceptable or desirable for this topographic dataset; you can let contour lines help you decide.

1. Add ArcToolbox to the map document and navigate to Data Management Tools > Projections and Transformations > Raster. Open the Project Raster tool. *Stretch the dialog box out completely so all fields are visible.*
2. Click the drop-down next to Input Raster and choose topo_10_dd. Notice that the Input Coordinate System is GCS_North_American_1983.
3. On the Output Raster Database line, click the Browse button and navigate to Slickrock_Terrain\GDBFiles\UTM83Z12. Open the SR_Terrain file geodatabase and save the file as a raster dataset with the name topo_10_utmB. Click Save but **not** OK.

4. For Output Coordinate System, choose Projected Coordinate Systems > UTM > NAD 1983 > NAD 1983 UTM Zone 12 N. Click OK once.
5. Click the Resampling Technique drop-down and choose BILINEAR (hence the "B" in the file name). Although the dialog box indicates this is an optional step, it is **not** optional. Now click OK to reproject this DEM. It will be added to the map.
6. Reopen the Project Raster tool. Select topo_10_dd as the Input Raster. On the Output Raster Database line, click the Browse button and navigate to Slickrock_Terrain\GDBFiles\UTM83Z12. Open the SR_Terrain file geodatabase. This time, save the file as a raster dataset with the name topo_10_utmC. Click Save but **not** OK.
7. For Output Coordinate System, choose Projected Coordinate Systems > UTM > NAD 1983 > NAD 1983 UTM Zone 12 N. Click OK once.
8. Click the Resampling Technique drop-down and choose CUBIC. Now click OK to reproject this DEM. It will be added to the map.
9. Check out the layer properties for each raster to verify that each has been reprojected. Save the map document.

↓ As an optional exercise, create hillshades from rasters reprojected using (A) NEAREST, (B) BILINEAR, and (C) CUBIC methods and compare them.



A B C

Challenge Exercises

If you want to test these methods further, reproject the original deographic DEM using the old Data > Export procedure or reproject it using the Nearest Neighbor technique. Use the Contour with Barriers tool, located in the Surface toolset of the Spatial Analyst toolbox to create topographic contours for these reprojected DEMs and compare your results.

In most cases, you will see that these earlier, simpler methods, based on the Nearest Neighbor algorithm, behave identically and do not properly reproject the data. To really see the difference, create and compare hillshades for all reprojected topography rasters. You will see why the undesirable Nearest Neighbor artifact is called herringbone tweed.

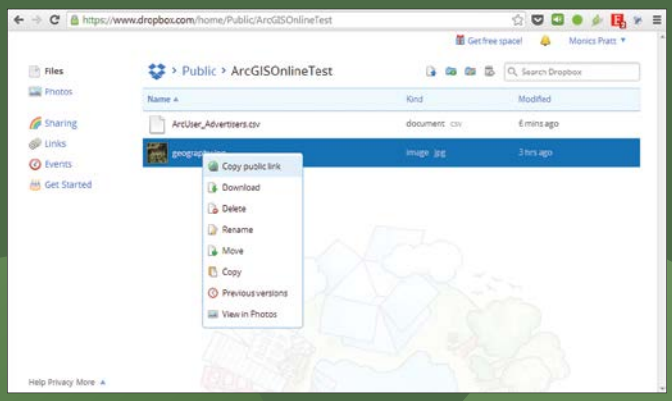
Summary and Acknowledgments

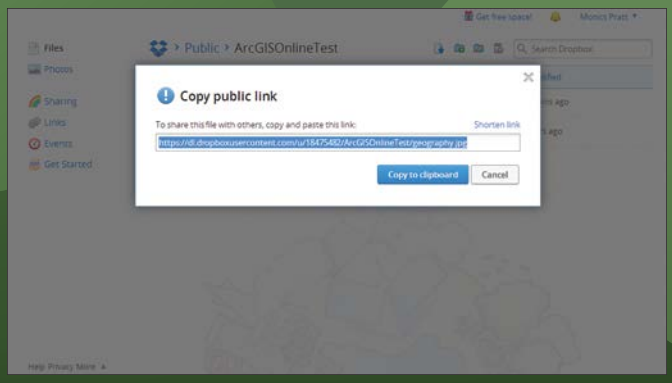
In this brief exercise, you learned how to properly reproject a digital topography grid using two resampling techniques. These techniques will work for other continuous and categorical rasters, so try them out with your own data. When acquiring background information for this aticle, the Esri Technical Support staff helped me better understand the raster resampling algorithms used by ArcGIS.

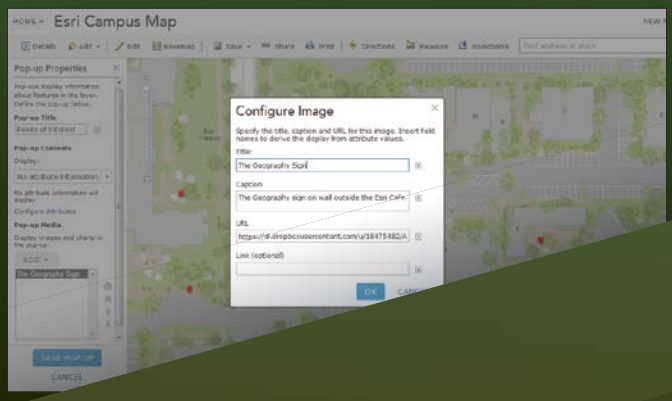
Using Dropbox Files in ArcGIS Online Web Maps

By Bern Szukalski, Esri Technical Evangelist and Product Manager

If you're a Dropbox user, there are a number of ways you can use Dropbox files with your ArcGIS Online web maps. Here are some tips on how you do this.







↗ Files in the Public folder display a Copy public link option when selected.

→ Copy the public link to your clipboard so you can use it to add content to ArcGIS Online maps.

↘ Use an image you have in Dropbox in a map pop-up by copying the public link as the URL when configuring the image.

Using Dropbox Share Links

Dropbox share links provide access to photos and files in your account. When you click a file in Dropbox, you will see the Share link at the top. When a share link is opened, files are viewed in a Dropbox display window. They can't be used directly for adding locations via spreadsheets or for adding photos to pop-ups, but this link can be used to reference files for downloading or opening them for viewing within Dropbox. This approach also enables users of your map to use the Dropbox tools for sharing or downloading your files.

Using Dropbox Public Links

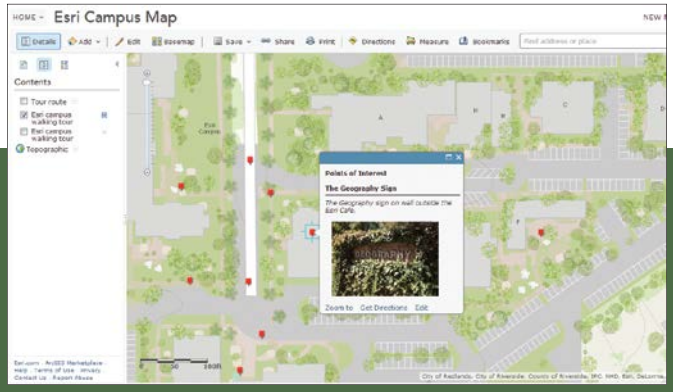
In the past, new Dropbox accounts automatically included a Public folder. With a Public folder, you could get a direct public permalink to your files. This enabled you to directly add photos or spreadsheets stored in Dropbox to your ArcGIS Online web maps.

While a Public folder is no longer automatically created with a new account, you can add one by following the instructions found in the What is the Public folder for? help topic at the Dropbox Help Center. When selected, files in the Public folder display a Copy public link option.

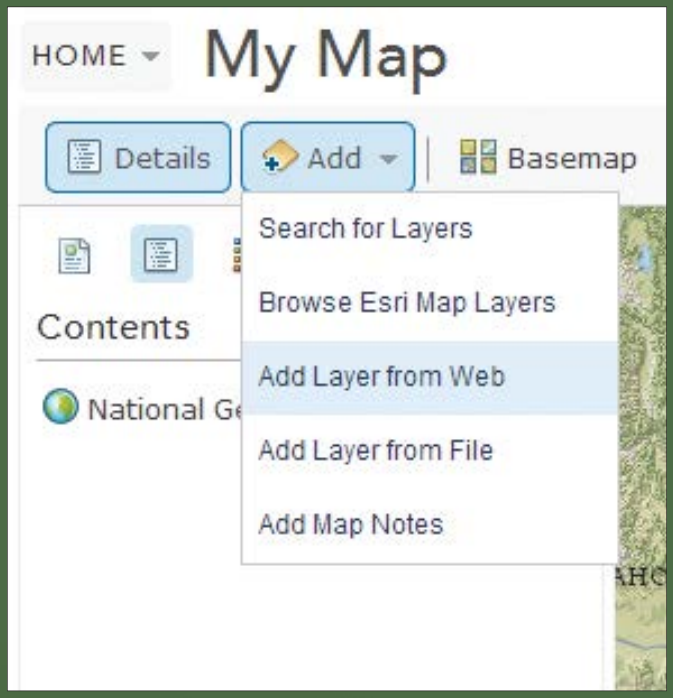
Adding CSV Files

This link points directly to the file stored in the Dropbox cloud, so it can also be used for adding locations from spreadsheets to your maps as well as photos to your pop-ups. You can use Dropbox public links to add locations from CSV files directly to your map by clicking Add, then Add Layer from Web. Then choose a CSV File from the drop-down list, paste the Dropbox public link in the dialog box, then click ADD LAYER.

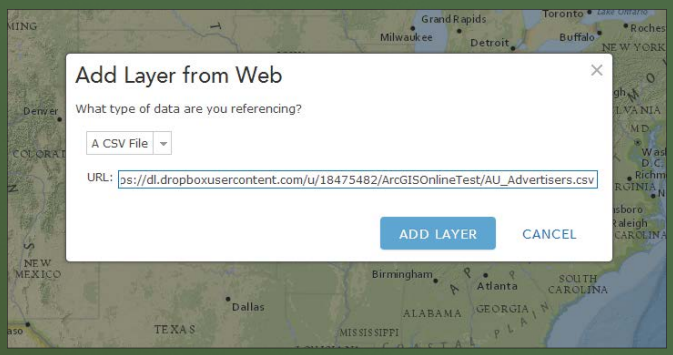
See the ArcGIS.com help for more information on adding layers from the web, using CVS files, configuring pop-up windows, and showing images and popups.



