

Fall 2012

ArcUser

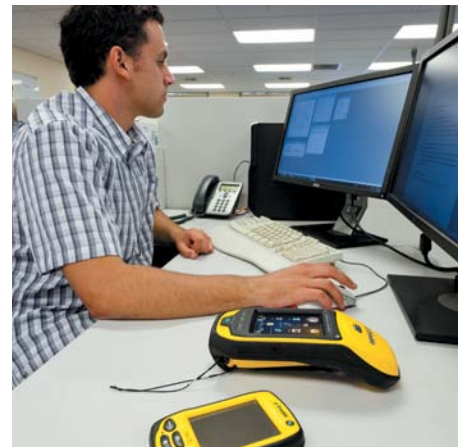
The Magazine for Esri Software Users

Information through a
Map Lens 16

A Workflow for Creating
and Sharing Maps 40

Opening Our World 62





The world looks different when you are **GEOptimized**



THERE IS NO SUBSTITUTE FOR CONFIDENCE IN YOUR GIS DATA

Business decisions are as good as the information they are based on. That's why Trimble solutions are trusted worldwide to ensure better data.

When you are GEOptimized, your organization is rewarded with professional-quality data and process improvements in geospatial fieldwork. Some Trimble customers report 2x productivity gains with smart solutions like Floodlight™ technology. Others show marked decreases in workload by getting work done right the first time. Better data, faster. It's the kind of thing you expect from a leader in the industry.

Trimble makes it easy. Because it's what we do best.

trimble.com/mappingGIS

esri.com/trimbleoffers





Focus

- 12 Location Intelligence Is More Than a Map
- 14 Keeping Service Levels High and Costs Low
- 16 Information through a Map Lens
Solutions that embrace the cloud and consumption-based models
- 20 Born Again
The antidote for zombie stores



Feature

- 22 The Parcel Fabric Offers Advantages at Any Scale
- 24 An Integrated Land Records Solution
- 25 Best Practices When Migrating to the Parcel Fabric



Special Section: ArcGIS Online

- 32 Many Hands Make Light Work
Crowdsourcing geoenables development assistance data
- 36 Get Up and Running with ArcGIS Online for Organizations
- 40 A Workflow for Creating and Sharing Maps
- 46 A Simple Approach
Preparing data for the Community Maps Program

On the Cover: The cover image was created from the ETOPO1 Global Relief Model: Color Shaded Relief tile map service shared by the National Oceanic and Atmospheric Administration (NOAA) National Geophysical Data Center (NGDC) on ArcGIS Online. This global relief model of the earth's surface, built from numerous global and regional datasets, integrates land topography and ocean bathymetry at a spatial resolution of 1 arc-minute.

Hidden Treasure

Businesses, blighted by slow economic growth and subject to high insolvency rates, have realized that the data they have been amassing on customers, operations, and competitors can be transformed into a source of operational insight and market advantage.

Like the Oakland Athletics baseball team described in Michael Lewis's book *Moneyball*, businesses have stopped relying on "gut feelings" and moved to meaningful metrics. Constrained by a much smaller budget than teams like the New York Yankees, the Athletics' manager Billy Beane used careful analysis of statistics to spot low-priced talent that possessed skills that translated into major league wins. In a similar fashion, businesses are delving into their data and coming up with winning strategies.

In an effort to squeeze more value from business intelligence efforts, these companies are embracing analytics informed by geography. According to the consulting and financial firm Deloitte LLP, "Organizations that combine the explosion of location-aware data with the power of geospatial analysis and wide accessibility of geospatial visualization can provide game-changing support for business decision making at levels never considered before."

Location analytics goes far beyond the capabilities of consumer mapping, bringing together dynamic, interactive mapping with spatial analytics and complementary data. More than just mapping points, it is about interrogating the data in a new way that provides context.

In addition to an arsenal of tools, location analytics requires access to an information ecosystem of rich cartographic resources and attribute data stores: basemaps and imagery and data on demographics, consumer lifestyles, businesses, and the environment. That ecosystem is ArcGIS Online, which also provides models, applications, and specialized maps and layers.

By directly integrating with leading business analysis platforms like IBM Cognos and Microsoft Office, Esri software has removed two of the major obstacles to the adoption of spatial analysis capabilities: cost and accessibility.

Technology solution provider Wall Street Network (WSN) is using ArcGIS Online to mash up business and spatial data in executive dashboards. According to Kristina Mazelis, WSN chief operating officer and chief financial officer, "We can remove the complexities of working with spatial data and provide our clients with the extensive discovery, collaboration, and analysis tools they need in their businesses."

The development of location analytics is taking GIS to the next step: GIS delivered throughout an organization as self-service mapping and simple spatial analytics integrated with systems staff already use. Now hundreds of decisions businesses make every day can benefit from this actionable information. Rather than diminishing the role of GIS professionals, it has been enhanced. Their work forms the foundation on which location analytics is built.

Monica Pratt
ArcUser Editor

editor's page

ArcUser

Fall 2012 Vol. 15 No. 4

Editorial

Editor Monica Pratt

Contributors Keith Mann, Matthew DeMeritt,
Karen Richardson

Technical Advisers Paul Dodd, Damian Spangrud

Copy Editing Mary Anne Chan

Design

Graphic Designer Doug Huijbregtse

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

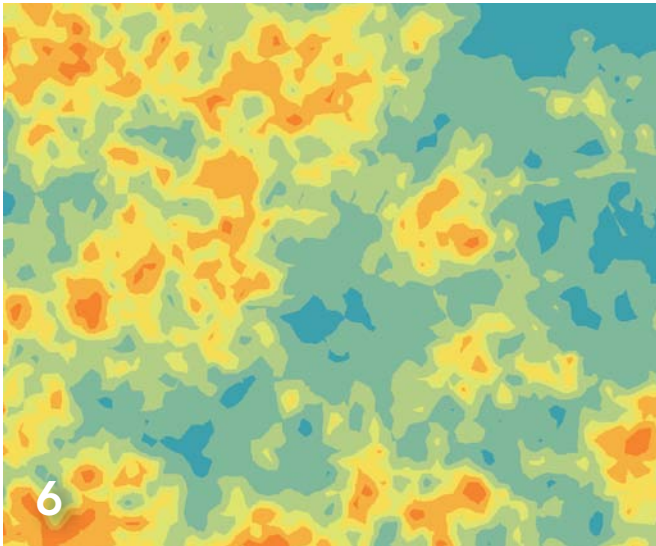
Monica Pratt, ArcUser Editor
380 New York Street
Redlands, CA 92373-8100 USA
arcuser_editor@esri.com

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



Software and Data

- 6 Empirical Bayesian Kriging
Implemented in ArcGIS Geostatistical Analyst

Manager's Corner

- 26 Extending GIS without Extending Your Day
- 27 The Importance of Keeping Current

Developer's Corner

- 28 Use Field Mapping and Python Scripting to Make Your Job Easier

Hands On

- 50 Unlocking Data Trapped in Paper
Address geocoding legacy geological data
- 56 Harnessing the Power of Query Layers

Bookshelf

- 60 GIS Bookshelf
- 61 GIS Modeling Explained and Explored

User

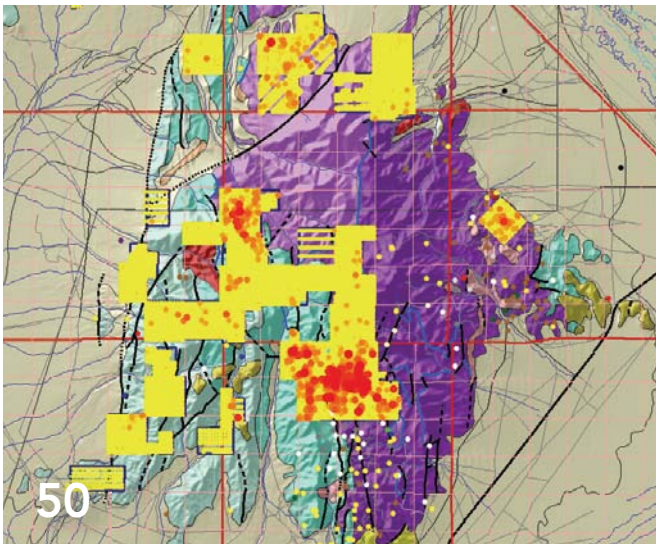
- 62 Opening Our World
- 65 The People's Choice GIS Awards

Education

- 66 Entering a New Era in GIS Education
- 66 Education Books on STEM Classes and Facilities Management
- 67 Talking about the Future of GIS Education

End Notes

- 68 Designing a Better Future for Belize



Empirical Bayesian Kriging Implemented in ArcGIS Geostatistical Analyst

By Konstantin Krivoruchko, Senior Research Associate, Software Development Team, Esri

Obtaining reliable environmental measurements can be costly and laborious, and in many cases, environmental contaminant samples are not collected where people live or work. The ability to predict values where observations are not available is, therefore, very important. Interpolation is the process of obtaining a value for a variable of interest at a location where data has not been observed, using data from locations where data has been collected.

There are many methods for interpolating spatial data. They fall into two broad classes: deterministic and probabilistic. Deterministic methods use predefined functions of the distance between observation locations and the location for which interpolation is required (for example, inverse distance interpolation). Probabilistic methods have a foundation in statistical theory. These predictors quantify the uncertainty associated with the interpolated values. The requirement of providing information on prediction uncertainty limits the choice of interpolators to statistical ones.

Development of reliable automatic statistical interpolation models has been a hot issue in the GIS community for a long time. However, this is a very challenging task because each statistical model is based on the users' data and the data is often so complex that it is extremely difficult to describe it mathematically without interaction.

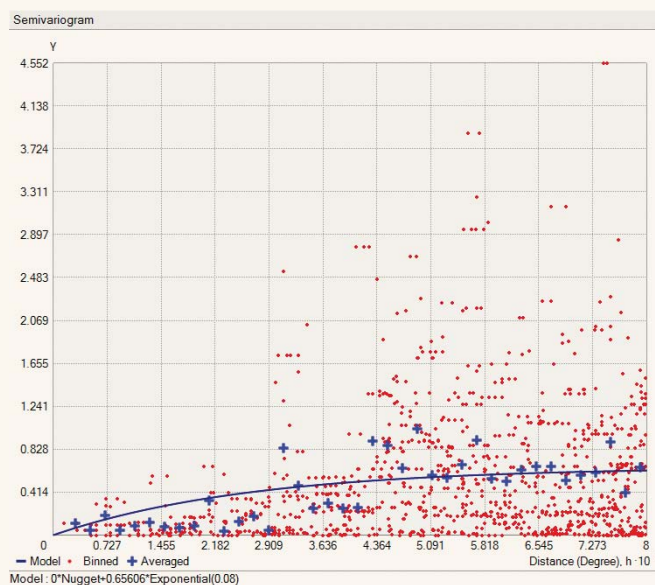
This article briefly discusses statistical interpolation features and then provides some details about the empirical Bayesian kriging (EBK) model implemented in ArcGIS 10.1 Geostatistical Analyst. Extensive testing using a large variety of data showed that EBK is a reliable automatic interpolator. This kriging model is also available as a geoprocessing tool that can be used in ModelBuilder and Python scripts.

Kriging

Kriging is the name given to a class of statistical techniques for optimal spatial prediction. It was developed by Lev Gandin in 1959 for meteorological applications. It has been used in many other disciplines, including agriculture, mining, and the environmental sciences.

Kriging is a probabilistic predictor and, as such, assumes a statistical model for the data. Kriging predictors have standard errors that quantify the uncertainty associated with the predicted values. Kriging predictors are called optimal predictors because the prediction error is minimized and, on average, the predicted value and the true value coincide. Kriging predictors:

- Have smaller prediction uncertainty than other prediction models
- Have the ability to filter out measurement errors
- Use information on the correlation between the variable of interest and covariates



↑ Figure 1a: The semivariogram values for the pairs of points (red), their averages (blue crosses), and the estimated semivariogram model (blue line.)

When kriging predictors are applied to the analysis of radioactive contamination, they can answer questions such as, What is the probability that food contamination exceeds the radioecological standard at the specified location? and provide estimates of average and total contamination in specified areas.

Kriging uses a semivariogram—a function of the distance and direction separating two locations—to quantify the spatial dependence in the data. A semivariogram is constructed by calculating half the average squared difference of the values of all the pairs of measurements at locations separated by a given distance h . The semivariogram is plotted on the y axis against the separation distance h .

Figure 1a shows the semivariogram values for the pairs of points (shown in red) and their averages for a set of the distance intervals between the points (shown as blue crosses). The blue line in Figure 1a shows the estimated semivariogram model. This semivariogram model is then used to define the weights that determine the contribution of each observed data point to the prediction of new values at unsampled locations.

There are some statistical assumptions behind kriging. The main assumption is stationarity (spatial homogeneity). If data is stationary, the data mean and the semivariogram are the same at all locations in the data extent. If this assumption is held, just a few kriging model parameters have to be estimated from the data to make

→ Figure 2: Spatial data simulated using power semivariogram model with power values of 0.1, 1.0, and 1.9 (from top to bottom)

optimal predictions and valid statistical inferences.

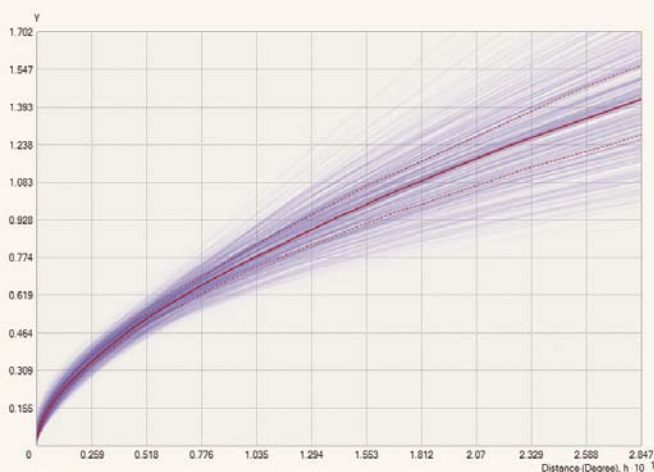
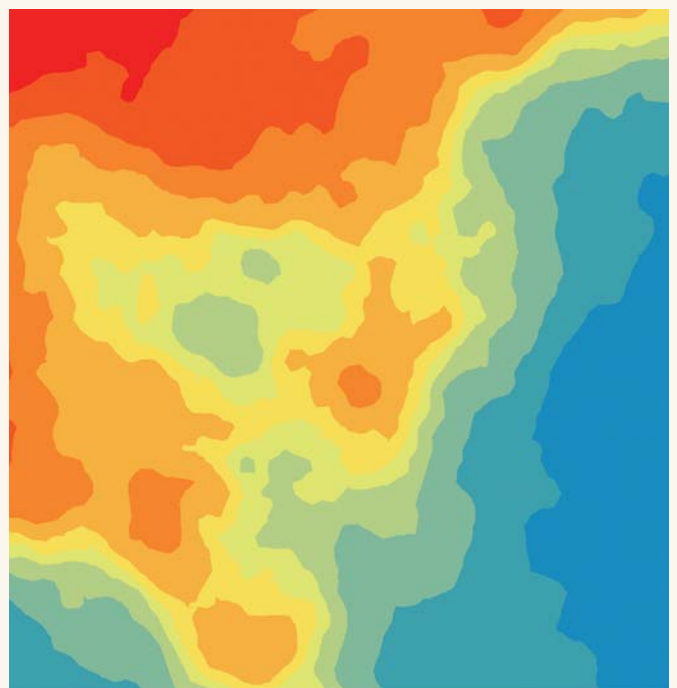
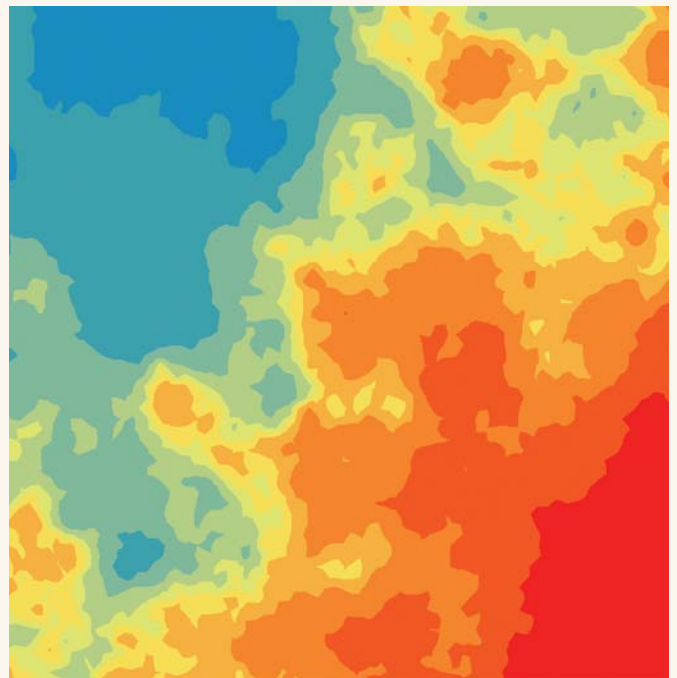
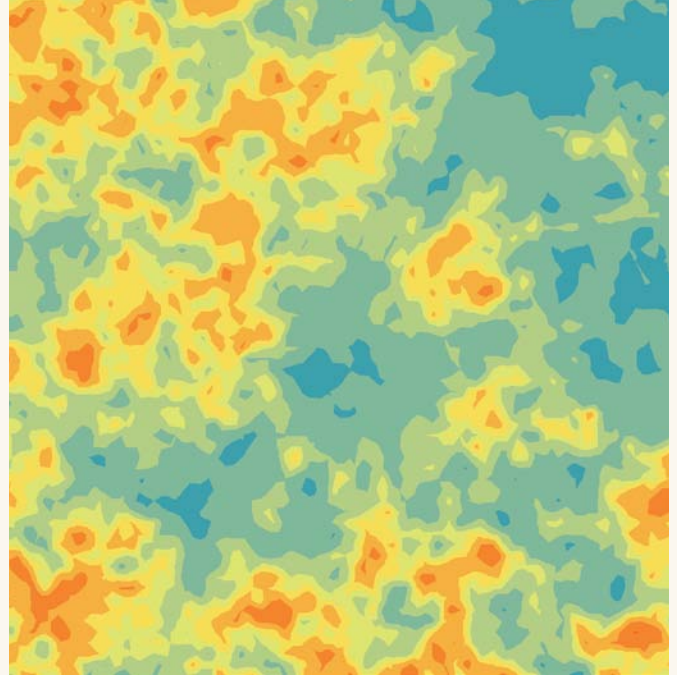
If the data distribution is Gaussian, the best predictor is one that uses a linear combination of the nearby data values. For other distributions, however, the best predictor is often nonlinear and, therefore, more complex. The data can be transformed to follow a Gaussian distribution. Then it is possible to accurately back transform kriging predictions to the original data scale, which can be done in ArcGIS Geostatistical Analyst.

Classical kriging also assumes that the estimated semivariogram is the true semivariogram of the observed data. This means the data was generated from Gaussian distribution with the correlation structure defined by the estimated semivariogram. This is a very strong assumption, and it rarely holds true in practice. Hence, action should be taken to make the statistical model more realistic.

Introducing Empirical Bayesian Kriging

EBK differs from classical kriging methods by accounting for the error introduced by estimating the semivariogram model. This is done by estimating, and then using, many semivariogram models rather than a single semivariogram. This process entails the following steps:

1. A semivariogram model is estimated from the data.
2. Using this semivariogram, a new value is simulated at each of the input data locations.
3. A new semivariogram model is estimated from the simulated data. A weight for this semivariogram is then calculated using Bayes' rule, which shows how likely the observed data can be generated from the semivariogram.



↑ Figure 1b: The spectrum of the semivariogram models produced by EBK

better predictions. In Geostatistical Analyst, this can be identified using the model diagnostics.

Plotting the ^{137}Cs soil contamination distributions in several areas of the data extent shows that they are clearly non-Gaussian and differ by region as shown in Figure 4a. Therefore, varying local data distribution clearly forms an essential feature of the optimal interpolation model. EBK provides an option to transform the observed process to a Gaussian process, using the estimated data transformation function as illustrated in Figure 4b.

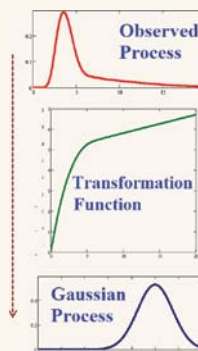
EBK with the data transformation option estimates the data distribution many times using the following algorithm:

1. The data is transformed to a Gaussian distribution and a semivariogram model is simultaneously estimated from the data.
2. Using this semivariogram, new data is unconditionally simulated and then back transformed at each of the input data locations.
3. The new data is transformed and a new semivariogram model is simultaneously estimated from the simulated data.
4. Steps 2 and 3 are repeated a specified number of times. Each repetition produces a new transformation and semivariogram.
5. Weights for the semivariograms are calculated using Bayes' rule.
6. Predictions and prediction standard errors are made using weights and then back transformed with bias correction.

These associated prediction uncertainties should be considered when using these results for decision-making purposes. Figure 5a shows ^{137}Cs soil contamination prediction (Ci/km^2) and prediction standard error maps produced by EBK for areas near the Fukushima Daiichi Nuclear Power Station. [A curie (Ci) is a unit used to measure the intensity of radioactivity of a sample.] Figure 5b shows the estimated ^{137}Cs distributions (with the median shown in red) for one location inside the data extent.

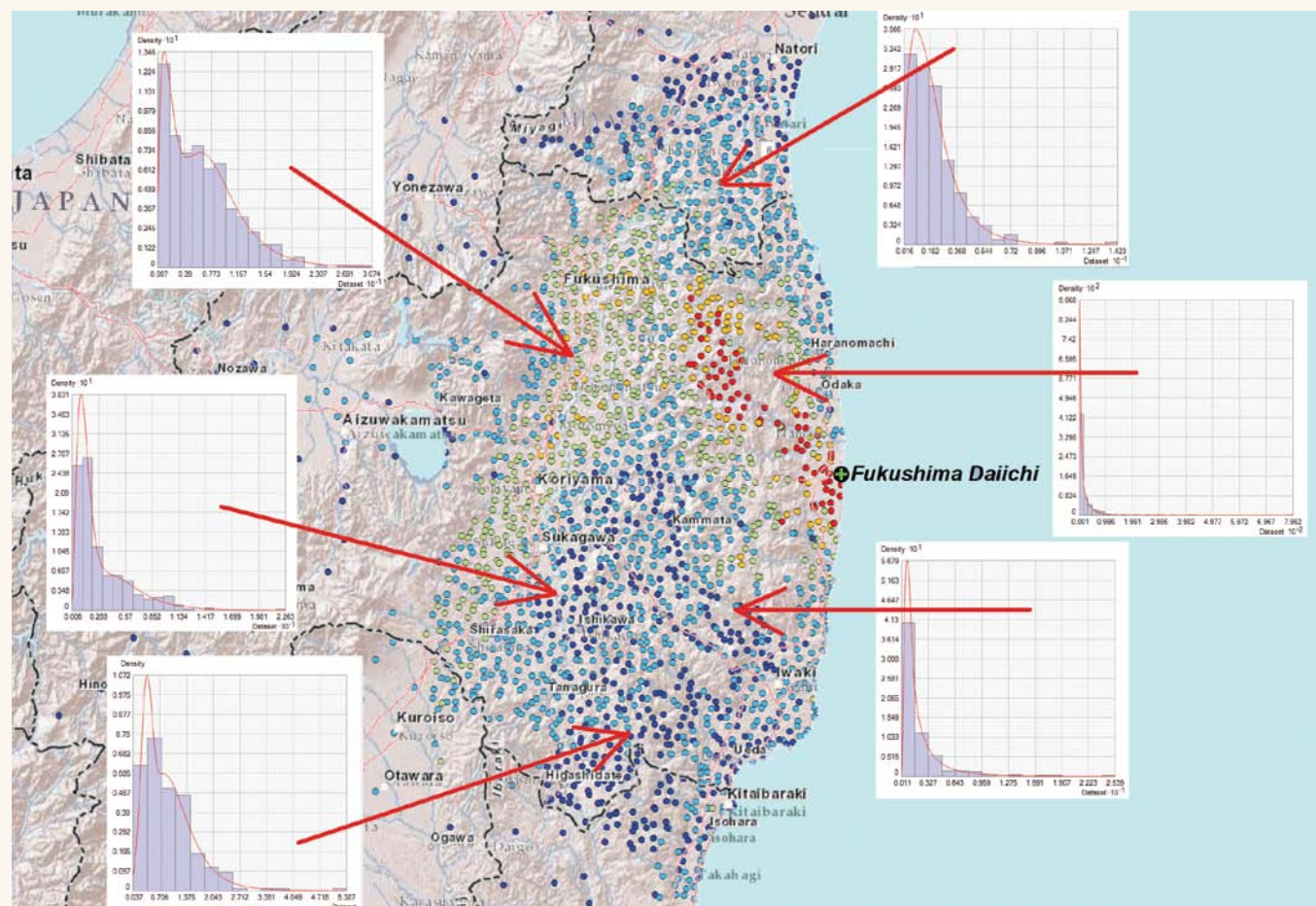
Radioactive decay provides an interesting example because it is a Poisson process rather than the more straightforward Gaussian process. The essential property of any Poisson process is that its mean is equal to its variance. Therefore, the variability of the predictions tends to be smaller for observed data of lower values and larger for observed data with higher values. This is illustrated in Figure 5a.

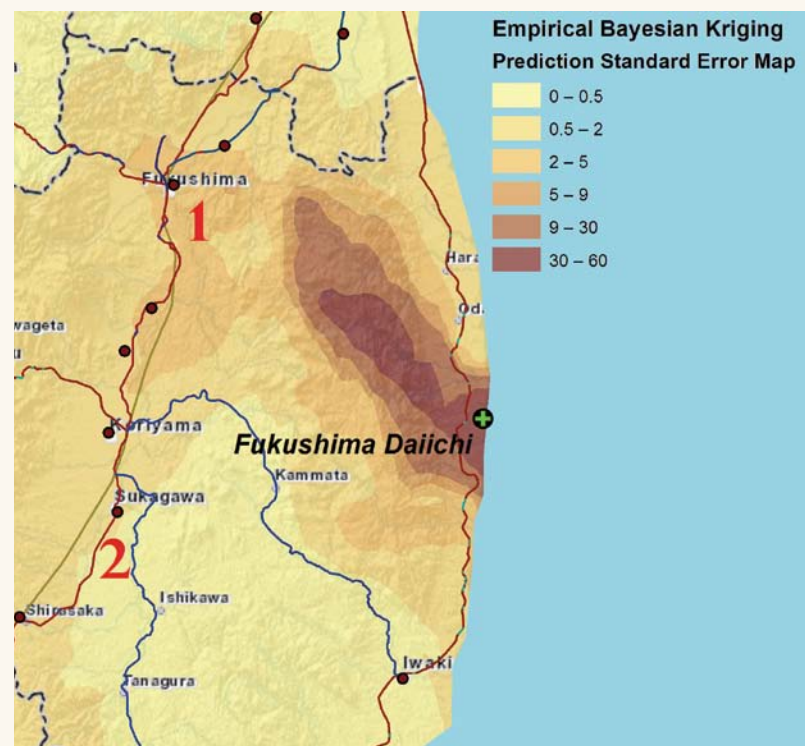
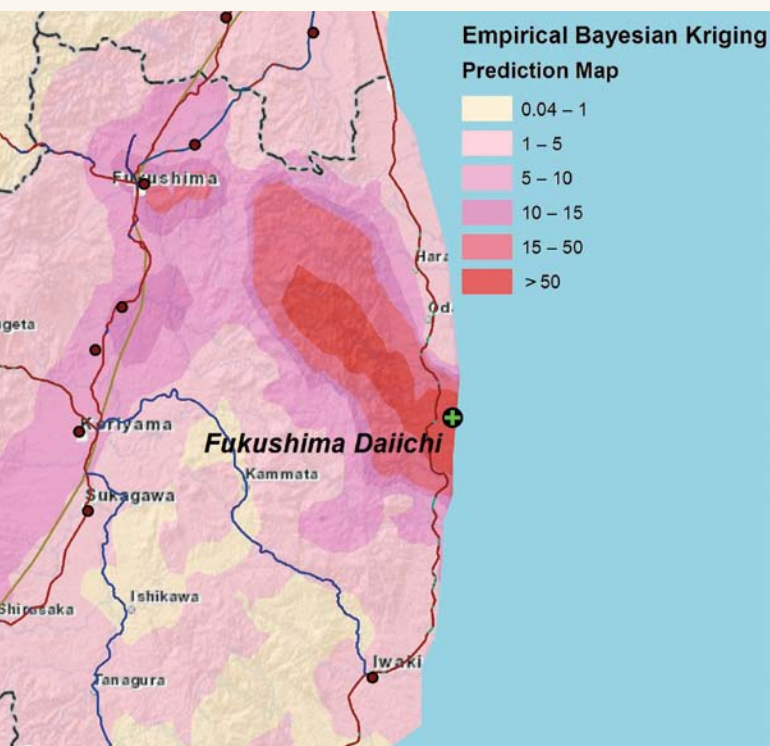
Interpreting predictions together with ➡



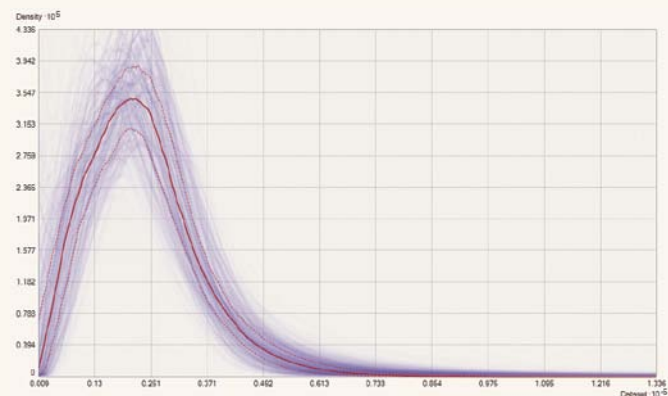
↑ Figure 4b: The data transformation process

↓ Figure 4a: The distribution of radiocesium soil contamination data in six data subsets





↑ Figure 5a: ^{137}Cs soil contamination prediction and prediction standard error maps; 95 percent prediction intervals for locations labeled 1 and 2 are [7.82, 21.62] and [1.17, 3.21] Ci/km².



↑ Figure 5b: Estimated ^{137}Cs soil contamination distributions at one location close to the Fukushima Daiichi Nuclear Power Station.

the prediction standard errors provides a better understanding of possible contamination levels. Analyzing two labeled locations in Figure 5a in more detail reveals that the predictions and their associated prediction standard errors are (1) 14.72 and 3.52 and (2) 2.19 and 0.52.

