

Briefly Noted

Esri Is a Key Geospatial Partner for Salesforce

Salesforce has selected Esri as the key provider of geospatial content for Salesforce Maps, which enables organizations around the world to combine their business data with geospatial analytics and mapping. By integrating ArcGIS Living Atlas of the World and allowing Salesforce Maps users to access ArcGIS Online, Salesforce is giving businesses the ability to analyze and visualize massive amounts of geographic and demographic data and gain competitive advantages.

ArcGIS Drone Collections Brings Drone Data Processing to ArcGIS Online

Esri is working with 3DR, a leading US drone data company and an Esri partner, to expand Esri's current drone imagery offering, Drone2Map for ArcGIS, with an end-to-end enterprise drone data and analytics solution for the ArcGIS platform. The new ArcGIS Drone Collections, which uses 3DR's unmanned aerial systems flight planning app and cloud-based Site Scan processing software, gives users ranging from small operators to enterprise-wide drone programs a complete, integrated, and scalable drone data collection and processing solution.

Mozambique Is Early Adopter of Land Administration Modernization Program

Mozambique's National Directorate of Lands (DINAT) successfully implemented the Esri Land Administration Modernization Program (LAMP), which helps developing countries jump-start and modernize their land administration systems. By using LAMP, DINAT is already making land administration business processes more efficient and productive while improving parcel data accuracy.

With Machine Learning, Australian State Automated Large-Area Land Classification

The state of Queensland, in northeastern Australia, is remarkably geographically diverse. It includes coastal rain forests, widespread eucalypt and acacia woodlands, tropical savannas, ephemeral inland rivers, deserts, and rich agricultural belts. With an area of 1,730,000 square kilometers (668,000 square miles), it is approximately seven times the size of Great Britain.

To map and assess land-use patterns and changes throughout the state, Queensland's Department of Environment and Science (DES) formed the Queensland Land Use Mapping Program (QLUMP) more than 20 years ago.

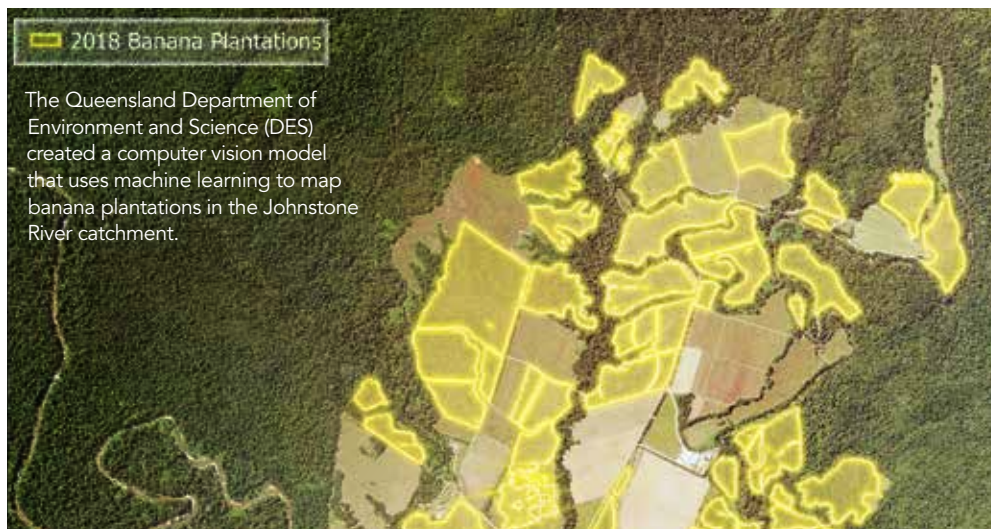
"Land use has been identified as a foundational spatial dataset that the government considers vital for the progression and development of

Queensland," said Andy Clark, senior scientist at the DES Remote Sensing Centre. "The state is large, and it is important that we continue to improve the speed at which we collect this data, as well as its accuracy. In addition, we must keep our procedures in accordance with the standards established by the Australian Land Use and Management Classification system so that it is consistent with data collected throughout the entire country."

Traditionally, the methodology used to keep QLUMP up-to-date relied on a team of skilled spatial scientists to manually digitize land-use features from satellite imagery. Because of the size of Queensland, this process took a lot of time and resources.

"Previously, we have made various attempts to automate QLUMP, all of which ultimately proved to be unsuccessful," said Clark. "Decision tree models were used to infer land-use features from ancillary data; however, this method did not provide an accurate representation of what was on the ground. We tried using the spectral information from satellite imagery to conduct a supervised classification but determined that this procedure could not successfully

continued on page 8



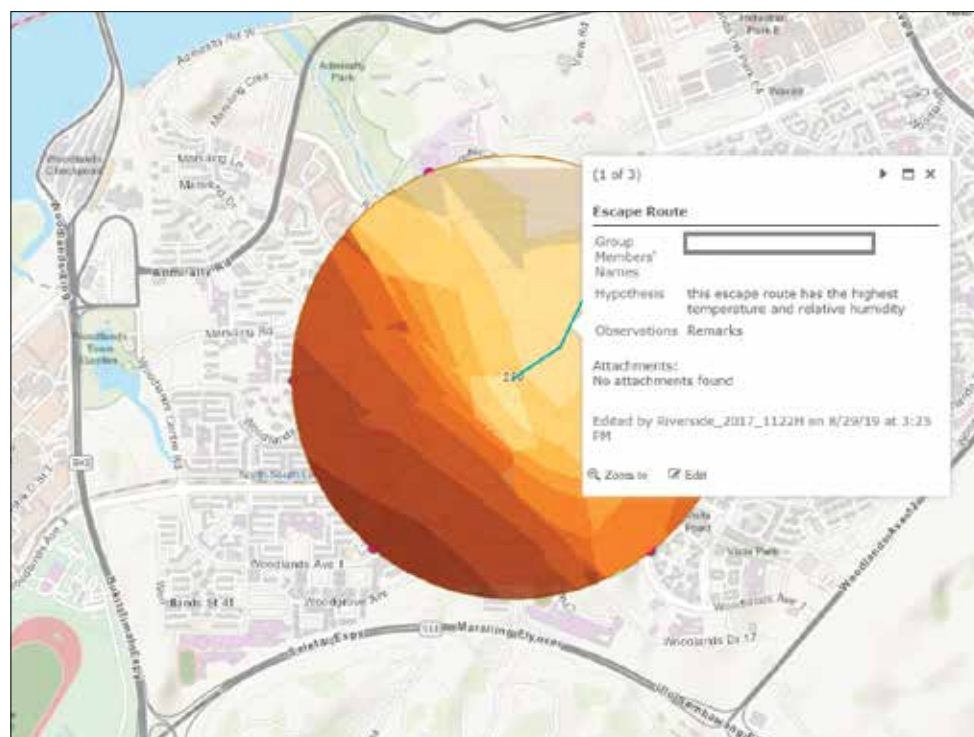
Singapore Is Building a Nation of Young Spatial Thinkers

Two decades ago in Singapore, GIS was brought into secondary schools to help teach geography. But only a small number of teachers ended up actually adopting GIS to support their geography lessons. Since then, integration of GIS into school curriculum has been slow.

The Ministry of Education (MOE) in Singapore wanted to change that. So in early 2018, with help from Esri Singapore, the ministry's Curriculum Planning and Development Division (CPDD) deployed MOE-EduGIS, a GIS platform that combines desktop, web, and mobile GIS apps to enhance the development of students' spatial thinking skills.