↗ The linked image residing in Dropbox is displayed in a pop-up.



→ Add locations from a CSV file in Dropbox directly to your map by clicking Add, then Add Layer from Web



↘ Add the CSV file using the Dropbox public link.

Maintain Address and Street CENTERLINE Layers More Efficiently

By Tim Witt, Brevard County, Florida

Attribute Assistant is an add-in that uses a series of predefined methods to automatically populate attributes when updating or adding new features to a geodatabase. It is one of the ArcGIS for Local Government apps preconfigured to perform common tasks with data stored in the Local Government Information Model.

Are you overwhelmed with having to maintain far too many fields in attribute tables? If you answered yes, the Attribute Assistant add-in can help.

Working with address and street centerline data goes beyond just an address or street name. In Brevard County, the address point layer has 21 unique fields that must be maintained. If more fields can be filled automatically, less time is required for each new address point/street segment. In my case, Attribute Assistant maintains 15 fields, which means I only have to fill in 6 fields.

Attribute Assistant, available at no charge from Esri, can also perform vital QA/QC tasks. All you need is a master street table containing all street names in your area. When you create a new address point or add a new street segment, Attribute Assistant checks the master street table to ensure the entry has a valid street name. If a street name is misspelled, Attribute Assistant will generate an error message and provide choices from the master street table that are similar to the entry. Combined with geodatabase domains for street types, street suffixes, and other address components, you can eliminate human error to a large extent.

Field	Value
SITE_HOUSE	2725
STREET_DIR	
STREET_NAM	JUDGE FRAN JAMIESON
STREET_TYP	WAY
SUFFIX	
SITE_APT_N	BLDG A
SITE_CITY	MELBOURNE
SITE_ZIP	32940
NAME	
LONGITUDE	-80.735995
LATITUDE	28.246279
EDITED	12:00:00 AM
EDITOR	
SUBDIV	
ORIGINATED	1/1/2008
ORIGINATOR	SC
ID_911	AD134276
TIB_STREET	JUDGE FRAN JAMIESON
TIB_STTYPE	WY
TIB_COMM	ME
COMMENT_	
ADDRKEY	267655
RENUM	2601292
ID_EXTRACT	134276
IDEX2	134276
Shape	Point
FULLADDRES	2725 JUDGE FRAN JAMIESON WAY
FULLSTREET	JUDGE FRAN JAMIESON WAY
ESN_	408
HANSEN_X	741164.181
HANSEN_Y	1422335.257
OBJECTID	50878
GLOBALID	{DB606D0C-128F-4A3B-A2BE-13DFA887E1CA}
SUBDIV_LIN	<null>

→ My address point attribute table has 21 fields that must be maintained, but because Attribute Assistant maintains 15 fields, I only have to worry about 6 fields. The data is also used in different 911 Systems, so some data needs to be formatted differently.

Table Name	The name of the feature layer to which the rule applies. To have a rule apply to all layers use *. To specify a layer, use the name it has in the geodatabase, not in the MXD.
Field Name	Specify which field in the attribute table of the Table Name layer the rule will apply to (e.g., LONGITUDE).
Value Method	Specify which rule will be run when the layer is being edited.
Value Info	This field supplies more information on the Value Method chosen.
On Create	If True, this rule will be run whenever you create a new feature.
On Change(Attribute)	If True, this rule will be run whenever you change an attribute of a specified feature.
On Change(Geometry)	If True, this rule will be run whenever you change the geometry of a specified feature.
Manual Only	If True, this rule will run whenever you click the Run manual for selected features button on the Attribute Assistant toolbar.
Rule Weight	Ranks rules determine which order rules will run. The greater the weight, the sooner it will be run. Rules with null values are always run last.
Comments	Document what each rule does.

↑ Table 1: Dynamic Value table fields

How to Get Attribute Assistant?

Attribute Assistant is part of the Water Utility Network Editing Template (10.2) download. Get it from ArcGIS Online by searching the Gallery for Water Utility Network Editing Template (10.2). With the template downloaded, extract the ZIP file, close all ArcGIS applications, and navigate to the Application directory on your machine to run the AttributeAssistant.esriAddin. *[If the Address Management, Capital Planning, or Water Utility Network Tools addins are installed, remove them.]*

How Do I Set It Up?

After installing Attribute Assistant, open ArcCatalog, navigate to <your directory>\MapsandGeodatabase\LocalGovernment.gdb and add the DynamicValue table. Navigate to the geodatabase containing the address and street centerline layers and import the DynamicValue table. Although the DynamicValue table doesn't need to be in the same geodatabase as the data being edited, it does need to be in a geodatabase. Open a new MXD or open the MXD in which address edits will be made and add the DynamicValue table. Start editing and delete all records except one empty one.

This table will contain the rules Attribute Assistant will use to determine how to handle certain fields in the layer currently being edited. Table 1 lists each field in the table with its function.

Popular Rules

Here are a few popular Attribute Assistant rules.

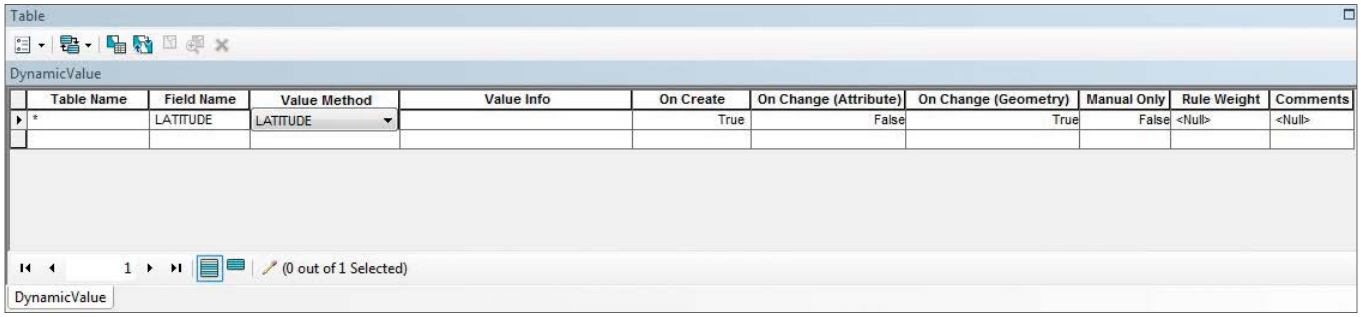
Time Stamp

Often you want to know when you created an address point/street segment or when you last changed it. If you have a field called CREATED, use this rule and set the On Create value to true but set the On Change value to false. Use the same approach with the EDITED field but set the On Create value to false and the On Change values to true.

Current Username

If more than one person edits data, you will want a field called CREATOR or EDITOR. Depending on the value, use your windows user name or database user name.

↓ The DynamicValue table after deleting all records but one.



Table

DynamicValue

Table Name	Field Name	Value Method	On Create	On Change (Attribute)	On Change (Geometry)	Value Info
*	LATITUDE	LATITUDE	True	False	True	<Null>
*	LONGITUDE	LONGITUDE	True	False	True	<Null>
*	ORIGINATED	TIMESTAMP	True	False	False	<Null>
*	ORIGINATOR	EXPRESSION	True	False	False	"TW"
*	EDITED	TIMESTAMP	False	True	True	<Null>
*	EDITOR	EXPRESSION	False	True	True	"TW"
*	HANSEN_X	X_COORDINATE	True	True	True	<Null>
*	HANSEN_Y	Y_COORDINATE	True	True	True	<Null>
*	BCSO_LBL	EXPRESSION	True	True	True	Trim(Trim(Trim([DIR] & " " & [BCSO_STREE]) & " " & [BCSO_TYP]) & " " & [SUFFIX])
*	TIB_STREET	EXPRESSION	True	True	True	[STREET_NAM]
*	TIB_STTYPE	EXPRESSION	True	True	True	(Iif([STREET_TYP]="BLVD","BL",Iif([STREET_TYP]="CIR","CI",Iif([STREET_TYP]="CSWY","C
*	RENUM	INTERSECTING_FEATURE	True	True	True	parcels|RENUM
AddressNineOn	ESN_	INTERSECTING_FEATURE	True	True	True	esn|ESN_
*	SITE_ZIP	INTERSECTING_FEATURE	True	True	True	zipcodes|Zip
*	FULLADDRES	EXPRESSION	True	True	True	Trim(Trim(Trim(Trim([SITE_HOUSE] & " " & [STREET_DIR]) & " " & [STREET_NAM]) & " " & [ST
*	ADD_LB	EXPRESSION	True	True	True	Trim(Trim(Trim([DIR] & " " & [ST_NAM]) & " " & [ST_TYP]) & " " & [SUFFIX])
*	FULLSTREET	EXPRESSION	True	True	True	Trim(Trim(Trim([STREET_DIR] & " " & [STREET_NAM]) & " " & [STREET_TYP]) & " " & [SUFFIX
*	TIB_COMM	EXPRESSION	False	True	True	(Iif([SITE_CITY]="BAREFOOT BAY","BB",Iif([SITE_CITY]="COCOA","CO",Iif([SITE_CITY]="CO
*	BCSO_STREE	EXPRESSION	True	True	True	[ST_NAME]
*	BCSO_TYP	EXPRESSION	True	True	True	(Iif([ST_TYPE]="BLVD","BL",Iif([ST_TYPE]="CIR","CI",Iif([ST_TYPE]="CSWY","CW",Iif([ST_T
*	BCSO_LBL	EXPRESSION	True	True	True	Trim(Trim(Trim([DIR] & " " & [BCSO_STREE]) & " " & [BCSO_TYP]) & " " & [SUFFIX])
*	ST_NAME	VALIDATE_ATTRIBUTE_LOOKUP	True	True	True	Master_Street_List|MASTER
*	STREET_NAM	VALIDATE_ATTRIBUTE_LOOKUP	True	True	True	Master_Street_List|MASTER
*	ADD_LBL	EXPRESSION	True	True	True	Trim(Trim(Trim([DIR] & " " & [ST_NAME]) & " " & [ST_TYPE]) & " " & [SUFFIX])

↑ In my DynamicValue table, I use lots of expressions that reduce the time I spend formatting columns for different 911 systems.