The radioactive soil contamination at these locations is approximately (95 percent prediction intervals) $14.72 \pm 3.52 \times 1.96 \approx 14.72 \pm 6.9$ Ci/km² and $2.19 \pm 0.52 \times 1.96 \approx 2.19 \pm 1.02$ Ci/km², respectively. Therefore, the “true” contamination in the first location could be larger than 20 Ci/km², although the predicted value is smaller than 15 Ci/km². If the upper permissible limit of soil contamination is 15 Ci/km² (as it was in the former Soviet Union), living in the first location is rather unsafe and people living nearby should be evacuated. At the second location, the “true” contamination could be as much as 3 Ci/km², given a predicted value close to 2 Ci/km².

Conclusion

Empirical Bayesian kriging as implemented in the ArcGIS 10.1 Geostatistical Analyst extension provides both a straightforward and robust method of data interpolation. For more information on using EBK, see the online help for the ArcGIS Geostatistical Analyst extension. To learn more about spatial statistics, read *Spatial Statistical Data Analysis for GIS Users* published by Esri Press.

About the Author

Konstantin Krivoruchko is a senior research associate on the Esri software development team who played a central role in developing the ArcGIS Geostatistical Analyst extension. Prior to joining Esri in 1998, he was director of the GIS laboratory at the Sakharov Institute of Radioecology in Minsk, Belarus, where he developed GIS and spatial statistics curricula and supervised doctoral and graduate school candidate research pertaining to GIS applications and spatial statistical data analysis. He has taught numerous courses on applied spatial statistics and GIS. These activities are summarized in *Spatial Statistical Data Analysis for GIS Users*.

Further Reading

Gribov, A., and K. Krivoruchko (2012). “New Flexible Non-parametric Data Transformation for Trans-Gaussian Kriging.” *Geostatistics Oslo 2012, Quantitative Geology and Geostatistics*, Volume 17, Part 1, pp. 51–65, Netherlands: Springer.

Krivoruchko, K. (2011). *Spatial Statistical Data Analysis for GIS Users*. Redlands, CA: Esri Press, 928 pp.



ArcGIS® for Server on Amazon Web Services Your GIS Cloud.



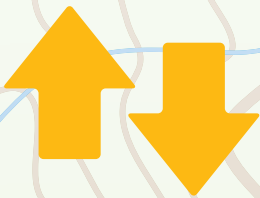
Scalable

Support for high-volume and interactive web mapping applications through Auto Scaling and Elastic Load Balancing



Secure

Ensure business continuity by placing instances in multiple regions and multiple zones within each region



Reliable

An ideal solution to build and test applications and services before deployment



Flexible

Back up GIS data and apps in the cloud by using Amazon Elastic Block Store volumes

Learn more. aws.amazon.com



Location Intelligence Is More Than a Map

By Wayne Eckerson, President, BI Leadership Forum, and Director of Research, TechTarget

For most business intelligence (BI) professionals, maps are becoming an increasingly common way to view data in a dashboard or report. However, most BI professionals have yet to be exposed to the full power of location intelligence, and that's a shame. But I'm hoping to change that.

In July, I immersed myself in the world of location intelligence at the Esri International User Conference in San Diego, California. I've been in the BI field for more than 20 years, so attending my first Esri conference was an eye-opener. Not only are the exhibits full of fascinating geographic displays, more than 15,000 people attended the event. That puts any BI event to shame.

For my BI brethren, location intelligence is the newest moniker for something that used to be called spatial analytics, geographic information systems (GIS), or just mapping software. Location intelligence creates maps that enable users to view the relationship of objects in space and perform a variety of spatial calculations, such as, How long will it take to drive from Detroit to Cleveland? or What percentage of high income customers are located within a 15-minute drive of this store? or What's my risk exposure to a hurricane that plows through Dade County, Florida?

Parallel Worlds

Like business intelligence, location intelligence supports analysis and decision making. But for the past 20 years, these two data-centric disciplines have forged independent but parallel paths. Only now are they beginning to converge.

After my presentation at the conference, one attendee asked, "Why hasn't location intelligence taken off in the business intelligence community?" My first response was that a majority of BI shops have been consumed trying to get adoption for basic reporting and analysis applications and only now are ready to incorporate new capabilities such as location intelligence, predictive analytics, and unstructured data.

But later I realized that the BI community has already embraced location intelligence, at least the mapping part of it. During the past 10 years, most BI professionals have spent significant time learning how to display the shape and content of data in visual form, using charts and graphics, including maps. Meanwhile, BI vendors have invested heavily in beefing up the visualization capabilities of their tools and adding new charting components, including maps. To BI professionals, maps are now an integral charting component of any BI portfolio.

The Intelligence in GIS

But location intelligence is more than just a map with dots on it. Location intelligence is a full-fledged analytical system. These so-called geographic information systems specialize in storing and manipulating spatial data, which consists of points, lines, and polygons plotted as coordinates in space.

Each spatial object can be imbued with various properties or rules that govern its behavior. For example, a road (i.e., a line) has a surface condition and a speed limit, and the only points that can be located in the middle of the road are traffic lights. Spatial engines can then run complex calculations against coordinate data to determine relationships among spatial objects, such as the driving distance between two cities or the shadows that a proposed skyscraper would cast on surrounding buildings or RFID tagged products that move beyond a specific area (e.g., geofencing). In essence, a GIS is an object-oriented analytical system that models things in space.

So without access to a GIS, analytically driven organizations miss valuable insights. Until recently, most spatial analysis was conducted by a handful of GIS specialists working in the bowels of a company who imported business data into GIS to create spatial models. But now, spatial insights can be delivered to all users via GIS-enabled applications, including BI, ERP, and CRM. And GIS providers, like Esri, can publish GIS applications to the cloud, allowing users to access interactive maps via web browsers.

Integration with Business Intelligence

In the BI world, the first step toward converging location and business intelligence is plotting business metrics on a map. Like other types of visualization, maps bring data to life and make it easier for business users to identify the significant trends and issues contained in most reports and dashboards. But location intelligence goes beyond basic geographic displays; it delivers interactive spatial models that correlate business data on a three-dimensional surface.

For example, BI users might use interactive maps to sift through hundreds of variables to optimize the siting of new stores, dealerships, branch offices, factories, drill heads, or pipelines. Or they could use maps to view how the buying habits and demographics of customers located around stores have changed over time. Facilities managers could use interactive maps to plot the optimal evacuation routes from any point in an office building or estimate the physical and financial impact of a bomb that explodes outside their building at various distances. Insurance agents could use GIS-enabled BI tools to simulate what they would have to pay policyholders whose homes are damaged by a hurricane, based on the wind speed and path of the oncoming storm.

Finally, the explosion of mobile devices, such as smartphones and tablet computers, places a premium on integration of business and location intelligence. For example, mobile dashboards will notify plant managers about the status of poorly performing machines as they walk a factory floor or alert store managers about stock-outs as they move through the aisles. Mobile

dashboards will deliver to executives and salespeople a 360-degree view of a customer as they approach the customer's site. The use cases are endless, and organizations will discover new ones once they GIS enable their BI applications.

Integration Options

Integrating BI and GIS applications is not as hard as it once was. GIS vendors now offer rich REST-based web services APIs to integrate GIS with other applications. And some, like Esri, now offer cloud-based GIS services so you don't even need to own a GIS to benefit from GIS functionality.

As a result, BI vendors are integrating greater GIS functionality into their applications. A decade ago, BI vendors delivered static, graphic maps that customers could overlay with dots. Many now embed GIS shapefiles that enable BI users to plot business data on standard baseline maps and support basic GIS functionality such as zoom, hover, drill, and synchronized filtering. And a few interface directly with GIS, allowing BI report authors to easily add custom maps and more sophisticated GIS functionality to reports and dashboards without having to write code.

Summary

As BI shops seek to infuse reports and dashboards with better visualization and more analytics, it's imperative that they explore the rich opportunities afforded by location intelligence. GIS integration is a simple way to add more robust analytical capabilities to run-of-the-mill reports and dashboards.



LANDinfo
WORLDWIDE MAPPING LLC

SATELLITE & AERIAL IMAGERY
30cm Aerial Photography: USA & Europe
Pleiades 50cm, GeoEye 50cm, WorldView 50cm, QuickBird 60cm, IKONOS 1m
SPOT Image & ALOS 2.5m - 10m, RapidEye 5m, ASTER 15m, DEIMOS 20m
Image Processing, Vector Feature Extraction & Classification

DIGITAL ELEVATION MODELS
Satellite-derived DEMs: 1m GeoEye & WorldView, 5m Intermap,
10m TerraSAR-X & ALOS PRISM, 20m SPOT Image HRS, 30m ASTER

TOPOGRAPHIC & NAUTICAL DATA
Global DRGs, Vector Layers & 5m-90m DEMs/Bathymetry

GeoEye Authorized Reseller • USGS & Esri® Partner
DigitalGlobe Distribution Partner • RapidEye Authorized Reseller
Actium GED Partner • Authorized Intermap Data Distributor

tel +1.303.790.9730 • fax +1.303.790.9734
sales@landinfo.com • www.landinfo.com

Keeping Service Levels High and Costs Low

By Karen Richardson, Esri Writer

“Using location analytics significantly changes your insights into the future—you get an understanding of where you came from and find out where you want to go,” said Bruce Wong, manager of advanced network analytics at General Motors (GM) Company as he spoke at the Plenary Session of the 2012 Esri Business Summit, held July 22–24 in San Diego, California.

The Esri Business Summit brings some of the best minds in business together to share how commercial organizations worldwide are using place-based decision making to support customer service, grow profitability, and manage change in an increasingly complex world. Nearly 400 attendees listened to

plenary speakers in the morning and then attended focused sessions on topics such as using GIS for better customer service, retail applications, and spatial modeling for better growth.

Being in the Best Place

Wong was the first of several plenary speakers. He began the morning talking about how important it is for GM to understand and improve its business analytics. The company transformed itself, going from bankruptcy to profitability and posting \$1 billion in first quarter profits this year. Wong said the company has been using more GIS analytics to trim fat and become more fiscally fit.

Dr. Wayne M. Gearey Jr., senior vice president of location intelligence at Jones Lang LaSalle, reiterated Wong’s emphasis on location and added that location intelligence is the game changer. “Using location analytics, we can define our data filters to understand the best location based on what the business ecosystem looks like,” said Gearey. “This is important because our ultimate goal is to get our clients to a geography of opportunity using the right people, data, and technology. As a result, we build trust and they come back again and again.”

Knowing What the Customer Needs and Wants

Rob Bakker, knowledge manager at Achmea, an insurance and financial services firm in the Netherlands, stressed that it is imperative for business managers to think about old things in new ways. Achmea’s use of GIS has led to streamlining processes for its 18,000 employees, cutting costs, and innovating new products.

While neither a GIS expert nor a practiced public speaker, Bakker said he felt compelled to share Achmea’s success using GIS for risk management, more efficient business processes, and transparency to both government authorities and its customers.

“Achmea has a complex structure—many labels and brands,” explained Bakker. “We have divisions in health, banking, real estate, life and pensions, and non-life. Each division has its own dynamics and methods of product distribution.”

Working on priority key performance indicators for each of these divisions, Bakker’s GIS team was able to build business cases showcasing the effectiveness of GIS for diverse business functions. “One tenet is to be



↑ Rob Bakker of the insurance and financial services firm Achmea stressed the importance of thinking about old things in new ways.

a leader in our industry,” said Bakker. “So, we focused on social solidarity and created a pilot project with the City of Eindhoven [in the south of the Netherlands] to help them measure rainfall and mitigate flooding. That translates to creating a digital underwriting map for the reduction of unknown risk accumulation. By doing this, we talk the same language as the decision makers and connect GIS to the strategic goals of our business.”

Using GIS, Achmea managers believe they also have a better view on underwritten fire risks and thus are more effective in their risk management. Having this common operational picture for the underwriters of several Achmea brands is more efficient and competitive. It makes claims data available for customers, increasing the company’s transparency, and allows Achmea staff to develop products and services that make them an insurer that customers can depend on.

Dependable and Nondisruptive

Interstate Batteries leverages GIS to enhance its outrageously dependable service model. A \$1 billion, privately held company, Interstate Batteries relies on a vast network of dealers to sell its products and provide spent batteries for recycling. Esri technology is at the center of its efforts to maximize the efficiencies of Interstate Batteries distributors as they serve supported dealers. “Esri mapping technology serves as the glue of our best-of-breed CRM [customer relationship management], business intelligence, and master data management solution by providing a visual delivery mechanism for distributor route fulfillment. At Interstate Batteries, we strive to serve our distributors and dealers with the best products and business/technology solutions, including opportunities to make GIS useful and effective,” said Mike Darr, program manager for Interstate Batteries’ Market IQ Program. “Before you know it, you’ll have the user looking at data in ways he never pictured it and uncovering previously unknown opportunity.”

Other plenary speakers during the morning session included Felma Degefa, senior staff engineer at Kohler Co.; David Kniffin, business manager for 3M Traffic Safety Systems; and Sudhir Potharaju, vice president of software development for AIR Worldwide. They emphasized the need to



↑ “Look for the simple opportunities to make GIS useful and effective,” said Mike Darr, program manager for Interstate Batteries’ Market IQ Program. “Before you know it, you’ll have the user looking at data in ways he never pictured it.”

keep projects small and simple and take care not to be a business interrupter that changes the way that managers work.

Keeping Service Levels High

Adam Kostecki, a claims examiner in the Property Loss Division at Amica Mutual Insurance, extended this train of thought in his afternoon breakout session “Pushing GIS to the Front Lines to Improve Customer Service.” Amica, headquartered in Lincoln, Rhode Island, is a provider of personal insurance for autos, homes, and boats. Known in the industry for its high standard of customer service, the company has been awarded several J.D. Power and Associates customer satisfaction awards.

During the presentation, Kostecki demonstrated how Amica uses GIS after hailstorms, tornadoes, and wildfires to proactively respond to policyholders’ needs. In one compelling example, Kostecki showed how local branch users kept policyholders informed during the High Park and Waldo Canyon wildfires in Colorado. During the height of these fires, tens of thousands of homes were under mandatory evacuation. Some people couldn’t access their homes for days. Amica used GIS technology and

up-to-date satellite images to notify some policyholders that their homes were still standing.

“They saw smoke and flames approaching as they evacuated and had no idea if they would have a home to return to,” Kostecki explained. “Our policyholders were amazed we had access to this technology. They really appreciated these updates.”

Kostecki also showed examples of how GIS could be used during the claims adjustment process to improve efficiency and lower expenses. “With GIS, we have a much better idea of what our claim potential is going to be after an event,” he said. “In the past, it might have taken days to fully understand the magnitude of an event. Now our branch users can generate reports with a few mouse clicks, and they can do this in real time as the event is occurring.”

Breakout sessions and Lightning Talks filled the balance of the afternoon. The day ended with a poolside social at the Omni San Diego Hotel, courtesy of Gold sponsor Microsoft and silver sponsors AccuWeather, CloudTrigger, i-cubed, Nokia, and TomTom.

For information on next year’s Esri Business Summit, visit esri.com/bizsummit.

Information through

Solutions that embrace the cloud and consumption-based models

Esri writer Karen Richardson sat down with members of Esri's newly formed location analytics team, Chris Owens, Esri's director of location analytics business, and James Killick, the Esri product management lead for location analytics. The team focuses on geoenabling and geoenriching data that is stored in enterprise systems such as business intelligence (BI), customer relationship management (CRM), enterprise resource management (ERM), and Microsoft Office. Solutions currently developed by this team include the ArcGIS Business Analyst suite of products, Esri Maps for Microsoft Office, and Esri Maps for IBM Cognos.



← Chris Owens, Esri director of location analytics business



← James Killick, Esri product management lead for location analytics

Richardson: How would you define *location analytics*?

Killick: Location analytics is one of the next big waves for the business analytics space. Location as a part of business analytics has always been relevant—most commonly for things like site analysis and customer intelligence applications—but it's been overlooked for too long. With the mass adoption of smartphones and location-aware applications, the amount of location-based data is

exploding, and people are more and more accustomed to looking at the information through a map lens.

This adoption is making a big impact in the business arena. People are more comfortable with viewing data on a map, and when they see patterns, they want to understand them—that's location analytics. And this is a good thing, since location analytics gives you the ability to see your data in a whole new way that graphs, charts, and tables can't reveal. Simply being able to interact with your data through mapping enables you to find and understand patterns that weren't obvious in tables or charts. For example, where are your sales concentrated? Or where are geographic features like mountains, rivers, or freeways having an effect on your business or your organization? Where do you have gaps in coverage? Where should you be allocating more resources?

Although this is a very useful and valuable exercise, simply mapping your data is not the whole story. It's when you start to leverage spatial analytics that things start to get more interesting. One very simple yet immensely powerful form of spatial analytics is to tie the data in the map to your graphs and

charts. As you drill down into the data, the charts and graphs update to reflect what you are seeing, or as you drill down into the charts and graphs, the map updates. For many people there are lots of "aha" moments, when they suddenly figure out the answer to a question that has bugged them for a long time. Seeing data on a map for the first time really brings that data to life. It's interesting to see just how much people want to explore and understand what those patterns mean.

But it can go much, much further than this. Imagine you needed to ascertain the true trade area of a store because of competition or cannibalization. With location analytics, you can answer a question like, Where exactly do 80 percent of our revenues come from? Or perhaps find out which customers are within a specific drive time of a location. With location analytics, you can use your table, chart, and map data to do new analysis. You can model how much business you would generate at one location versus another as well as quantify the effect a new location would have on your existing locations. Let's say you need to determine how many sites you need to open to cover 80 percent of the market and maximize revenues. Obviously you want to find the locations for those sites. Can you do that with traditional analytics? All of this is possible with the kind of location analytics that Esri's platform provides.

So location analytics is really about three key things: It's about dynamic, interactive mapping. It's about sophisticated spatial



a Map

Lens

analytics. And it's about rich, complementary data that can be used to enhance the overall picture of your market. Used together, you can get better understanding and knowledge so you can make the best decisions.

Ovens: A very popular business book was released in 2007 called *Competing on Analytics: The New Science of Winning*. The big idea in this book was that organizations could harness their data for competitive advantage. Arguably, this book contributed to the growth of the business analytics movement, where investment in IT systems has been pervasive—even through the recent economic downturn. By and large, however, the location or geographic perspective has been missing from these systems. Location analytics is the complementary addition of spatial capabilities—mapping visualization, spatial analytics, and information enrichment—to these important information systems.

Richardson:
What
macro trend
do you think
is most influencing
the adoption of location
analytics?

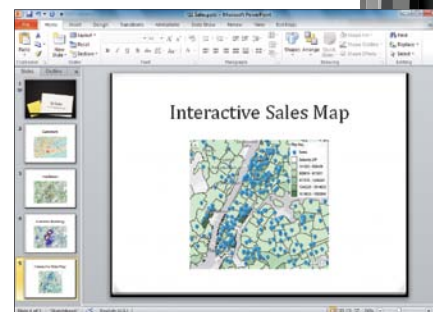
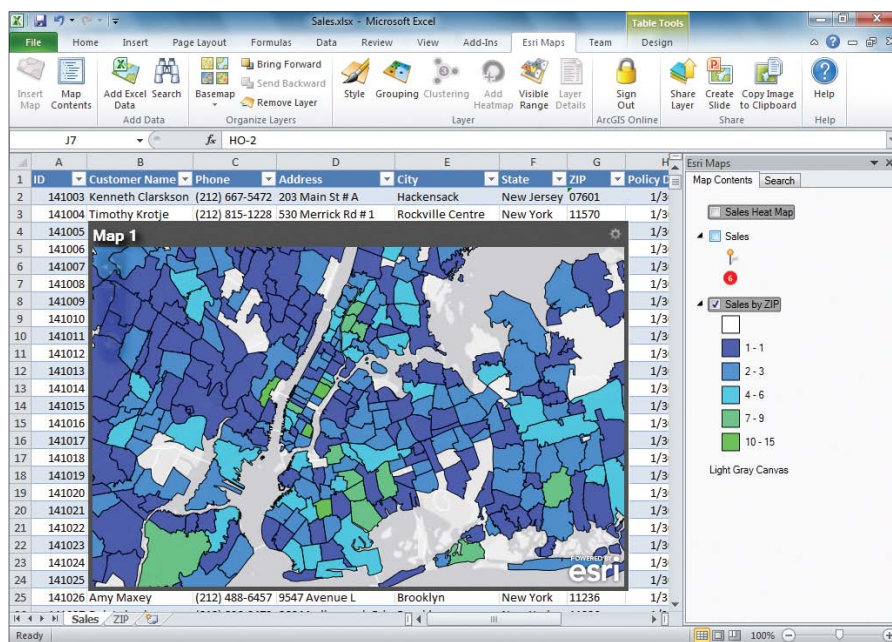
Killick: The consumerization of web mapping has been a huge influence. This started in the late 1990s with the introduction of MapQuest and was taken to the next level with Google Maps and the Google Maps API. More recently though, it has been most influenced by the mass adoption of smartphones and tablets and the location applications that have come along with that. It moved from being about maps to doing business with maps. People are starting to expect maps. People are generally very, very excited just to see their own data on a map. However, as I've tried to communicate previously, location analytics is about much more than just mapping. Yes, it's about dynamic mapping and visualization of your data. But it's also about spatial analytics so you can interrogate your data in a whole new way, and it's about data enrichment, so you can get the context of the people, places, and businesses in the areas where you operate.

Ovens: Unlike 20 years ago, the world now understands the notion and power of a digital map. This is not only driving acceptance of location analytics solutions but actually driving demand. Line of business executives and even CEOs want to see their information on a map. It is no longer simply a nice thing to have, it is essential. The acceptance of the cloud as a platform for both capabilities and content will continue to drive adoptability and pervasiveness of location analytics.

Richardson: Esri is pulling many different products together. How would you see an enterprise making the best use of these technologies?

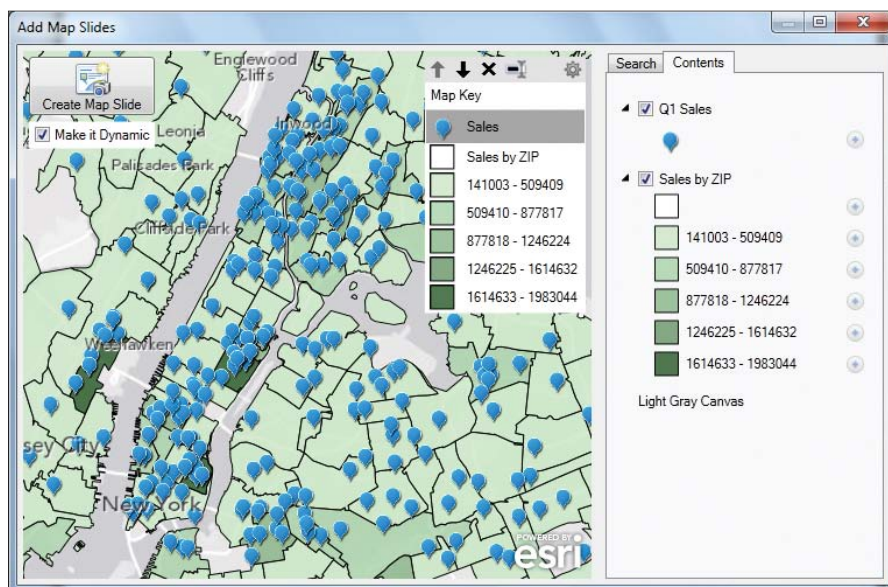
Ovens: The strength of the Esri location analytics portfolio is that an organization can use the right pieces that make the most sense for its business. If a company relies on business intelligence, we can improve those systems. If Microsoft SharePoint is the mission-critical solution, Esri location analytics makes it better. As we all know, Microsoft Office is pervasive in business. Esri Maps for Office delivers far more than an Excel mapping plug-in. It provides a complete mapping system including collaboration. The point is that there is no one-size-fits-all solution for business. The breadth of the Esri location analytics portfolio allows for flexible deployment of spatial capabilities, enhancing the mission-critical enterprise information systems, whatever these may be.

Killick: Enterprises can use location analytics across their organizations in new ➔



ways and get the most from their investments in enterprise IT and GIS. Certainly companies are going to use location analytics to expand on their traditional use of GIS like in a real estate planning department of a retailer that needs to make better decisions about where to open—or close—a store.

But we expect to see the finance department tie in to the GIS system and spatial data using location analytics from spreadsheets. GIS analysts are going to create useful data and map layers that let non-GIS professionals, knowledge workers, and anyone in the organization start using location and geography to make better business decisions. With location analytics, anyone can start to understand the overall performance of their organization, and those people who need to find areas that should be doing better or where there's opportunity for growth, they can start to answer those questions for themselves using the tools they are most familiar with like Microsoft Office or a BI dashboard. Marketing departments can use it for customer intelligence by analyzing who the best customers are by finding out information about them. There are many questions that can be answered: Where are the highest concentrations of people who look and behave like my best customers? How do we reach our best customers? What message would resonate best? Using a nonsiloed approach across an



↑ With Esri Maps for Office, users can make data driven maps in Microsoft Excel that can be shared in Microsoft PowerPoint or published to ArcGIS Online.

organization means businesses can start to make consistent decisions based on consistent data.

Richardson: The users of location analytics are different from traditional GIS users. How is this influencing your thinking?

Killick: You are right: Typical location analytics users are not GIS users or analysts. They don't work in GIS departments. They

are businesspeople. They are knowledge workers. Many of them have never even heard the term *GIS* or know what it stands for. Typical users will spend much of their day using standard business productivity tools—Excel, Word, or PowerPoint. Some of them may spend most of their day using business intelligence tools and running reports. This is the group that is going to drive the uptake of location analytics.

There will also be a subset of customers who use very sophisticated tools and want to expand them. These are the professional



While we are focused on the everyday business users and knowledge workers who spend their days working in Excel or with BI, we also have to cater to professional analysts. These users need the power and flexibility to perform ad hoc queries or create sophisticated models. We have to give these users what they need too—but at the same time keep it extremely intuitive, and hopefully fun.

For more information, visit esri.com/software/esri-maps-for-ibm-cognos/index.html.

analysts. They spend most of their day creating financial models in SAS or IBM's SPSS or perhaps authoring BI reports for the rest of their organizations. Our products are also designed to appeal to this group—that's why we don't have a one-size-fits-all approach. Our audience needs to create impactful, insightful reports and presentations for senior management. Adding mapping and geographic analysis dramatically expands what they are doing now. Many users will be accustomed to using simple mapping tools and consumer technology, so Esri's location analytics is ideal for this segment.

People don't have the time or desire to learn software; they just want it to work. They expect their business applications to be as easy and intuitive as their best consumer applications on their iPad or smartphone. When people use location analytics, they expect to understand it immediately and use it. That's what we are giving them.

Esri® Hardware Offerings

For all your ArcGIS® needs, Esri has the solution for you.

Esri works with leading hardware vendors to provide a variety of hardware offers to its customers. Take advantage of these cost-effective solutions to configure or upgrade your geographic information system (GIS). Esri has server, desktop, mobile, and data products that are prepackaged with ArcGIS software. Custom hardware-only configurations are also available for existing Esri customers.



For more information, visit esri.com/hardware


Copyright © 2012 Esri. All rights reserved.



↓ Often retail stores have not adapted to changes in the composition of the market and are no longer suited to their current location.

BORN AGAIN

The antidote for zombie stores

“He’s already dead, he just doesn’t know it yet.” That phrase, popularized by horror movies, describes the living dead who naively roam the earth, not realizing that their lives have passed. This phrase has also been applied to retail outlets—stores, restaurants, and service venues—with declining businesses and dwindling operating capital that are limping along with marginal profits.

Although these businesses have outlived their usefulness in their current locations, their owners cling to the hope that they will be able to keep the lights on for just one more lease cycle.

“This recession has created zombie stores, stores that appear to be alive but that are really dead,” said Ted Hurlbut, a consultant at the retail consulting firm Hurlbut Associates. “In good times, in every chain there are below-average stores that only generate 70 percent or 80 percent of the average store but are still four-wall profitable. In this downturn, with sales in some of these weaker stores off by as much as 10 percent to 20 percent, these stores are now four-wall cash drains.”

Finding the Best Use

GIS can help retailers fight off the zombie virus. In real estate, it all comes down to one simple question, What is the best use for this land or this building? according to David Beitz, GIS director at EDENS, which is a developer, owner, and operator of community-oriented shopping places in primary markets along the East Coast of the United States.

“If a retail site is barely making it, GIS can be used proactively to spot opportunities that could increase the value of the real estate,” Beitz said. “Maybe that tired chain store location would make a great bank branch. Or maybe it could be combined with several other parcels to build an apartment complex. GIS gives us the tools to research locations and find opportunities in order to make smarter real estate decisions.”

Matt Felton, GIS director at MacKenzie Commercial Real Estate Services, agrees: “With GIS, we can help owners of vacant stores with *[information on]* current, up-to-date market reach, customer profiles, and market potential for zombie sites. Most of these zombie stores are in markets that have dramatically changed quicker than the owners can adapt. Often, these types of stores have outlived their nature in a given market and should instead turn into something new, or they have been completely out-positioned so that no other retailers will want to show interest in the site.”

Connecting People to Real Places

As a shopping center company, EDENS uses GIS in the leasing process to first identify potential retailers for a site, then uses the technology to communicate to the retailer why EDENS leasing and development staff think a site is good for it. “Studies show that the more time customers spend at a shopping center, the more money they spend,” said Beitz. “Great shopping places provide a variety of activities for people in the community to connect through shopping, services, entertainment, and restaurants.”

For example, when EDENS has a retail space or outparcel *[a small lot at the outer edge of a shopping center, reserved for later sale]* that—if developed as a restaurant—would complement one of their shopping centers, staff look at a number of questions:

- What other restaurants are nearby?
- Who is not in this market but is successfully operating in other similar markets?
- How do the demographics of their target site line up with the potential restaurant’s other locations?
- Is this a breakfast/lunch crowd or lunch/dinner crowd?
- What is the daytime (employment) population?

- Where are the schools nearby that help determine commuting patterns?

GIS helps EDENS to understand and communicate the answers to these questions, determining if additional retail square footage might be profitable for landlord and tenant. In addition to maps and demographics, EDENS has also been using Esri Tapestry Segmentation data to better understand its markets. Tapestry classifies US residential neighborhoods into 65 unique market segments based on socioeconomic and demographic characteristics. By understanding lifestyles, life stages, likes, and wants of people, it is easier to understand what may interest people living in specific neighborhoods.