To make the platform work, curriculum resource development officers from the MOE take geospatial data obtained from government, open-source, and proprietary portals; process it using ArcGIS Pro; and publish the resultant digital maps in a cloud GIS. These officers and schoolteachers can then embed the maps in online lessons that students access via the Singapore Student Learning Space, the national e-learning platform. From

continued on page 16



↑ A group of students from Riverside Secondary School used weather data to figure out the best routes for avoiding a fictitious zombie invasion. They were told that the zombies would avoid areas with high temperatures and humidity.



The Pacific Ocean covers more than 30 percent of the earth's surface, yet we know very little about it. The United Nations Economic and Social Commission for Asia and the Pacific partnered with Esri to develop the Pacific Ocean Accounting Portal, which brings attention to this body of water in ways that decision-makers can quickly understand.

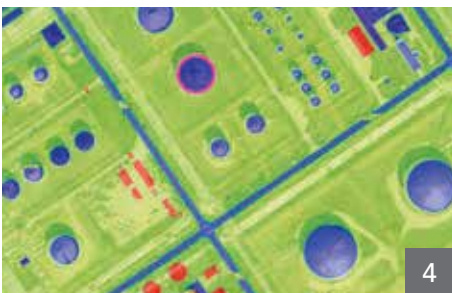


Table of Contents

NEWS

- 1 With Machine Learning, Australian State Automated Large-Area Land Classification
- 1 Singapore Is Building a Nation of Young Spatial Thinkers
- 1 Briefly Noted
- 4 Serbian Petroleum Company Uses Enterprise GIS to Record and Manage Property
- 6 Release Ready Partner Commits to Having Fully Certified Technical Staff



ESRI TECHNOLOGY

- 3 Harness the Power of Location in the Internet of Things
- 13 The Next Generation of Mapmaking in ArcGIS Online: Map Viewer Beta
- 14 Navigation Takes a Turn for the Better
- 15 Location Tracking for Field Personnel Gets Wider Release
- 33 New Expressive Tools for Storytelling
- 34 New Subscription Option Lets More Creatives Reimagine Mapping

YOUR WORK

- 7 Engineering Firm Extends Enterprise GIS to Clients
- 10 In Baton Rouge, Dashboards Give Citizen Service Calls Perspective
- 18 3D GIS Helps Taiwan Prepare for Flood Events
- 22 Oregon/Washington BLM Modernizes Range Monitoring with Digital Workflows
- 27 Setback Mapping in Newport Beach, California, Gets an Update
- 28 With GIS, Communities See How Land-Use Changes May Affect Local Water Quality
- 30 Smart Community Enhances Asset Management with Location Intelligence
- 32 Managing Data Geospatially Makes Pipeline Operator More Efficient



GIS PEOPLE

- 12 GIS Manager Puts People at the Center of GIS
- 20 The Power of Shared Information for the Pacific Ocean
- 35 The Importance of Institutions
- 36 How to Grow Your GIS Career

COLLABORATIONS

- 24 With Help from Esri Partners, Communities Get Smart Upgrades
- 26 Startup's Panoramic Mapping Platform Helps Port of San Diego Share Data
- 37 New Training and Certification Offerings
- 37 Esri Press
- 38 Career Opportunities



Share Your Story in ArcNews

Tell readers around the world how your organization saved money and time or acquired new capabilities through using GIS.

esri.com/ansubmission

Copyright © 2020 Esri. All rights reserved.

Executive Editor
Monica Pratt

Managing Editor
Citabria Stevens

Graphic Designer
Takeshi Kanemura

Illustrator
Daniel Gill

Manage Your ArcNews Subscription

To subscribe, unsubscribe, or make changes to your Esri publications, please go to esri.com/manage-subscriptions.

Outside the United States, please contact your international distributor to subscribe, unsubscribe, or change your address. For a directory of distributors, visit esri.com/distributors.

Article Submission Guidelines

Before writing an article, read and follow the publication guidelines at esri.com/ansubmission.

ArcNews

Esri
380 New York Street
Redlands, CA 92373-8100 USA
arcnews_editor@esri.com
Tel.: 909-793-2853, ext. 1-2730
Website: esri.com/arcnews

ArcNews (ISSN 1064-6108) is published quarterly by Esri at 380 New York Street, Redlands, CA 92373-8100 USA. ArcNews is written for the Esri user community as well as others interested in mapping and geographic information system (GIS) technology. It contains material of interest to planners, foresters, scientists, cartographers, geographers, engineers, business professionals, and others who use spatial information.

Advertise in ArcNews

Reach more than 800,000 potential customers.

Reserve space in the longest-running GIS magazine.

ads@esri.com

Copyright © 2020 Esri. All rights reserved.

Harness the Power of Location in the Internet of Things

In almost every industry, organizations are increasingly using sensors to collect massive amounts of real-time data. This data can be used to create smarter systems. But first, organizations need to make sense of it.

ArcGIS Analytics for IoT, a new real-time, big data processing and analysis capability of ArcGIS Online, can help organizations use this data to gain spatial insight and awareness. It works at scale in the Esri Geospatial Cloud to process streaming and historical observations from Internet of Things (IoT) devices and requires no deployment or maintenance.

Analytics for IoT can ingest, visualize, analyze, and act on data from IoT sensors. The modern, streamlined user experience enables users to effortlessly tap into sources of observation data and make it available to anyone in an organization. GIS analysts, operations officers, and data scientists alike can analyze streams of real-time sensor readings or historical data. The diverse set of data connectors and analytic tools in Analytics for IoT supports workflows for industries ranging from city agencies and electric utilities to commercial companies and nongovernmental organizations.

With Analytics for IoT, users can configure feeds and ingest streaming data to immediately visualize real-time information in web maps and dashboards. Real-time data can be brought in over HTTP and from cloud platforms such as Microsoft Azure IoT and Amazon Web Services (AWS) IoT

↓ ArcGIS Analytics for IoT can be used to ingest, visualize, analyze, and act on data from real-time sensors.

or consumed from industry-standard messaging technologies like Apache Kafka, MQTT, and RabbitMQ. Analytics for IoT also works with IoT observations that have already been collected, such as data in ArcGIS feature layers or in external big data sources like Amazon Simple Storage Service (Amazon S3) and Azure Blob storage.

Beyond data visualization, Analytics for IoT can filter, process, and use high-velocity event data to trigger action as well. Users can leverage virtually any kind of streaming data and automatically alert personnel when specified conditions occur. For example, an electric utility operations officer can construct a process to receive regular readings from smart meters, and when there are indications of a power outage, Analytics for IoT can automatically notify the field crew closest to that area.

The real-time analysis tools in ArcGIS Analytics for IoT include fundamental and powerful spatial operators for

- Analyzing patterns.
- Finding locations.
- Managing data.
- Summarizing data.
- Using proximity.
- Data enrichment.

These tools can easily be combined to mine incoming information that's relevant to the mission at hand. Whether performing geofencing, detecting incidents, identifying trends, or finding areas of data clustering, Analytics for IoT has myriad ways to uncover the hidden meanings in incoming data.