Intersecting Features

Many times, address points need additional information, such as a real estate number (RENUM) or ZIP code. If you have a ZIP code/parcel polygon layer, data can be automatically extracted from those layers and added to an address point. For Table Name, choose the address point layer. For Field Name, choose the field you want filled. For the Value field, use the Input|Source format (e.g., the zipcodelayer and the ZIPCODE field). This can be done with every polygon layer the new address point intersects with.

Expression

This rule uses an expression (in Visual Basic) to automatically fill a field. Often, there are separate fields for street name, house number, and street type, but you need a field that combines all these fields to create a full address. Once each separate field is filled, an expression like

```
Trim(Trim(Trim([DIR] & " " & [ST_NAME]) & " " &
[ST_TYPE]) & " " & [SUFFIX])
```

placed in the Value Info field can be used to populate a FULLADDRESS field.

Validate Attribute Lookup

This is a great rule for QC/QA. It uses another table to validate a new table entry. For example, you need a table that consists of all available street names in your area of interest. Use the format Source|Field (e.g., Street_Master_Table|StreetName) in the Value Info field. In this case, the Source would be the Name field in Master_Table, and the address point layer and the Field name would be StreetName, the field to be checked.

My Rules Are Done. What Now?

Once you finish editing the DynamicValue table, save your edits. Now you are ready to find out if your rules work properly by doing some editing. Open and activate the Attribute Assistant toolbar by choosing Customize > Toolbars > Attribute Assistant in the standard menu of ArcMap. Click the Attribute Assistant toggle button to turn it on. The green plus sign indicates Attribute Assistant is active. The red exclamation point means the Attribute Assistant is off. Test each rule to ensure that everything runs smoothly and you get the results you want.

Additional Help

This article only scratches the surface of what the Attribute Assistant can do, so visit the Esri Help document on this add-in on the ArcGIS Resources pages on ArcGIS for Local Government.

About the Author

Tim Witt has a bachelor's degree in geography form the University of South Alabama and more than five years of experience with geospatial technologies and Esri products. He worked for the University of South Alabama from 2008 to 2009 and currently works as a GIS Analyst III for the Brevard County Board of County Commissioners, Florida, Emergency Management. He can be reached at tim.witt@brevardcounty.us.

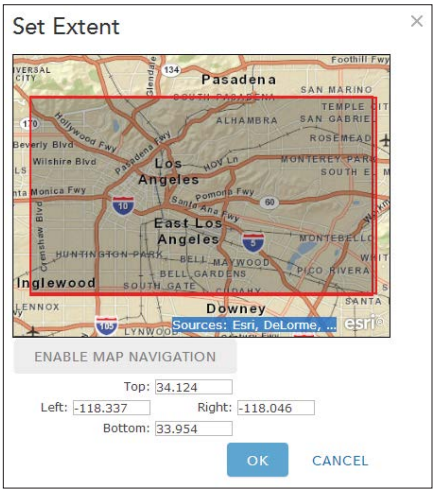
Working Smarter

Control the Map Extent in ArcGIS Online

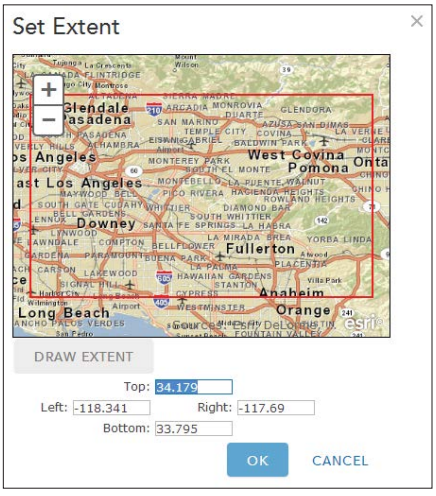
Need to refine the initial map extent of a web map saved to ArcGIS Online opened in the ArcGIS.com map viewer? Or perhaps you have two or more web maps that need to have exactly the same extent.

Here is a better way to achieve these results. Instead of painstakingly readjusting map extents visually and then saving each map only to be disappointed, use the map properties to set the extent used when the map opens.

1. Click the desired map in My Content and click Edit in the Details page. If the map is already displayed in the ArcGIS.com map viewer, click Details > About > More Details... to get to the Details Page.
2. Scroll to the bottom of the page. The last item under Properties is Extent. Click Set Extent.
3. Use the plus and minus symbols to adjust the extent displayed as needed.
4. To draw the extent interactively, click Draw Extent and create a rectangle that encompasses the desired extent. Click Save.
5. If you already know the coordinates you would like to use for the extent, select the existing coordinate in each box and replace it completely with the new coordinate. Click Save.
6. No matter which method you used to assign the next extent coordinates, click My Content, then reopen the map you just modified. It should display the new extent.

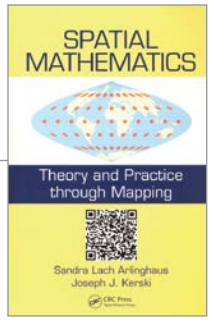


↑ Set the extent on a web map in ArcGIS Online interactively so it will display exactly the extent you intend by drawing a new extent using the map's properties.



↑ If you know the coordinates for the extent you want, select the existing coordinates and replace them with the desired coodinates.

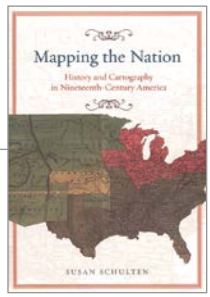
GIS Bookshelf



Spatial Mathematics: Theory and Practice through Mapping

By Sandra Lach Arlinghaus and Joseph J. Kerski

The book's premise is that mapping can be used to teach mathematics, particularly the mathematics that underpin both mapping and GIS. The authors maintain that in a world that is not only increasingly analyzed but also uses maps to understand that analysis, this understanding is critical for better decision making. They also believe that GIS is an excellent method for teaching mathematical concepts and skills through visualizing numbers. A wealth of companion material can be accessed via QR codes in the text. The book has won praise for filling an important gap in geospatial literature and for its innovative approach to teaching mathematics. Sandra Lach Arlinghaus, a mathematical geographer who has published more than 300 articles and books, is currently adjunct professor of Mathematical Geography and Population-Environment Dynamics at the University of Michigan. Joseph J. Kerski holds three degrees in geography and served for 22 years as geographer and cartographer at the National Oceanic and Atmospheric Administration, the US Census Bureau, and the US Geological Survey before taking the position he currently holds as the education manager for Esri. In 2011, he was the president of the National Council for Geographic Education. CRC Press, 2013, 300 pp., ISBN: 978-1466505322



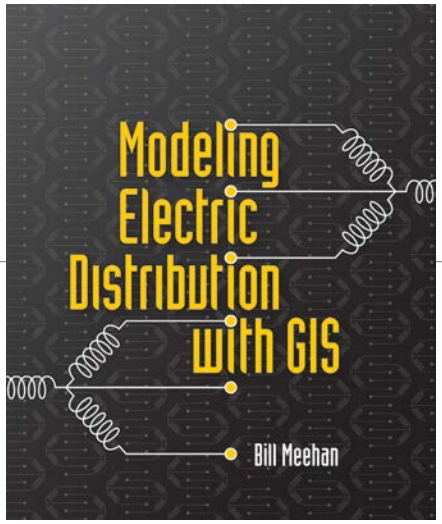
Mapping the Nation: History and Cartography in Nineteenth-Century America

By Susan Schulten

The ascendency of mapping as a means of visualizing data, examining problems, and proposing solutions may seem a relatively recent event. However, in her new book *Mapping the Nation: History and Cartography in Nineteenth-Century America*, Susan Schulten demonstrates that this approach to mapping has its roots in the 19th century, when a new way of thinking about maps emerged. Mapping became the means to make an argument rather than describe a place. These maps were thematic (although Schulten points out that all maps are in some sense thematic because cartographers suppress and enhance elements to communicate their message). Initially, historical maps and atlases helped create a national identity by conveying the country's territorial growth and political development. Later maps, focused on the "distribution of phenomena rather than the landscape itself," examined natural and social environments. In this context, they became powerful agents for change as well as the source of innovation. In particular, mapping slavery led to significant improvements in statistical mapping. The development of GIS in the 1960s has accelerated the use of maps for examining phenomena because it is designed to be just that—an analytical tool for visualizing data. University of Chicago Press, 2012, 272 pp., ISBN: 978-0226740683

Modeling Electric Distribution with GIS

By Bill Meehan



Through the story of Ron, a fictional new GIS manager at AnyTown Energy, this book illustrates how electric utilities can improve operations by implementing GIS. Ron must create a GIS model of the electric distribution network that will form the basis for implementing an enterprise GIS that is more than just a mapping system. His goal: to model the behavior of the electric distribution network from both a technical and a business perspective.

The book's 12 chapters follow his progress toward this goal beginning with his evaluation of the legacy mapping procedures he has inherited and moving through chapters that discuss developing a GIS model and implementing smart grid technology. Sidebars, labeled "Ron's notes," are sprinkled throughout the book and provide useful insights and fundamental information about electric distribution systems.

Based on author Bill Meehan's many years of experience with the electric industry, the book's narrative style is engaging. The appendix includes sections describing the basics of electricity, its history, electric distribution equipment, a detailed electric utility glossary, and a comprehensive list of related books.

Meehan, a professional engineer (PE), is the director of utility solutions at Esri and a former vice president of electric operations at a major electric and gas utility. He is also the author of *Empowering Electric and Gas Utilities with GIS* (Esri Press 2007), Esri Press, 2013, 334 pp., ISBN: 978-1-58948-241-8.