"Above and beyond demographics, the Tapestry data profiles the households and gives us a deeper view of the consumers in the market," said Beitz. "I think the key here is to add retail space only if it accomplishes the larger goal of creating a dynamic shopping place where people want to spend time. If you only look at retail square footage per capita, then you will see that lots of areas are overretailed. The problem is that often the retailer has not adapted to the changing composition of the market. Tapestry gives us the consumer understanding of the business equation to better capitalize on opportunities in the market."

Secure Access to Information Anywhere

MacKenzie brokers and retail partners can present retail centers in the most positive light using an online dashboard created by Felton. MapDash, built on ArcGIS Online for Organizations, a cloud-based solution from Esri, provides designated staff with secure access to information from anywhere.

When an anchor store leaves a mall, customer counts and sales often decline. This triggers the material adverse change clause in most leases and affects the rates other tenants pay. To counter this situation, Felton and his team use MapDash to define the current customer dynamics in trade areas and quantify the market opportunity, depth of demand, and spending capability of consumers in the area. With this information, MacKenzie staff can match opportunities with tenant prospects.

"I think about the world I was in just 10 years ago—me having to build applications and run analyses for people—and now the barriers have been lifted," said Felton. "Today, I can focus on the content, the business use, and not worry about the infrastructure."

From Reactive to Proactive

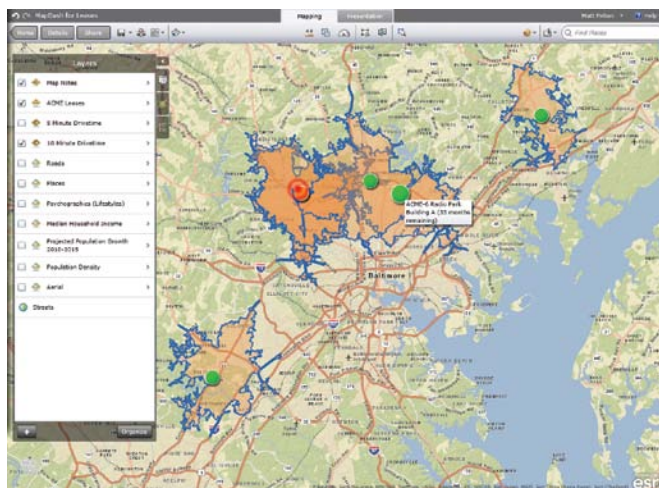
MapDash helps the brokers communicate lease information to their customers. The dashboard helps organizations that hold between 10 and 40 leases in a region access all related information, identify where properties are located, and know when leases on those properties should be renewed.

Red flashing dots on the dashboard map signify stores that require attention relating to a time-sensitive issue such as a lease option. Clicking these dots provides both street and bird's-eye views of the retail location, along with reports that summarize the pertinent information about the lease such as length of lease, price per square foot, and length of time at the site. This gives decision makers a better understanding of the terms of all leases, turning the often reactive lease renewal process into a proactive strategy for optimizing the company's portfolio.

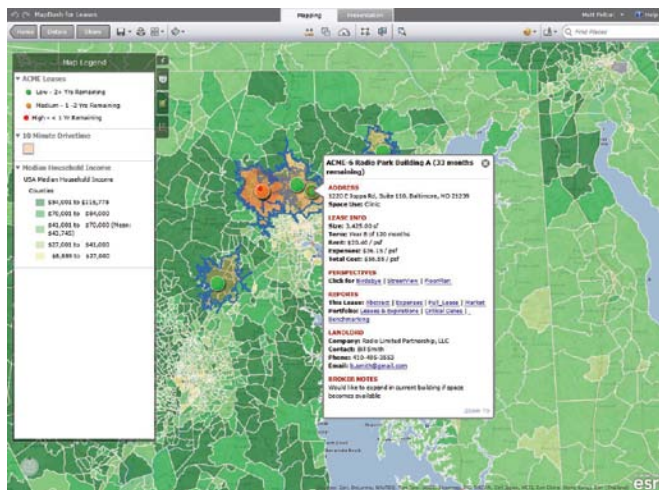
"MapDash allows our customers to see their entire portfolio, not just one lease at a time," said Felton. "Accessing information in this manner is better and faster and keeps our clients more informed. This gives them more leverage in the process, and this translates into healthier retail stores."

Opportunity in a Sea of Change

Today's retailers have a tremendous opportunity to leverage their retail locations to gain significant competitive advantages. GIS technology and data help retailers gain a comprehensive understanding of daily store operations and the customer. These retailers can more quickly identify key trends, make decisions, and respond to changing consumer behavior. This is a key competitive advantage. Being agile and responsive is the key to maintaining a viable and growing business in a dramatically evolving economic landscape. For more information on how GIS can help retailers, visit esri.com/retail.



↑ Customers can see their entire portfolio, not just one lease at a time, allowing them to be proactive in their management strategies. This translates into healthier retail stores.



↑ MapDash helps organizations that hold between 10 and 40 leases in a region access all related information, identify property location, and know when leases on those properties should be renewed.



The Parcel Fabric Offers Advantages at Any Scale

By Matthew DeMeritt, Esri Writer

The City and County of Denver, Colorado, and Mono County, California—jurisdictions that present a marked contrast in size and staff—have both transitioned to the parcel fabric and now enjoy significantly improved workflows, better management of cadastral data, and a vastly improved editing experience.

In ArcGIS 10, Esri introduced the parcel fabric, a new method for parcel management that helps governments by replacing manual editing of cadastral information with a geospatially integrated data model. The parcel fabric, a composite group layer, manages the spatial and topological relationships inherent in cadastral data. Esri's new parcel data model conforms to a set of rules that continually refine existing parcel data and make land information easier to edit, track, and share throughout the organization and with the public.

Increasing Efficiency on a Large Scale

DenverGIS, Denver's GIS department, received a 2011 Special Achievement in GIS award for its Parcel Fabric Conversion, a project that converted more than 450,000 lots, parcels, easements, subdivisions, and associated annotation to the new data model.

In March 2010, the City and County of Denver began discussing migrating its parcel data to the parcel fabric data model. The main impetus for Denver's conversion to a modern data model was to increase efficiency and improve communication between different groups that edited parcel maps and data. At that time, staff from three teams—Public Works Survey, Assessment, and Technology Services DenverGIS—were authorized to edit parcels, lots, subdivisions,

and easements that were maintained in ArcInfo Region Coverage format. "This increased the potential for errors and redundant work," said Doug Genzer, senior GIS analyst at DenverGIS. "For example, an edit to a lot might negatively impact a parcel without the Assessment group knowing about it and vice versa."

After gathering requirements, DenverGIS decided to use the Esri Parcel Fabric Template and extend the data model as needed. Before the conversion, DenverGIS had no comprehensive control point layer. Surveyors maintained points not only in different files but also in several formats (e.g., Microsoft Excel, Esri shapefile, ArcGIS file geodatabase, AutoCAD), making data difficult to access. It was also difficult to determine if files contained duplicate data points.

"To build the control network, we gathered more than 8,000 survey control points from those various data formats, identified the

duplicates, and retired less accurate points," said Genzer. Benefits from the actual conversion process included discovering and fixing more than 1,000 geometric and attribute errors, consolidating survey control point data into one GIS layer, and creating a cadastral dataset that complied with Federal Geographic Data Committee standards.

The new system went into production in January 2011. The project successfully converted all existing datasets and identified inconsistencies and minor data issues. Improved workflow processes are increasing parcel geometric accuracy over time.

The ArcGIS Workflow Manager extension now manages the work process and has improved coordination between departments in terms of communication, quality, and timeliness. DenverGIS used Workflow Manager to create editing workflows specific to each department's editing needs. Both the Public Works Survey and Assessment



↑ Denver's Survey Editing Map is designed for the editing of lots, subdivisions, and ordinances and importing and assessing the accuracy of control point data.

groups' workflows contain an editing map optimized for the maintenance of the cadastral features those groups have authorization to edit. The maps use feature editing templates containing only the features specific to their work.

Workflow Manager also manages versioned editing of the fabric, which enabled Genzer and his team to incorporate automated e-mail alerts. "Our workflows send e-mail notifications when a step is completed that alerts the Assessment group that the Survey group has made a significant change," said Genzer. "If a survey edit affects a parcel, it will alert the Assessment group to get the approval for it."

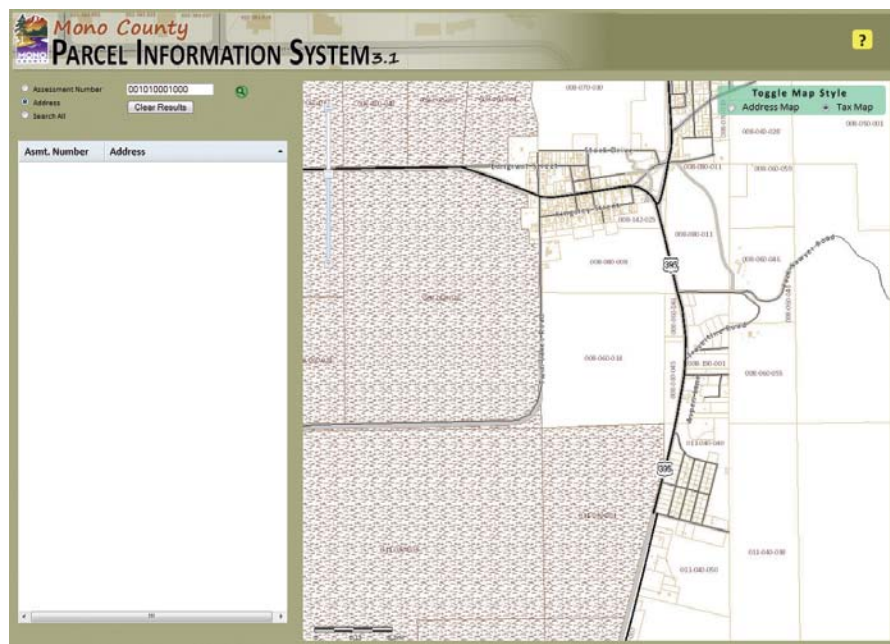
Innovative County Is Early Adopter

Mono County maintains more than 21,000 parcels within its parcel fabric. Its public-facing Parcel Information System website, online since 2010, has received praise from all county departments for delivering more accurate and frequently updated cadastral data.

The Mono County Assessor's Office manages cadastral information for Mono County and the Town of Mammoth Lakes in California's beautiful eastern Sierra Nevada. As early as 2004, the county began investigating a more efficient and integrated solution for producing and maintaining parcel data in its GIS.

"We worked very closely with Esri in those early stages of GIS-based parcel management, because at the time there wasn't a standardized data model or dedicated set of tools we could rely on," said Nate Greenberg, GIS coordinator for Mono County and the Town of Mammoth Lakes. "Managing cadastral data at the time meant working in standard feature classes with a set of topology rules applied to them to ensure data integrity and facilitate editing workflows." While that process was vastly superior to a CAD-only workflow, Greenberg and his team found it challenging to strike a balance between maintaining accurate dimensions for a parcel and fitting that parcel into surrounding parcels.

Mono County's head start on parcel management prompted an invitation to become part of Esri's Cadastral Editor beta program



↑ Mono County's Parcel Information System makes its parcel information publicly accessible.

in 2007, and the county officially became an early adopter of the methodology. In the ensuing years, Greenberg worked closely with Esri's cadastral team and the Mono County Assessor's Office to help influence product development, testing and implementing improvements to the tool and data.

"We had strong coordination between our GIS staff, Assessor's Office staff, and Esri's cadastral team to identify the parts that needed refinement and discuss ways to improve the editing experience within ArcGIS," said Greenberg. "It's been really fun and rewarding to help the product grow and see the quality, stability, and ease of use improve."

When Mono County first started managing parcels with the ArcGIS Survey Analyst extension, even simple operations like modifying attributes of parcels in the fabric were laborious. Now, common editing operations, such as attribute editing, are tightly integrated into the ArcGIS user interface.

With the release of ArcGIS 10.1, the data loader has been optimized to overcome traditional flaws in parcel data that cause inaccuracy such as poorly rendered curves or overlapping geometry. Now the data loader runs as a geoprocessing tool against topology that contains rules to ensure cleaner geometry. Parcels must meet the data loader's standards before being committed to the fabric. These improvements to the migration process caused Greenberg and his team to

load data on condominiums, subdivisions, and general common elements, which had previously been maintained as separate feature classes, into the fabric.

Moving to the Parcel Fabric

When asked what advice he would give to governments and agencies considering the move to the parcel fabric, Greenberg offered a general game plan: "First, demonstrate the technology in a small-scale pilot project to get buy-in from key stakeholders, such as cadastral mappers, assessors, and other personnel that depend on parcel data. Second, carefully consider data conversion from your legacy systems to the parcel fabric, and devise a phased approach that includes getting data into the system, cleaning it up once it's loaded, and maintaining it going forward."

To help governments transition to the parcel fabric, Esri created the Local Government Information Model, which harmonizes GIS datasets, web services, and maps. It connects information silos and integrates processes across typical government departments. It includes foundation layers and operational information that support key maps and applications in local government. To download it, visit ArcGIS for Land Records, a public group on ArcGIS.com that provides maps, applications, and best practices information.

An Integrated Land Records Solution

Land records provide the foundation for local government GIS. Not only are parcel records used for assigning landownership, managing valuations of land and associated improvements, and applying land-use and zoning designations, but they also act as a basemap for overlaying feature classes, such as building polygons or utility lines, which are constructed in relation to parcel boundaries. Thus parcel layers provide the framework for other GIS applications that maintain public infrastructure, encourage economic development, and optimize emergency response.

ArcGIS 10 introduces a comprehensive solution for land records creation and maintenance that consists of three key components: the parcel data model or parcel fabric, the Parcel Editor toolbar, and the Tax Parcel Editing template. This systematic approach uses topology to enforce data integrity, streamlines daily maintenance tasks, and can improve positional accuracy over time.

The parcel fabric is a map layer depicting land division that stores a continuous surface of connected parcels, or a parcel network. The parcel fabric dataset is a set of related feature classes, tables, and relationships in a geodatabase that supports the management, analysis, and mapping of land parcels. A parcel-based topology stores each parcel's boundary lines and the common corners shared by neighboring parcels.

There are many reasons to migrate parcel data currently maintained outside the parcel fabric in feature classes, coverages, or CAD layers:

- New editing workflows and Parcel Editor toolbar functionality improve editing efficiency.
- Historic parcels are automatically maintained by the parcel fabric

because parent parcels are not deleted when child parcels are created.

- Integrity between parcels and between parcel types is maintained because slivers and gaps between parcels of the same type or between parcels of different types are eliminated.
- Configurable and free predefined maps and applications from the ArcGIS for Local Government solution for land records can be used.
- Accuracy can be improved over time by introducing better control and measurements and running least-squares adjustment.
- ArcGIS functionality is available such as labeling, spatial analysis, automated map production, and publication of parcel information.
- Measurements and geometry are separated. Parcel areas are based on the measurements (COGO) with misclosures taken into account.

The other two components of land records maintenance in ArcGIS are the Parcel Editor toolbar and the Tax Parcel Editing template. Available with ArcGIS for Desktop at the Standard and Advanced license levels, the Parcel Editor toolbar contains tools for performing splits, combines, and other common operations on parcel data using a streamlined set of workflows. The Tax Parcel Editing template provides a multiscale editing map that organizes the survey framework (Public Land Survey System and control), subdivisions, lots, tax parcels, and encumbrances in the parcel fabric data model that can be used with the Parcel Editor toolbar.

The parcel data model, additional parcel editing tools, and Tax Parcel Editing template can be downloaded from the Land Records section of the ArcGIS for Local Government resource center (resources.arcgis.com/content/local-government/land-records).

↓ Components of the parcel fabric dataset

Component	Type	Function
Parcel lines	Feature class	Store and preserve recorded boundary dimensions
Parcel points	Feature class	Store x,y,z coordinates derived from a least-squares adjustment
Parcel polygons	Feature class	Are defined by parcel lines
Line points	Feature class	Are parcel corner points that lie on the boundaries of adjacent parcels
Control points	Feature class	Contain the accurate, published coordinates for a physical location
Plans	Table	Store information about the record of survey
Parcel fabric jobs	Table	Track edits to the parcel fabric
Accuracies	Table	Weight parcels in the least-squares adjustment
Adjustment vectors	Table	Store sets of displacement vectors from least-squares adjustments

Best Practices When Migrating to the Parcel Fabric

- Identify the best migration path by starting with a sample data-set of a few thousand parcels.
- Geoprocessing models can streamline the migration process for large datasets.
- Start the parcel cleanup process in the source environment if possible.
- Train your staff before the final migration and make sure they know how to use the tools for your editing workflows. Migrated sample data can be used for training.
- Always use the latest release of ArcGIS with service packs installed.
- Importing rights-of-way (ROWs) as polygons connects the parcels and allows you to run adjustment without having to add connection lines. Break ROW polygons at subdivision boundaries or into smaller segments. Remember that ROWs are also part of the vacations and dedications editing workflows.
- Import and maintain lot parcels, which are needed to maintain tax parcels and are usually referenced in legal documents.
- If the target environment is SDE, copy the source geometry to the target SDE before loading.
- If the target is a file geodatabase, repair geometry prior to migration.
- If you do not have a good subdivision layer, you may be able to dissolve parcels to create a subdivision layer.
- Keep data modeling to a minimum and follow best practices for editing workflows.
- When importing large datasets, import in descending order by size (i.e., first import the largest parcel types, such as townships, then sections).

PENN STATE | ONLINE



Geospatial Education Portfolio

Enroll in one of our high-quality online education programs to help you achieve your career goals:

- Master of Geographic Information Systems
- Master of GIS—Geospatial Intelligence Option
- Postbaccalaureate Certificate in GIS
- Graduate Certificate in Geospatial Intelligence



U.Ed.OUT 12-0171/12-WC-0112ajw/jms/smb

www.worldcampus.psu.edu/ArcUser12

Extending GIS without Extending Your Day

By Monica Pratt, *ArcUser* Editor

Your life as a GIS manager just got a little easier.

With Esri Maps for Office, your organization's non-GIS staff can map their own tabular data and incorporate the map and feature services your department creates and maintains on ArcGIS Online for Organizations without leaving the comfortable and familiar confines of Microsoft Office.

Dealing with Mission Creep

As a GIS manager, your mission is to geoenable your organization. This means you are responsible not only for supporting the people who build, manage, and maintain your organization's GIS but also the customers in your organization who use geospatial intelligence to inform decisions and improve workflows.

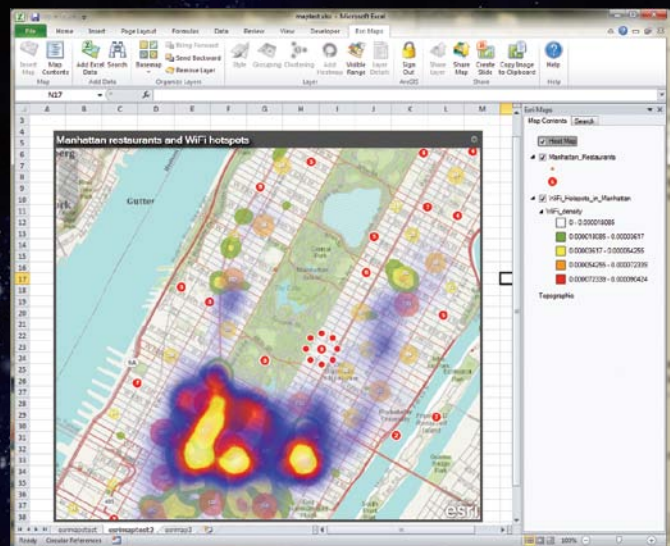
As the value of GIS has been recognized, its role has expanded from a tool to accomplish specific projects to an enterprise-wide information framework. In the process, the focus has shifted from making data available to providing actionable information to the organization. As a result, many GIS departments not only directly help individual customers but have developed strategies that let customers help themselves. Esri Maps for Office is a leap forward in this second process.

With 500 million users, Microsoft Office is likely the most used software in your organization for both presentation and analysis. Microsoft PowerPoint presentations are a staple of both conferences and staff meetings. Business professionals rely on Microsoft Excel for calculating, aggregating, manipulating, and graphing all kinds of data.

Although much of this data contains geographic information in the form of addresses, place-names, or coordinates, there was no way to visualize and analyze using location until now. With the Esri Maps for Office add-in, decision makers and managers can add location to their analysis and presentations without changing the way they work. It will make patterns in the data visible that graphs, charts, and tables cannot reveal. Interactive maps add impact to PowerPoint presentations and can be shared via web pages, mobile applications, and ArcGIS Online.

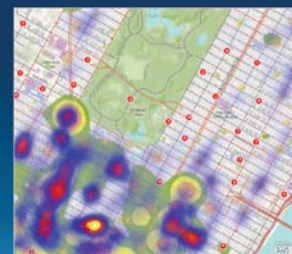
A Shortcut to Productivity

To get started, all that is required is Microsoft Office 2010 for Windows, an ArcGIS Online for Organizations subscription (either paid or trial), and the Esri Maps for Office add-in, which comes with



↑ Dynamically clustering points aggregates points as a single symbol at a small scale that can be broken apart when selected. At larger scales, points are displayed as individual symbols.

Hotspot analysis of restaurant locations and Wifi



↑ Point density can be represented as a heat map. Maps created with Excel data can be combined with map and feature services from ArcGIS Online. PowerPoint slides can be generated directly from Excel maps.

the ArcGIS Online subscription. The add-in seamlessly embeds in Microsoft, installing its own ribbon in both Excel and PowerPoint.

With the add-in, hard-core business users can immediately start creating interactive maps in Excel by choosing the Esri Maps tab, clicking Insert Map, and accepting the default basemap or choosing another. Add Excel data from a table, named range, or cell range. If this data is associated with areas, such as countries, subcountry regions (in the United States, Canada, and western Europe), ZIP Code, or custom regions (supplied as feature services), color-coded maps of sales, customers, or other types of data associated with areas can be created.

Locating data as points on a map is simple but remains very useful. Esri Maps for Office can geocode by address, ZIP Code, state, and country. The symbology of Excel data points can be manipulated in terms of marker style, color, size, and grouping. Esri Maps for Office handles point data intelligently. Tightly spaced points are dynamically clustered. Dynamically clustering aggregates points as a single symbol at a small scale, but aggregated symbols separate when selected. At larger scales, points are displayed as individual symbols. Point density can also be represented as a heat map.

Users can use Search to locate map services or feature services on ArcGIS Online. They can choose services added by your organization or some of the thousands of services contributed by other organizations. Having everyone use data layers that are centrally maintained by your organization ensures that the most current data is being used for analyses and presentations. Content created using the Esri Maps for Microsoft Office add-in can be added

to ArcGIS Online maps or shared back on ArcGIS Online for use by others in mashups.

Like other maps on ArcGIS Online, maps created with this content can be used by a mobile device (smartphone or tablet), embedded in a web page, shared via social media such as Facebook or Twitter, or converted to a web application. As the GIS manager, you maintain control over who can access, use, or contribute to the content you maintain on ArcGIS Online through assigning roles (i.e., user, publisher, administrator).

PowerPoint slides with interactive maps can be created from inside Excel and placed directly into an open PowerPoint file. Alternatively, web maps located on ArcGIS Online can be placed in a PowerPoint presentation by simply clicking the Add Map Slides button on the Esri Maps ribbon in PowerPoint. Maps can also be shared as static images.

Language support is provided for Arabic, Chinese (simplified), English, French, German, Italian, Japanese, Portuguese, Russian, and Spanish.

A Complete Geospatial Platform

With the Esri Maps for Microsoft Office add-in, non-GIS users can take advantage of geointelligence without changing the way they work and without making more work for you and your staff. They can use your work, their work will be accessible across many platforms, and they will feed content back into your system, further integrating GIS into business systems and leveraging the organization's GIS assets. For more information, visit esri.com/software/esri-maps-for-office.

The Importance of Keeping Current

Isaac Asimov was right: "The only constant is change, continuing change, inevitable change."

This applies to software as well as other aspects of life. The GIS user community requires new functionality and applications. Operating systems, databases, complementary software, and industry standards are constantly revised. ArcGIS software, too, constantly evolves to meet users' needs and function in this changing environment.

Consequently, it is important to keep up-to-date with service packs. Each service pack helps improve performance and get the most functionality from ArcGIS. A service pack contains all the fixes and patches released for a version of a product as of that date, including *all previous service packs*. Occasionally, service packs even add functionality.

Because patches and hot fixes are built on the most recent service pack, software must be current on service packs to implement patches and fixes. Regularly applying service packs to all installations of ArcGIS also simplifies maintenance and troubleshooting because all machines will be running the same software.

Service packs relate to specific products and language versions of the software. Each is supplied as a Windows Installer patch (.msp) file or as a .tar archive file, depending on the product and/or

platform addressed by the service pack.

To download service packs, go to the Support section of esri.com and click the Patches and Service Packs link to view a list of the available current service packs and patches. Make sure service packs are downloaded to a location other than the one where ArcGIS is installed. All users can download service packs, whether or not they are on maintenance. Upon request, service packs can also be supplied on CD on a quarterly basis to those on maintenance.

To find out which Esri service packs are currently installed on a machine, use one of the PatchFinder utilities available for Windows and UNIX platforms from the Patches and Service Packs page on the Esri Support site.

Prior to installing a service pack, read all the accompanying documentation. If several Esri products are installed on the same machine, the order in which service packs are applied may be important. Once a service pack is applied to the software, it can only be removed by uninstalling and reinstalling the software to which the service pack was applied.

Use Field Mapping and Python Scripting to Make Your Job Easier

By Drew Flater, Product Engineer, Esri Geoprocessing Team

A number of geoprocessing tools, including Spatial Join (Analysis), Append (Management), Merge (Management), Feature Class To Feature Class (Conversion), and Table To Table (Conversion), have a parameter for controlling how fields from input datasets are processed and written or mapped to the output dataset—the Field Map parameter. In addition to the simple moving of attributes from input to output, field mapping can also be useful for some common tasks such as field concatenation and calculating statistics like mean, sum, and standard deviation.

If you haven't used the Field Map parameter before, you should. Understanding and using field mapping will often reduce the number of processing steps in a workflow and ensure that, in any scenario, attributes are handled in an appropriate way. Yes, the Field Map parameter is a complicated one, but it is well worth the time it takes to figure it out.

Because it is a complicated parameter, working with it in Python can also be complicated. The best way to interact with field

mapping in Python scripting is with the FieldMappings object.

In Python, most geoprocessing tool parameter types are seen as simple numbers or strings (specifying a feature class input is as easy as providing the path to the feature class). But several of the more complex parameters have objects that exist to help you effectively work with the parameter. The Field Map parameter can accept a long structured string indicating the field map settings (you may have seen this long string equivalent in geoprocessing messages); however, working with the field mapping string is inefficient and error prone, so use the FieldMappings object for the best experience.

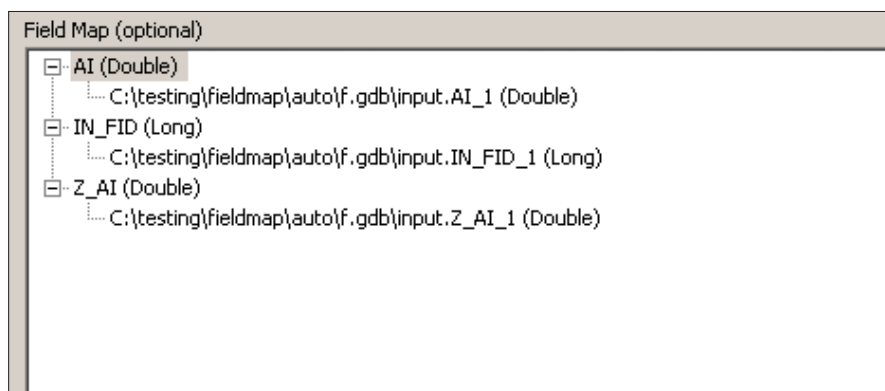
Problem

I was recently presented with a data migration problem where field mappings and Python scripting literally saved me weeks of work. The goal was to convert a collection of hundreds of Vector Product Format (VPF) databases containing many feature classes to a handful of geodatabases, and because

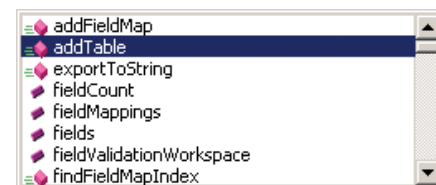
of the large scale of the migration, it had to be accomplished in an automated fashion (thus saving many weeks of work). The schema of the geodatabases was already set up with a number of feature datasets and empty feature classes into which the VPF feature class data would be imported using the Append (Management) tool.

The iteration through the collection of VPF databases was solved with some simple looping techniques involving the `arcpy.ListDatasets()` and `arcpy.ListFeatureClasses()` functions. However, there was a fundamental problem that nearly derailed the automation of this process: VPF feature classes can have spaces in their field names, while geodatabase datasets cannot. When the empty geodatabase feature classes were created from the schema of the VPF feature classes, the spaces in the field names were automatically changed to underscores (`_`) in the geodatabase feature classes. This very subtle difference caused huge ripples in the automated process because the Append tool cannot automatically match fields like `mcc description` to `mcc_description`. In the

↓ Append (Management) tool default Field Map, showing the target geodatabase feature class schema




```
>>> fieldmappings = arcpy.FieldMappings()
>>> fieldmappings.
```



↑ The FieldMappings object has many properties and methods to efficiently work with field mapping.

output geodatabase feature class, all the values in the mcs_description field are NULL because the fields were not matched.

Viewing the Field Map parameter on the Append tool helps illustrate the issue. The fields f_code description, mcc description, and mcs description are not automatically matched to the geodatabase target schema because of the difference of the space and underscore characters.