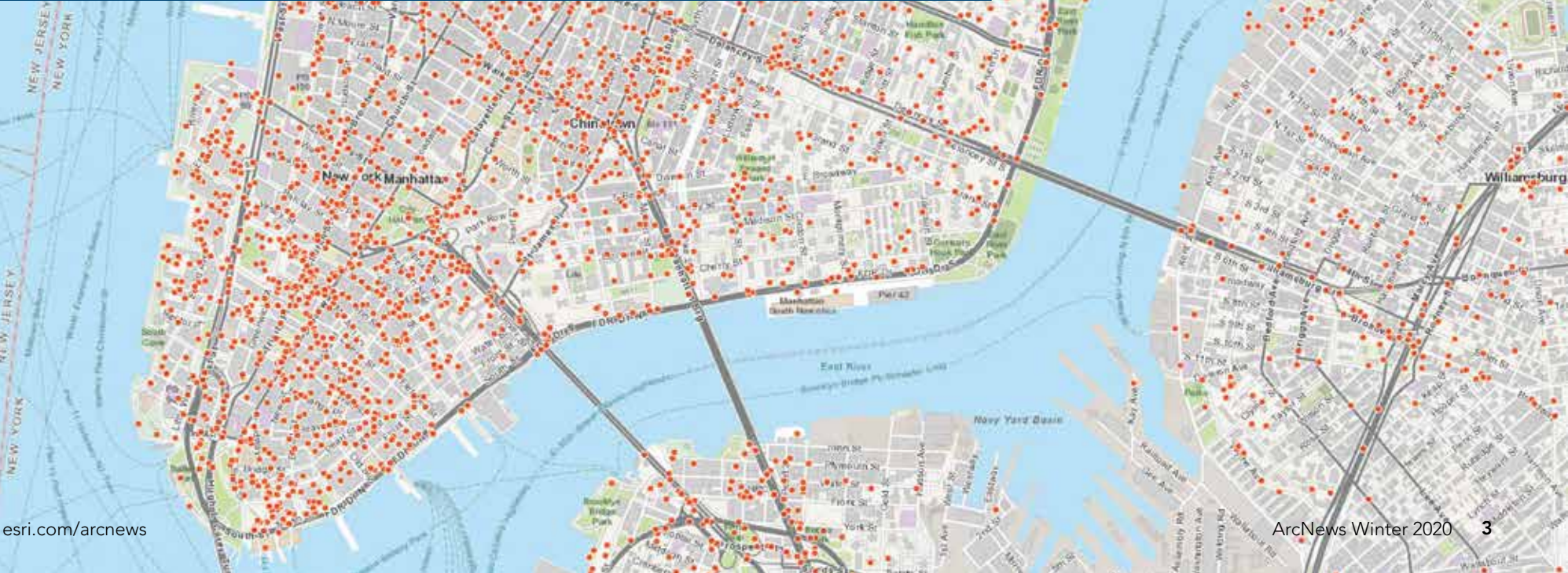
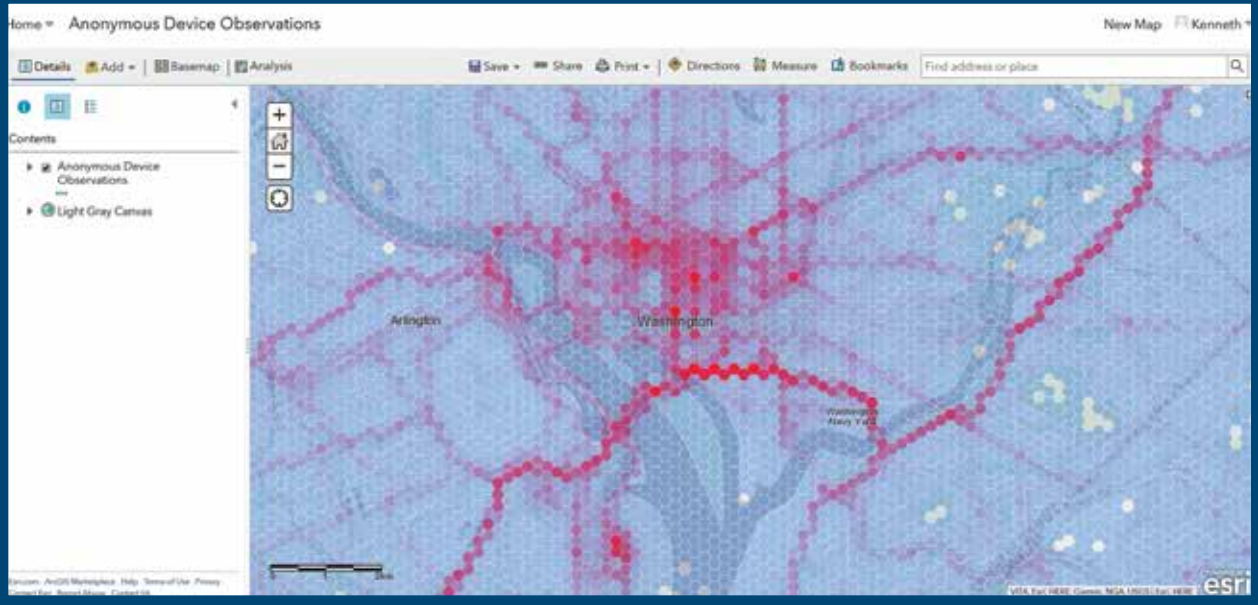


↑ Using Analytics for IoT, a city agency could look at vehicle movements on roads and then take action to mitigate traffic, plan detours, and more.

While Analytics for IoT is well suited for workflows that deal with observations received from IoT devices and sensors, users can also employ it to work with nearly any source of real-time or big data. For instance, users could design an analytic model to process high-volume historical crime data to assess patterns and trends or summarize human movement data in urban areas to better understand how workday population cycles ebb and flow. In addition, analysis results can be stored in ArcGIS for further exploration and evaluation on maps and to share with key stakeholders. Users can also deliver their results to external cloud stores, such as Amazon S3, for more processing.

ArcGIS Analytics for IoT unlocks the power of location in the Internet of Things. With this capability, smart cities, federal agencies, utilities, transportation administrations, oil and gas companies, retailers, and many other organizations can start taking advantage of the IoT in innovative ways and gain real-time visibility into day-to-day operations. This increased situational awareness supports data-driven decision-making at both the right time and the right place.

The first release of Analytics for IoT, scheduled for this quarter, caters to organizations with high-velocity needs or that monitor a large number of data streams. Future releases planned for later this year will be suitable for organizations with lower-velocity use cases. Sign up and stay informed about Analytics for IoT at go.esri.com/arcgis-analytics-for-iot.



Serbian Petroleum Company Uses Enterprise GIS to Record and Manage Property

Naftna Industrija Srbije (NIS) is the biggest petroleum company in the Republic of Serbia and also the country's largest company. Founded in 1949 as the Oil Exploration and Production Company, NIS has expanded its operations to include exploration, refining, sales, and distribution. It is a multinational company with subsidiaries and offices in Bosnia and Herzegovina, Bulgaria, Hungary, Romania, Russia, Croatia, and Angola.

Until 2009, NIS and its assets were owned by the state. That year, the Serbian government decided to sell off a portion of the business. The new majority shareholder in NIS reorganized the company in its entirety, and part of that restructuring included establishing a new division of NIS called the Department of Real Property Management. The primary purpose of this new department was to reregister ownership rights for all pieces of NIS property that had previously been registered under the state, as well as record all formerly unregistered assets in the Serbian Real Estate Cadastre (REC).

“When ownership changed, it became essential that a process be implemented to formally map and register rights on the fixed assets owned by NIS so they could be formally registered in Serbia’s Real Estate Cadastre,” said Marko Maric, the GIS manager and director of land affairs in the Department of Real Property Management. “To successfully complete this task, it was necessary to have an accurate inventory of all our properties.”