Inspirational

Esri UC reveals the future of GIS

It's not every day that a musician inspires a mapmaker.

But that's exactly what happened at the 2013 Esri International User Conference (Esri UC) in San Diego, California. It's where will.i.am, the hip-hop/pop recording artist and founder of the Black Eyed Peas, gave Katherine O'Brien, the GIS coordinator for facilities at the University of North Carolina (UNC), Chapel Hill, the nudge to commit to mentoring students in how to use geospatial technology.

"I need to go back and work with kids," said O'Brien, whose interest in helping young people learn GIS was kindled by a talk given by will.i.am at the Esri UC. He started the philanthropic i.am.angel Foundation in part to support science, technology, engineering, and mathematics (STEM) education in the classroom. Esri president Jack Dangermond spoke one-on-one with will.i.am, born William James Adams, at the Esri UC Plenary Session about his passion for helping young people get a strong STEM education, including learning to use GIS.

Their 30-minute conversation followed a demonstration of mapping projects by four 11th graders from Roosevelt High School in the Boyle Heights neighborhood

Transformational

By Carla Wheeler, Esri Writer

↑ A Map Gallery visitor explores the Urban Observatory.

of Los Angeles, California. Though he did not attend school in Boyle Heights, will.i.am grew up there and now supports the community and the students through the i.am.angel Foundation. He helped arrange for the students to use ArcGIS for their school projects after meeting Dangermond at a conference in 2012 and seeing the technology in action.

The i.am.angel Foundation chief of staff Enrique Legaspi said GIS is an innovative tool for people to better understand the challenges in their neighborhoods.

"GIS maps are part of a new feature of education—getting students to think critically, collaborate meaningfully, and ask the right questions to design real solutions using GIS technology," he said after the students finished their presentation.

will.i.am followed up on that theme. "The maps are really like a filter. They filter information for you to make better decisions on where you are going and what to do," he told Dangermond. "I want to thank you for opening the doors and transforming these kids' lives with these tools."

will.i.am, who said he plans to study computer science starting in the fall, emphasized that in a world that now uses technology so much to communicate, it's important to be tech savvy and computer literate. "Most people don't read or write code, but we all use technology to communicate," he said.

Gini Connolly, the GIS manager from the City of Hurst, Texas, took will.i.am's message of promoting a STEM education to heart. "will.i.am was pretty neat with what he's doing," Connolly said during a visit to the i.am.angel Foundation section in the Map Gallery, where maps from the students' projects were displayed. "He's a change agent."

She was touched by his story about growing up in Boyle Heights, a predominantly Latino working-class neighborhood in East Los Angeles, and his desire to help the youth pursue their education and dreams. "He's humble," said Connolly. "Our eyes kind of welled up."

Transforming India

Esri UC keynote speaker Sam Pitroda wants GIS and other technologies to be a change agent in India. Pitroda, an adviser to India's prime minister on public information, infrastructure, and innovations, talked about India's plan to build a national GIS as part of a public information infrastructure. He said 400 million people live below the poverty line in the country of 1.3 billion and that democratizing information using technology will play an enormous role in lifting them out of poverty.

"We believe a lot of the poverty has to do with the poverty of information. We really don't have information organized in a manner people can use. If we democratize information, I think we can really radicalize our democracy," said Pitroda, who thinks that increased access to information by the poor will lead to improvements in housing, education, employment, health, and justice. "We have a moral responsibility to solve the problems of the poor. And that's where we believe technology, including GIS, is going to help us in the next couple of decades to come."

The creation of a nationwide platform for GIS is under way, with plans to use the technology to tag every physical asset in the country and unique identifications (UIDs) for all residents. GIS would be a part of government and public service applications to help streamline everything from the justice system to the food distribution system.

"Our goal is really to empower a billion people with knowledge information, and this is where GIS, we believe, will play an important role," Pitroda said.

Transforming Urban Areas

A project unveiled during the Esri UC caught the imagination of many who visited the Map Gallery. The Urban Observatory, an idea that originated with Technology/Entertainment/Design (TED) Conference creator Richard Saul Wurman, Ron Kamen of @radical.media, and Jack Dangermond, used geospatial technology from Esri to compare demographic and other information about major cities at the same scale.

The Urban Observatory operates both as a live exhibit and on a website. Participating cities include New York, New York; Tokyo, Japan; Abu Dhabi, United Arab Emirates; Milan, Italy; Mumbai, India; Paris,

↑ Esri president Jack Dangermond welcomed will.i.am to the Esri International User Conference.

France; and Rio de Janeiro, Brazil.

Visit the website and find the comparison app, then click the maps and compare, for example, the population density in London, New York, and Tokyo. You can see where the youth population is concentrated in Chicago, Illinois; Hamburg, Germany; and Johannesburg, South Africa, and compare the amount and location of open space in cities such as Abu Dhabi, London, and Milan. Even photographs taken from the International Space Station (ISS) for each city can be compared side by side.

You can select the cities you want to compare and journey through fascinating data about each one including the urban footprint, traffic conditions, and new development. It's a project that involves a type of crowdsourcing. "For land-use planners, this is a gold mine of understanding," Dangermond said.

"I think one city could look at other cities relative to their city and learn something," he said in a recent conversation with Wurman. "What can we learn as New Yorkers from Tokyo or people in Tokyo looking at Abu Dhabi or people in Abu Dhabi looking at New Delhi or Rio or Auckland? "

Dangermond invites cities around the world to participate.

"We think it's so clear and seductive to see things relative to each other that everybody is going to want to come in and play," Wurman said. "Why wouldn't you want to do that from the start? Why wouldn't you [want to] be able to talk to each other and plan together and play together and create together and make better decisions together? "

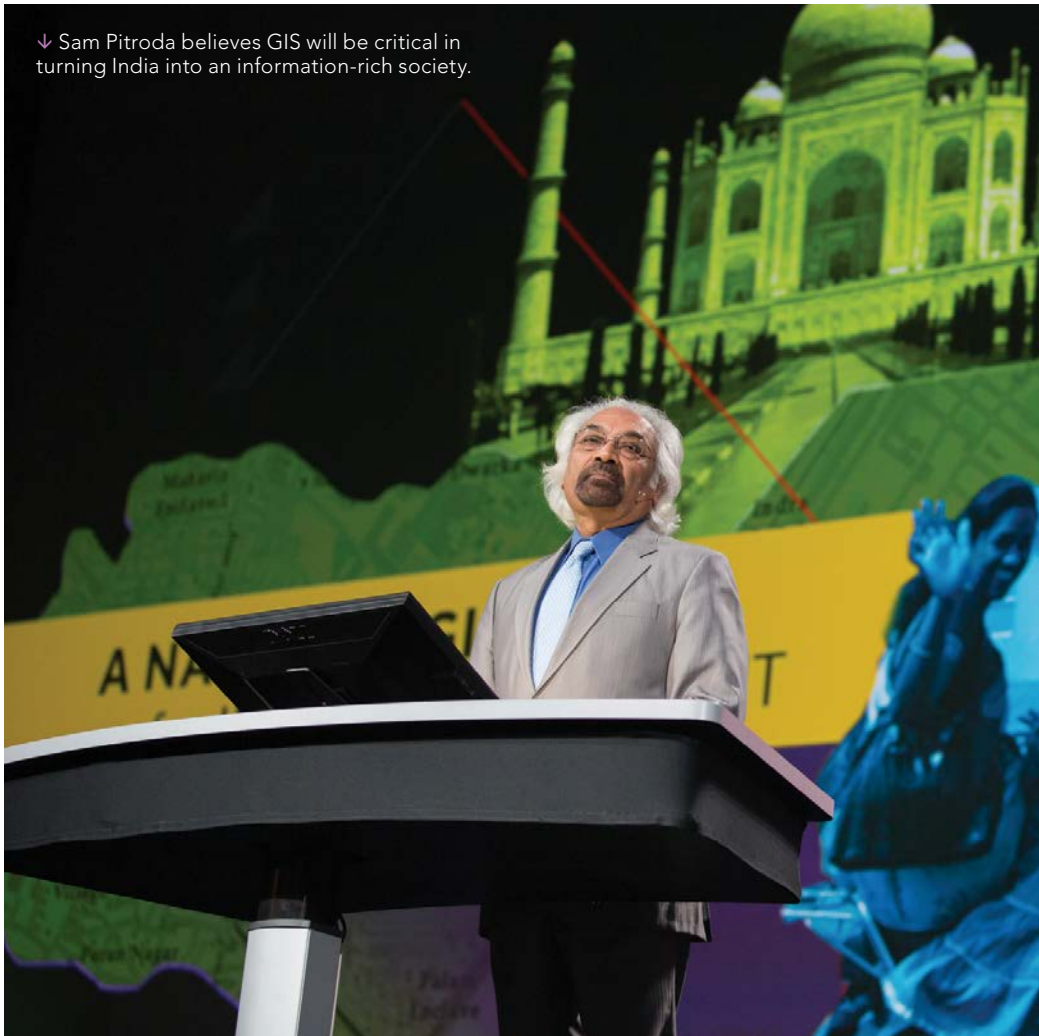
Transforming Journalism

The Atlantic magazine's national correspondent James Fallows' message at the Plenary Session was that GIS, coupled with big data, can enrich journalism and give readers insight into using what he called "explanatory maps."

"In the beginning, journalism was about only words," Fallows said, adding that time and technology brought drawings, illustrations, photography, numerical drawings, graphics, videos, audio, and live streaming into the mix, too. GIS and big data will advance storytelling even more, according to Fallows.

"Map-based information has the power to convey, at a glance, relationships that are slow and murky to describe in words, plus the power to reveal patterns that would otherwise lie concealed," he said.

Fallows will use maps created using Esri technology in his reporting for the upcoming American Futures project, which will see *The Atlantic*, Esri, and a radio station collaborate to tell the stories of small towns across the United States.



↓ Sam Pitroda believes GIS will be critical in turning India into an information-rich society.