Solution

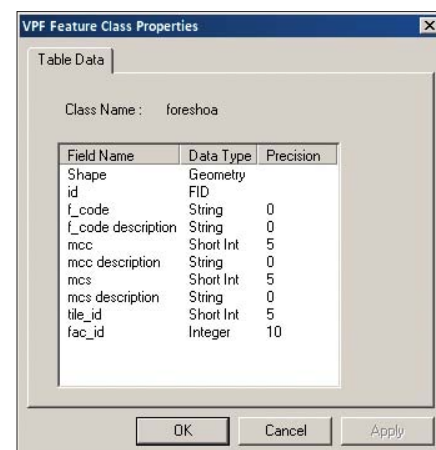
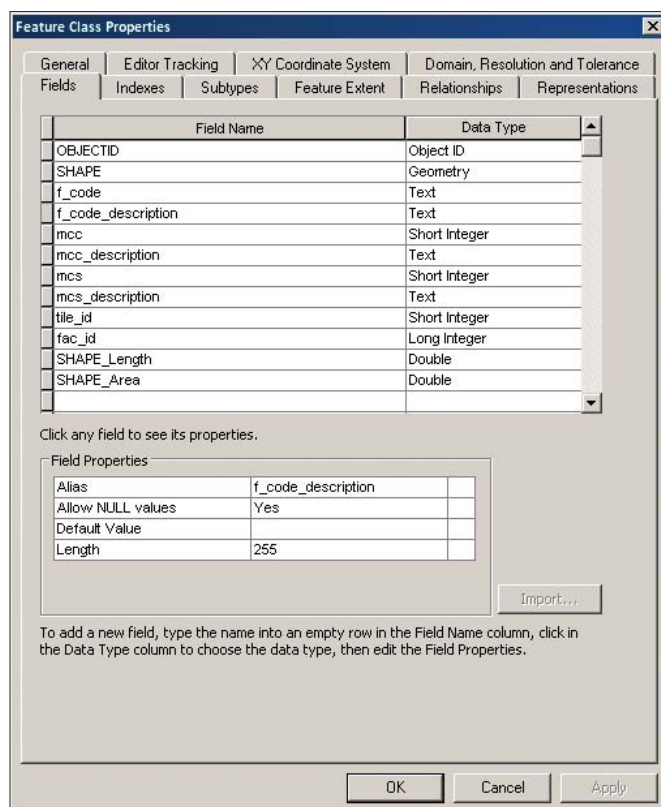
This situation can be rectified by manually adding the matching input fields using the Field Map controls on the Append tool. On

each field that does not have a match, right-click and add the appropriate input field from the VPF feature class.

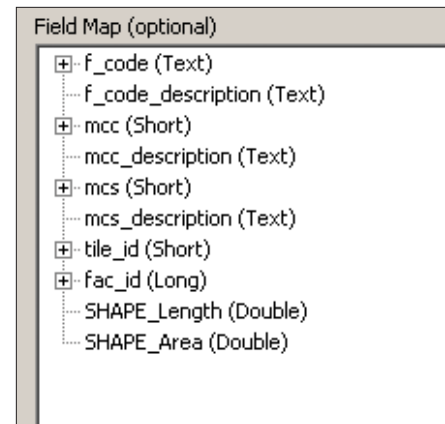
These manual steps resulted in a correct field mapping and import of the VPF feature class data to the geodatabase for a single VPF feature class. To successfully perform the automated migration, I incorporated this additional field mapping work into the migration script using the FieldMappings object. For each iteration before a VPF feature class is appended into a geodatabase feature class, the script iterates through each VPF feature class field, does a find and replace for those fields with

a space and the corresponding field with an underscore, and matches the two fields in the FieldMappings object.

A good way to understand the usage of the FieldMappings object is to think about these steps in the same context as when field mapping is done in the tool dialog. The script goes through each output field in the Field Map (these are the fields from the target dataset) and adds an input field from the VPF feature class that matches, regardless of the differences in space and underscore characters, before finally executing the Append process with the customized field mapping. ➔



↑ VPF and geodatabase feature class fields



↑ The Append tool default Field Map, showing the target geodatabase feature class schema

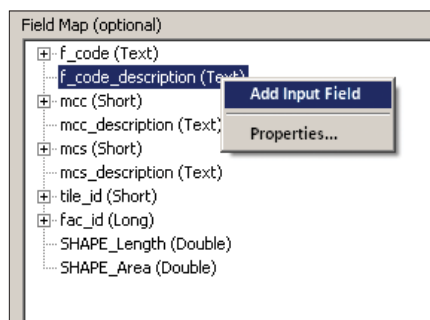
Summary

Several geoprocessing tools use the complex but powerful Field Map parameter to control how attributes from input datasets are mapped to the output dataset. Understanding and using the Field Map parameter on geoprocessing tools can enable time-saving workflows; will often reduce the number of required processing steps; and can ensure that, in any scenario, attributes

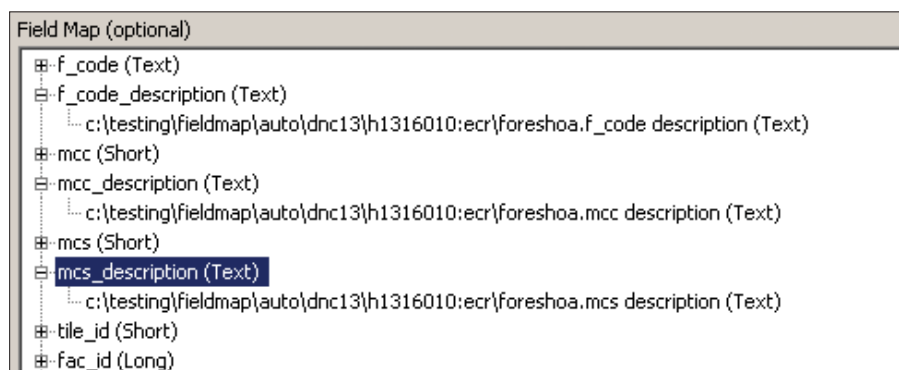
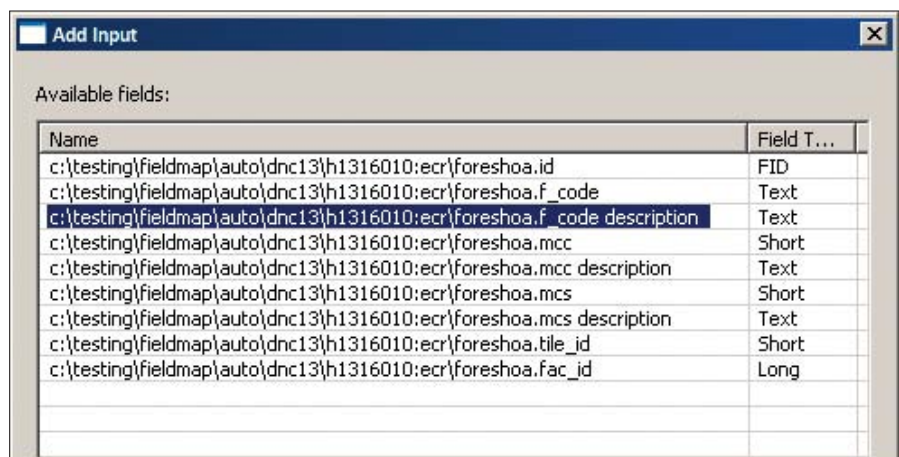
are never lost and always handled in an appropriate way. In Python scripting, the FieldMappings object provides efficient, automatable access to all the same functionality available with the Field Map control on the tool dialog and can be used in many scenarios including programmatically matching fields with different names. Use field mapping—it will make your job easier.

About the Author

Drew Flater has been designing, testing, and writing about geoprocessing tools and spatial analysis for Esri since 2008. He loves creating models and scripts that solve spatial problems and make GIS analysis and data management tasks easier.



↑ Use the Field Map controls to do manual field mapping




```

import arcpy
import os

folder = r"C:\testing\fieldmap\auto\dnc13"
gdbfolder = r"C:\testing\fieldmap\auto\gdb"

arcpy.env.workspace = folder
listvpf = arcpy.ListDatasets()

for vpf in listvpf:
    # First character of the VPF determines the geodatabase to append
    # to
    #
    if vpf[0] == "h":
        gdb = os.path.join(gdbfolder, "DNCHarbor.gdb")
    elif vpf[0] == "a":
        gdb = os.path.join(gdbfolder, "DNCApproach.gdb")
    elif vpf[0] == "c":
        gdb = os.path.join(gdbfolder, "DNCCoastal.gdb")
    elif vpf[0] == "g":
        gdb = os.path.join(gdbfolder, "DNCGeneral.gdb")

    # The characters after the : in the VPF name determine the feature
    # dataset to append to
    #
    fd = vpf.split(":")[1]
    arcpy.env.workspace = os.path.join(folder, vpf)
    listvpffc = arcpy.ListFeatureClasses()
    for fc in listvpffc:
        targetd = os.path.join(gdbfolder, gdb, fd, fc)

        # Create FieldMappings object and load the target dataset
        #
        fieldmappings = arcpy.FieldMappings()
        fieldmappings.addTable(targetd)

        # Loop through each field in the input dataset
        #
        inputfields = [field.name for field in arcpy.ListFields(fc) if
            not field.required]
        for inputfield in inputfields:
            # Iterate through each FieldMap in the FieldMappings
            #
            for i in range(fieldmappings.fieldCount):
                fieldmap = fieldmappings.getFieldMap(i)
                # If the field name from the target dataset matches
                # to a validated input field name
                #
                if fieldmap.getInputFieldName(0) == inputfield.replace(
                    "\ ", "_"):
                    # Add the input field to the FieldMap and replace
                    # the old FieldMap with the new
                    #
                    fieldmap.addInputField(fc, inputfield)
                    fieldmappings.replaceFieldMap(i, fieldmap)
                    break

            # Perform the Append
            #
            arcpy.management.Append(fc, targetd, "NO_TEST", fieldmappings)

```

Save Time, Expense & Embarrassment!

Spell check your maps with...



"I love your product!"

"What a useful tool!"

*"One of the best extensions
anybody has created for
ArcMap."*

The extension corrects:

- Tables
- Legends
- Layer labels
- Scale objects
- Grouped graphics
- Geodatabase annotations
- Map and layout annotations
- Dynamic text (75+ properties)



English French Spanish
German Portuguese
Italian Danish Dutch
Finnish Norwegian Swedish

U.S. Patent No. 7,681,126
ELA and volume discounts available
Esri trademarks provided under license from Esri

888-334-3832
www.Edgetech-US.com
Edgetech America, Inc.
An Esri partner since 1995



Many Hands Make Light Work

Crowdsourcing geoenables development assistance data

By Karen Richardson, Esri Writer

In just 16 hours, a crowd of volunteers processed 117,000 records for US Agency for International Development (USAID) that showed where credit was made available to entrepreneurs around the world through loan guarantees extended by USAID's Development Credit Authority (DCA).

The crowdsourcing event, held to make international development data more accessible and transparent, was not only a first for the agency but also the first time the approach was used by the US government to open data and use Data.gov as a crowdsourcing platform.

An independent agency, USAID has provided economic, development, and humanitarian assistance around the world in support of the foreign policy goals of the United States for more than 50 years.

Getting by with a Little Help from Friends

Crowdsourcing is a relatively new phenomenon that has evolved significantly since the emergence of Web 2.0. In the words of Jeff Howe, contributing editor at *Wired* magazine, "Crowdsourcing is the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call." While still a nascent movement, increased public participation using crowdsourcing and other new technologies presents a shift in how the US government engages with its citizens and how citizens can participate in their government.

In the context of humanitarian and development, crowdsourcing was used in

response to the 2010 earthquake in Haiti. Over the last two years, as the information landscape has continued evolving, this sector has identified innovative ways to incorporate new data and methods into well-established workflows. The use of crowdsourcing for humanitarian or development interventions has spurred a lively debate about the advantages and disadvantages of this approach. The discussion has included many questions relating to data quality, security, and usability. These issues were carefully addressed in USAID's case study on crowdsourcing open data.

Putting the Crowd to Work

To enhance understanding of the geographic distribution of loans guaranteed by the agency, USAID's GeoCenter worked in cooperation with DCA to identify a global dataset of records to map and make available to the public. Interested individuals, including volunteers from the online technical communities Standby Task Force and GISCorps, structured data on certain USAID economic growth activities and then geocoded the data. The data cleaning and geocoding process, originally estimated to take 60 hours, was completed by the volunteer technical communities 44 hours earlier than anticipated.

In the DCA database, all geographic information is stored in a single field that is not standardized across all records. Sometimes the city is given, sometimes a street address, and sometimes only the first administrative level (Admin1) or state level. The data must be broken out into different fields so it can be mapped at the lowest level of granularity across all records. Once parsed out, the city name can be used to capture Admin1 level information using a gazetteer such as the National Geospatial-Intelligence Agency's (NGA) GEONet Names Server.

Given the country name and original location data, volunteers mined the data for clues that would allow them to determine the correct Admin1 unit, Admin1 code, and place-name for a populated area. (The Admin1 code is designed to eliminate problems of transliteration between disparate languages.) Because the data was problematic, not all records could be processed, so volunteers flagged some records as bad data.

USAID worked with Data.gov, Esri, and Socrata to develop web applications for the project. Socrata, a developer and provider of open data services, designed a custom application that allowed Data.gov to be used as a platform for data editing and generation, ➔



↑ Getinet Enyew, who grew up in Ethiopia, left the country when he was younger but always dreamed of going back to be part of his country's development. When he learned a local bank was approving loans for qualified members of the diaspora who returned to start businesses, he jumped at the chance to build an organic farm in Menagesha, Ethiopia. (Photo credit: Morgana Wingard)

considerably extending its original viewing capabilities. With the Socrata application, users could check out as many as 10 records at a time from the database for processing.

Esri created a custom web map application available through ArcGIS Online that allowed users to easily and quickly find administrative names and codes. Because volunteers registered on Data.gov, each geocoded record could be traced back to a specific volunteer. Records were linked to volunteers and USAID staff members could perform spot checks during the crowdsourcing event to look for anomalies in how data was being entered. If a volunteer was incorrectly entering data, that volunteer could be contacted directly or any records they edited could be redacted from the final product if necessary.

Opening Doors with Data

The geocoded data can now be visualized as an Esri story map or shared on ArcGIS Online. Spatially enabling this data lets the private sector explore new areas for collaboration with host countries, researchers, development organizations, and the public. With an appropriate basemap and the addition of other content found on ArcGIS Online, such as world demographic information, organizations and citizens can create, save, and share maps and web applications.

Since the event, USAID has been notified via Twitter that visualizations using the data have been created. One example is OpenSpending, a project operated by the Open Knowledge Foundation (openspending.org/usaiddca) in Cambridge in the United Kingdom. A visualization on the organization's website displays USAID data from the crowdsourcing project and further enables discussion, analysis, and action related to important development strategies.



Maximizing Impact

USAID anticipates that the release of this data will cause several substantive impacts: better service to entrepreneurs, targeted lending, more insights into opportunities for cooperation across national boundaries, and improved partnerships with other donors.

By creating a map specifically listing available financing, USAID is making it easier for entrepreneurs to see where they could qualify for local financing. In addition, organizations working to help certain groups of entrepreneurs around the world access financing can take advantage of the USAID guarantee map to connect their networks with available financing. While the map does not list bank names or contact information, it provides a contact e-mail address so individuals can connect with local banks via USAID staff.



← USAID staff and volunteers at the USAID Innovation Lab in Washington, DC, during the crowdsourcing event (Photo credit: USAID)

be easily analyzed across country borders with beneficial results. For example, if the map shows that all loans in one region of a country focus on agricultural projects while loans in a bordering region in another country fund infrastructure projects, this may lead to future collaborations between these adjacent USAID missions.

While USAID and other donors often try to collaborate to maximize impact, there is no overall database of active guarantees offered by all development agencies. By making available the map service layers, other donors can compare or even overlay their guarantee data to identify opportunities for increasing collaboration.

Committed to Open Data

"The US government is committed to opening data and increasing aid transparency. This pilot is an example of this commitment," said Eric Postel, assistant administrator for economic growth, education, and environment at USAID. "By enabling the crowd to help us sort through and clean nonconfidential data, we are able to release information that we never previously thought was possible."

USAID hopes that this initiative will encourage government agencies to move forward with their own crowdsourcing projects. Whether the intent is opening data, increasing engagement, or improving services, agencies must embrace new technologies that can bring citizens closer to their government. "USAID will also continue to explore unique ways to engage the public in our work," said Ben Hubbard, director of USAID's DCA. "Development isn't something that happens overnight. But with increased transparency, we can start working together to solve development challenges in a more efficient—and fun—way."

Visualizing loan data on a map can also change the way USAID field offices (or missions) plan for future guarantees. Often the goal is to make guarantees available in areas outside capital cities or in certain regions of a developing country. By seeing where the loans are concentrated, USAID missions can better determine whether the guarantees are reaching targeted regions. In addition, USAID can overlay other open datasets on the USAID map. For example, by adding a layer of open World Bank data describing access to financial services organized by income group, USAID can quickly see where its activities line up with other financial indicators.

Previously, USAID missions in one country didn't have time to analyze the location of all loan guarantees in surrounding countries. For the first time, USAID loans can

"By enabling the crowd to help us sort through and clean nonconfidential data, we are able to release information that we never previously thought was possible."

Get Up and Running with ArcGIS Online for Organizations



↑ ArcGIS Online for Organizations integrates your organization's servers and desktops, catalogs information, and can provide backup hosting and cloud hosting.

The release of ArcGIS 10.1 is pivotal. It has been engineered as a system for your entire organization. ArcGIS Online at 10.1 integrates cloud platform technologies to support not only the GIS professionals in your organization but also non-GIS users who will be able to use applications and maps to support their work on any device. ArcGIS Online for Organizations makes integration with your organization's servers and desktops—as well as cataloging your information and providing backup hosting—easy. If you don't have ArcGIS for Server, you can use the cloud server.

ArcGIS Online can evolve with your organization, but when you initially set up the site, spend some time considering how members in your organization—especially non-GIS staff—can benefit from ArcGIS Online capabilities such as Esri Maps for Office.

Considerations for Site Administrators

This guide assumes that you, as the site administrator, will configure your organization's ArcGIS.com website.

Before you configure your ArcGIS Online website, consider how your organization works and what geospatial content it possesses.

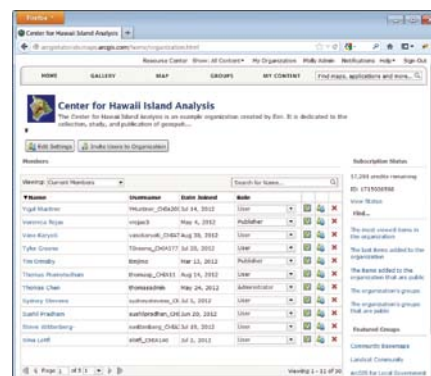
What content should you feature? Which maps, data, applications, and tools should be made available to specific groups? Which content can be made public? Some time spent considering these questions will help you intelligently set up groups and permissions to optimize communication, sharing, and collaboration within the organization. When appropriate, you can also allow access between organizations.

ArcGIS Online can manage organizational resources maintained as ArcGIS Online hosted services, ArcGIS for Server services, on-premises services, managed services, and Amazon Elastic Compute Cloud (EC2) services. All content is automatically set as private until you explicitly share it with specific groups or make it publicly available.

Groups in ArcGIS Online will let members of your organization collaborate and exchange content related to a specific project or common activity. Groups can be public or private. Public groups can accept members or simply share content without letting others join or share their content. Private groups invite members, and only those members can share or contribute content.

Setting Your Site

The person who requested the subscription will receive an e-mail with an activation link. As the administrator, you must activate the account. If you are already using ArcGIS Online, sign in with your existing account to transfer ownership of your contents to the organizational account. If you wish to keep existing



↑ On the My Organization page, you can view your organization's members and groups, determine how many credits have been used, and see which items have been added recently and which are the most popular.

content separate or are not already using ArcGIS Online, sign up for a new account.

Once you have an ArcGIS.com account and are logged in, you can activate your subscription using the activation link. When you first log in to ArcGIS Online, you will be prompted for the URL indicator for the organization. The syntax is <organization name>.maps.arcgis.com. Note: Make sure the organization name is appropriate and correctly spelled because there is no way to change it once it is set. Once the URL indicator is set, you will be sent to the My

Organization page. This page lets you monitor your organizational account: monitoring credit usage, finding out which items have been recently added and are the most popular, seeing featured groups, and viewing your organization's members and groups.

This is also where you will customize the various components that make up the site. You will set the source for basemaps, choose the featured maps, set up the galleries, and create groups and invite members to them. Click the Edit Settings button to start this process.

← General Page

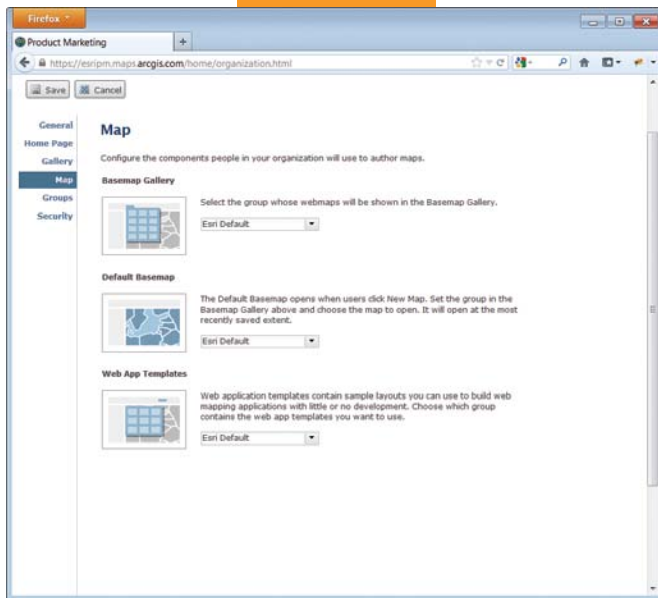
Click General. You will add the organization name and its logo and include a description of it on this page. This is where you set the default language for the site, although individual users can customize this choice using their profile page. This is also where you will set the permissions that determine how members share and search for content outside the organization.

Home Page

Click Home Page to customize the site's home page by adding a banner, by either selecting an image or entering HTML that creates the contents of the banner. This is also where featured content is specified, but since that content has not been set up, accept the default settings for now. You will return to this part later.

← Gallery Page

The next link is Gallery, where you will highlight the content from a group in your organization. For now, accept the default setting, and revisit it later. →



← Map Page

Click Map to configure the basemap gallery, default basemap, and map templates that people in your organization will use to author maps. You can use the Esri defaults for each of these components or choose a group whose basemaps and web map applications will be available instead.

If you will use basemaps from your organization, it is best to create a group called Basemaps that is owned by the site administrator. Note that only ArcGIS for Server and Open Geospatial Consortium, Inc. (OGC), Web Map Service (WMS) services can be used as basemaps. Layers from a file, KML services, and editable layers created in the ArcGIS.com map viewer cannot be used as basemaps. The default basemap will be the basemap your users will get when they click New Map. This map will open to its most recently saved extent. Web application templates contain sample layouts that people in your organization can use to build web applications with little or no development work.



NEW ONLINE PROGRAMS

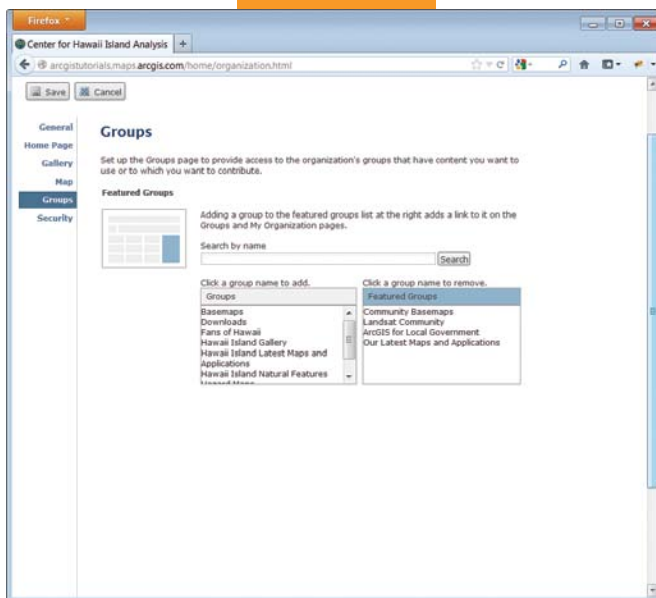
Geospatial Information Systems

* Master's Degree and Graduate Certificate



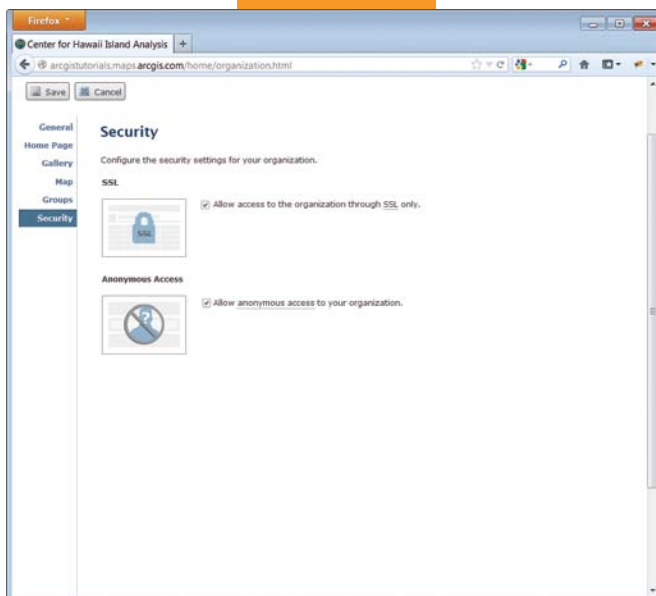
- * **ACCREDITED**
- * **ONLINE**
- * **FLEXIBLE**
- * **AFFORDABLE**

866.922.5695 | moreinfo@americansentinel.edu | www.americansentinel.edu/ARCMGIS



← Groups Page

This is where you add an existing group to the Featured Groups list. For now, accept the default setting. Click the Groups button at the top of the site to begin creating the groups you identified earlier and setting appropriate permissions.



← Security Page

When configuring the security settings for your organization, allow access only through Secure Sockets Layer (SSL). If you will have content that will be public, enable anonymous access, which means a user will not be prompted for login credentials.

Initially Provisioning the Site

Once you have established the basic website and created groups, you can begin moving your organization's content to it as web maps, data layers, web applications, and tools. Click the My Content button, add items, and set their access permissions to public or specific groups. Use the information on your organization to aid in this process.

With content and groups established, you can revisit the Gallery and Groups pages to select the content and groups you want to highlight in your gallery and on your home page.

Inviting Stakeholders

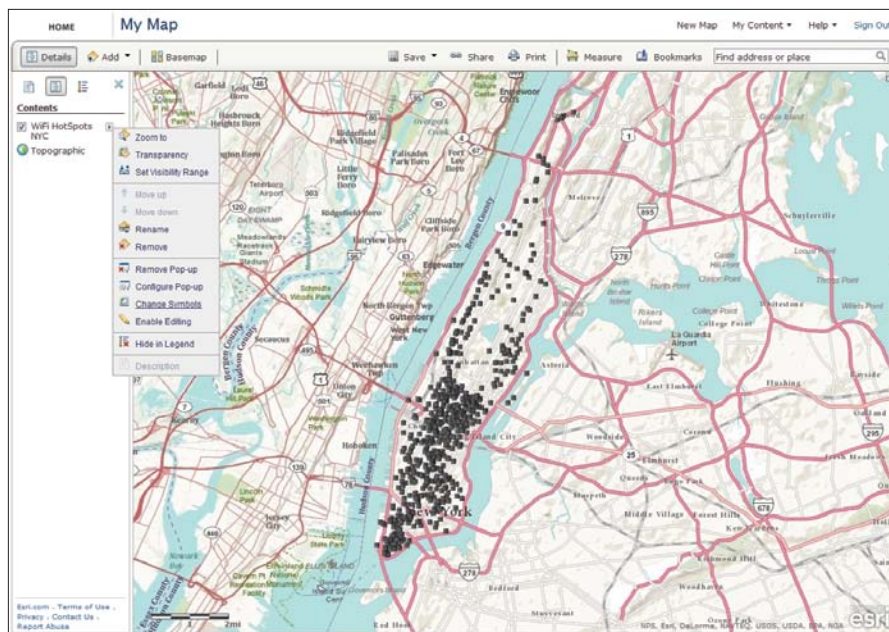
Once you have moved content for private groups you have established, you can invite stakeholders to join the group using the Invite Users button on that group's details page. To ensure your members experience the best performance from the site, encourage them to use Mozilla Firefox, Google Chrome, or Microsoft Internet Explorer 9 or higher.

Moving Forward

As members of your organization begin not only using content but also contributing their own, you will want to add to your gallery, feature different content, and modify groups to ensure the site continues to meet your organization's needs. For detailed information on setting up and using ArcGIS Online, visit help.arcgis.com/en/arcgisonline/help.

A Workflow for Creating and Sharing Maps

By Keith Mann, Esri



What You Will Need

Item	Source
ArcGIS Online for Organizations	Can use the free 30-day trial subscription
ArcGIS 10.1 for Desktop (Any license level)	Can use the free 60-day trial
ArcGIS Spatial Analyst extension	Can use the free 60-day trial
ArcGIS mobile application for smartphones and tablets running iOS, Android, or Windows Phone	Free from App Store, Google Play, Windows Phone Marketplace

↑ After creating a new map on ArcGIS Online, drag WiFi_HotSpots_NYC.gpx onto the map.

As more organizations adopt the ArcGIS Online platform, the web map is becoming an essential communication tool that helps GIS professionals empower decision makers and other non-GIS staff. In this tutorial, you'll learn basic workflows for generating web maps, analyzing a web map layer in ArcGIS for Desktop, publishing the analysis as a hosted service, and creating new web maps that can be shared in web map applications and with ArcGIS mobile applications.

Getting Started

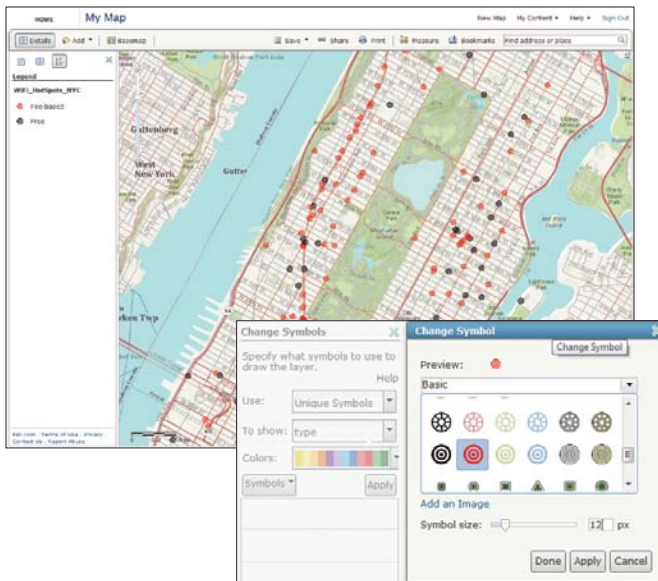
If you do not already have an ArcGIS Online for Organization subscription or ArcGIS 10.1 for Desktop and the ArcGIS Spatial Analyst extension, you can get evaluation copies from the Esri website. The free mobile application is available for iOS, Android, and Windows Phone platforms. In Windows Explorer, create a folder named

Manhattan and leave Windows Explorer open. Next, visit the *ArcUser* website and download the sample dataset, WiFi.zip. Extract the files to the Manhattan folder.