For this reason, NIS implemented ArcGIS Enterprise in 2011.

“Normally, a petroleum company implements a GIS to help field operations and to maintain its facilities or manage its pipeline infrastructure,” Maric pointed out. “However, in our case, we did it for the purpose of property rights registration.”

From Simple Web App to Key Technology

According to Maric, the original idea for using GIS at NIS was to create an app that would help the company register assets in the official state registry—the REC—and then expand its use from there. In 2011, NIS began developing an enterprise web app called GIS ODEON (which, in Serbian, stands for Unified Digital Registry of Immovable Assets).

“Our initial release was later that year, and it was just a small web app that was used for visualizing our assets on a map,” said Maric. “At that time, there were about 25 users of the application, and they were all in the Department of Real Property Management. Since then, we have recorded the exact positions of more than 25,000 fixed assets, including land parcels, buildings, production facilities, wells, pipelines, utilities, tanks, office space, and apartments, which are mapped through the geodatabase.”

Over the last eight years, the staff at NIS have increasingly understood the value of integrating and analyzing georeferenced data and making it part of the decision-making process. This is also supported by management and is now an important part of the company’s operations.

“I refer to this as the GISification of NIS,” said Maric. “By applying GIS functionalities and using different kinds of data from geodatabases, many business processes have become easier and more efficient. Finding spatially related data in our existing workflows has spurred the further development of this enterprise app, making it very useful for a wide variety of applications throughout the company.”

Although the Department of Real Property Management has continued to use GIS ODEON in more advanced ways, the largest number of active users today is from the upstream (exploration and production) and downstream (refining, marketing, and distributing) divisions. That said, there are also quite a few app users from capital construction, accounting, investments, health, safety and environment, and corporate security. Additionally, Maric and his team have adapted the app so that employees in NIS-affiliated companies in Bosnia and Herzegovina, Bulgaria, and Romania can use it for asset management as well.

A Complete Picture of Assets

GIS ODEON manages three different types of data, including a geodatabase, a relational database, and

another database that is specifically for scanned documents and attachments. This allows NIS to limit access to the data to different user groups, depending on their needs and potential uses for the data.

“The ability of this application to integrate georeferenced assets with a variety of other data and documents related to that asset—such as legal, cadastral, accounting, lease, land surveying, and so on—is invaluable to our entire operation,” said Maric.

NIS can also include photos and scanned documents, such as building permits, usage permits, title deeds, and contracts, in the database. Thus, the company has a complete picture of all its assets that is easily accessible from the central database maintained by GIS ODEON. This makes the app valuable to departments throughout the company.

“For example, by having all company assets specified on a map and linked to supplemental data, employees in the field can easily do audits to maximize the effective use of company real estate using the mobile app GIS ODEON Survey, which we developed,” said Maric. “By determining the coordinates of an asset, they can measure the distance between them and other areas of interest for the potential acquisition of additional assets or the sale of current ones. With the implementation of the Query Builder tool (a four-step module for non-SQL experts), users are now able to easily get a wide variety of reports from both the geodatabase and the [relational] database based on their specified criteria.”

GIS ODEON has other specialized outputs as well. The Passport of Assets, for instance, is a PDF that helps NIS monitor specific assets from a legal perspective. Additionally, the app can be used to create more accurate and detailed work orders for appraisers.

“We have also implemented thematic views in GIS ODEON so that users can easily understand the current status of an asset,” said Maric. “The views can specify, by color, property registration rights or exploitation status, or even the current status of the implementation of corrective measures necessary for some assets.”

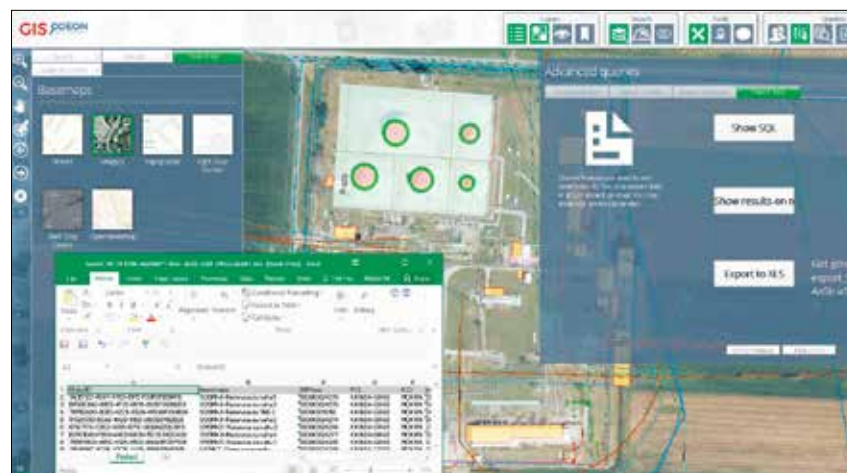
Future Plans for the App

Because of the myriad uses of GIS ODEON, the number of users at NIS continues to grow. Currently, the app has more than 370 active users.

“In addition, we are getting regular requests for the implementation of new functionalities in the app that will help employees fulfill their specific business needs,” said Maric. “Through the dashboard available on the GIS ODEON portal, our management can get a clear view—in real time—of the current status of audit projects.”

Future planned functionalities for GIS ODEON include a pipeline maintenance module that will be part of the existing app, the ability to support more precise property tax filing procedures, and a separate app for fleet management.

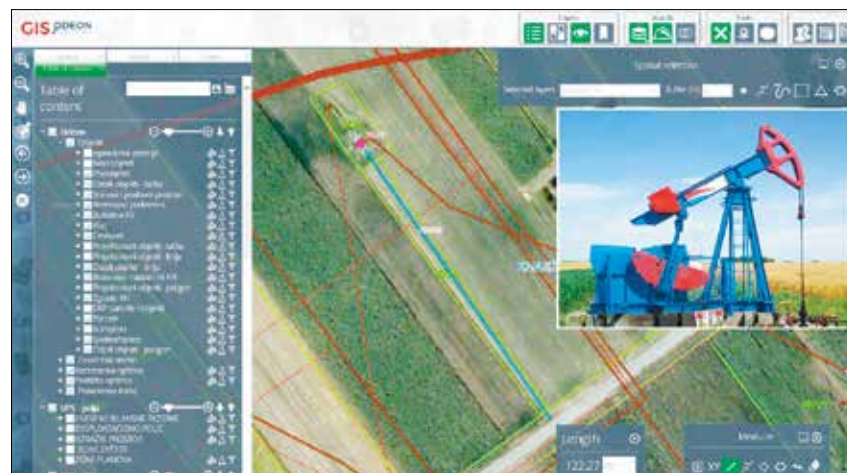
“We also have a plan to synchronize data between ArcGIS and IBM Maximo to enhance the system’s asset management capabilities and integrate our supervisory control and data acquisition (SCADA) system with our geodatabase,” added Maric. “In addition, we are discussing future implementation of an ArcGIS Indoors application that would be very useful for building maintenance and in the event of an emergency.”



↑ Users can do advanced data analysis on assets using the Query Builder tool, which highlights specific objects on the map and/or in a Microsoft Excel spreadsheet.



↑ A dashboard available on the GIS ODEON portal provides management with insight into the current status of real estate audits.



↑ GIS ODEON helps NIS plan new construction by allowing users to easily measure the area of and distance between various assets.



↑ Thematic views, which use different colors to represent different types of registered property rights, make it easy for users to understand an asset’s current legal status.