GIS analysis is being used to identify cities with diverse economic and social bases, unusual records of absorbing immigrants, robust school systems, and the ability to cope with economic shock, Fallows said. Traveling by small plane—a Cirrus SR22 that he pilots—Fallows will visit communities such as Holland, Michigan, and Columbus, Indiana.

The reporting in *The Atlantic* will include interactive maps such as story maps. These types of maps are easy to create, said Fallows, adding that he would like to see journalism embrace this new form of storytelling.

"We need to show journalists—professional and amateur—the difference these new geographical tools can make."

Fallows grew up in Redlands, California, the hometown of Esri. Dangermond called him "My favorite American journalist."

"Jim is working on transforming journalism. I call it geojournalism."

Transforming GIS

"We need to create a better future with GIS."

That's what Dangermond underscored in his talk about web GIS, which he thinks will be transformational going forward as geospatial technology increasingly becomes easier to use and more accessible and can integrate big data, 3D data, and much more. "Look what GPS did as a technology. It totally transformed us as human beings so we are never lost. Nobody's lost anymore. " he said. "Think for a moment if we could make GIS exactly that pervasive so our organizations would not be lost, our communities would not be lost, and our society would not be lost."

Lauren Bennett, Esri product engineer on the spatial analyst development team, demonstrated how ArcGIS Online is quickly maturing as a web GIS.

"At this time last year, pretty much all you could do in ArcGIS Online was make a map," she said. "But over the last year, ArcGIS Online has transformed from a mapping application to a true web GIS."

Bennett went on to show the audience how to use some of the new analysis tools in ArcGIS Online, including Summarize Nearby, which finds features that are within a specified distance of features in the analysis layer, and Find Hotspots, a tool that will help you create a map that shows any statistically significant spatial clustering that's in your data.

"We are able to answer these common spatial questions using these simple tools in ArcGIS Online," Bennett said. "Clearly, ArcGIS Online is so much more than a mapping application," she said. "It lets us solve problems, it helps us make more informed decisions, and it helps us share our work with the whole world."

Dangermond said that these capabilities will be both in the cloud and on-premises.

"What Lauren showed was not just content," he said. "She showed a new workflow using online analytics, and this is just beginning. [In the near future], there is going to be more analytics being put in this environment."

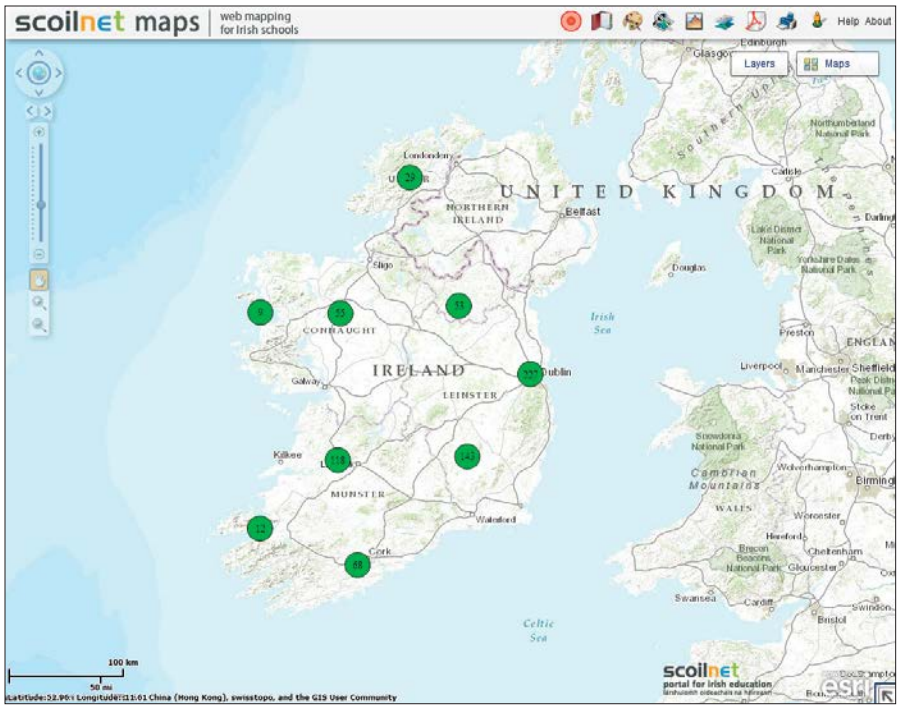
O'Brien from the UNC said she plans to work with ArcGIS Online in the future, perhaps on a personal project mapping hiking and biking routes. "ArcGIS Online empowers us to be contributors and not just users," she said.

To see videos from the conference, visit video.esri.com.

Scoilnet Maps Reborn

Esri technology delivers geography resources to more students

By Joanne McLaughlin, Marketing Manager, Esri Ireland



↑ Geography is part of the national educational curriculum in Ireland.

To help students meet national curriculum requirements, Ireland's Department of Education and Skills (DES) is using online maps and mapping tools to help students develop geospatial thinking skills; explore their local communities; and learn more about world population growth, global climate change, and other topics.

DES added a mapping section to Scoilnet (Schoolnet), the department's teacher resource portal. The portal makes more than 13,000 digital resources and online services available. In Ireland, educators recognize the many practical applications of geography and mapping in today's society. Because geography is part of the national educational curriculum, students learn how to interpret satellite and aerial photographs, perform spatial data analysis, and understand geographic change over time.

Scoilnet Maps uses Esri technology to serve maps through the Scoilnet portal. Teachers and students can call up aerial, topographic, and street maps to better understand the world and their local communities.

Originally, DES used another service for Scoilnet Maps. That service was suspended because it was too expensive. Recognizing the importance of mapping to the geography requirement in the Irish National Curriculum, Karin Whooley, Scoilnet's national coordinator, began to research how to include a cost-effective mapping module in the Scoilnet portal. Then she heard about Esri and its technology.

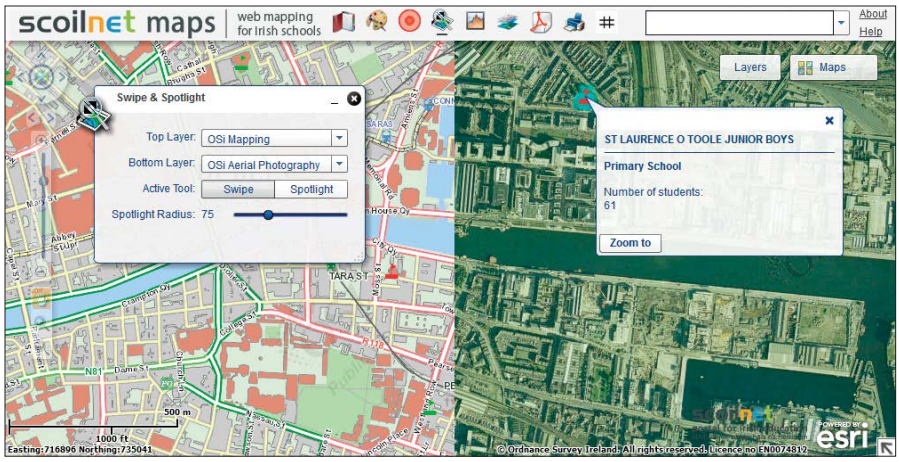
"We had to find a new way to deliver all the mapping services and functionality teachers wanted at a cost that was economically viable," Whooley said. "I happened to be talking with a colleague in the Department of Environment and found out about Esri's ArcGIS Viewer for Flex. I immediately realized that this viewer, coupled with ready access to a wealth of free spatial data, was exactly what we needed to reinstate Scoilnet Maps."

Scoilnet Maps, using Esri technology, was relaunched in 2012. Esri Ireland had a preexisting contract with DES to provide GIS consulting services, so it worked with the Scoilnet team to build a viewer with the content and functionality the teachers needed. Several other government departments and public-sector groups in Ireland already use ArcGIS Viewer for Flex, so the Scoilnet team turned to these organizations for ideas, functions, and data. Esri ArcGIS Viewer for Flex is a free, open-source software application.

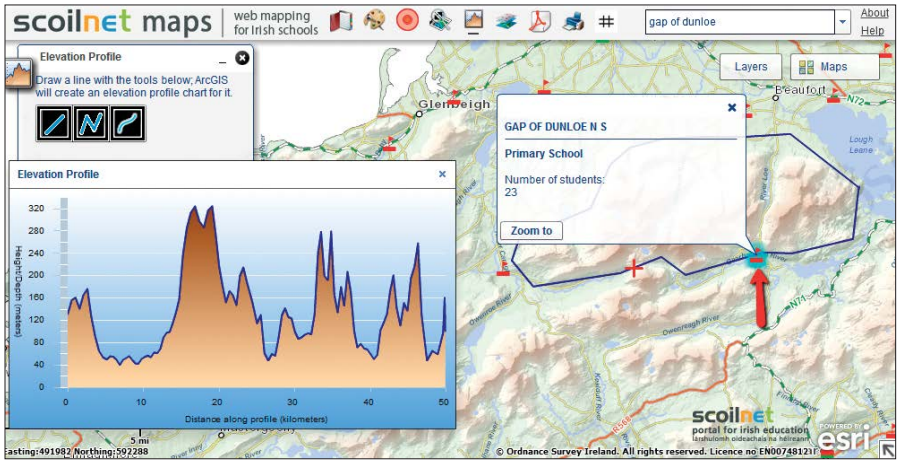
The new Scoilnet Maps service streams maps and images directly from Ordnance Survey Ireland and draws on dozens of free data layers made available by the Department of Environment and other agencies. Faster and more responsive than its predecessor, the current version of Scoilnet Maps delivers to teachers and pupils a better experience, and more of them are embracing it than ever before.

The mapping portal offers a range of features that support teaching and learning, including spotlight and swipe tools that help teachers highlight locations and compare aerial photos with maps. Teachers can also flip between historical maps to give pupils a visual perspective of changes to the landscape that occur over time. An elevation tool lets the students study map contours, landscapes, and terrain variations.