Create a Web Map from a GPX File

Creating a web map using ArcGIS Online is an easy way to visualize raw data on a map and share that information with others. In this scenario, suppose that you have some Wi-Fi hotspot location data for Manhattan that was collected using a smartphone GPS application. The data is stored in the WiFi_HotSpots_NYC.gpx file in the sample dataset.

1. Sign in to your ArcGIS Online for Organizations account and click Map. Create a new folder for the group called Manhattan.
2. In Windows Explorer, navigate to the Manhattanexercise folder, select the WiFi_HotSpots_NYC.gpx, and drag the file onto the map.

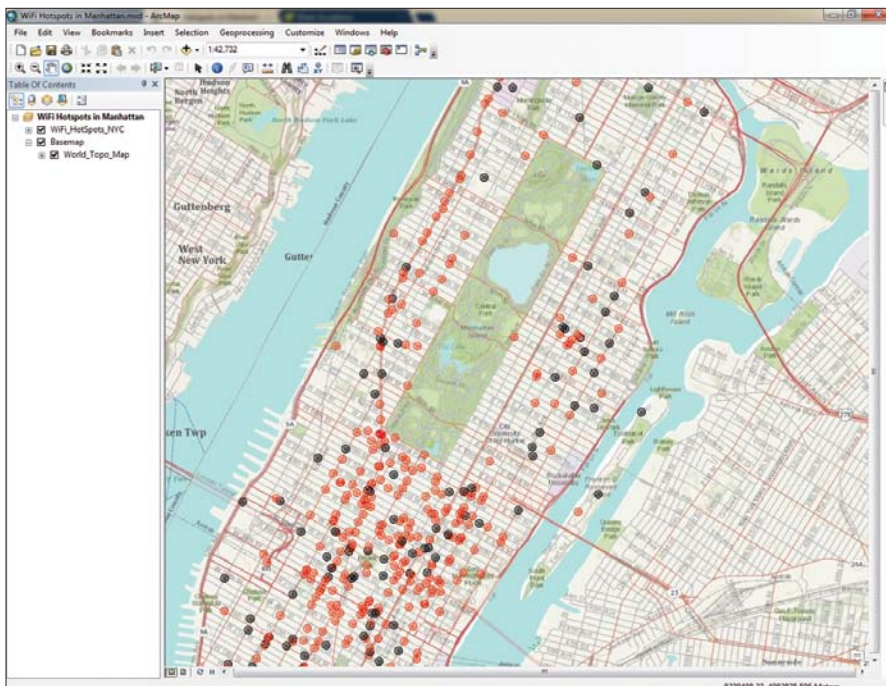


↑ Change the symbology to indicate fee-based and free Wi-Fi hot spots.

3. To symbolize the hotspots, click the Details button, then the Show Contents of Map button. Click the arrow symbol next to the Wi-Fi_HotSpots_NYC layer and choose Change Symbols from the context menu. For Use, select Unique Symbols. For To Show, select type.
4. Click Fee-based symbol. In the Change Label and Symbol dialog box, click Change Symbol. In the Change Symbol dialog box, choose a red symbol and make the symbol 12 pixels in size. Click Done and then click OK.
5. Use the same process to change the symbol for the free hotspots to a black 12-pixel symbol. Click Apply in the Change Symbol

dialog box to finalize these changes and close the dialog box.

6. Configure the pop-ups for the Wi-Fi hotspots by clicking the arrow symbol on the Wi-Fi_HotSpots_NYC layer and choosing Configure Pop-up from the context menu. Click the Configure Attributes button and, in the dialog box, confirm that the boxes next to name and type are checked. Click OK. Click the Save Pop-up button.
7. Save this web map by choosing Save As. Complete the Save Map dialog.
Title: Wi-Fi Hotspots in Manhattan
Tags: New York City, Manhattan, Wi-Fi
Summary: Free and fee-based Wi-Fi hotspots in Manhattan.
Save the map.
8. Click My Content and choose Groups. Click Create a Group and complete this page as follows:
Name: Manhattan Internet Access Project; Summary: Public Internet access in Manhattan interest group; Description: This group provides inventory and analysis of public Internet access in Manhattan. Make sure Status is Public. Add the following tags: NYC, Manhattan, Wi-Fi, Internet. Complete the Description section.
9. Click the thumbnail image area to the left of Name, click the Choose File button, navigate to the Manhattanexercise folder, and choose MIAP_logo.png. Select it and click Open. Click OK. Click Save.
10. Click the Manhattan folder and then click Wi-Fi Hotspots in Manhattan. Click the Edit button. Complete the description page as specified in Table 1. Click Save. ➔



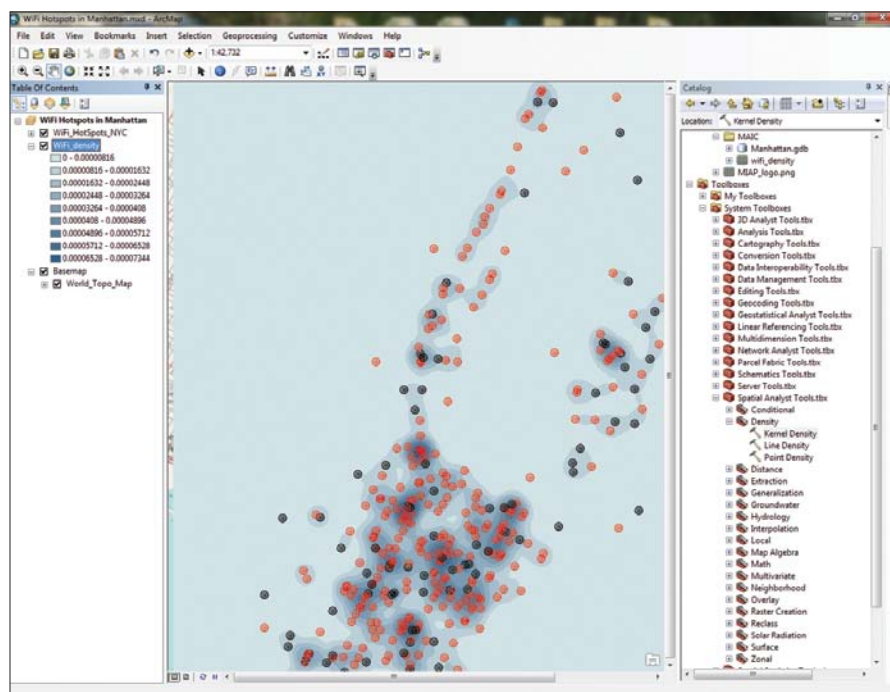
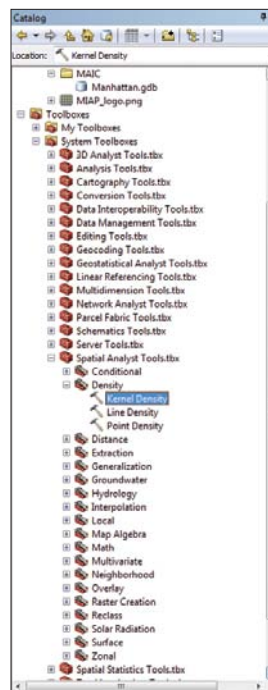
← Open the Wi-Fi Hotspots in Manhattan map in ArcGIS 10.1 for Desktop. Create the WiFi_HotSpots_NYC feature class in the new Manhattan file geodatabase to enable spatial analysis on the hot spot locations.

Title	WiFi Hotspots in Manhattan
Summary	Free and fee-based Wi-Fi hotspots in Manhattan
Description	An inventory of Wi-Fi hotspots in Manhattan. This map is for testing purposes only.
Access and Use Constraints	None
Credits	New York City

↑ Table 1: WiFi Hotspots in Manhattan details

→ Activate the ArcGIS Spatial Analyst extension and locate the Kernel Density tool in the Density toolset in the Spatial Analyst toolbox.

↓ Place the raster created by the Kernel Density tool in the Manhattan file geodatabase.

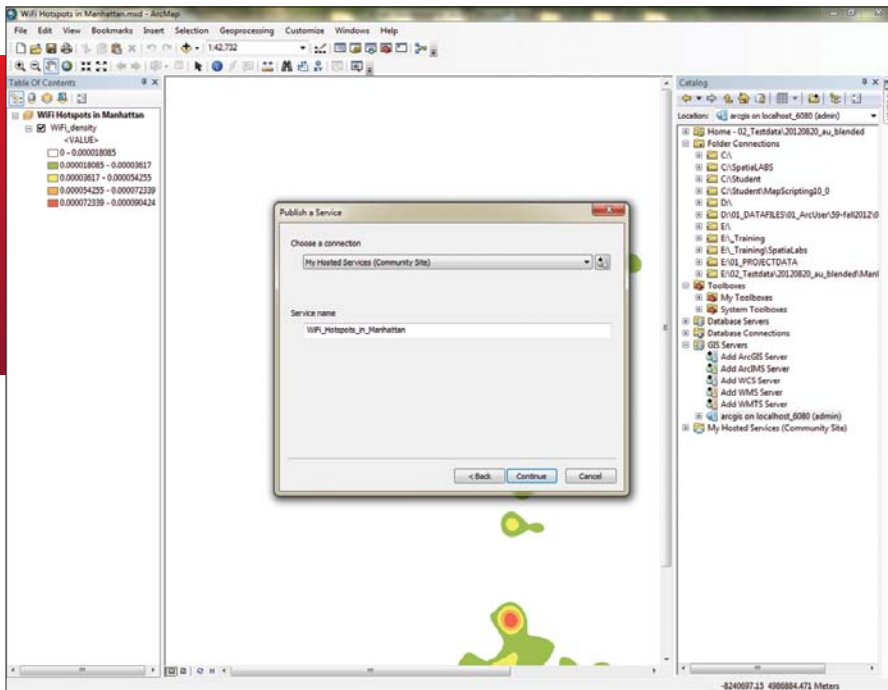


11. Click the Share button. In the Share dialog box, check Everyone (public) and These groups. Check Manhattan Internet Access Project. Click OK. Leave ArcGIS Online open.

Use ArcGIS for Desktop to Analyze Wi-Fi Hotspots

In this next step, you'll analyze the Wi-Fi hotspot locations in ArcGIS 10.1 for Desktop. You can use features in a web map as inputs for spatial analysis using ArcGIS for Desktop.

1. On the WiFi Hotspots in Manhattan Details page in ArcGIS Online, click Open > Open in ArcGIS 10 for Desktop. This will create a map package and download it to your browser. Double-click the downloaded package to open it in ArcGIS 10 for Desktop.
2. In ArcMap, choose Customize > Extensions from the menu. Check Spatial Analyst and click Close.
3. In ArcMap, open the Catalog window and click Connect to Folder. Navigate to the location of the Manhattan folder created earlier and click OK.
4. In the Catalog window, select the Manhattan folder and choose New > File Geodatabase. Name the geodatabase Manhattan.
5. Still in the Catalog window, expand Toolboxes and expand System Toolboxes, then Spatial Analyst Tools, then Density and double-click the Kernel Density tool. Drag the WiFi_HotSpots layer from the ArcMap table of contents (TOC) and drop it on the Input point



← After using a green to red color ramp to symbolize the raster, remove all but the raster layer from the map and publish it to ArcGIS Online as a hosted service.

↓ Open the WiFi Hotspots in Manhattan map in the ArcGIS.com map viewer and the WiFi_Hotspots_Analysis service to the map.

or polyline features field of the Kernel Density dialog box. Leave Population field as NONE. For Output raster, click the folder icon and navigate to the Manhattan geodatabase and name the output raster WiFi_density. For Output cell size, enter 10. For Search radius, enter 300. For Area units, choose SQUARE_METERS. Click OK.

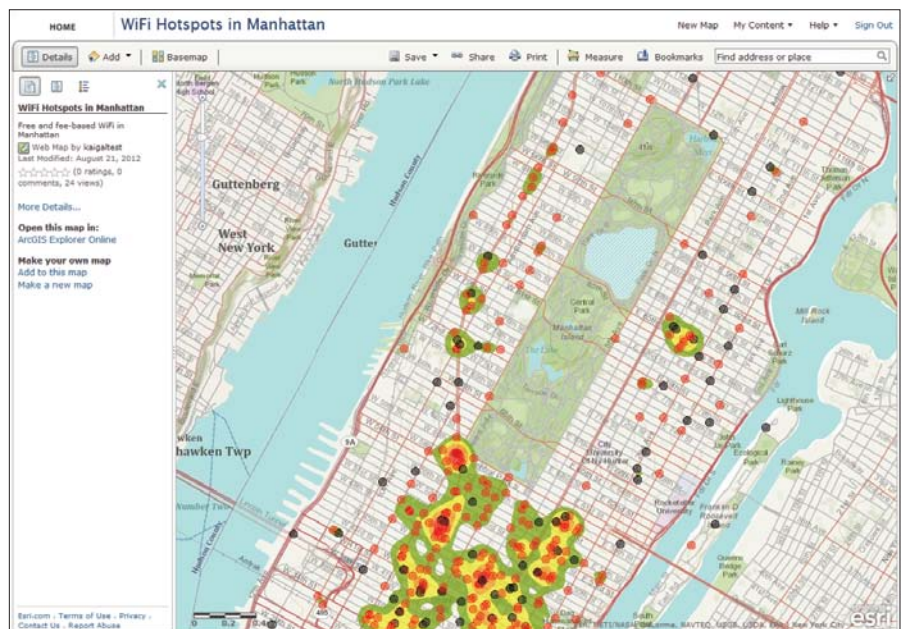
- Once the WiFi_density raster is added to the map, right-click the layer and choose Properties. Click the Symbology tab, choose Classified, set the number of classes to 5, and choose the Slope (Green to Red) color ramp. Click Apply.
- Double-click the symbol for the first value range, choose No Color, and click Apply. Click the Display tab. Click the Resample drop-down and choose Bilinear Interpolation. For transparency, enter 30 percent and click OK.
- In the TOC, uncheck the WiFi_HotSpots_NYC layer to turn it off so you can inspect the WiFi_density layer. Save the map and leave ArcGIS for Desktop open.

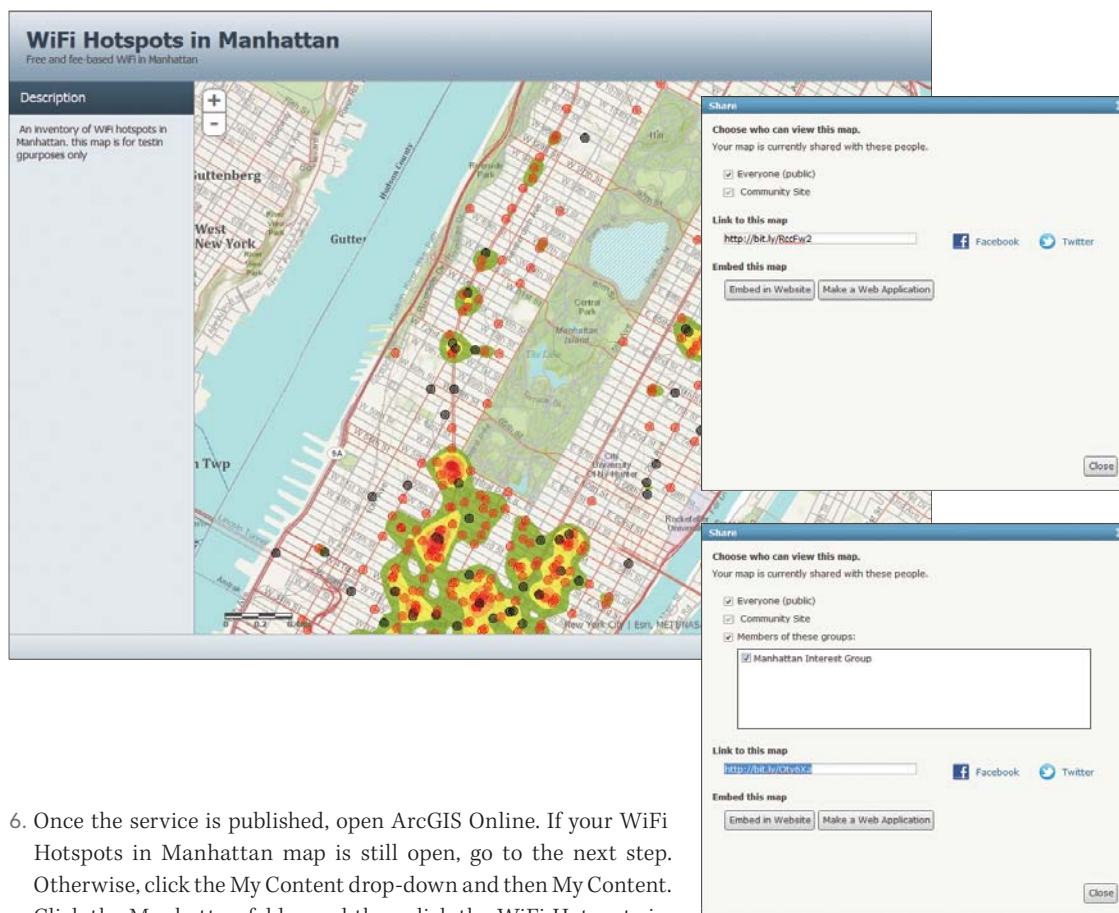
Publish Your Analysis to ArcGIS Online

- In ArcMap, remove the WiFi_HotSpots_NYC layer and any basemaps from the TOC, leaving only the WiFi_density layer.
- Choose File > Sign In and log in to your organizational account if necessary.
- Click File > Share As > Service and click Next. In the Publish a Service dialog box, your organizational account should be listed under Choose a connection. For Service name, enter

WiFi_Hotspots_Analysis. Click Continue.

- In the Service Editor panel, click Sharing and check the name of your organization, Everyone (public), and the Manhattan Internet Access Project group.
- Click Analyze and review any messages. If you get an error that tells you that basemaps cannot be published, right-click the error and choose Remove layer, then analyze again. If you get a message that the raster layer does not have pyramids, right-click the message and allow ArcGIS for Desktop to build pyramids. Click Analyze again. Click Publish.





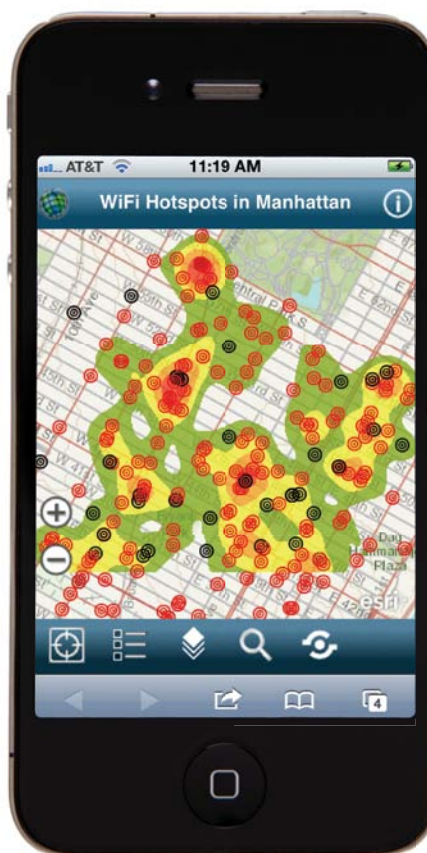
← Make sure the map is shared with Everyone. Then create a web application from the map and share the application with everyone.

← Open the map in the ArcGIS.com map viewer, click Share, and copy the shortened link to the map. Mail it to yourself and open it using the ArcGIS mobile application for smartphones.

6. Once the service is published, open ArcGIS Online. If your WiFi Hotspots in Manhattan map is still open, go to the next step. Otherwise, click the My Content drop-down and then My Content. Click the Manhattan folder and then click the WiFi Hotspots in Manhattan item to open the web map. Click Open > Open in ArcGIS.com map viewer.
7. In the map viewer, click the Add drop-down and then Search for Layers from the web, and enter *wifi*. Click Go. Click Add to add WiFi_Hotspots_Analysis to the map. Zoom in to see both the layers. Choose Save As and complete the Save Map dialog box. The title is WiFi Hotspots in Manhattan and enter tags for New York City, Manhattan, WiFi. Under Summary, type in *Free and fee-based Wi-Fi hotspots and Wi-Fi density analysis in Manhattan*. Click Save Map.

Sharing Your Web Map Using a Template

1. Click Share and make sure that your map is shared with Everyone (public), your organization, and the Manhattan Interest Group.
2. In the Share dialog box, click the Make a Web Application button. Choose the Chrome Twitter map template, click the Publish drop-down, and then click Preview to see what the map looks like in the template. Close the preview.
3. Now click the Publish drop-down and choose Publish. Enter the title, WiFi Hotspots in Manhattan. For Save folder:, choose the MIAP folder. Click Save & Publish.
4. But wait...your new templated web map application isn't shared yet. Go back to My Content. Check the WiFi Hotspots in Manhattan web map that you just created. Click Share and share the item with Everyone, including the Manhattan Interest Group. Click OK. **Note:** You can configure the map application further by clicking on the item in My Content and then clicking Configure App.



Share Your Web Map Using E-mail

This time, you'll share the map so it can be used with the ArcGIS mobile application.

1. Go back to the WiFi Hotspots in Manhattan Details page on ArcGIS Online and open the map in the ArcGIS.com map viewer.
2. Click Share. Under Link to this map, copy the shortened URL. Close the Share dialog box.
3. Open your e-mail program. Paste the URL into the body of a new e-mail, enter a subject line, and send the e-mail to yourself.
4. On your smartphone (iPhone, Android device, or Windows Phone), open the e-mail and click the URL. This will automatically open the ArcGIS application and display your map.

Conclusion

ArcGIS Online provides a new way to access GIS maps and analyses. Web maps can become an essential communication tool for you and your organization. Not only can you quickly create web maps without any programming or development, you can share them with everyone or with specific group members through application templates and the ArcGIS mobile application. You can use operational layers in the web map as inputs for analysis in ArcGIS for Desktop and then turn that analysis layer into a hosted service on ArcGIS Online.

apps beyond maps

Take your maps to a whole new level with UI controls from ComponentOne.

You're covered on all platforms, from Silverlight and WPF to HTML5/JavaScript and Windows Phone. Visit ComponentOne today to access maps powered by Esri® software and data visualization controls like charts, gauges, and grids to enhance your user interfaces.

download the ui controls today @ componentone.com/esri

100s of controls for
HTML5 & JavaScript
Silverlight
WPF
Windows Phone
Windows Metro

ComponentOne
a division of GrapeCity®

© 2012 GrapeCity, Inc. All rights reserved. Trademarks provided under license from Esri. All other product and company names herein may be trademarks of their respective owners.

A Simple Approach

Preparing data for the Community Maps Program

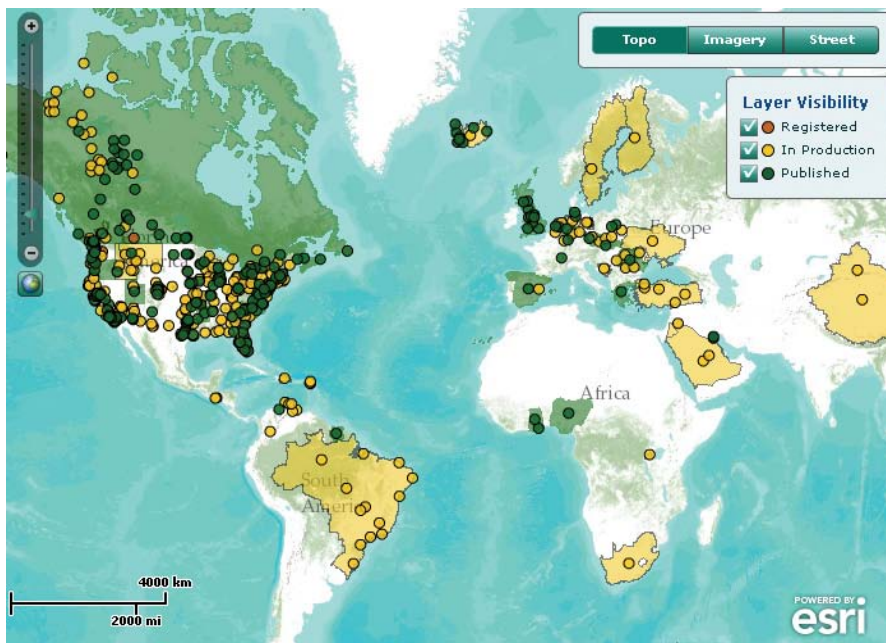
By Mark Stewart, Community Maps Training and Support Coordinator, Esri

Through the Community Maps Program, the ArcGIS community and Esri are building a collection of fast, authoritative, and freely available web maps compiled from premier GIS data sources. These maps are authored at multiple levels of detail with map scales as large as 1:1,000. Organizations can contribute to these world basemaps while retaining ownership of the data.

However, to participate, organizations must migrate their basemap layers to the geodatabase schema associated with the Local Government Information Model. This tutorial will explain the Local Government Information Model feature classes and attributes that are relevant to the Community Maps Program generally—and the World Topographic Map specifically—and suggest a workflow for preparing source data for migration.

Getting Started

The Local Government Information Model includes the datasets necessary to support virtually any common municipal application from public safety to election administration. Because it is so robust, the data model can seem overwhelming at first, but you will soon realize that you only need to concentrate on two or three of the model's feature datasets to support your basemap contribution.



↑ The ArcGIS community members across the world are contributing to the Community Maps Program as shown on this dashboard application.

What You Will Need

- ArcGIS for Desktop (version 10.0 or 10.1, any license level)
- Microsoft Excel 2003, 2007, or 2010
- Sample dataset downloaded from the *ArcUser* website (esri.com/arcuser)

In terms of the number of user contributions and the extent covered, the World Topographic Map exemplifies the Community Maps Program. This map service includes administrative boundaries, cities, water features, physiographic features, parks, landmarks, highways, roads, railways, airports, and buildings overlaid on land cover and shaded relief for added context. It was designed for use as a basemap or reference map. This tutorial will show you how to prepare your data for inclusion in the World Topographic Map.

To get started, download the archive file containing the tutorial data. Unzip it locally on your computer. In Windows Explorer, navigate to the CommunityMapsTutorial folder and open the CommunityMapsDataLayers.xlsx Excel spreadsheet. This spreadsheet will help you understand the data layers and associated attributes that are used to build the World Topographic Map. It can also help organize the layers you will contribute and determine what you will need to do to them so that they conform to the Local Government schema that Community Maps uses.

Click the Contents tab of the workbook. This workbook contains a lot of information. You can use the table of contents to easily navigate between its many worksheets. Each worksheet contains information on one of the feature classes in the Local Government Information Model that is relevant to the World Topographic Map. Click the feature class name in the Table of Contents worksheet to go directly to that worksheet.

In the Table of Contents worksheet, click OwnerParcel to go directly to the OwnerParcel worksheet. The top part of the worksheet contains information about the OwnerParcel feature class, including what attributes are required for labeling and symbolization.

In this case, because parcels are all symbolized with a single symbol type and are not labeled in the World Topographic Map, no attributes are needed from this feature class. The bottom portion of the OwnerParcel worksheet contains a table with empty cells that you could populate with information about source data you would use to populate the required feature class if you were going to contribute data for that feature class to Community Maps. Working through this information will help you understand which Community Maps feature classes correspond to your source data layers and determine if this data will require any processing to conform to the Local Government Information Model.

At the top of the OwnerParcel worksheet, click the Return to Table of Contents link. Now that you are familiar with how the spreadsheet works, you can examine a source data layer for the RoadCenterline feature class in the Local Government Information Model and see how well your source conforms.

Examining the RoadCenterline Feature Class

Start ArcGIS for Desktop and open a new, blank ArcMap document. Click the Add Data button and add the PDStreets shapefile from the CommunityMapsTutorial folder to the map. This shapefile contains road centerlines for the city of Palm Desert, so it will correspond to the RoadCenterline feature class in the Local Government schema.

In the CommunityMapsDataLayers Table of Contents worksheet, click the RoadCenterline link. Use the Participant Source Data section of the worksheet to begin documenting ➔



the comparison of the PDStreets shapefile to the RoadCenterline feature class.

Type *PDStreets.shp* in the Dataset Name column. For Geometry, type *Polyline*. For Geometry Change Required?, type *No*.

In ArcMap, right-click the PDStreets layer and choose Open Attribute Table. Explore the fields in the PDStreets shapefile to get an idea of the field names and the types of values in those fields. Notice that the StreetName field contains the street name value, while the StreetType field contains the standardized street type abbreviation (e.g., Ave, Dr.). StreetDir, the final field, contains suffix directions. Pay special attention to the Level and Class fields.

Now return to the CommunityMapsDataLayers spreadsheet and examine the Required Attributes section of the RoadCenterline worksheet. The RoadCenterline feature class has two required attributes: FULLNAME and ROADCLASS. The FULLNAME field is used for labeling in the World Topographic Map. The values in the ROADCLASS field are used to symbolize the features based on the type of road they are (e.g., local, highway, ramp). The ROADLEVEL field can be used to symbolize one road feature above or below another, so that bridges and underpasses can be represented properly. The remaining attributes can be used to refine the general information in the FULLNAME and ROADCLASS fields but can be omitted from the feature class if you do not have the data to populate them or they are not needed.

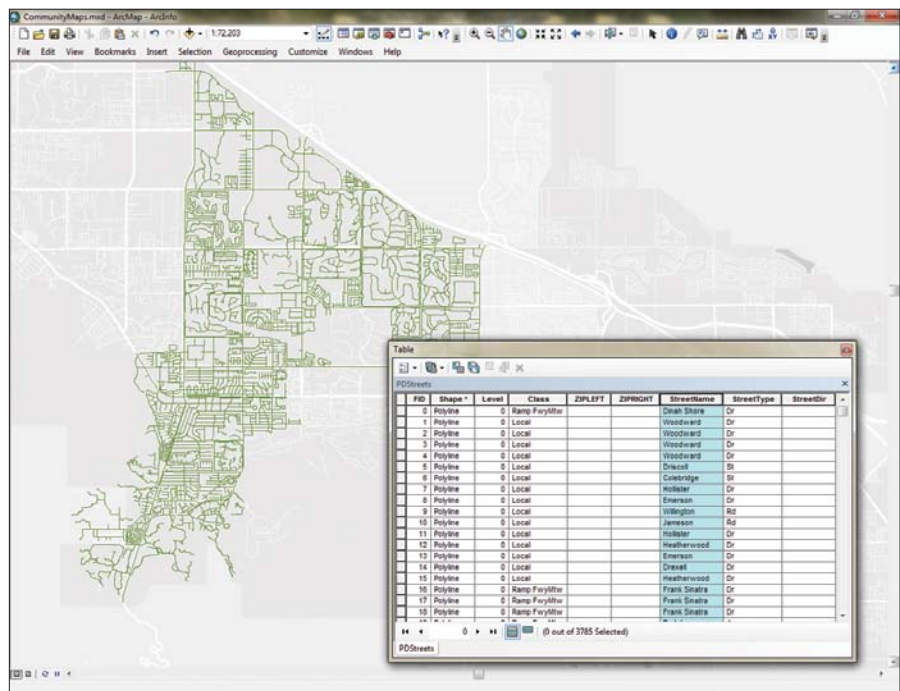
Examining the PDStreets attribute table reveals that the StreetType, StreetName, and StreetDir fields will need to be combined to supply the necessary values for the FULLNAME field in the RoadCenterline feature class. The PDStreets Level and Class fields will map to the RoadCenterline ROADLEVEL and ROADCLASS fields.