Release Ready Partner Commits to Having Fully Certified Technical Staff

Esri partner True North Geographic Technologies knows the value of staying ahead of the curve. For 12 years, the Tennessee-based company has provided its customers with GIS implementation services to help them embrace location technology and apply it to their daily workflows. Now, with 20 employees and a customer base of sizable utilities that stretches from Texas to Massachusetts, True North is continuing to raise the bar.

In June 2019, True North CEO David Speight announced that the company's entire technical staff would earn Esri Technical Certifications. In just a few months, he expects these employees, which account for about three-quarters of True North's staff, to accomplish that.

"We want to show that, at a company level, we're on the same page as Esri," said Speight.

Really Understanding Esri Technology

True North's core mission is to help its customers solve problems. With a thorough understanding of Esri products, the company offers valuable insight into how ArcGIS technology should be architected, deployed, and used.

"We're primarily a services provider, so the value of our time to our customers is based both on our domain expertise in various industries and our technical expertise in the platforms we support," said Speight.

It was in pursuit of this mission that True North decided to become a Release Ready specialty partner in 2018. The Release Ready designation is awarded to partners that adopt the latest Esri technology, migrate their offerings in a repeatable practice, and have a well-trained staff to support the latest Esri software releases.

"Customers want to work with an Esri partner that they know is in step with their primary technology provider," said Mitch Maddox, director of business development at True North.

One way to demonstrate being at the forefront with Esri is to get certified in ArcGIS technology.

"It's a good indicator that an individual has a solid understanding of the technology they work with," said Speight. "I think a lot of times, you can know things at a surface level, but being able to pass a certification exam conveys that you really understand the software well enough to answer questions about scenarios that you don't typically encounter."

Esri offers Desktop, Enterprise, and Specialty certifications, as well as exams for developers and administrators. Speight said he encourages employees to get whichever certification they want to pursue.

"I typically make recommendations, but usually they have something in mind that they want to achieve first," he said. "We have a good mix of Desktop and Enterprise certifications at multiple levels. We're already looking at some of the new certifications coming out as well, and we'll be going after those."

A Way to Inspire Customers and Employees

As an early adopter of Esri technology, True North is well versed in what it takes to inspire trust and confidence in the market. For starters, customers need to recognize that the company is an industry expert with proven solutions and services. Being a Release Ready specialty partner does this, but the commitment True North made to having a fully Esri-certified workforce sets it apart even further.

"When a Release Ready specialty partner's staff is certified, customers have the confidence that the partner has an in-depth understanding of Esri technology," explained Maddox. "Our staff have the expertise to implement systems that will help customers overcome their business challenges."

And while spurring customer confidence is certainly important, True North also seeks to inspire its own workforce. Part of True North's annual organizational plan includes training and certification opportunities for employees. The company encourages technical staff to make learning—with a focus on technical certification—a priority through financial incentives and recognition. And

while this benefits the individuals on both a personal and professional level, it also pays dividends to True North and its customers.

"It has been our experience when working with traditional IT partners, that a high level of emphasis is placed on acquiring and maintaining vendor-specific certifications," said Speight. "Particularly in the private sector, certifications are often required on specific products and, in some cases, specific versions of that product. We see that requirement extending to GIS as well within organizations when GIS moves out of the departmental level and is adopted as an enterprise platform."

Displaying a Dedication to Achievement

Having a fully certified workforce demonstrates True North's commitment to adopting and maintaining current technologies to support not only its GIS business but also the GIS operations of its customers.

"It's a pretty strong indicator that we know what we're talking about," said Speight. "It's not just a résumé builder; it's a proven measurement of our knowledge base."

Through its involvement in Esri's Release Ready partner initiative, True North already has access to current technology and release resources. It can also connect its customers to industry-leading advice from Esri experts and share best practices with a broad audience. Partners aligned with the Release Ready specialty and the Esri Technical Certification program showcase their organizational achievements and dedication to helping customers attain their goals.

In addition, certification translates to the real world in verifiable ways. According to the 2018 Value of IT Certification survey conducted by Esri testing partner Pearson VUE, 33 percent of people who were self-motivated to get certified

"When a Release Ready specialty partner's staff is certified, customers have the confidence that the partner has an in-depth understanding of Esri technology."

Mitch Maddox

True North Director of Business Development

said that improving their professional standing and increasing their technical knowledge were the primary reasons they elected to become certified. And about three-quarters of all respondents said "they 'completely' or 'mostly' accomplished their objectives by becoming certified."

Speight believes that his staff is aligned in these views.

"Anytime you pass a test, it's a good feeling. It's a confirmation that you know what you're doing," he said. "I think that snowballs, and you end up wanting to push yourself to do the next one. There's hopefully some cumulative effect where that continues."

Become Release Ready and Certified

True North's success as an Esri partner comes not only from staying on the cutting edge of Esri technology but also from prioritizing training and certification as part of its long-term organizational goals.

For any organization looking to showcase its expertise, enhance customer confidence, and connect with Esri's best and brightest, becoming a Release Ready specialty partner and getting a fully certified workforce are effective means to those ends. Find out what it takes to be Release Ready at esri.com/partners, and get more information about Esri Technical Certification exams at esri.com/training/certification.



Engineering Firm Extends Enterprise GIS to Clients

To help rural utilities throughout Nevada track and manage their assets, Farr West Engineering provides high-quality geospatial solutions using the latest Esri technology. The civil engineering firm—which essentially steps into the role of the GIS department for many small utilities—has come a long way in its 18 years of existence. It started in Reno, Nevada, with just one employee and has now grown to a team of 70.

Of course, as the company evolved, so did its technological needs. Back in the early 2010s, Farr West had a single ArcGIS Desktop license and used file-based data storage.

“Gathering information to build the assets and utility systems was a challenge when we first started,” said Matt Forrest, a senior GIS analyst at Farr West. “We had to find lots of workarounds to get data.”

When Forrest started at Farr West almost eight years ago, the driving force for building a more extensive GIS was to understand what assets each client had and needed to take care of.

“How many miles of sewer mains do *[they]* have and maintain,” asked Forrest as an example, or “How much water system pipe do *[they]* have?”

Farr West wanted to provide its clients with all the benefits of GIS in an affordable and scalable way. In 2013, the two-person GIS team realized that to do this, it needed to start modernizing the company’s infrastructure.

The first step was to build a comprehensive platform that gives Farr West clients dynamic, real-time access to their data rather than siloed products and taxing workflows. With this objective in mind, the GIS team at Farr West chose to leverage distributed collaboration using ArcGIS Enterprise and Esri’s AEC Project Delivery subscription, which also incorporates ArcGIS Online.

“The big selling point was technology that was better, faster, and more cost-effective,” said Lucas Tipton, a principal engineer and utility planning manager for Farr West.

To share data from ArcGIS Enterprise, Farr West needed something that could synchronize changes in real time. That’s where the AEC Project Delivery subscription comes in. A new ArcGIS Online instance for companies in the architecture, engineering, and construction (AEC) spheres, it enables organizations to quickly deploy GIS projects to their clients, allowing for deeper collaboration and direct sharing with stakeholders. Clients can view, edit, and review workflows and assets in real time throughout a project’s life cycle.

Being able to take numerous sets of data that get edited by many users and share them in ArcGIS Online, which Farr West’s clients have access to, has been huge.

In using ArcGIS Enterprise and the AEC Project Delivery subscription, Farr West was able to reduce the time it takes to deliver data to clients by about 14 hours. Instead of taking 16 hours like it used to, it now usually takes 2—thanks, in part, to Farr West’s GIS team being able to access data and customize apps by directly connecting to web services.