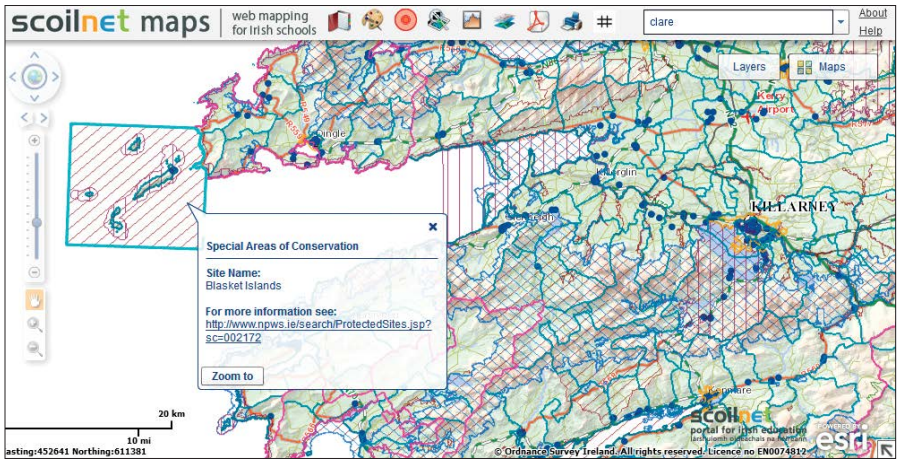
This tremendous resource helps teachers deliver engaging, imaginative lessons that accelerate learning. Mark Boggins is a primary school teacher at Holy Family National School in Rathcoole, a suburban village, southwest of Tallaght, Ireland, in South Dublin. He uses Scoilnet Maps and



↑ The Scoilnet resource portal makes more than 13,000 digital resources and online services available to Irish teachers.



↑ Using resources from Scoilnet, teachers can use geography to incorporate different subjects into one lesson. Students use math skills by measuring distances between locations and learn history by viewing different map layers over time.



↑ This Scoilnet Maps service streams maps and images directly from Ordnance Survey Ireland and draws on dozens of free data layers made available by the Department of Environment and other agencies.

other tools to explore social, environmental, and scientific education issues in the community. Scoilnet Maps is one of the five different station activities used: some paper based, others information and communications technology (ICT) based. All support the development of mapping concepts and geographic investigation skills.

Because it uses Esri ArcGIS software, the mapping application gives pupils the opportunity to experience real-world technology and develop skills that will equip them for adult life. "Our new Scoilnet Maps service enables students to work with technology at the same level as that used in workplaces around the world and gain valuable skills," Whooley said.

The previous map service was only available to the country's 723 second-level schools. The new Scoilnet mapping solution is accessible to all 4,023 of Ireland's first-level (primary and special) and second-level schools. Now up to 875,500 young people in Ireland have the opportunity to develop a deeper understanding of GIS technology and geography.

Whooley anticipates that Scoilnet Maps will be highly beneficial in primary schools, where teaching is topic based and can cross different subject areas. For example, a geography lesson in which students look at maps of the local area could incorporate math by measuring distances between locations and history by viewing different map layers over time. "For primary schools, the new Scoilnet Maps service is a gift," she said. "Teachers can engage pupils in cross-curricular ways that just aren't possible with printed maps."

The new solution is also very economical. DES has calculated that it will save more than 200,000 euro per year compared to the previous service. Developed by leveraging the experience of other government departments, the solution represents tremendous value for the money.

Transforming Essential GIS Skills

By Bern Szukalski, Esri Technical Evangelist and Product Manager

Over the years, GIS has grown to cover a very broad horizon. It's no longer the domain of specialized departments; instead, it has become deeply woven into an organization's fabric and extends to a very public and connected audience. The fact that we think differently today than in the past about how we use—and perhaps more importantly, how we *can* use—GIS reminds us that we need to continue to evolve our skills in new directions, whether we're seasoned GIS veterans or simply trying to land that first job.

A recent e-mail from someone just beginning to take their first steps into the GIS job market had me thinking about this again. They asked me whether they should take a course in Python to improve their GIS job prospects. "Sure, that would definitely be a good idea," I said. But at the same time I realized that when I meet with GIS organizations, the things they seem to wrestle with are beyond the usually anticipated skills of data conversion and management, modeling, metadata, and Python prowess. Even cartography has to be considered in a different light in the web mapping world of mashups, slippy maps, and fast and furious app development.

In what areas do users feel challenged or tell me they're seeking additional talent? The answers are easy when you consider how GIS has moved online toward transparency, self-service mapping, and great browser apps and into a device-centric world on your phone or tablet. Clearly this is a case where the technology of the day dictates the habits and expectations of consumers of geographic information and also the corresponding requirements for today's GIS professional. Here's what I've come to understand are sought-after skills.

Design and User Experience

Even the best functionality or information can't be appreciated or effectively used behind a poorly designed website or app. The user experience (UX), and design of compelling apps and websites, is a key factor in reaching a target audience and how that audience perceives the information presented. It doesn't matter whether it be a longtime resident in a city trying to find the office to pay a late bill or a community activist looking to push the envelope by hacking with data the city's GIS has provided. What you deliver must be compelling and friendly. Lots of GIS organizations are challenged with a lack of design and UX talent.

Web Development

Great JavaScript, CSS, and HTML skills are sometimes harder to find in GIS organizations these days than experience with Python, C++, or ArcObjects. While GIS-centric skills are essential for a nuts and bolts GIS professional, if you want to push into new frontiers or land your first job, core competence in current web technologies is a must.

Responsive Design

Any app these days must work on a variety of form factors, from full-screen browser to tablets to smartphones. If you can build responsively designed apps that magically morph to fit all needs and form factors, you've got some valuable skills.

Mobile Platforms

Beyond ArcPad on your Trimble, Android and Apple devices rule the landscape, with Windows tablet devices close behind. If you want to reach a broad, public audience, skills in mobile and native app development are what GIS organizations are looking for. And, as an existing professional or new job seeker, skills in these areas will open doors for you.

Data Authoring, Cartography, Publishing

Remember when you published a GIS service with 20 layers and 50 sublayers? In the world of mashups, this is more than a speed bump—it's a roadblock. Understanding the tradecraft involved in delivering building-block layers for authoring web maps begs for a different approach. And web cartography sometimes requires different considerations and thinking than the cartographic design principles applied to that National Geographic-quality map you've hung on your wall.

Integration with Other Systems

A successful GIS does not live alone but integrates with a variety of other systems in an organization. These can be business systems, enterprise tools, or real-time feeds. Experience in bridging these systems into GIS and integrating the work of other departments with skills in SharePoint, Cognos, or other enterprise software and systems are increasingly valuable.

Online Best Practices

As the ArcGIS platform moves to the cloud, there are lots of things to know about establishing and curating a successful GIS online. The new pattern of a cloud-based GIS means different ways to do things and a new set of best practices. Many educational institutions are moving forward with specific courses and learning opportunities in these areas that can bring value to you and your resume.

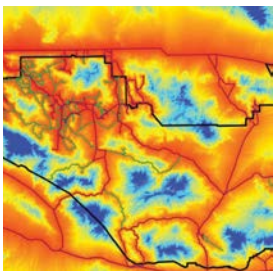
Clearly, GIS and how we use and think about it has transformed. The age of ubiquitous geographic information and geo-enabled apps is upon us and moving fast. With a few additional skills, you can evolve your role in your organization or land that first job and hit the ground running. GIS has transformed, and you should be sure you've transformed along with it.

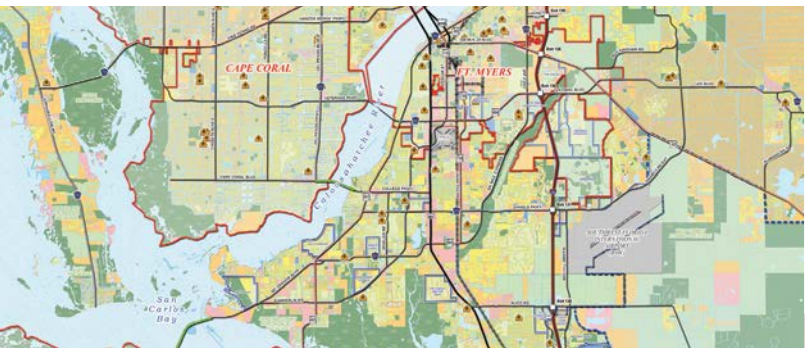
About the Author

Bern Szukalski is an Esri technical evangelist and product manager, focusing on ways to broaden access to geographic information and helping users succeed with the ArcGIS platform.

Aggregate. Analyze. Act.

Resolve Real-World Challenges





Esri is a registered trademark of Environmental Systems Research Institute, Inc.

MS in Geographic Information Systems

- Learn cutting-edge GIS science and theory
- One-year, full-time residential program (two-year option available)
- Access to extensive Esri® resources
- Small classes and workshops led by distinguished faculty
- For professionals and recent grads with GIS experience/education

UNIVERSITY OF
Redlands
Education+

(909) 748-8128
msgis.redlands.edu

Her Years of Living Dangerously

Fighting hunger in perilous places

By Carla Wheeler, Esri Writer

Nadika Senadheera's job as a GIS consultant takes her to places where death may be next door.

In May 2013, when she was on assignment in Kabul, Afghanistan, with the United Nations World Food Programme (WFP), a good friend suffered severe burns when suicide bombers set off an explosion outside a compound that housed the International Organization for Migration (IOM) in Kabul. This woman, who worked for IOM, later died.

During that attack, Senadheera hid in a bunker nearby as Taliban attackers detonated bombs, lobbed grenades, and fired at Afghani police and NATO forces. "Holes were everywhere," Senadheera said during an interview at the 2013 Esri International User Conference (Esri UC), almost six weeks after her 14-month assignment in Afghanistan ended.

Though she left Kabul physically uninjured, the experience was frightening and heartbreaking. "Our good friend, we lost her because the Taliban attacked. She didn't survive," said Senadheera, pausing to wipe away tears. "She was 80 percent burned. I apparently had the last picture of her. We had a sushi night in one of our guesthouses, and she came over."