In the CommunityMapsDataLayers spreadsheet, update the Relevant Attributes column with the information you have discovered from examining the PDStreets attribute table. You can also add some explanatory comments to indicate which source attributes correspond to which RoadCenterline fields.

Now that you have examined one source feature class and compared it to the Local Government Information Model for Community Maps, you will investigate a few other layers. In ArcMap, close the PDStreets attribute table and remove the PDStreets layer.

Explore the FacilitySite Feature Class

In this step you will use the CommunityMapsDataLayers spreadsheet to explore the FacilitySite feature class and compare it to the source datasets you will use to supply its attributes. FacilitySite is another primary layer in the basemap. This layer represents a combination of area



Return to Table of Contents					
Feature Class Name	Feature Dataset	Geometry	Feature Types (RoadClass Domain)	Required Attributes	Comments
RoadCenterline	ReferenceData	Polyline	Freeway Highway Ramp Major Arterial Minor Arterial Collector Local Service 4WD Recreation Resource Ferry Other Unknown/Unclassified	FULLNAME (Alias: Full Road Name) FEDROUTE (Alias: Federal Route) FEDRTYPE (Alias: Federal Route Type) AFEDRITE (Alias: Alternate Federal Route) AFEDRTYPE (Alias: Alternate Federal Route Type) STRROUTE (Alias: State Route) ASTRITE (Alias: Alternate Route) CTYROUTE (Alias: County Route) ROADLEVEL (Alias: Above or Below Grade) ROADCLASS (Alias: Road Class)	Polyline features representing street centerlines. FULLNAME is often a concatenation of several attributes (i.e. Prefix, Name, Suffix, Type) ROADCLASS uses a coded value domain to differentiate road types for symbology. Highway shield and labeling are derived from the FULLNAME AND ROADCLASS fields. They can also be derived from FEDROUTE and FEDRTYPE or alternate fields if they are included.
Participant Source Data					
Dataset Name	Geometry	Geometry Change Required?	Relevant Attributes	Comments	
PDStreets.shp	Polyline	No	StreetName, StreetType, StreetDir, Level, Class	FULLNAME is a combination of StreetName, StreetType, and StreetDir ROADLEVEL corresponds to Level ROADCLASS corresponds to Class	

↑ After examining the PDStreets attribute table, you discover that the StreetType, StreetName, and StreetDir fields will need to be combined to supply the necessary values for the FULLNAME field in the RoadCenterline feature class.

feature types. Features as varied as parks, cemeteries, shopping malls, and casinos can be stored in this feature class. Often this means that several source data layers will be used to complete the FacilitySite feature class.

In the CommunityMapsDataLayers spreadsheet, navigate to the FacilitySite worksheet and review the information it contains to gain an understanding of the types of features in the FacilitySite feature class. In ArcMap, click Add Data and navigate to the CommunityMapsTutorial folder. Open the PDSourceData geodatabase and add the entire Facilities feature dataset. The feature classes in this feature dataset will supply the features for the FacilitySite layer in the basemap.

In the CommunityMapsDataLayers spreadsheet, add the source feature class names to the Participant Source Data section of the FacilitySite worksheet. In ArcMap, open the table for the GolfCourses layer.

This feature class has a field called FacilityName that can be used to label golf courses in the map, so you will note that in the Relevant Attributes column of the spreadsheet. For the GolfCourses layer, type *Polygon* for Geometry and *No* for Geometry Change Required.

In the spreadsheet, notice that the features in the FacilitySite feature class are grouped into subtypes based on values in a field named SubtypeField. The GolfCourses layer does not have an attribute that will correspond to SubtypeField. However, since the golf course features are in their own separate feature class, you will be able to migrate them directly into the correct subtype in FacilitySite. In the Comments section for GolfCourses, type *Will load directly into Public Attractions and Landmark Buildings subtype*.

The remaining source layers (Parks, Schools, and ShoppingCenters) have schemas similar to the GolfCourses layer. They have a FacilityName field but no subtype field. Once again, because the different types of facilities are divided up into their own feature classes, you can load them directly into their corresponding subtype in FacilitySite.

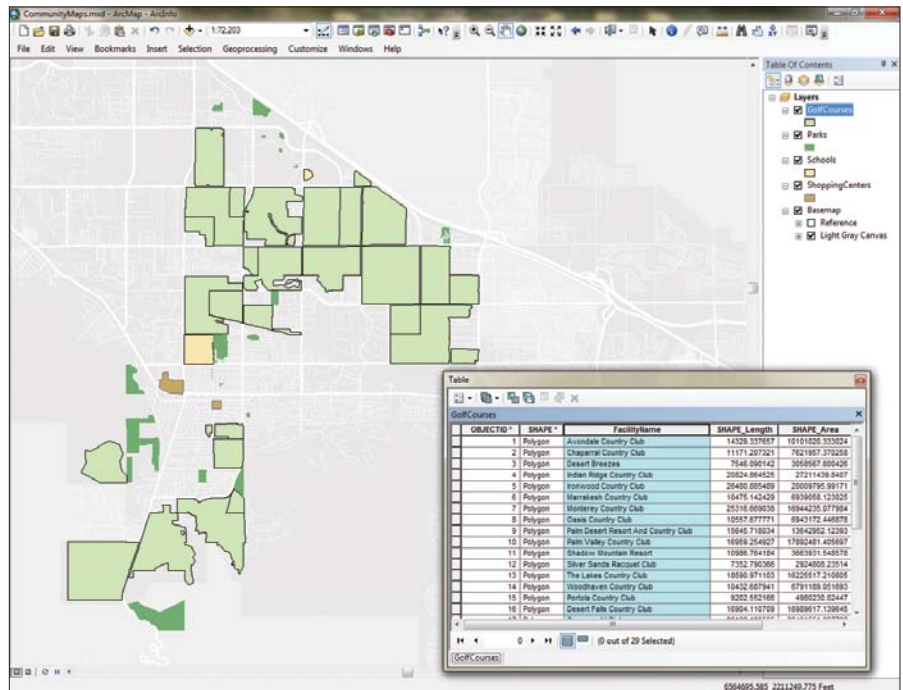
Use your best judgment to fill in the blanks for the missing subtypes in the following statements and check your answers.

Parks belong in the _____ subtype.
 Schools belong in the _____ subtype.
 Shopping centers belong in the _____ subtype.

Use your answers to fill in the remaining information for the layers in the Participant Source Data portion of the worksheet.

Conclusion

In this tutorial, you learned a simple workflow for preparing data layers so they can be migrated to the Local Government Information Model. You also used the CommunityMapsData Layers spreadsheet to record relevant information to make the process of migrating the source data into the Local Government Information Model more efficient. For more information about the Community Maps Program, visit the Community Maps Program resource center.



↑ The entire Facilities feature dataset in the PDSourceData geodatabase will supply the FacilitySite layer in the basemap.

Unlocking Data Trapped in Paper

Address geocoding legacy geological data

By Mike Price, Entrada/San Juan, Inc.

Editor's note: In this tutorial, geologist and GIS modeling guru Mike Price shares a novel strategy for making old datasets trapped in non-spatially-aware formats available for use in GIS.

Every now and then, geologists encounter an impossibly old dataset that might be very useful in a modern exploration setting. There are several strategies for dealing with this situation. The data can be brought into a digital format by scanning, georeferencing, and digitizing paper maps and cross sections. Old printed tables can also be scanned and digitally recognized. In extreme cases, the data in printed tables can be entered—one record at a time—into a modern digital data format.

When I began my career as a field geophysicist in the early 1970s, most of my field data was hand entered into field books

or stenographer's notepads. Field locations were often crudely sketched on topographic maps. If I was lucky, these records included a surveyed project baseline and a perpendicular reference of origin with beginning stations. The field crew was responsible for maintaining a true course along all survey lines and measuring the distance between stations. The times—and field procedures—have certainly changed.

This exercise takes up the challenge of making an impossibly old dataset and field map fit into the modern digital world. This exercise expands the Battle Mountain, Nevada, training model used in "Prospecting for Gold: Building, mapping, and charting point geochemical data," a tutorial that ran in the summer 2012 issue of *ArcUser*. Some legacy subsurface electrical methods geophysical

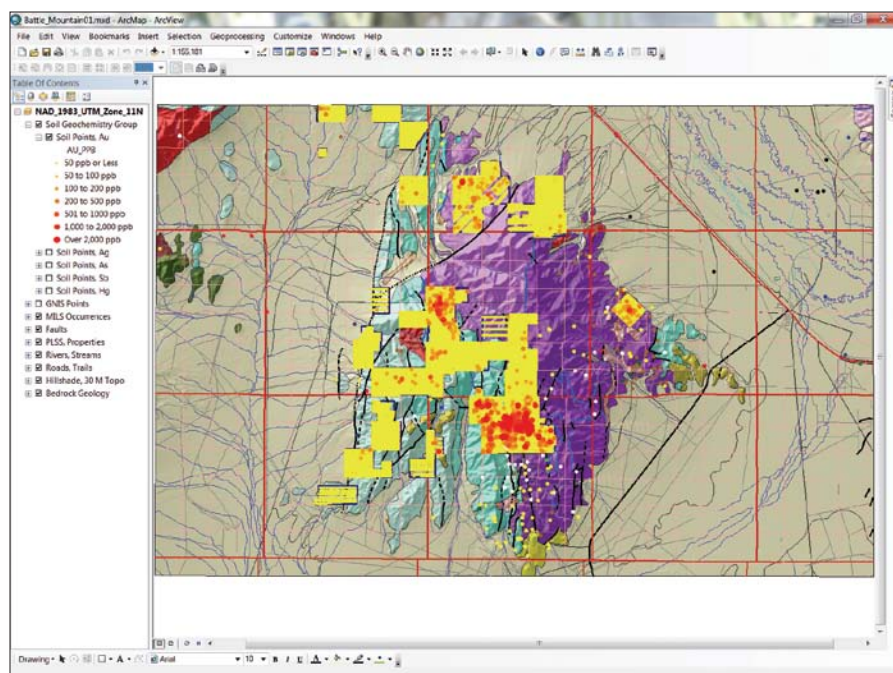
data was added to the data on the soil geochemical anomaly identified in that exercise. This legacy data was obtained in the 1980s using traditional methods. Lines were surveyed using the compass and pace method. Fortunately, the field geologist had a new personal computer and a spreadsheet program. He used both to compile and model the field data. However, survey lines he used were supplied in a paper map.

Getting Started

To begin this project, go to the *ArcUser* website (esri.com/arcuser) and download the sample dataset for this article. Verify that ArcGIS 10 for Desktop has service pack 5 applied.

Unzip the training set into a new folder, separate from any other training data used for previous exercises, and inspect the data. The root folder contains an ArcMap document called *Battle_Mountain01* and three subfolders. The *SHPFiles* folder contains a polyline shapefile of the 1989 survey lines.

↓ The exercise, set in Battle Mountain, Nevada, uses tabular and polyline geophysical datasets that are synthetic but match the area's underlying geology.

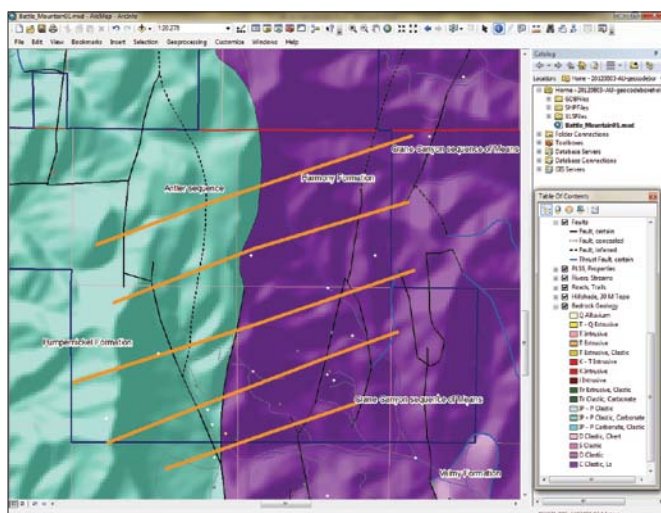


About the Sample Dataset

The exercise uses the same data from Battle Mountain, Nevada, that was used in two recent ArcUser tutorials. Both the tabular and polyline geophysical datasets are synthetic but match the area's underlying geology and work with the synthetic soil dataset previously used. It is similar to data packages that were developed prior to the early 1980s when the use of small computers for data development, mapping, and charting was beginning to evolve. Landownership is also fictitious. Bedrock geology was derived from the Nevada Bureau of Mines and Geology county mapping series. The Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) data used was developed by the US Department of Energy National Uranium Resource Evaluation (NURE) program.

What you will need

- ArcGIS 10 for Desktop (Basic, Standard, Advanced editions) with service pack 5
- An Internet connection
- The sample dataset downloaded from the ArcUser website
- An unzipping utility such as WinZIP



↑ Use the Add Data tool to add the digitized traces of the survey lines to the map and symbolize them with a wide line.

The XLSFiles folder holds an Excel spreadsheet containing processed geophysical data listing the conductivity of rocks below the survey lines. Let's check out these two files and see how this data can be added to the map.

Exploring Battle Mountain

Start an ArcMap session and open Battle_Mountain01. Scan the map to familiarize yourself with the Battle Mountain area. The cluster of bright red points in the central area represents a significant precious metals anomaly, detected during a recent geochemical survey. Does something important lie underneath these points?

Choose Bookmarks > Anomalous Soil 1:20,000 to zoom to an area of the map. Explore this area carefully. Turn on the labels for the Bedrock Geology polygon layer and look at the bedrock units, including the Harmony, Valmy, and Pumpnickel Formations, and two larger lithologic groups, the Crane Canyon and Antler sequences. By using the Identify tool on the faults in these areas, you can

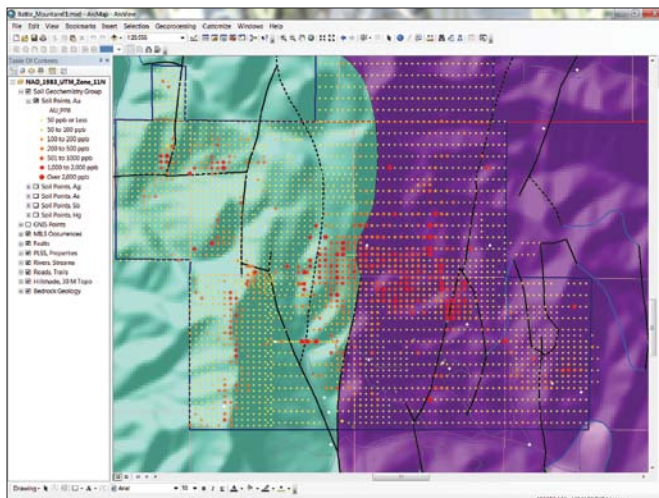
see that the area of interest is crossed by many high angle normal faults and remnants of several horizontal thrust faults. Is it possible that these faults, cutting a variety of geologic units, could influence mineralization?

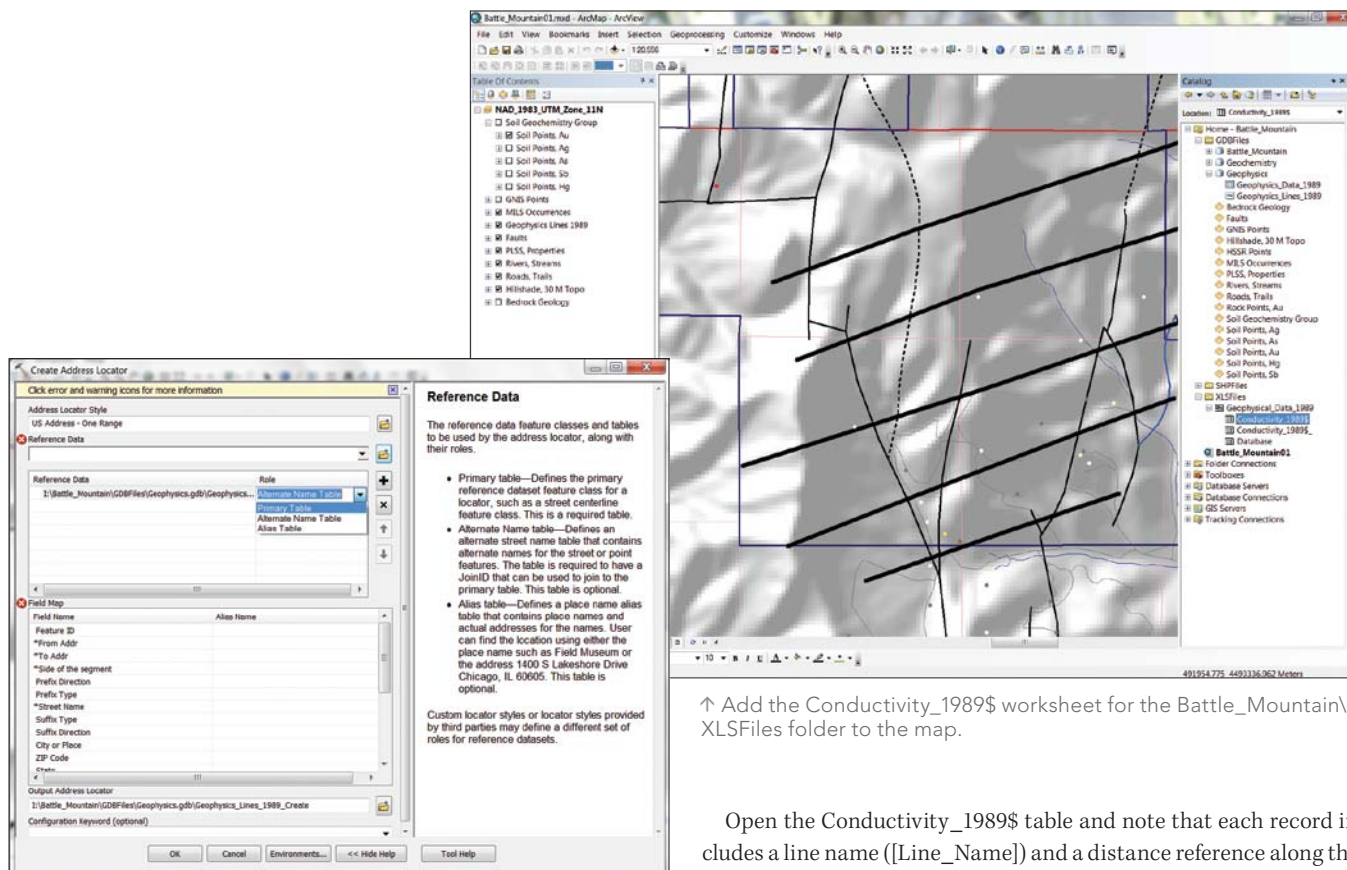
Fortunately we have information from an early geophysical survey that measured the area's resistance to electrical flow and have several digitized survey lines and files containing information about the conductivity (the opposite of resistivity) of the underlying rocks. Because metal-bearing rocks often contain significant pyrite, pyrrhotite, and other conductive sulfide minerals, a conductive precious metals ore body can sometimes be located and defined using this information. The first step is to map and analyze this conductivity data.

Preparing to Post and Map Legacy Geophysical Data

The old paper map shows that five survey lines cross the prospect from southwest to northeast, generally perpendicular to ➡

↓ The cluster of bright red points in the central area represents a significant precious metals anomaly, detected during a recent geochemical survey.





↑ Add the Conductivity_1989\$ worksheet for the Battle_Mountain\XLSFiles folder to the map.

↑ To create a new address locator, right-click Geophysics, select New > Address Locator, and specify the US Address—One Range style.

regional faulting. These lines are stored in a shapefile, Geophysics_Lines_1989, located in the \SHPFiles\UTM83Z11\ folder. Use the Add Data tool to add the digitized traces of the survey lines to the map. Symbolize these survey lines with a wide line. Notice that the lines are not quite parallel, nor are they perfectly straight. Just how did they do this before GPS?

Mapping Survey Lines

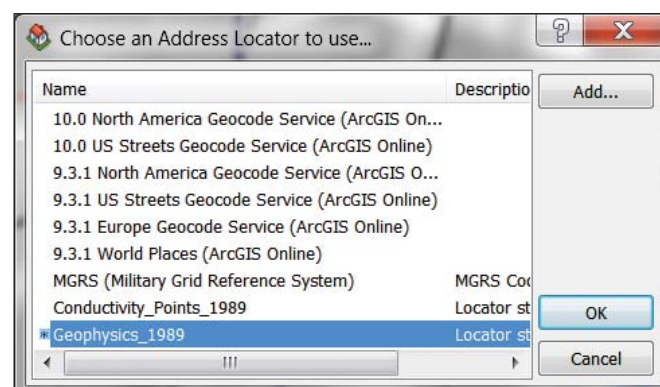
Next, create a new geodatabase in the project folder and export the survey lines into it. Open the ArcCatalog window in ArcMap, navigate to the Battle_Mountain\GDB files\ folder, and create a new file geodatabase named Geophysics. Right-click the Geophysics geodatabase and choose Import. Navigate to SHPFiles\UTM83Z11\ and choose Geophysics_Lines_1989. Keep the same name for the feature class, add it to the map, and delete the original shapefile. You could also simply change the data source for the Geophysics_Lines_1989 layer from the original shapefile to the new feature class. Open the attribute table and review the attributes. Save the map.

Exploring Legacy Point Data

Now to look at the tabular data in the XLSFiles folder. At least the data is in a spreadsheet, so it probably won't require much preparation. Add the Conductivity_1989\$ worksheet from the Battle_Mountain\XLSFiles folder to the map.

Open the Conductivity_1989\$ table and note that each record includes a line name ([Line_Name]) and a distance reference along the line ([Station_M]). Conductivity is measured in Siemens per meter. Each record includes the [N_Factor] (or depth below the surface defined by dipole geometry). However, there are no coordinates. How can these points be easily placed on the map or displayed in 3D?

I learned about geocoding early in my GIS career. At first, I imagined it was something special for geologists and was somewhat disappointed to learn that it was mostly used to place address strings as points on a map. However, shortly after this I needed to quickly map a table quite similar to this conductivity table. I imagined that if I could convert the line names and distances into something resembling street addresses, I might be able to geocode them. I tried it, and it worked. Let's try the same technique with the Battle Mountain data.

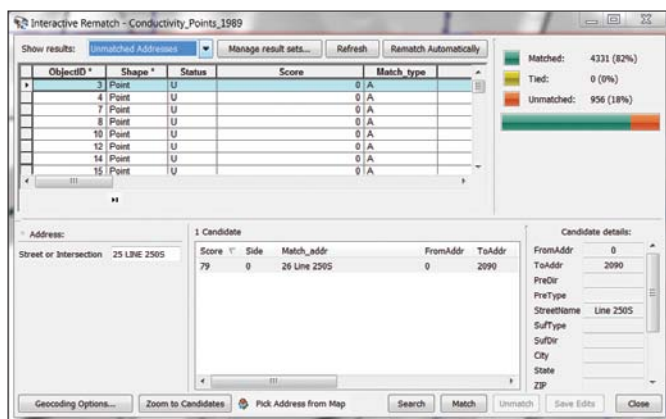


↑ In the dialog box, click the Add button, navigate to the Geophysics geodatabase, and select the Geophysics_1989 address locator.

Preparing Geophysical Data for Geocoding

Inspect the [Line_Station] field and notice how geophysical points (stations) were often described on a survey line. Characters to the left of the plus (+) sign are the name of the survey line. The numeric characters to the right of the plus sign measure the distance along the line. Imagine the distance along the line as the address numeric and the line designator as the street name. If the order of these elements was reversed, these records should geocode using a numeric, range-based centerline geocoding method.

To work, this would just require adding and populating one new field. But wait, this is a Microsoft Excel spreadsheet that can't be edited inside ArcMap. This can be solved simply by exporting this



↑ After the first geocoding pass, more than 900 points were not geocoded.

Excel worksheet to the Geophysics geodatabase. Right-click the Geophysical_Data_1989\$ table, choose Data > Export All Records to \Battle_Mountain\GDBFiles\Geophysics.gdb, and name it Conductivity_Table_1989. Open this table and verify the new table has 5,287 records and delete the Geophysical_Data_1989\$ table from the map. Save the map.

Add a new 20-character text field named [Address2]. Right-click [Address2]. Open the Field Calculator by right-clicking a field header and use it to create this expression: [Station_M] & " " & [Line_Name]. Make sure String is selected for Type. Click OK. The calculated field should contain records for the contents of both the [Station_M] and [Line_Name] fields (e.g., 145 Line 250S). If the calculated data does not conform to this format, check the formula and recalculate the field.

Creating a One Range Address Locator

Now to build an address locator in ArcCatalog. Close ArcMap and open ArcCatalog.

1. Open the Geophysics_Lines_1989 table and make sure all the fields necessary for a One Range locator are present. With a One Range locator, all address elements are contained within a single field. The technique substitutes information about the survey

lines for traditional geocoding elements. [Line_Name] represents the street name, [Line_Start] provides the From Addr, and [Line_End] is the To Addr. Because the method will geocode on a centerline, [ID] is a filler for the required street side parameter. Close ArcCatalog.

2. Inside ArcMap, open the ArcCatalog window and navigate to Battle_Mountain\GDBFiles\Geophysics. Right-click Geophysics, select New > Address Locator, and specify the US Address—One Range style. Select Geophysics\Geophysics_Lines_1989 as the Reference Data. If the Role field in the dialog box defaults to Alternate Name Table, click that field and change the Role field to Primary Table.
3. Now set the Field Map as shown in Table 1. In the output field, navigate to the Geophysics geodatabase and save the address locator as Geophysics_1989. Click OK to create this new address locator.

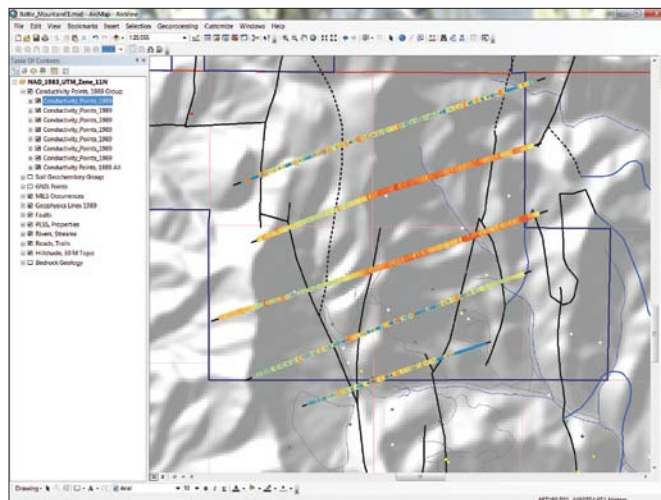
Field Name	Alias Name
From Addr	Line_Start
To Addr	Line_End
Side of segment	ID
Street Name	Line_Name

↑ Table 1: Setting map fields

Geocoding the Data

Now this data can be geocoded along the digitized survey lines. First, right-click in an unused area of a toolbar and load the Geoprocessing toolbar.

On the Geoprocessing toolbar, click the Geocode Addresses button. In the dialog box, click the Add button, navigate to the →



↑ Export the geocoding results as a feature class in the Geophysics geodatabase. Add it back to the map, apply symbology using a layer file, and make seven copies of the layer.

Geophysics geodatabase, select the Geophysics_1989 address locator, and click OK.

In the next dialog box, set Address Input Field to Address2 and save the results as Conductivity_Points_1989 in GDBFiles\Geophysics.

Click OK to start geocoding.

When the first pass finishes, you will have points that were not geocoded. Set Show results to Unmatched Addresses and inspect the problem records. Notice that all unmatched points have a score of 79. With this database, a minimum match score of 75 is acceptable, so change the minimum matching score from 85 to 75.

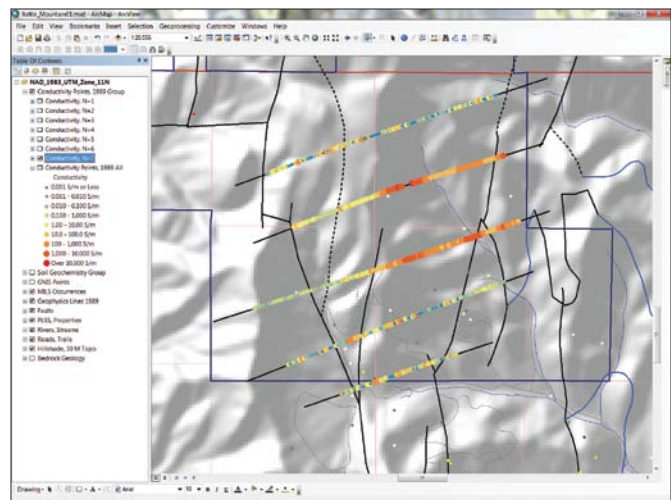
Click the Rematch button. In the next dialog box, click the Geocoding Options button and lower the score to 75. Click OK to close Geocoding Options and click the Rematch Automatically button.

Close any warning messages and watch as the remaining 956 points match successfully. Close the Geocoding wizard and save the map.

Now save the geocoding results as a feature class. Right-click Conductivity_Points_1989 and choose Export > Data to save the results as a feature class in the Geophysics geodatabase.

Let ArcGIS add the new feature class to the map and remove the original geocoding result set from the TOC. Doing this clears the current geocoding session from the map document and releases several locks on those files. Save the map again.

However, if you needed to return later to update or enhance the geocoding session, you would not remove the geocoding results from the TOC but would use the Review/Rematch Addresses option on the Geocoding toolbar to make changes.



↑ Use a definition query on each layer to split the points into separate layers by depth.