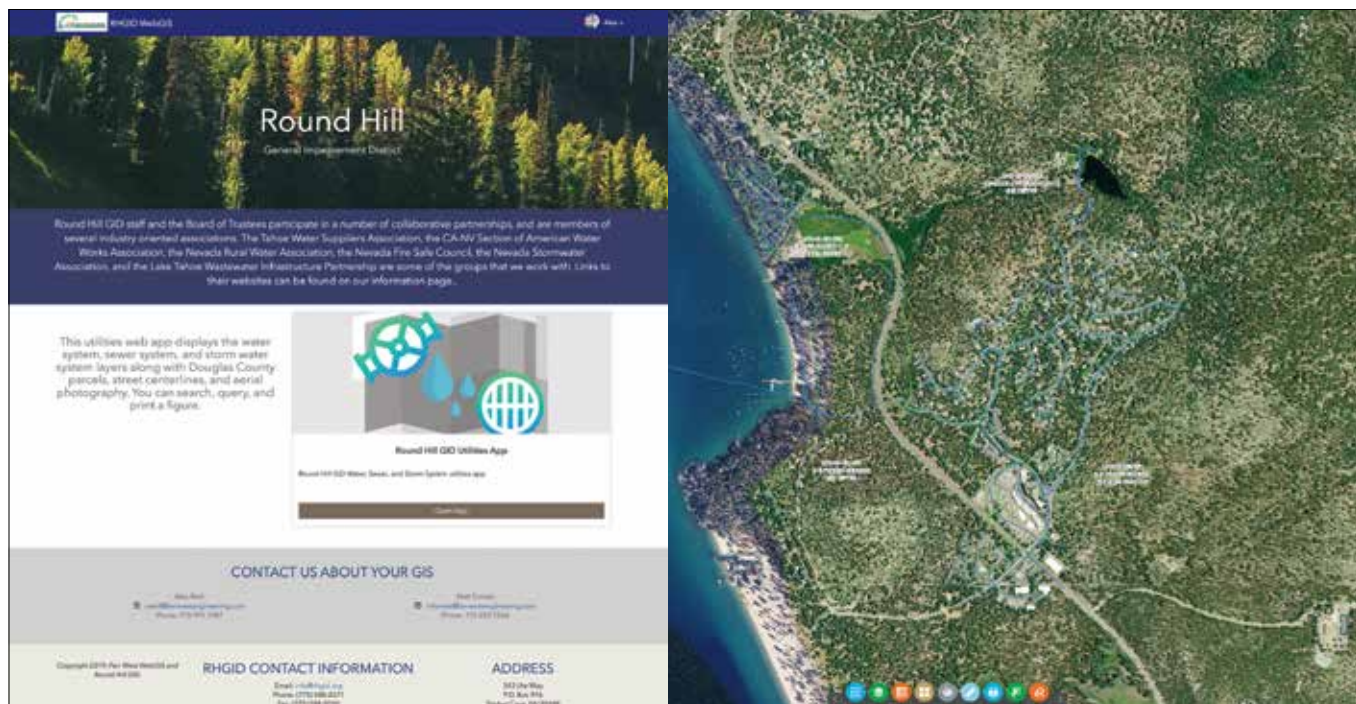
This increase in efficiency allows Farr West to serve a lot more client needs—and quite a few more clients—than it used to. Clients can also now use a suite of Esri apps, including Explorer for ArcGIS, on their computers and mobile devices to visualize their data.

Improved data visualizations are a hit with utility workers, who can now see photos, forms, and videos of their assets, which range from manholes to fire hydrants.

“That’s key for them because they are able to tie what they see in person and on paper to what is shown digitally,” said Forrest.

So far, Farr West has successfully employed this framework for 12 projects. And its GIS offerings are continuing to expand.

Farr West is now deploying the AEC Project Delivery subscription for ArcGIS Enterprise on behalf of its clients so they can use apps such as Survey123 for ArcGIS and Collector for ArcGIS for field data collection. This allows clients to connect to enterprise databases for data gathering and editing.



↑ Farr West Engineering uses ArcGIS Enterprise Sites and leverages other Esri technology to enable its clients, such as Round Hill General Improvement District in Nevada, to better display and share GIS information.



↑ The engineering firm has helped the City of Yerington, Nevada, create and maintain maps (left) and build a customized ArcGIS Enterprise site (right) so the city could share GIS data internally.

Farr West is also able to leverage ArcGIS Enterprise Sites to build custom content for its clients. Staff at Farr West like using Sites for several reasons. For starters, they can set up Sites within one place—in ArcGIS Enterprise—and then customize backgrounds, pictures, text, and more. Sites also lets them build customized web pages for clients’ different departments. And while Sites provides multiple ways of interacting with data, the user experience is simple, so clients see only what they need.

“We can now more easily set up our clients to edit their own GIS data on the web,” said Forrest.

For one of Farr West’s clients, seeing a customized web page with its own data on it sparked some creativity.

“They came back to us a week after we provided the new site with a list of app ideas and new ways to use their data that we hadn’t even suggested to them,” said Alex Reid, a GIS specialist at Farr West. “This is exactly the kind of reception we love getting when delivering these products to clients. Even our more difficult clients to please are complimenting the usability of the new sites.”

In addition to being able to provide its clients with improved usability for their GIS data, Farr West benefits from administering users within its own portal. For example, the Farr West GIS team can add, remove, and reset passwords all from one place. According to Reid, this has saved Farr West a lot of time and headaches.

As its client base continues to grow, Farr West will begin to offer its clients more customized apps built with ArcGIS API for JavaScript and ArcGIS API for Python.

This kind of constant innovation has enabled Farr West’s GIS department to provide direct business value to the firm—so much so that it no longer plays a supporting role in the company. In fact, GIS is now part of every contract at Farr West.

“It is gratifying that we are getting to a point where we can be self-sustaining in bringing additional business into the company,” said Reid.

Supported by Esri technology, Farr West will continue to provide new and existing clients with GIS apps and features that help their businesses grow while fostering efficiency within its own operations.

distinguish between features because, spectrally, they appear very similar. Also, object-based image analyses tended to be just as resource-intensive as manually drawing land-use features.”

In recent years, however, machine learning—a subdiscipline of artificial intelligence (AI)—has progressed to the point that using computer vision and deep learning in image analysis and classification is now viable.

“With advanced programming tools and computer hardware, the speed and capabilities required to successfully apply machine learning to accurately classify large areas of land looks very promising,” said Clark.

In fact, he and his team developed a model that can automatically classify different types of land use throughout Queensland. Here’s how they got it working.

Refining the Data and Training the Process

It requires a lot of information to train a model to do machine learning. Fortunately for DES, it had been using QLUMP for years to collect data.

“It was just a matter of refining it so that it could be used in the machine learning process,” said Clark.

He used ArcGIS Pro and ArcPy to generate and refine the training data. Clark also applied a range of geoprocessing tools to post-process the prediction probability from the computer vision model.

“*[The] Reclassify [tool was] used to convert the prediction to a binary raster,”* he explained. “*Raster to Polygon [was used] to convert the data to a feature class. Union [was used] to derive change. And Eliminate [was used] to merge small features into larger ones.*”

The QLUMP team independently verified the accuracy of the process by randomly generating thousands of points and assessing the land use at each point.