↓ As a GIS consultant for the United Nations World Food Programme (WFP), Nadika Senadheera has worked on the front lines of relief efforts in numerous countries including hot spots such as Pakistan and Afghanistan.

Danger comes with the territory for aid workers, even GIS professionals like Senadheera. In Kabul, she helped organize and manage WFP's GIS and infrastructure and train its staff to use GIS. Though they often work indoors on computers, standardizing and analyzing data or training colleagues how to use geospatial technology, they sometimes work in the field—in less than hospitable conditions.

Even inside compounds protected by security details, there's no such thing as absolute security. One night in May 2012, Senadheera huddled in a guesthouse in Kabul for more than six hours, listening to gunfire and bombing outside. "Eight suicide bombers were there shooting and blowing themselves up. I was so scared, and I was under the bed, wondering, when would this be over?"

Calling her a "real hero," Esri president Jack Dangermond presented Senadheera with a Making a Difference Award at the 2013 Esri UC in recognition of her GIS work for WFP under such dangerous conditions.

Senadheera, who grew up in Sri Lanka, accepts the risks inherent in her assignments for WFP, a nongovernmental organization (NGO) that has been her employer for the better part of the last 13 years. There's passion in her voice when she talks about the value geospatial technology brings to the mission of feeding people mired in poverty or displaced by a natural disaster or a conflict.

"Yes, it's risky," she said. "But if everybody tried to stay in comfortable, secured zones, how could we spread [knowledge of] these wonderful tools—geospatial tools—[that help] to identify the most vulnerable populations and fight hunger? "

One of the ways WFP uses GIS is for food security

analysis—identifying who does not have access to enough nutritious food and the underlying causes of the hunger problem in a certain region. The organization's Vulnerability Analysis and Mapping (VAM) unit does this work.

Part of Senadheera's job involves training WFP national staff to use GIS. She also helps to standardize available spatial data and analyzes and maps the information using ArcGIS. The mapping technology helps WFP identify who needs food assistance (such as malnourished children or disaster victims), where they live, how to safely route food to them, and what areas of the country are vulnerable to natural disasters or conflicts. WFP often steps in to help during a crisis and needs to quickly know what areas will likely be the hardest hit.

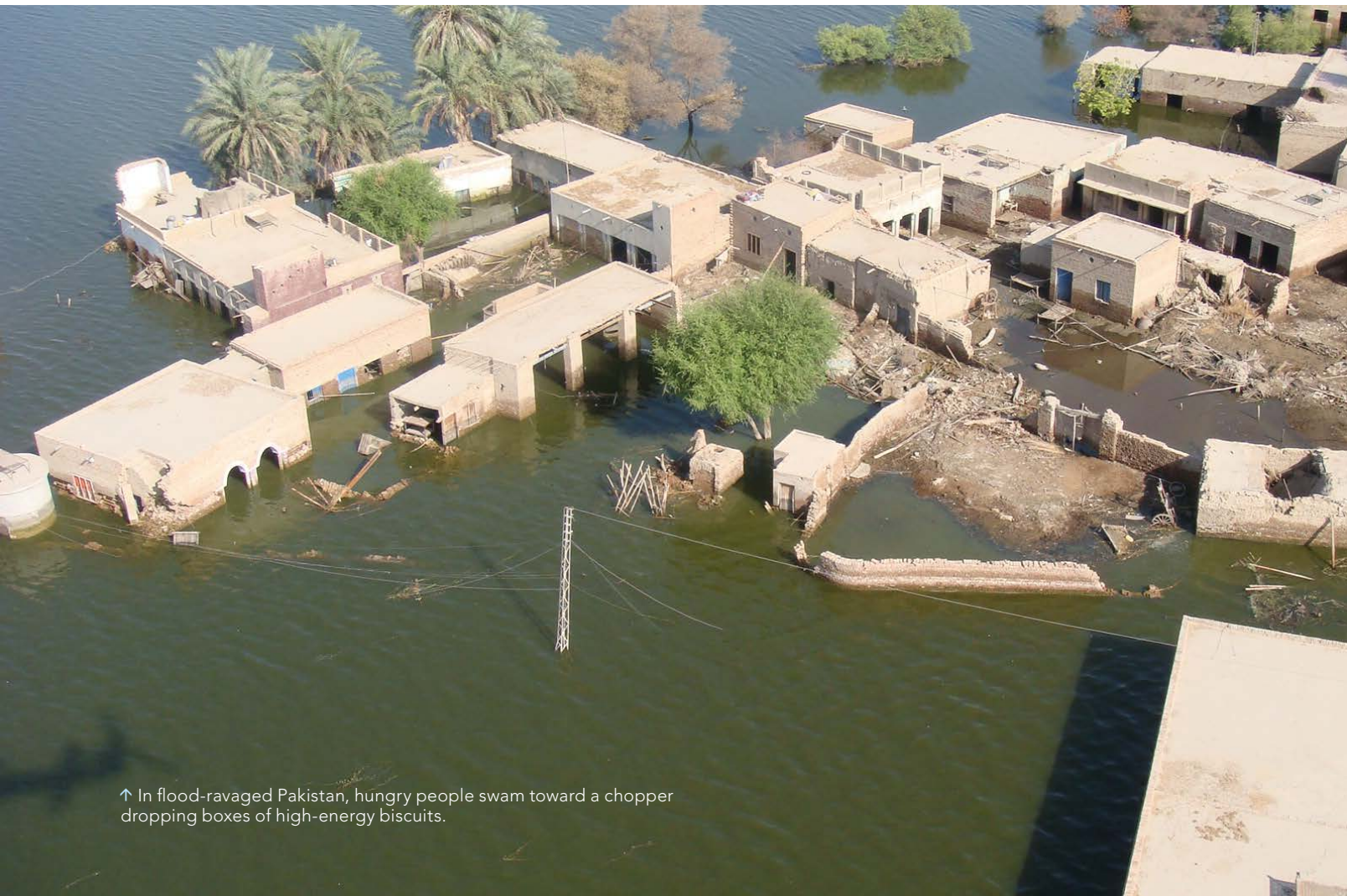
Though she's worked in many countries in Asia, including the Lao People's Democratic Republic, Thailand, and her native Sri Lanka, her most recent assignments in Pakistan and Afghanistan were fraught with more than the usual danger.

In 2010, floods ravaged Pakistan. In parts of the province of Sindh, whole villages were wiped out. Roads, bridges, and many homes were destroyed. Senadheera flew in a United Nations Humanitarian Air Service (UNHAS) helicopter piloted by Russians that hovered low over hard-hit Sindh province to drop food to hungry people. People swam toward the chopper or scrambled from their houses, waving with outstretched arms while the crew dropped boxes of high-energy biscuits to them.

"They really wanted to get the food because they were starving," said Senadheera. "I was shocked when I saw the people in the muddy water, swimming." The smell of sewage and the bodies of cows and other dead animals made her stomach churn. "The water was all polluted. The smell was so bad. I was thinking, how can they live? How can they sleep? How can they breathe this air?"

While the crew dispensed the biscuits, Senadheera used a GPS to get the exact locations of where the food was dropped and marked those locations on a basemap. She also kept track of how many cases of biscuits were left at a given location and took an estimated head count of how many people picked up the food. By figuring in

"All we want to do is spread our wings and look for where we need to be to help someone that needs a helping hand to enter the spatial world."



↑ In flood-ravaged Pakistan, hungry people swam toward a chopper dropping boxes of high-energy biscuits.

↓ Senadheera created maps showing where food had been distributed and where more food was needed.

the average family size for each person who carried away a box of biscuits and village population data, she could calculate whether the helicopter needed to return to that area and drop off more food. She also used ArcGIS to create maps that showed where WFP had distributed food and where the helicopters still needed to go to distribute more biscuits.

Senadheera operated on a few hours of sleep each day during the five-week-long helicopter assignment. She stayed up until 2:00 AM daily, analyzing data and making maps, and returned to the airport at 6:00 AM to board the chopper. "Pakistan was crazy," she said, yet she enjoyed the frenetic pace of the assignment. "I was doing everything. It was kind of fun."

Like Father, Like Daughter

Senadheera said her father instilled a love of maps and travel in her when she was only five. Hema Senadheera served as a radio officer aboard cargo ships from 1975 to 1995. The stories he told during his brief trips back home were the stuff of legend for the young girl.

"Whenever he came home, he took the globe and he started [to

show us] his route—'I went to this country, I boarded the ship, and this is the route I took, and these are the people that I met, and these are the countries that I passed,'" she recalled. "And he was showing us his passport and the coins, which fascinated me most."

A seed was planted. "I thought, this is something cool. Why can't I follow in my Daddy's footsteps?"

She started to draw and color maps. Then she studied history of the countries on the maps. By the time she headed off to college, Senadheera knew geography was for her. She graduated with a bachelor's degree in geography from the University of Colombo in Sri Lanka in 1995 and soon went to work for the Esri distributor in Sri Lanka.

After working briefly for the Asian Development Bank, she received a 15-day contract with WFP in 2000 to analyze World Health Organization (WHO) data and map where malnourished people, especially children, were living in Sri Lanka. She used Esri software to analyze the data and create the maps that helped WFP deliver food to the neediest people in the country.

Senadheera received a Fulbright Scholarship to attend State University of New York (SUNY), Albany, from 2004 to 2006. She earned her master's degree in geography and spatial sciences from SUNY. She later interned at Esri in Redlands, California, before returning to WFP and her life on the road.

"It's always good to see places," said Senadheera, who has been to 30 countries. "I love to read, but it's good to see and feel it. Then you know exactly what people are thinking and what you read about each place is correct."

Though she resisted the idea for a long time, Senadheera finally agreed in 2012 to work in Afghanistan to help the VAM analysts properly organize spatial data for WFP (such as the location of helipads and airfields for the aircraft delivering food) and transfer the data into a working geodatabase. GIS will help WFP identify the neediest people there who need the food and safely deliver it.

WFP's eventual goal is to use ArcGIS Online to create one geospatial platform for all the countries the organization serves. "Then when there is an emergency, everybody can work together at the same time, on the same platform. All the data is standardized," Senadheera said.