Symbolizing and Displaying Geophysical Data

Since conductivity for rocks may vary between 0.000001 and 10,000 Siemens per meter, I have created a simple logarithmic legend and stored it as a layer file. (For more information about rock resistivity/conductivity, check out the University of British Columbia website at www.eos.ubc.ca/ubcgif/iag/foundations/properties/resistivity.htm.)

After adding the now geocoded conductivity points into the map, a predefined layer file can be used to assign symbology. The sample dataset contains layer files to expedite symbolizing the results. They are located in the GDBFiles folder. Double-click the Conductivity_Points_1989 layer in the TOC. Click the Symbology tab, then the Import button, and navigate to the Conductivity_1989 layer file and apply it.

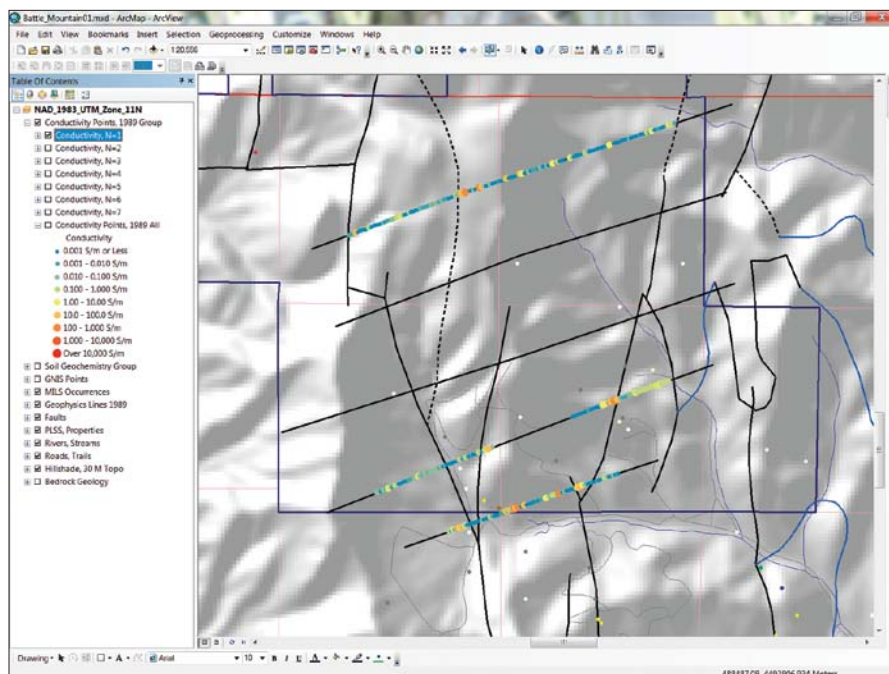
Often warmer (red) colors and larger point sizes are used to show conductive (possibly mineralized) data. Use the Identify tool to check points on any line. Points are stacked as many as seven levels deep, coded by the integer [N_Factor] field. Higher N values represent deeper readings. Actual depths are defined by spacing of transmitter and receiver electrodes along each line.

Displaying Conductivity Data by Depth

Let's split the points into separate layers by depth and go gold prospecting (again).

To display points on separate levels defined by an N factor, first copy the Conductivity_Points_1989 layer seven times by right-clicking Conductivity_Points_1989 and choosing Copy. Next, right-click the NAD_1983_UTM_Zone_11N data frame and select Paste Layer.

Repeat the paste layer procedure six more times until you have eight instances of Conductivity_Points_1989.



↑ To display data level by level, from the surface down, turn off all Conductivity instances and turn on one instance at a time, beginning with N=1.

Select all eight layers, right-click, and save them as a group layer called Conductivity Points, 1989 Group.

Start at the bottom of the group and rename that layer Conductivity Points, 1989 All.

Select the layer at the top of the group and rename it Conductivity N=1. To display only points at the N=1 depth by right-clicking on this layer, click the Definition Query tab and create the definition query "N_Factor" = 1.

Repeat the process to rename and create a definition query for the next six layers, using N=2, N=3, and so on. When finished, save the map.

To display data level by level, from the surface down, turn off all Conductivity instances and turn on one instance at a time, beginning with N=1. What do you see?

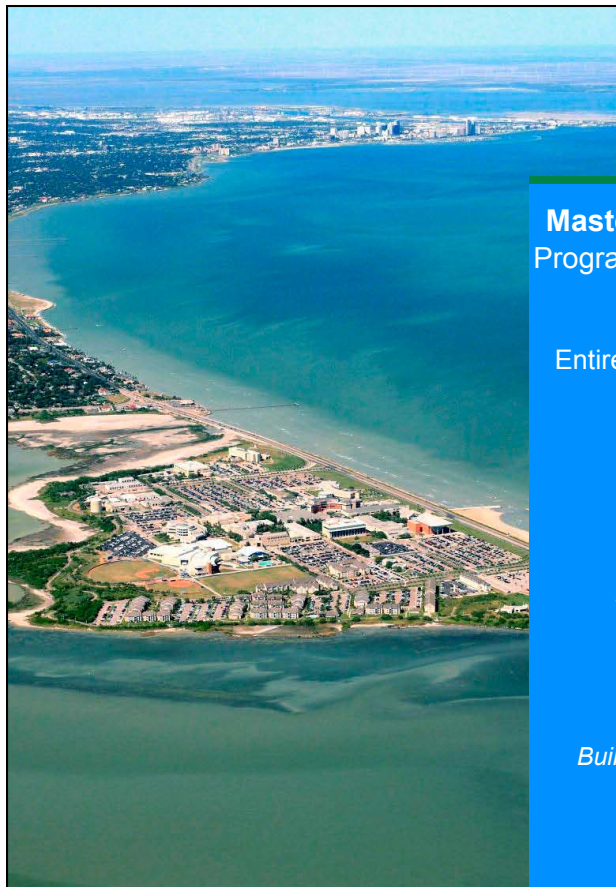
In this simple model, big red points represent conductive rocks. Their conductivity is probably related to high sulfide content and could possibly indicate associated gold, silver, and copper mineralization. The previous exercise using Battle Mountain data mapped US Bureau of Mines Mineral Industry Location System (MILS)

points and explored the multiple styles of mineralization in this area. Surface MILS points in the anomalous area show evidence of silver and lead, as well as instances of gold, antimony, and even copper. This could be the next Comstock Lode. Notice that shallow conductivity occurs primarily on Lines 250N and 750N. At depth (N=7), conductive rocks are much more pervasive. Perhaps we should look at this data a little more closely.

Digging Deeper

In this exercise, we successfully incorporated legacy geophysical data using a simple one-range address locator. The data was digitized survey lines and a spreadsheet with a spatial reference consisting only of line names and station distances along the lines. Using this simple methodology, 5,000 data points were posted to the map in just a few minutes.

Can this approach be used for data from other traditional sampling methods such as line-based soil geochemistry, surface trench samples, underground face samples, and underground longhole drilling? Why not? You just need to understand your data.



TEXAS A&M UNIVERSITY
CORPUS CHRISTI

On Campus
Online

Master of Science in Geospatial Surveying Engineering
Program in the School of Engineering and Computing Sciences
on our beautiful island University campus offers:

Entire degree plan can be completed both on campus and online

Research, design, development, and use of geospatial
data capture and analysis technologies


Programming, statistical analysis, and spatial analysis
using Esri® and other geospatial software

Several University and Program scholarships available

Opportunities for Graduate Research and Teaching
Assistant positions

Building Geospatial Technologies from the Ground Up Since 1995

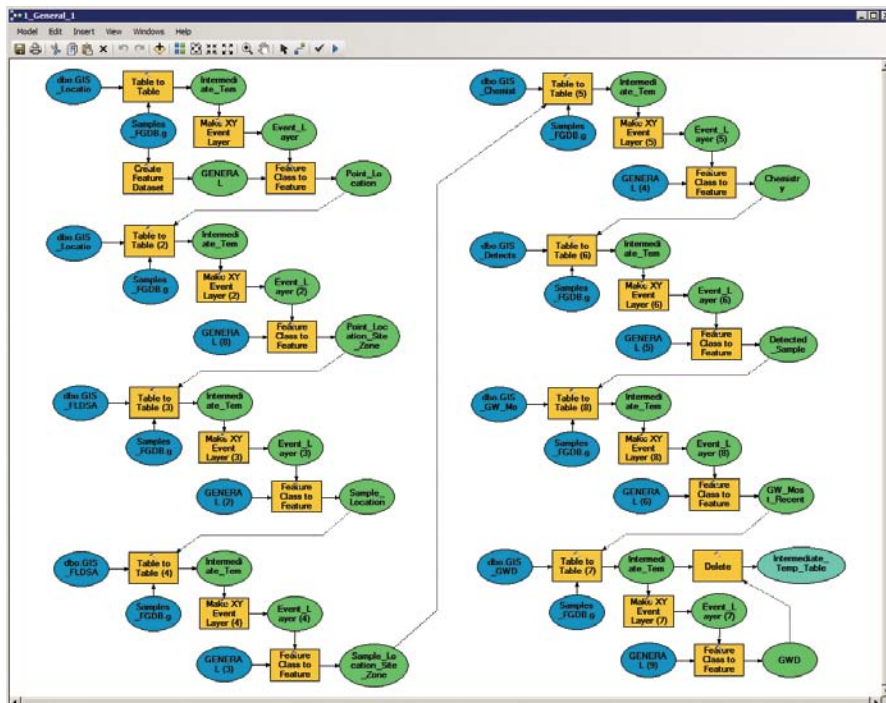
For information visit gisc.tamucc.edu
or call (361) 825-5850



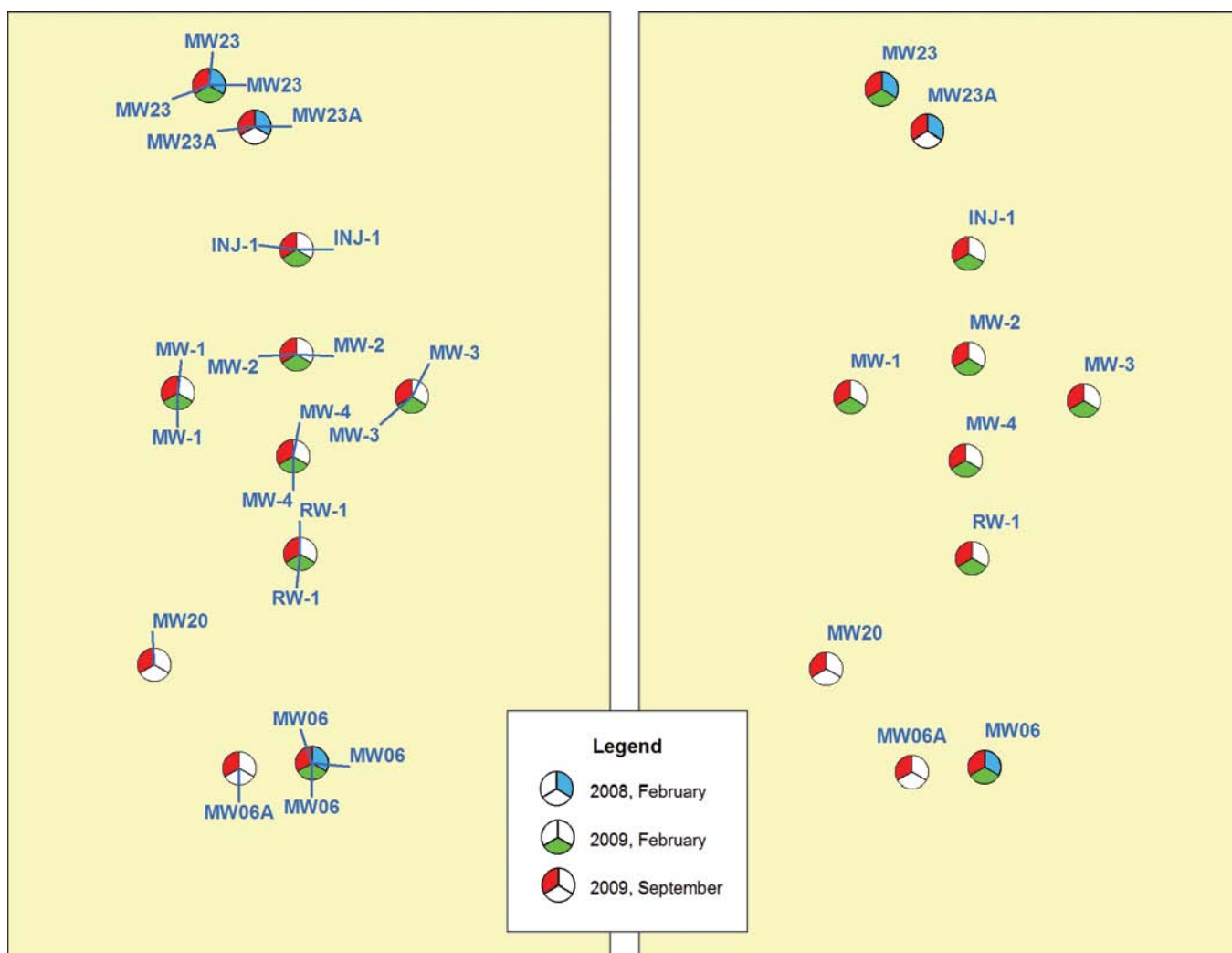
Harnessing the POWER of Query Layers

By Alex Zhuk and Wing Tse, ITSi Gilbane Company

↓ Prior to ArcGIS 10, a typical geoprocessing model was used to import data tables into a file geodatabase in a semiautomated way.



Editor's note: Query layers, added at ArcGIS 10, give users direct access to data in a relational database without requiring the contents of that database to be exported into a geodatabase. Query layers use an SQL query. They can be used to display data like any other layer, used as input for a geoprocessing tool, or accessed programmatically using developer APIs. A query layer can be saved as a layer file or used to create a layer package. ITSi Gilbane Company of Walnut Creek, California, which offers environmental management as well as construction, fuels, and energy services, uses GIS to map project site data.



↑ With query layers, the clutter has been reduced, but the map has dynamic labels.

ITSI Gilbane maintains a custom data portal, which is based on a Microsoft SQL Server 2008 R2 database. This portal has an extended interface where users (scientists, engineers, and regulators) can, at any time, find all sorts of information, raw or pre-packaged, about a particular site/job. Esri's ArcGIS suite is ideally suited for dealing with thousands or millions of analytical samples taken in soil, air, groundwater, and facilities.

Mapping environmental conditions at project sites uses data stored in the portal's relational database. Most of ITSI Gilbane's database projects are built from a single template. It makes administration easier and uniform and allows for rapid deployment of new projects. This template includes dozens of tables with multiple fields carefully arranged in the most efficient manner.

For years, the firm's GIS users relied on a limited set of GIS-related dynamic composite database views that the administrator had developed specifically for mapping purposes. Tabular data could be brought into maps using Event Layers or Display XY Data or by converting the database views into either geodatabase feature classes or shapefiles. These methods are still widely used, but they had serious drawbacks for ITSI Gilbane. For example, Event Layers are not selectable. Also, converting database views was time-consuming and created a disconnected static dataset.

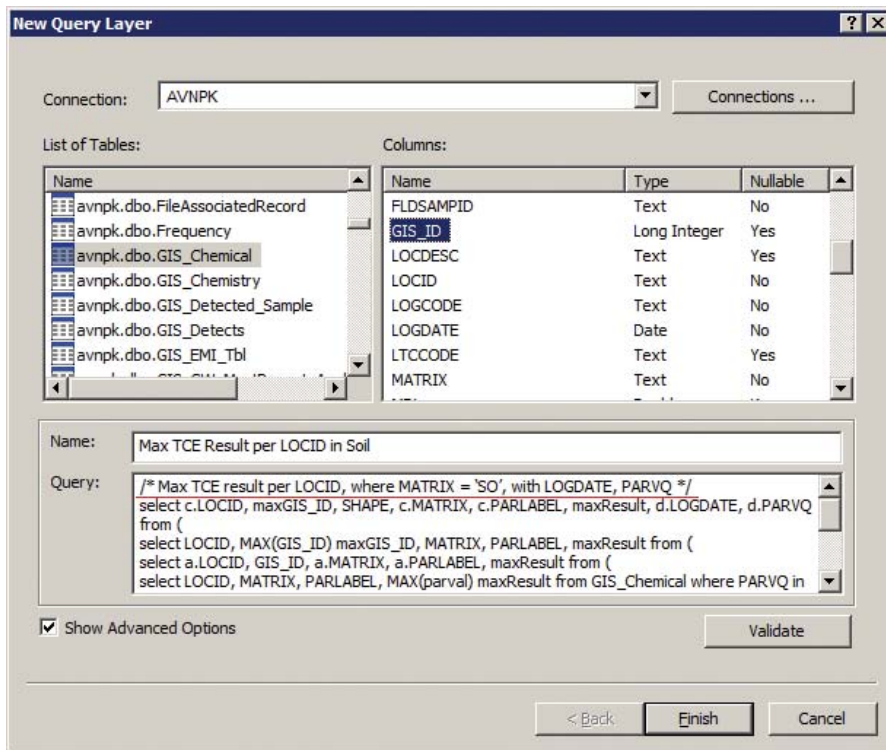
Prior to ArcGIS 10, ITSI Gilbane's GIS group preferred the conversion approach and had developed a set of geoprocessing models for importing data tables in a semiautomated way. Import procedures

were initiated manually as needed. The disconnected nature of those geodatabases sometimes caused outdated data to be used unwittingly.

A Workable Solution

Many GIS users yearned for a fundamentally new approach and wanted a full-fledged, direct database-to-GIS mechanism. The QueryLayer tool in ArcGIS 10 was the answer.

Although it was a breakthrough from a user's perspective, some sophisticated preparation work was necessary. To geoenable the data in the SQL Server database required adding the Geometry/Geography data type to the database views, creating a unique index field, and adding a spatial index. To add the Geometry/Geography data type, a new column called SHAPE ➔



↑ Now a description and complex nested query can be entered in the New Query Layer dialog box.

was added to the view. Adding the SHAPE column can be scripted using the database syntax in Listing 1.

```
geometry::STPointFromText('POINT('
+ CAST(ECOORD AS varchar(20))
+ ' ' + cast(NCOORD AS var-
char(20)) + ')', 1) AS SHAPE
```

↑ Listing 1: Adding the SHAPE column to the database view. ECOORD and NCOORD are the field names for x and y in the Location table, one of the base tables that forms the view.

The second task—adding the unique index field (GIS_ID)—turned out to be much trickier. Creating a view from multiple tables is not a difficult task as long as the tables are properly joined using key fields in a script. However, adding a column with a unique number in a view is not easy in SQL Server, especially if the view has been created by using different base tables. The primary key from any base tables—assuming the keys are numeric—cannot be used in the unique number field because it will probably be replicated in the view. After much research, using the ROW_NUMBER

function from Transact-SQL was the solution. It allowed a unique number column to be incorporated in a view without requiring a user-defined function. (A detailed description is beyond the scope of this article. See MSDN at msdn.microsoft.com for more information.)

The last task was the addition of a spatial index to boost mapping performance. SQL Server is one of several database systems that supports spatial gridding. Although the code is relatively simple, it took some creativity to apply, especially considering that these indexes (under certain circumstances) must be rebuilt. Listing 2 shows the text used to add the spatial index.

```
create spatial index MyTABLE_
_shape on MyTABLE_ tbl (shape)
USING GEOMETRY_GRID
WITH (BOUNDING_BOX =
(Xmin,Ymin,Xmax,Ymax))
```

↑ Listing 2: Adding the spatial index

Occasional performance issues can be easily solved by targeted querying. Instead of calling a table that may consist of hundreds

of thousands (or even millions) of records, a user can narrow down to just one specific subset of the entire table. After that, a more refined selection can be displayed using a definition query if needed.

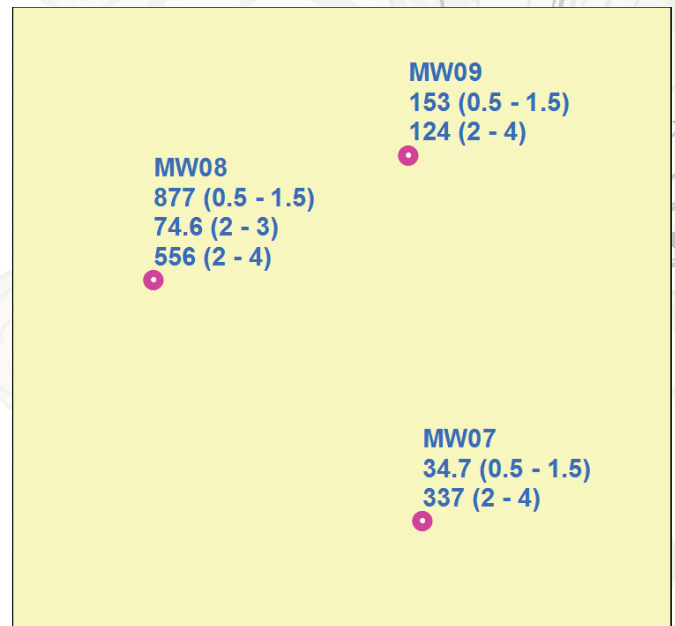
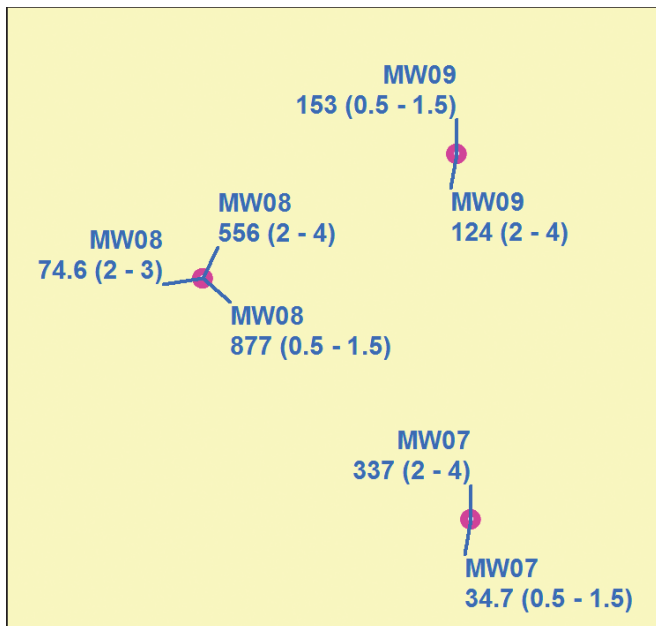
Unfortunately, database views could not be used as a basis precisely because of their dynamic nature. The Query Layer tool can only use real tables. To overcome this problem required that all database views, relevant to GIS, are automatically converted twice a day. Although this sounds as if it contradicts the original objective, it lets GIS users avoid dealing with dozens of tables to get just the limited chunk of data they needed. This was a compromise solution that did not provide real-time access, but owing to hardware and network limitations, it is as close as is currently technically possible. As the company continues improving its IT infrastructure, more frequent updates will become feasible. However, this change has eliminated the manual geodatabase import routine except for individual urgent cases that can be handled by a database administrator.

Results

Because almost all processing happens on the SQL Server database side, rather than the GIS/map side, powerful new possibilities, such as complex nested queries, open up for GIS users. The amount of work needed to get data in a particular format is minimized as is the chance of error. In many cases, the need to resort to using Microsoft Excel or third-party utilities has been eliminated.

One of the advantages of this protocol, from a GIS analyst's point of view, is the greater reliance on the underlying database. The GIS analyst now can focus more on other aspects of the job rather than making sure that the correct query was put together. That task (or most of it) can be left to the database administrator, who usually is more familiar with the intricacies of the data. Usually this approach produces more accurate results and less blame to go around—something many GIS users can appreciate.

One small (but very nice) benefit is that a user can now enter a coherent query description in a query layer's Properties using proprietary database syntax (which is still not allowed using the standard Definition Query



↑ Seven discrete samples/records in one table were combined into three samples/records by conversion of the second table in SQL Server. This operation simplified labels and improved readability. The labels here indicate location IDs, with analytical results and depth ranges in parentheses.

tool). This description can be very useful when dealing with complicated data calls. It is also very gratifying to see a map immediately display the most current point dataset as soon as the underlying database table is updated. All it takes now is just a click of the Refresh button. Another important benefit is that near real-time sampling data for some projects can be accessed not just by GIS professionals using desktop GIS but by a wide pool of users, both inside and outside the company, 24/7 via the online maps.

For more information, contact Alex Zhuk at 925-946-3366 or Wing Tse at 415-882-4518, ext. 108.

About the Authors

Alex Zhuk, MS, has 8 years of experience in mechanical design and architecture and more than 15 years of experience in CAD and GIS for the environmental industry.

Wing Tse, MS, has 25 years of experience in designing, developing, and maintaining database systems for government agencies and private industry. Over 20 years of his database experience are related to environmental work.

Aggregate. Analyze. Act.

MS in Geographic Information Systems

Resolve Real-World Challenges

- 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 lead by distinguished faculty
- For professionals and recent grads with GIS experience/education



(909) 748-8128 | msgis.redlands.edu

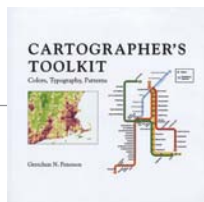
GIS Bookshelf



Geographic Information Analysis, Second Edition

By David O'Sullivan and David J. Unwin

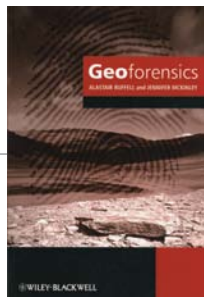
This text provides a well organized introduction to the fundamental concepts of spatial analysis for GIS students. The first edition of this book appeared in 1981. In this edition, chapters have been rewritten to accommodate the many substantive changes that have occurred in this field in the intervening 30 years. Throughout the text, there is a greater emphasis on local descriptions. Two chapters on geovisualization and local statistics were added and two chapters on analysis of line objects and multivariate statistics dropped. A basic knowledge of statistics is assumed, but appendixes supply explanations of the basic statistical and mathematical theories used in the book. The topics covered include the pitfalls and potential of spatial data, fundamentals of geovisualization, point pattern analysis, area objects and spatial autocorrelation, describing and analyzing fields, the statistics of fields, and emerging approaches to spatial analysis. Thought exercises, illustrations, and a bibliography accompany each chapter. Wiley, 2010, 432 pp., ISBN-13: 978-0470288573



Cartographer's Toolkit: Colors, Typography, Patterns

By Gretchen N. Peterson

This is a reference for cartographers that is more about getting useful results and less about exploring theory. *Cartographer's Toolkit: Colors, Typography, Patterns* provides an assortment of color palettes, type samples, and examples of various map styles designed to inspire cartographers and add to their expertise. The color section presents coordinated, color ramp, and differentiated color palettes. The type section displays serif and sans serif fonts organized by source: standard, free, and fee. The patterns section differentiates this book from other practical books on cartography by providing a collection of tried and true strategies for dealing with common mapping challenges, explanations of the techniques employed, and suggestions for effectively using each style. This book, which assumes a working knowledge of cartographic theory, geoanalysis, and projections, nicely complements the author's 2009 book, *GIS Cartography: A Guide to Effective Map Design*, in which she systematically explains cartographic conventions and discusses layout design, the use of color, and other aspects of map creation. PetersonGIS, 2012, 184 pp., ISBN-13: 978-0615467948

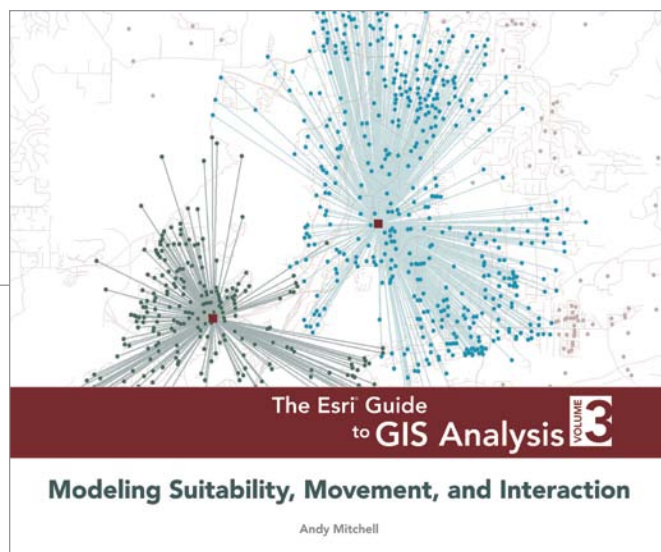


Geoforensics

By Alastair Ruffell and Jennifer McKinley

This book covers the application of geoscience to criminal investigations, as well as humanitarian and disaster incidents, to determine what happened, where and when it happened, and how and why it happened. The case study material presented is of three types: sections that supply descriptions of criminal investigations, locations, and materials; published articles on techniques and their application to historic cases; and summaries of relevant published pieces as they relate to individual chapter topics such as soils, synthetic aperture radar (SAR) and interferometry, and trace materials. Of interest to GIS practitioners involved in criminal investigations are two chapters, one on spatial location and geographic information science and another on scale, sampling, and geostatistics. Undergraduate and post-graduate students obtaining forensic science degrees or those taking geoscience courses are the target audience for this book. Wiley-Blackwell, 2008, 340 pp., ISBN-13: 978-0470057353

GIS Modeling Explained and Explored



The Esri Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction by Andy Mitchell helps readers explore the basic questions behind GIS analyses, understand the spatial concepts that underlie those questions, and determine appropriate methods to employ when performing GIS analyses that answer those questions. Unlike books that focus on navigating the user interface or on detailing software functionality, this book is concept driven.

Increasingly, GIS is used in many disciplines to provide valuable insights into problems from estimating the path of a wildfire to siting fire stations. This latest volume in the Esri Guide to GIS Analysis series, published in 2012 by Esri Press, helps GIS professionals and students make better use of GIS modeling when evaluating locations or analyzing movement.

Location analysis focuses on the familiar suitability analysis, used to answer questions such as where should the next store be built, as well as unsuitability analysis—analysis that identifies areas to avoid because they have greater risk potential from threats such as flooding or fire.

Analysis of movement includes not only people or animals, which involves some degree of decision making, but also the movement of material such as water, which follows the path of least resistance. In either case, travel is modeled as a cost surface and the analysis determines the route of least cost, whether in terms of money, time, distance, or some other metric.

The analytical process is complex because the questions posed are subjective in nature. They require defining what a suitable site is or which metric is most appropriate when measuring cost. These judgments can be based on the modeler's own expert knowledge of the specific subject, standards or published research in that discipline, or the consensus of area experts (the Delphi process).

Modeling Suitability, Movement, and Interaction gathers analysis methods that have typically been confined to specific disciplines and makes them more widely available. Beyond simply introducing these methods, it also includes best practices associated with implementing them using the ArcGIS platform, its tools, and its modeling framework, ModelBuilder. The scenarios discussed in the text are illustrated with full-color maps and diagrams. A basic familiarity with GIS concepts and ArcGIS desktop software is assumed.