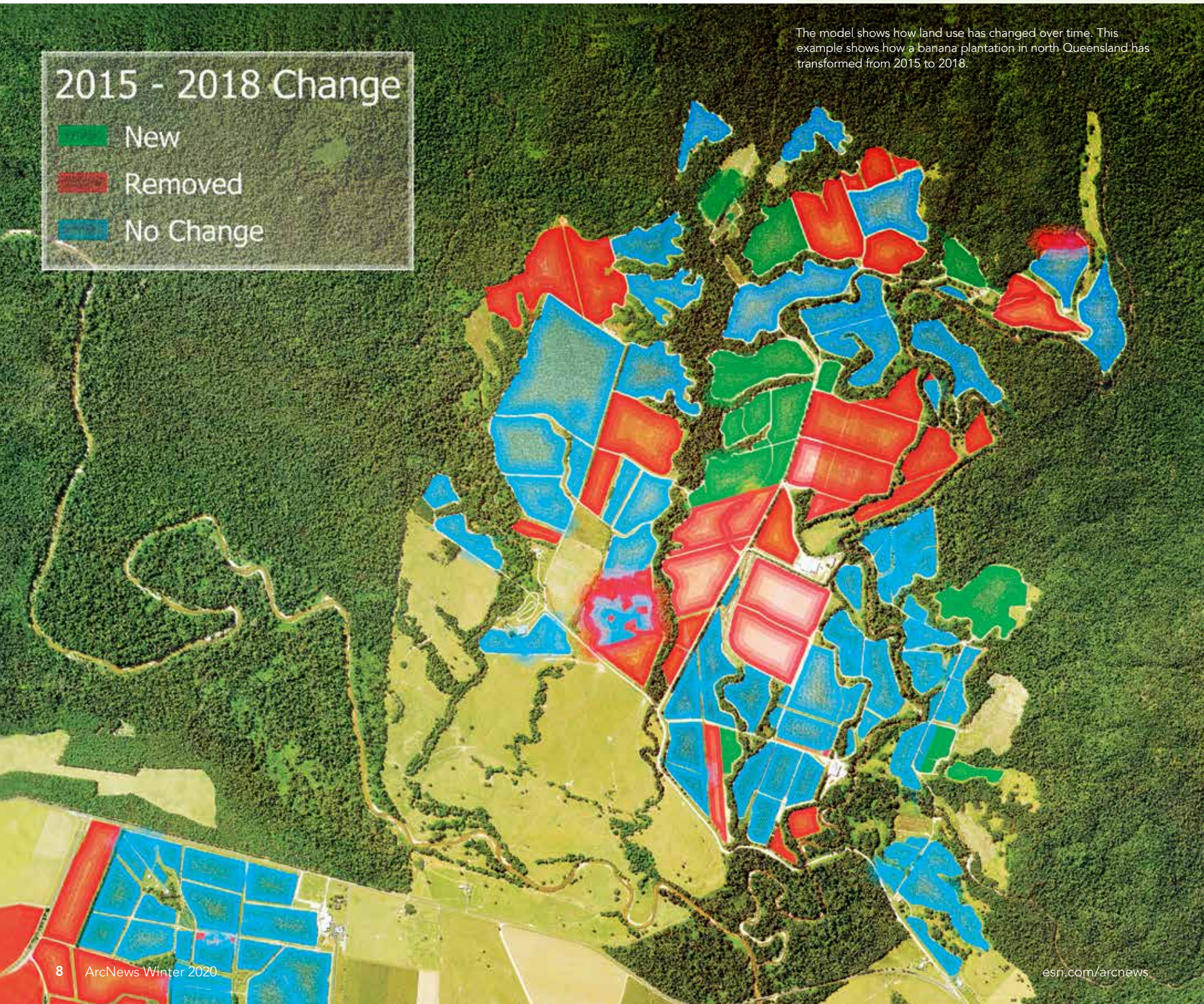
“ArcGIS Pro also generates the error matrix for us, as well as the creation and publication of web maps, apps, and reports to communicate with our stakeholders,” Clark added.

In the machine learning process, DES uses a convolutional neural network (CNN) based on a U-net architecture to help the model visually recognize land cover. CNNs are algorithms that mimic the functions of the human brain. By being exposed to

“Computer vision in fusion with high-performance supercomputing and integrated with ArcGIS represents a paradigm shift that increases our capacity to compile and publish timely land-use information.”

Andy Clark

Senior Scientist, Queensland Department of Environment and Science’s Remote Sensing Centre





↑ After an outbreak of Panama Tropical Race 4 in 2015, DES had to put biosecurity measures in place at certain banana plantations.

large amounts of visual data, the model can learn to distinguish between similarities and dissimilarities in the data.

“We borrowed the idea from Olaf Ronneberger, who developed it for biomedical image segmentation, which is a way to identify cells in microscopy images,” Clark explained. “Using this architecture, we created an algorithm with 87,153,153 parameters.”

The team iteratively fed thousands of satellite imagery patches through the neural network to produce a prediction. The algorithm then self-evaluated and refined the prediction, and the cycle was repeated until it ultimately achieved a 97-percent-accuracy rate.

“Python was used to develop the computer vision part of the project,” said Clark. “We used NumPy, a library with a large collection of high-level mathematical functions for Python, to handle the multidimensional array and the Geospatial Data Abstraction Library (GDAL) to read the imagery and convert it to the NumPy array—the format required for the neural network.”

GDAL can then take an output array and convert it back to an image.

“There was a small component of GDAL reading vector data, but ArcGIS Pro was the main tool for processing vectors,” said Clark. “We also used Keras, a Python library, for developing and evaluating deep learning models. TensorFlow ran in the back end. It is an artificial intelligence library for data flow and the creation of large-scale neural networks.”

In machine learning, because of the amount of data that has to be processed and refined quickly and repeatedly, processing speed is critical. That’s why DES is using eight Tesla V100 graphics processing units (GPUs) that are connected to its high-performance computing infrastructure for deep learning data processing.

“The processing speed is amazing,” said Clark. “Each GPU essentially provides us with the equivalent of a year’s worth of conventional CPU processing in about 2.5 days.”

Expanding Machine Learning to Other Land Uses

Originally, the model was trained to identify and map banana plantations in the Johnstone River catchment in north Queensland. It was then used to infer banana plantations in the Tully catchment. This allowed the scientists involved in image analysis to focus on the interpretation of the imagery the model produces so they can better inform department decision-makers about appropriate biosecurity responses to plant diseases.

Panama Tropical Race 4 is a serious disease that can spread rapidly through a banana plantation. In 2015, Queensland’s Department of Agriculture and Fisheries (DAF) detected it when examining plant samples.

At the time, DES had not implemented its computer vision-based image analysis process. So determining the potential spread of the pervasive fungus required a team of five scientists per year to manually map and analyze all the banana plantations and other land-use classes in Queensland.

These scientists’ mapping efforts were subsequently used to help train the CNN model. In 2019, DES received new imagery and updated the banana plantation mapping, which took four days for the computer to complete. Because of its speed and accuracy, the CNN model is currently being trained to map other land-use classes.

“Computer vision in fusion with high-performance supercomputing and integrated with ArcGIS represents a paradigm shift that increases our capacity to compile and publish timely land-use

information,” said Clark. “The methods are sustainable for any image segmentation task and have been applied to mapping wooded vegetation in Queensland, which is quite a different application, as these areas range from dense rain forest to scattered-tree landscapes.”

DES intends to expand its methods into most land uses, including other crop types, forestry plantations, and urban land-use classes.