WFP uses Esri technology to share information with donors and potential donors such as in the Syria Crisis Map on esri.com. The map shows the location of refugee camps, food distribution points, and the number of people the program reached in May and June 2013.

Though her 14 months in Afghanistan were marked by violence, Senadheera feels a sense of accomplishment, having led the effort to build WFP's geospatial enterprise system for the country and trained close to 120 people—all men—in how to use GIS.

Where Will She Go Next?

"I'd love to go to Africa—I want to go to the Sudan," said Senadheera, who is currently taking a break at home in Colombo, Sri Lanka. "It's another hot spot. I know it's red, red, but it's not red, red like Kabul because the war is kind of over, and there are no suicide bombers. But if I go, it will be, as a female mapper, another challenge for me."

To Senadheera, life as a geographer means going out into the world to share what she knows about geospatial technology with people who are just beginning to understand its transformational power.

"Life is hard, and it is an adventure. At times we need to take risks because we are so passionate with maps and spatial analysis," she said. "All we want to do is spread our wings and look for where we need to be to help someone that needs a helping hand to enter the spatial world."

↑ Calling her a "real hero," Esri president Jack Dangermond presented Senadheera with a Making a Difference Award at the 2013 Esri UC in recognition of her GIS work for WFP.

Nadika Senadheera says she could not have accomplished her work for WFP without the support of many people, including her parents; the late Professor Kusuma Gunawardena from the University of Colombo; Anil Wijewardene, who gave her a job at the Esri distributor in Sri Lanka; Hildegard Tuttinghoff, who offered her the first WFP assignment; Esri president Jack Dangermond, who provided an internship; and Michael Sheinkman, the regional VAM adviser for WFP, who offered her GIS projects in Myanmar, Laos, Italy, Pakistan, Cambodia, Afghanistan, and Indonesia.

Esri Corporate Headquarters

380 New York Street
Redlands, CA 92373-8100 USA
T 909 793 2853
F 909 793 5953
info@esri.com
esri.com

Esri Technical Support
T 888 377 4575
F 909 792 0960
support@esri.com
esri.com/support

Online Discussion Forums
Esri-L: esri-l@esri.com
ARCVIEW-L: arcview-l@esri.com
esri.com/forums
FTP ftp.esri.com

Esri Desktop Order Center and Software Information
T 800 447 9778 (USA only)
F 909 307 3049
info@esri.com

Esri Customer Service
Toll Free
T 888 377 4575
F 909 307 3082
service@esri.com
esri.com/customerservice

Esri Store
esri.com/store

Esri Developer Network
edn.esri.com

Esri US Regional Offices

Boston
Danvers, MA
T 978 777 4543
F 978 777 8476

California
Redlands, CA
T 909 793 2853 x1906
F 909 307 3025

Charlotte
Charlotte, NC
T 704 541 9810
F 704 541 7620

Denver
Broomfield, CO
T 303 449 7779
F 303 449 8830

Minneapolis
St. Paul, MN
T 651 454 0600
F 651 454 0705

Olympia
Olympia, WA
T 360 754 4727
F 360 943 6910

Philadelphia
Chesterbrook, PA
T 610 644 3374
F 610 644 3379

San Antonio
San Antonio, TX
T 210 499 1044
F 210 499 4112

St. Louis
St. Charles, MO
T 636 949 6620
F 636 949 6735

Washington, DC
Vienna, VA
T 703 506 9515
F 703 506 9514

For additional information about Esri US regional offices, please visit esri.com/usa.

Esri Distributors Worldwide

Esri Australia Pty. Ltd.
esriaustralia.com.au

Esri BeLux N.V.
esribelux.com

Esri Bilgi Sistemleri Muhendislik ve Egitim, Ltd.
esriturkey.com.tr

Esri Bulgaria Ltd.
esribulgaria.com

Esri Canada Limited
esri.ca

Esri Chile S.A.
esri.cl

Esri China (Beijing) Holding Co. Ltd.
esrichina.com.cn

Esri China (Hong Kong) Limited
esrichina.hk

Esri CIS Limited
esri-cis.ru

Esri Deutschland GmbH
esri.de

Esri Eastern Africa Limited
esriea.co.ke

Esri España Geosistemas S.A.
esri.es

Esri Finland Oy
esri.fi

Esri France S.A.
esrifrance.fr

Esri Italia Sp.A.
esriitalia.it

Esri Japan Corporation
esrij.com

Esri Korea, Inc.
esrikr.com

Esri Lebanon sal
esrilebanon.com

Esri Muscat Co LLC
esrimuscat.com

Esri Nederland B.V.
esri.nl

Esri Northeast Africa
esrinea.com

Esri Polska sp. z o.o.
esri.pl

Esri Portugal—Sistemas e Informação Geográfica, S.A.
esri-portugal.pt

Esri Romania S.R.L.
esriro.ro

Esri South Africa (Pty) Ltd.
esri-southafrica.com

Esri Southern Africa
esri-southernafrica.com

Esri South Asia Pte. Ltd.
esrisa.com

Esri Sverige AB
esri.se

Esri (Thailand) Co. Ltd.
esrith.com

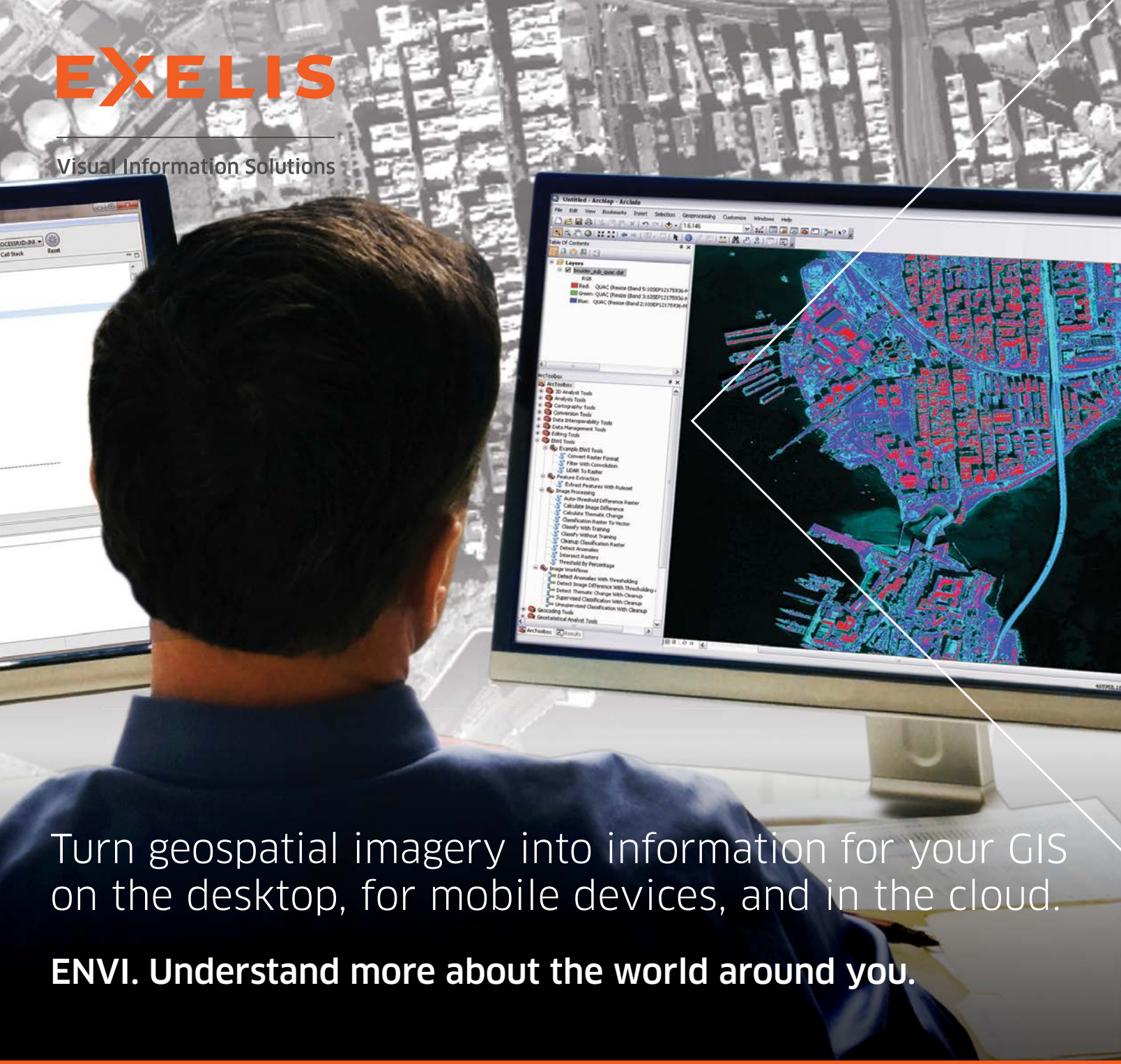
Esri (UK) Ltd.
esriuk.com

Esri Ukraine Ltd.
esri.ua

Grupo Esri de Venezuela, C.A.
esriven.com

NIIT GIS Limited (Esri India)
esriindia.com

Esri also has distributors in other countries around the world. For more information, contact Esri.
T 909 793 2853 x1235
F 909 307 3070



Geospatial imagery, such as multispectral, hyperspectral, LiDAR, and SAR, is a powerful and cost effective way to update your geodatabase with the most current and detailed information about a geographic area. Exelis Visual Information Solutions provides you with a seamless integration of ENVI® image analysis tools and ArcGIS® from Esri® to deliver the power of advanced image analysis to the desktop, mobile devices, and the cloud.

ENVI

www.exelisvis.com/ENVI-ArcGIS

esri Partner Network Platinum

380 New York Street
Redlands, California 92373-8100 USA

Presorted
Standard
US Postage
Paid
Esri

137559 QUAD491M10/13dh

WHERE AMAZING IS ALL IN A DAY'S WORK

Seek amazing at **esri.com/careers**.