The first book in the Esri Guide to GIS Analysis series, *Geographic Patterns and Relationships*, explained how GIS is used to identify relationships and trends for better decision making. *Spatial Measurements and Statistics*, the second in the series, detailed the use of GIS to identify patterns and clusters to analyze geographic relationships using statistics. Mitchell, who wrote the entire series, has written other Esri Press books and has more than 20 years' experience in analyzing and explaining the use of GIS technology. Esri Press, 2012, 432 pp., ISBN-13: 978-1589483057



OPENING OUR WORLD

"GIS today is at a major turning point because it is now capable of broadening its reach, enabling pervasive adoption," said Jack Dangermond, president of Esri, as he welcomed nearly 15,000 attendees from more than 130 countries to the Plenary Session of the Esri International User Conference (Esri UC) held July 23–27, 2012 in San Diego, California.

"Geography is our platform for understanding the world," said Dangermond, underlining the conference theme, GIS—Opening Our World. He observed that GIS makes geography come alive by condensing data, information, and our knowledge into a kind of language that can be easily understood. "It's a language that is increasingly recognized as a powerful means for reducing complexity and quickly understanding the dimensions of a situation."

Dangermond observed that this year marks the 50-year anniversary of GIS. The technology has advanced rapidly during these decades, allowing many geographic processes to be abstracted and modeled as well as creating maps and records that accurately portray the world and how it is changing. The adoption of GIS by hundreds of thousands of organizations has improved planning and management and led to greater efficiencies. In its next phase, GIS is being applied to the design of a better future through evaluating scenarios, involving citizens through crowdsourcing, and assessing the impact of human activities at different scales.

"Yet, the greatest achievement of GIS is yet to come: the widespread understanding and application of geographic knowledge

by everyone," said Dangermond. "The emergence of GIS in the cloud, together with new concepts for web enabling geographic knowledge, provide promising possibilities for accessing and leveraging the work of GIS professionals around the world."

This new paradigm amplifies the work done on the desktop and server by disseminating geographic knowledge through an online platform that can make it available everywhere to anyone via pervasive mobile devices. That online platform is ArcGIS Online. In another Plenary Session presentation, Bern Szukalski, Esri product strategist and technical evangelist, remarked that ArcGIS Online has evolved from the simple framework for sharing data introduced four years ago into a cloud component tightly integrated with the ArcGIS system. ArcGIS Online content has grown rapidly as a result of user contributions and the substantial investment of resources by Esri—building basemaps, integrating available data, and purchasing commercial data.

However, Szukalski said the biggest impact of ArcGIS Online is that it has transformed "the way that we think about and the way that we use GIS." Szukalski introduced members of the Utah Department of Transportation (UDOT) who have used ArcGIS Online to transform their organization. UDOT's GIS manager Frank Pisani explained how the ability to rapidly publish web content has extended the value and capability of UDOT's GIS and changed the way people think about maps. Instead of handling map requests with static PDFs, users now expect a link to a live, dynamic web map.

With a simple web application template, the end-user functionality of GIS is now in the hands of nonusers, and everyone now has access to the information.

"Oftentimes when someone asks you for a map, they're not asking *just* for a map," said Szukalski. "They're asking for a way to convey answers to certain questions."

A Glimpse into the Future

Each year, during the Plenary Session, attendees are introduced to future leaders and innovators in the GIS industry through presentations made by high school students enrolled in GIS classes. This year, students from Washington-Lee High School in Arlington, Virginia, presented their senior projects. Students applied GIS to real-world problems that ranged from storm water contamination to analyzing the impact of a proposed metro station. Washington-Lee is one of 16 schools participating in the Geo-Spatial Semester program sponsored by James Madison University in Virginia in the past three years.

Awards for Excellence

In addition to sharing Esri's plans for the development of GIS technology, the Plenary Session was an occasion for reflecting on achievements of Esri users and presenting awards. The first of these awards was the Esri President's Award. Its recipient, the US Environmental Protection Agency (EPA), has been using Esri GIS products for more than 25 years to support environmental decision making. The agency's most recent project for integrating science with public policy is GeoPlatform. EPA uses GIS as a platform that incorporates a private GIS subscription service for accessing data and building web applications, a private cloud for sharing data internally that uses role-based security, and data and application services built on its GIS server infrastructure that feeds the public and private clouds. Malcolm Jackson, EPA assistant administrator and CIO, received the award from Dangermond.

The Esri Making a Difference Award is given to organizations that have used GIS to bring about meaningful change in the world. This year, two organizations received the award. The first, the Trust for Public Land, has been helping create more livable cities by conserving more than three million acres of open space and developed recreation over the last 40 years. Breece Robertson, the trust's director of conservation vision, and Will Rogers, chief executive officer, accepted the award.

The City of Honolulu received the second Esri Making a Difference Award for a rail transportation project that employed geodesign techniques and the 3D visualization tools in CityEngine. When accepting the award, Honolulu mayor Peter Carlisle remarked that the city famously has the worst traffic in the United States, coupled with ever-increasing urban sprawl that threatens

the city's sustainability. Ken Schmidt, Honolulu's GIS administrator, and Michael Contreras of Esri demonstrated how GIS was used to show residents the efficiencies that would result from the elevated rail line and spread of urban sprawl if action is not taken.

"Of course, having all this great GIS content and knowledge means nothing if we can't share it, especially given that we need the public backing to make the elevated rail transit line happen," said Carlisle. Quickly generating 3D representations that use photos of actual buildings and the ability to interactively explore design options at public meetings has helped enlist public support. Carlisle expressed his belief that transportation oriented development "will provide the spinal column for sustainable transportation, long-term job growth, a greener future, and smart land use that will last for a century to come."

"So Geodesign Has Taken Over My Life"

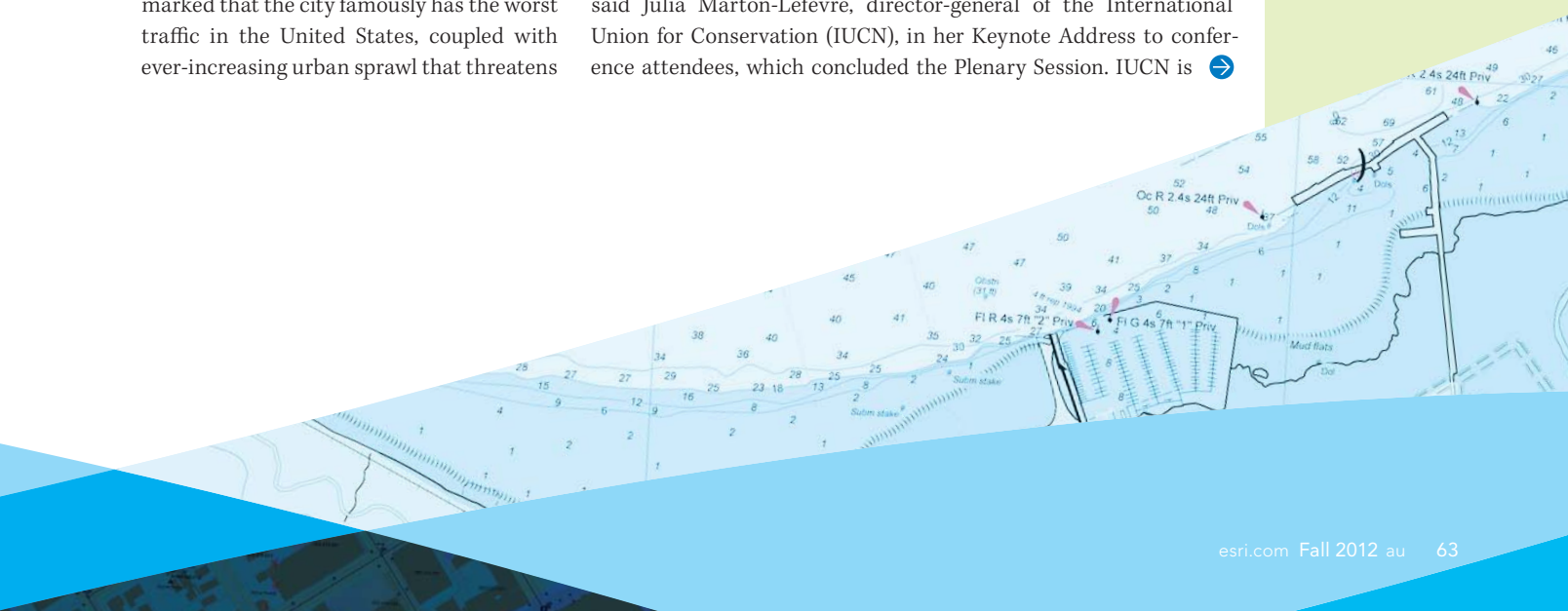
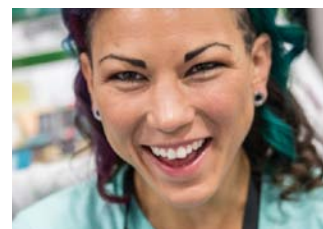
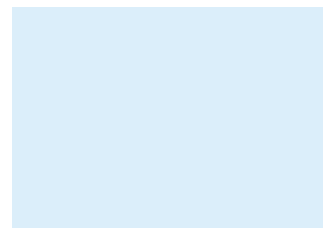
Stephen Ervin, a Harvard University professor and geospatial science visionary who has been instrumental in the development of geodesign, received the Esri Lifetime Achievement Award. "Geodesign fuses imaginative and functional creativity in environmental design and planning with analytic geospatial science. It is thinking about systems and realizing that transportation planning affects agriculture planning," said Ervin during his acceptance speech. "And so, geodesign is just in time, as I've said, powerful enough to help make the planet better for the maybe 10 billion people who will be here by the end of the century—not just cities and dams and housing developments and transit systems, but systems for people."

SAG Awards

As in previous years, Esri recognized organizations from around the world for innovative and intelligent applications of GIS technology with Special Achievement in GIS (SAG) Awards. "Each year, the SAG Awards highlight extraordinary achievements and efforts to improve our world," said Dangermond at a special ceremony on July 25 honoring the 170 recipients. For more information about the 2012 SAG Award winners, see esri.com/sag.

Keynote Address

"With each species' extinction, the beauty of our planet diminishes," said Julia Marton-Lefèvre, director-general of the International Union for Conservation (IUCN), in her Keynote Address to conference attendees, which concluded the Plenary Session. IUCN is ➔





the world's largest global environmental network, and its Red List of Threatened Species is considered the most comprehensive and authoritative resource for threatened species information. The list is compiled by thousands of volunteers, and GIS has become an important technology for locating species and preserving their habitats. During her address, Marton-Lefèvre announced the launch of the Red List of Endangered Species map viewer, built on ArcGIS 10.1, which enables people to access species information to improve planning decisions.

A Busy Week



The three days following the Plenary Session were packed with paper presentations, technical workshops, special interest group meetings, and social events. The information and contacts were valuable to veterans as well as first-time attendees like Barry Conner.

"My first Esri conference exceeded my expectations more than I could have imagined," said the GIS analyst from the City of Huntsville, Texas. "Though I came with many years of GIS experience in my area of specialization, I very quickly learned of methods and resources which will totally revolutionize the way I work. I can hardly wait to implement the things I've learned. Beyond the knowledge, I met many helpful and brilliant people who have shared generously of their time and expertise."



For others, the conference reinvigorates their passion for the technology. "The Esri User Conference is the most valuable week of my year. The technical workshops are excellent and the opportunities to meet others and exchange ideas are unsurpassed. I get energized each year by attending the conference," said Kevin Sato, GIS/IT services manager for Cottonwood Heights, Utah.

Developer Events

Developers at the 2012 Esri UC attended special events designed specifically for them: the UX Design Summit, a Dev Meet Up, and the Hackers' Sandbox. At the UX Design Summit on July 24, design industry professionals from Esri, Seso, and the California College of the Arts communicated their holistic approach to designing great applications through presentations and Lightning Talks. They discussed design rationale, implementation procedures, and strategies for building great user experiences.

At the Dev Meet Up on July 25, Dave Bouwman, CTO of Data Transfer Solutions, gave the featured keynote presentation. Developers demonstrated web and mobile applications and discussed ideas for their development.

Hackers' Sandbox, held July 24–26, was a place for developers to meet, network, demonstrate projects, and share ideas using machines provided by Esri to test-drive ArcGIS technology in group or self-paced activities.

Ancillary Events

GIS legend Roger Tomlinson kicked off this year's unconference for GIS managers on July 24. Held concurrently with the Esri UC, this unstructured event, now in its third year, gave GIS managers, business and technology strategists, and other decision makers a chance to discuss whatever topics they deemed important.

The 2012 Education GIS Conference, held July 21–24, 2012, drew a record number of educators, librarians, and others involved in GIS education. (See the accompanying article, "Entering a New Era in GIS Education," on page 66 of this issue.)

The 2012 Esri Business Summit, another concurrent event, brought together business leaders interested in place-based decision making that improves customer service and profit margins. (See the article "Keeping Service Levels High and Costs Low" on page 14 of this issue.)

Reviewing 2012 and Looking Forward

Esri UC plenary talk videos and technical session podcasts are available at esri.com/uc for those who missed this year's conference. The next Esri International User Conference will be held at the San Diego Convention Center, San Diego, California, July 8–12, 2013. In the words of 2012 attendee Robert Largent, an environmental specialist for the Cherokee Nation, "The Esri User Conference is the one-stop shop learning experience every GIS professional should mark on their calendar."

The People's Choice GIS Awards

Contests in which the fans determine the outcome—*American Idol* and *Dancing with the Stars*—are familiar. GIS has its own version: the User Software Applications Fair.

This contest, held during the Esri International User Conference, gives attendees the opportunity to test, evaluate, and vote for applications developed by their peers. This year's top three vote getters in each of the four categories were announced as the winners by Esri president Jack Dangermond during the conference closing session on July 27.

As GIS applications have moved from the desktop to other platforms, the contest has evolved and now includes categories for web-based applications delivered via web browser; mobile GIS applications developed for Android, iOS (iPad or iPhone), Windows Phone, ArcGIS Mobile, or ArcPad; multimedia maps (previously known as the Virtual Map Gallery), which encompasses animations, CD/DVD-ROM, and other multimedia presentations displaying the results of GIS analysis; and desktop GIS applications (either ArcGIS for Desktop or ArcGIS Engine) developed using Visual Basic for Applications (VBA), ArcObjects SDK (Java, C++, or .NET), or Python.

The City of Johns Creek, Georgia, staff members found the voting results this year especially gratifying. They walked off with not just one but two awards: a second place in the web-based GIS competition and a second place in the multimedia map category.

Johns Creek GIS manager Nicholas O'Day, citizen responder Kim Lavender, and web manager Sue Pearlman created a web-based roadwork map that helps commuters by flagging the location, duration, and nature of road repairs and their likely impacts on travel times.

GIS analyst Liz Parrish and O'Day developed the Fire Department Interactive Map Book, the second place winner in the multimedia map category. The map book is downloaded to fire truck computers and provides information on specific addresses and nearby buildings, the location of fire hydrants, and topography. Because it is stored

locally, it is not dependent on connectivity to the Internet and can be transferred to other computers or mobile devices.

Johns Creek, with a population of 76,000, is staffed by just two GIS professionals, O'Day and Parrish, who receive assistance with specific projects from other city staff. However, O'Day felt it was important to participate in the software applications fair for two reasons: "It validated all the work we do, and it brought us some recognition from average citizens," said O'Day. He

sees it as a way to give GIS more visibility to citizens and encourage them to use the city's many web applications to answer their questions.

Although the contest was "a lot of work," he characterized it as a fun experience. "We are definitely going to do it next year."

For the complete list of 2012 Software Applications Fair winners, go to esri.com/events/user-conference/participate/user-app-fair-results.html.

Your Success is Our Cause

Achieve your career goals by focusing in Geospatial Engineering with our online master's program offered through the Department of Civil and Environmental Engineering. Gain skills in:

- Engineering applications of GIS, GPS, GNSS
- Geospatial modeling and analysis
- Geospatial web technologies for engineers
- Photogrammetric engineering/remote sensing
- Object-oriented GIS programming
- Geospatial engineering management

In addition to online courses, the program also offers fully-licensed access to Esri® products and other geospatial software.

CSUEngineeringOnline.com

970-491-6898





Entering a New Era in GIS Education



← Juliana Rotich, cofounder and executive director of Ushahidi, spoke on the mobile future of crowd mapping.

Community was the focus of the 2012 Education GIS Conference, and more than 700 members of the GIS education community, a record number, turned out for the event held July 21–24, 2012, in San Diego, California.

In his plenary address, David DiBiase, Esri's director of education industry solutions, introduced the conference theme, Education Community 20.2: The Next Generation of GIS Education. DiBiase noted that 2012 marks the 20th anniversary of several events of importance to GIS educators. Not only was 1992 the year in which the first commonly available web browser with a graphical user interface was released, it was also the year Michael Goodchild coined the term *geographic information science*, the year ArcView 1.0 was released, and the year the Esri Education Program was started.

DiBiase asked the audience to reflect on how much GIS education has changed since 1992. The convergence of three trends—ease of use, pervasive mapping technologies, and democratization of education through cloud-based media platforms that make learners both producers and consumers of educational resources—is now making a new era in GIS education possible. The challenge is harnessing these trends to improve educational access and quality.

In response to this challenge, DiBiase announced the meeting of the first GIS Education Community Advisory Board during the conference. The board's purpose is to help Esri's education team align its priorities with those of the GIS education community's. Esri is committed to supporting the community of both learners and educators.

Juliana Rotich, cofounder and executive director of the nonprofit technology company Ushahidi, also spoke to the democratization of GIS education in a presentation entitled "Crowd-mapping, Citizen Science, and Participatory Learning."

Ushahidi means "testimony" in Swahili. The company, based in Nairobi, Kenya, supports map-based, crowdsourced data collection for the democratization of information. Ushahidi's work is self-perpetuating. Projects spring up that are self-organizing, self-run, and self-sustaining. Esri, a longtime supporter of Ushahidi, recently released an ArcGIS add-in for the Ushahidi platform.

Said Rotich, "I think the future for mapping crowdsourced data is decidedly mobile. It will be a mix of mapping systems and crowdsourcing systems with interfaces that are simple, so that regular people can quickly and easily provide and access relevant data."

The Education GIS Conference attendees also enjoyed nearly 100 user presentations, workshops, learning labs, and special interest group meetings as well as the GIS Solutions EXPO, which included many of Esri's education partners. The conference extended into the Esri International User Conference at the San Diego Convention Center with the Academic GIS Program Fair, featuring the GIS programs of a number of colleges and universities and Youth Community GIS, which highlighted student work.

Planning for the 2013 Education GIS Conference has already begun and education community members—including educators, education researchers, learning designers, administrators and staff, and especially learners of all ages—are encouraged to make plans now to attend.

Education Books on STEM Classes and Facilities Management

Two new books on best practices in education can be downloaded for free. *Advancing STEM Education with GIS*, edited by Esri education manager Tom Baker, includes case studies detailing the successful implementation of GIS-based STEM (science, technology, engineering, and math) classes in both formal and informal settings. Other articles discuss potential career paths and opportunities for collaboration. *GIS in Education: Across Campuses, Inside Facilities*, edited by Esri industry managers George Dailey and Shelli Stockton, is a collection of articles about GIS-based facilities management in schools and universities. Topics covered include planning, portfolio management, operations, maintenance, security, compliance, and sustainability. Visit esri.com/industries/ebooks/index.html to download these books and others.

Talking about the Future of GIS Education

It all began with a conversation.

Rather than listening to a series of presentations on Esri's plans, attendees to the 12th annual Education GIS Conference engaged in a 90-minute facilitated community conversation with Esri education managers and community spokespersons during the first meeting of a new GIS Education Community Advisory Board on July 23, 2012.

The advisory board, made up of education leaders and other professionals, is charged with helping ensure that Esri's education industry solutions team (education team) aligns its strategic priorities with GIS education community needs.

"We made a concerted effort to engage the community at this year's conference to help formulate the direction of GIS education for the next 20 years," said David DiBiase, Esri director of education for industry solutions.

The discussion during the meeting revolved around four questions:

1. With regard to educational resources, what is the GIS education community? What is the Esri education team's relationship to it?
2. Does the ArcLessons collection address community needs effectively? In light of trends in the GIS education community, what should ArcLessons become?
3. What should Esri's priorities be for educational resource development in 2013?
4. What should Esri's education team do to advance research-based knowledge about the efficacy of GIS in education?

"Attendees were encouraged to join the conversation with respected thought leaders," said DiBiase. "I believe that it was a useful way to better understand the challenges and opportunities we face at the cusp of a new generation of GIS education." Conversation topics included education and the cloud; open educational resources; careers in science, technology, engineering, and mathematics (STEM); educational policy; campus facilities; and global initiatives.



↑ Attendees at the 12th annual Education GIS Conference engaged in a facilitated conversation with thought leaders in GIS education about the challenges and opportunities specific to GIS education.

Diana Sinton, director of spatial curriculum and research at the University of Redlands, is an inaugural member of the GIS Education Community Advisory Board. "I think it was a very forward-thinking idea for Esri to organize this group," said Sinton. "They have done a very good job in selecting people from a variety of backgrounds in both academics and the professional world that will help shape and inform the range of activities that the Esri education team is responsible for. One of the team's problems is that it is a relatively small group, but it is responsible for a breadth of educational programs and activities. My area is in applied spatial thinking. I think that geospatial technologies have the potential to be a very effective tool to support applied spatial thinking, and I will be sharing this knowledge with the advisory board."

Based on feedback from the advisory board, the education team will review Esri educational resource development and dissemination to make sure that educational materials are relevant to the needs of users.

2012 GIS Education Community Advisory Board

Amy Ballard Central New Mexico Community College, New Mexico

Sarah Bednarz Texas A&M University, Texas

Margaret Chernosky Bangor High School, Maine

Sara Damon Stillwater Junior High School, Minnesota

Adam Dastrup Salt Lake Community College, Utah

Eva Dodsworth University of Waterloo, Ontario, Canada

Kenneth Field Esri, California

Iain Greensmith Esri Canada Limited, Ontario, Canada

Keene Haywood University of Texas, Austin, Texas

Khusro Kidwai Pennsylvania State University, Pennsylvania

Erika Klose Winfield Middle School, West Virginia

Bob Kolvoord James Madison University, Virginia

Mark Lindberg University of Minnesota, Minnesota

Anita Palmer GISetC, Texas

Lori Ann Rubino-Hare Northern Arizona University, Arizona

Adena Schutzberg ABS Consulting and Directions Media, Massachusetts

Diana Stuart Sinton University of Redlands, California

Debbie Stevens William Penn University, Iowa



Designing a Better Future for

By Monica Pratt, *ArcUser* Editor

Belize

Although you can't go there now, you might want to visit Terra Nova or Nebulous in 2027.

These two cities were winning entries in a contest to design sustainable cities in the Central American country of Belize. The My Virtual City Competition, sponsored by Total Business Solutions Limited (TBSL), Esri's local distributor in Belize, and the United Nations Development Programme (UNDP) Belize, challenged students in primary and secondary schools to envision a city for 50,000 residents set 15 years in the future. The contest theme was Designing Our Future, Mobilizing People for Change!

"This competition is about more than just kids experiencing GIS; it's about working together to sustain our world. We have an opportunity here to create a more spatially literate and socially developed society," said Regina Campbell, marketing and business development manager at TBSL and the coordinator of the contest.

More Than Just a Contest

With almost half of the world's population of seven billion people currently living in cities and that figure expected to rise to 60 percent by 2030, the need for innovative approaches to sustainable

city design has never been greater. The Rio+20 United Nations Conference on Sustainable Development in June 2012 highlighted some of the problems associated with this trend. Although they occupy just 2 percent of the earth's surface, cities account for between 60 and 80 percent of energy consumption, produce 75 percent of carbon emissions, and increasingly exert pressure on freshwater supplies.

The TED committee recognized the pivotal role of city design by awarding the 2012 TED Prize to an idea, City 2.0, "the city that works," rather than an individual. "This idea is capable of inspiring millions of people around the world to contribute to one of the biggest challenges and opportunities humanity faces," the committee stated when making the award. "The City 2.0 is not a sterile utopian dream, but a real-world upgrade tapping into humanity's collective wisdom."

From SimCity to Farmville, games that let players escape from the real world by creating landscapes that satisfy individual desires have become tremendously popular. Now, the technology that creates these refuges from reality is poised to take on a more serious role. Esri has combined virtual reality technology with

the spatial analysis tools of traditional GIS, resulting in powerful collaborative tools for designing cities.

These tools engage and inform more than just policy makers. In the words of Esri president Jack Dangermond, "Smart cities of the future will be those where the citizenry is engaged in their design and evolution, where we fully leverage the collective intelligence of the masses and allow everyone to actively participate in shaping our communities." Esri supported the young citizens of Belize who are tackling some of the world's most serious challenges by donating ArcGIS for Desktop Basic for Home Use licenses to carry out the projects and as prizes for the contest.

Tackling Serious Problems

The first My Virtual City Competition was announced November 16, 2011, during the World GIS EXPO held at the Best Western Belize Biltmore in Belize City. Students would use GIS to research and design sustainable cities. Their designs would be summarized in a brief narrative listing their city's key attributes and special features, reproduced as a physical model built to scale using recycled materials, described in detail in a 1,000- to 2,000-word essay,

and explained in a 10-minute presentation to be given at the contest exhibition on May 23, 2012, at the Princess Hotel in Belize City.

As they developed city designs, students learned how GIS can be used for planning and problem solving. Over the course of five training sessions with TBSL, as well as additional one-on-one coaching, they also learned how to use Esri software. Beyond technical training, the contest enhanced students' leadership skills and teamwork and made them more aware of human rights and national and international development standards.

Winning Designs

Teams competed in two categories: primary school and secondary school. Students' entries demonstrated innovative approaches to city planning that addressed environmental, societal, and economic concerns. First prize winners received laptops and ArcGIS for Desktop Basic Home Use licenses. Second prize winners received smartphones and ArcGIS for Desktop Basic Home Use licenses. Third prize winners received Apple iPods and ArcGIS for Desktop Basic home user licenses. Winning teams' schools also received a \$500 honorarium and a plaque.

Max McField, Chloe Kelly, and Ethan Singh from Belize Elementary School took first place in the primary school category for their city called Nebulous. Kelly described the city as eco-friendly with



↑ In the secondary school category, Corozal Community College students Philip Gongora and William Mahler won for their design of Terra Nova.

many job opportunities and sustainable energy supplied by solar and wind power. Brandon Bennett and O'Sean Hyde of Horizon Academy took second place in this category with their city Arcadia. The pair have high hopes for their city. "Arcadia is an eco-friendly, technology-based city that provides safety first and great entertainment. The city hopes to improve Belize and find its way onto the map as the best little city in the world." Bennett and Hyde also won prizes for Best Use of Millennium Development Goals and Best City Layout. Jordan Campbell and Zazie

McKenzie of Belize Elementary School received third place for the design of their city, Healthmore.

In the secondary school category, Corozal Community College students Philip Gongora and William Mahler won for their design of Terra Nova, "the city of opportunity." In addition to capturing the overall prize, the pair also won prizes for Best City Layout, Best Use of GIS, and Best Use of Millennium Development Goals. Samantha Chan, Armando Perez, and Asher Canto from Edward P. York High School took second place overall with the City of Jex design. They also won the award for Best Team Work. Jovan Gongora, Trei Solis, and Lance Howard of Belize High School, who designed the city of Je La Tron, comprised the third place team.

In the course of completing their My Virtual City entries, all students were required to comprehensively address the needs of their cities from basic services, such as sanitation, water, and power, to employment opportunities to recreation and education facilities. This contest, in the words of contest sponsors TBSL and UNDP, can help "the younger generation to become strategic decision makers who understand how planning and decisions impact our lifestyle, community, nation, and world."

For more information, contact TBSL at info@tbsl.bz.

↓ In the primary school category, Max McField, Chloe Kelly, and Ethan Singh from Belize Elementary School took first place for their city called Nebulous.



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-chile.com

**Esri China Information
Technology 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 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



Copyright © 2012 Esri.
All rights reserved.
Printed in the United States of America.

The information contained in this work is the exclusive property of Esri or its licensors. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by Esri. All requests should be sent to Attention: Contracts and Legal Services Manager, Esri, 380 New York Street, Redlands, CA 92373-8100 USA.

The information contained in this work is subject to change without notice.

Esri, the Esri globe logo, 3D Analyst, ArcAtlas, ArcCatalog, ArcData, ArcDoc, ArcEditor, ArcExplorer, ArcGIS, the ArcGIS logo, ArcGlobe, ArcIMS, ARC/INFO, ArcInfo, ArcLogistics, ArcMap, ArcNetwork, ArcNews, ArcObjects, ArcPad, ArcPress, ArcReader, ArcSDE, ArcSurvey, ArcToolbox, ArcTools, ArcUser, ArcView, ArcVoyager, ArcWatch, ArcWeb, ArcWorld, ArcXML, BusinessAnalystOnline, BusinessMAP, CommunityInfo, EDN, GeographyNetwork, GIS Day, MapData, MapObjects, Maplex, MapStudio, ModelBuilder, MOLE, NetView, RouteMAP, SDE, Sourcebook*America, StreetMap, Tapestry, @esri.com, esri.com, arcgis.com, geographynetwork.com, gis.com, and gisday.com are trademarks, registered marks, or service marks of Esri in the United States, the European Community, or certain other jurisdictions.

Other companies and products or services mentioned herein may be trademarks, service marks, or registered marks of their respective mark owners.

Cityworks®

In the Cloud



Take **CONTROL** of your **ASSETS**.
PLAN and ANALYZE for **SUCCESS**.
Go **MOBILE**. Enable field workers.
Be **AWARE** of your **OPERATIONS** everywhere, 24/7.
ENGAGE and empower your **CONSTITUENTS**.

Empowering GIS™ for
**ASSET MANAGEMENT,
PERMITTING, LICENSING
and more!**

POWERED BY
esri®

801.523.2751
www.cityworks.com



esri[®]

380 New York Street
Redlands, California 92373-8100 USA

Presorted
Standard
US Postage
Paid
Esri

132343 QUAD466M10/12dh



Who is GIS?

Virtually everyone is. The fire marshal who plots out past incidents in hopes of averting future ones. The priest who maps out his church grounds so he can locate problems that need fixing. The student who does demographic research for a marketing class project.

Come to esri.com/whoisgis to learn all their stories and enter the diverse community of your fellow GIS users.

Are you GIS? We hope to hear your story, too.



esri[®]