“Anything that you can see in the imagery, you can train an algorithm to find. You just need lots of good-quality training data,” said Clark. “Based on the methods developed to date, computer vision has the capability to bring efficiencies to large-area mapping and monitoring programs that inform natural resources management and monitoring by governmental and nongovernmental organizations.”

Since the completion of this project, ArcGIS Pro and ArcGIS API for Python have undergone several enhancements. ArcGIS API for Python now natively supports the U-net model, and in addition to being able to train a model using ArcGIS Notebooks, users can now train deep learning models natively through ArcGIS Pro using a geoprocessing tool. Both ArcGIS Pro and Notebooks support end-to-end deep learning workflows, from labeling and preparing data to training a model and running inferencing. This—combined with ArcGIS Image Server technology that manages imagery data efficiently—significantly simplifies workflows. Moving forward, DES is looking into running its land-cover classification workflow through ArcGIS.

↓ Mapping and assessing land-use patterns and changes throughout Queensland used to be a very time-consuming, resource-heavy process. But with machine learning, the DES Remote Sensing Centre has reduced the amount of time it takes to classify land use across large areas of land—and has gotten the algorithm to a 97-percent-accuracy rate.





In Baton Rouge, Dashboards Give Citizen Service Calls Perspective

As one of the fastest-growing metropolitan regions in the United States, Baton Rouge, Louisiana, has been described as a mid-size city with big-city problems. The Louisiana capital faces significant challenges including traffic, violent crime, and severe weather events.

The information services (IS) department at the City of Baton Rouge-Parish of East Baton Rouge delivers IT services and technology to create a more effective and responsive government for the city's expanding population. Recently, IS helped city officials take on a significant challenge: improving how service requests from citizens are handled.

Baton Rouge's public officials needed better tools for visualizing and filtering the thousands of citizen service requests they receive on a monthly basis. So the IS department's GIS team was

called on to create a dynamic dashboard to simplify data analysis and viewing.

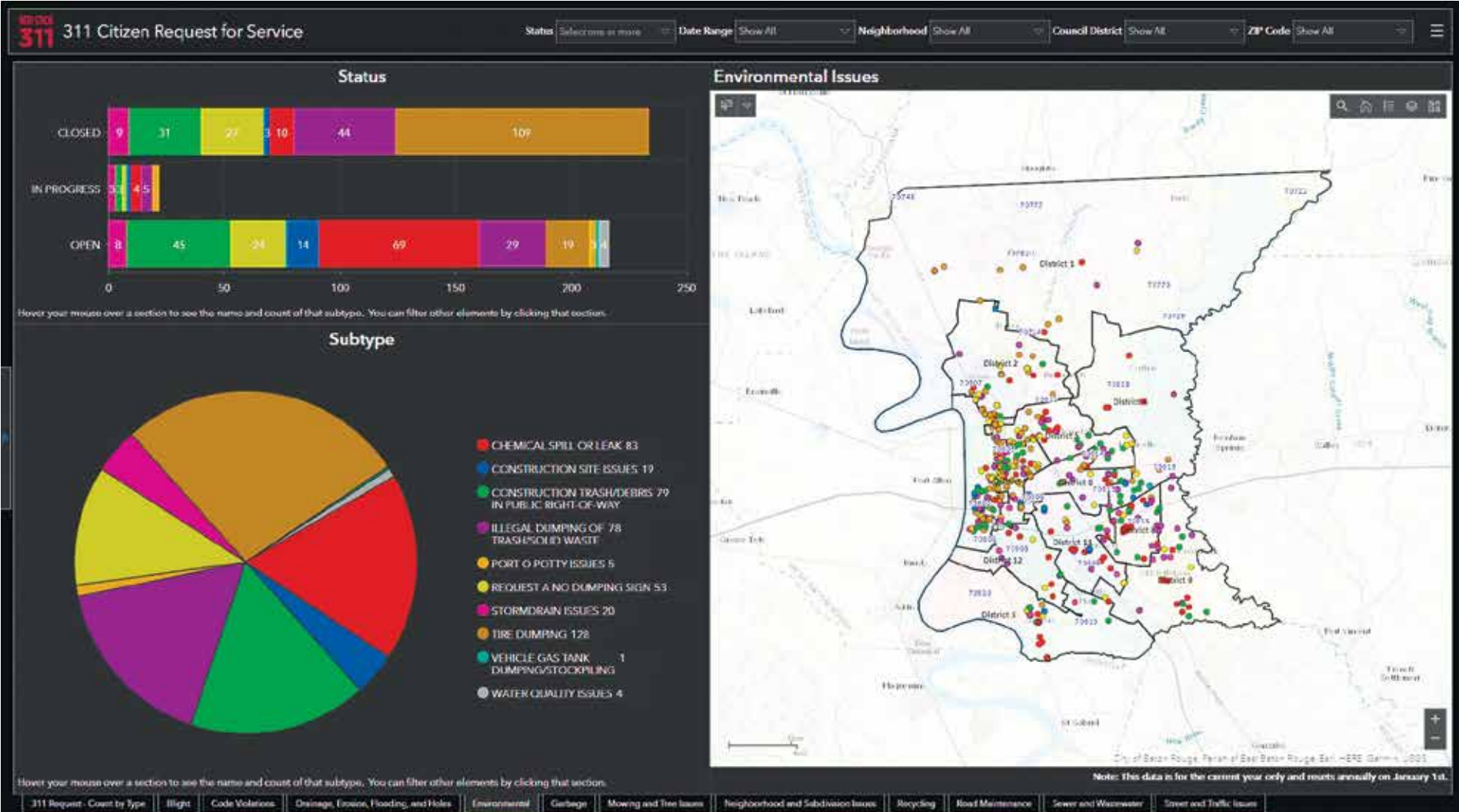
"Our vision for our GIS program is to extend GIS and its capabilities to benefit not only our local government but also our entire community," said Warren Kron, the GIS manager for the City-Parish IS department.

Envisioning a Better Way to View and Share Data

The GIS team within IS consists of nine GIS staff members who support all City-Parish agencies with a variety of requests, from administering surveys and performing data analysis to making custom maps. With an increasing number of citizen service requests coming in, city officials asked the GIS team for a better way to manage and view the large amount of associated data.

The GIS team worked with programmers to spatially enable the 311 call data, which includes resident-reported issues such as potholes, grass that's too tall, and missed solid waste pickups. But the real challenge involved developing a comprehensive solution that would simplify how city officials displayed the data in a desktop app to communicate this information in public meetings.

Moreover, the GIS team wanted to come up with a better way to relay any associated open data to the public. The City of Baton Rouge has executed a strong open data initiative to increase transparency, and IS has published hundreds of datasets for the public. The GIS team wanted to enhance the open data user experience by providing location-based information along with easy-to-use filtering tools to help residents answer their own questions when possible.



↑ Data can be filtered by type of 311 request, neighborhood, request status, date range, council district, or ZIP code.



↑ When users select a pie slice related to a particular subtype, the parent category's map updates.



↑ Upon launching the 311 dashboard, users see a count of all open, in-progress, and closed tickets organized by parent category, such as blight, code violations, and drainage.

Dressing Up a Database and Making It Interactive

After examining other data management solutions, the GIS team decided to create a dashboard using Operations Dashboard for ArcGIS. The IS department initially began using the tool for emergency operations and response but pretty quickly recognized its potential to support other business workflows, such as 311 data visualization and analysis. It would allow the GIS team to aggregate numerous datasets and display the information in a single, dynamic dashboard.

The 311 dataset provided by IS comprises all service requests received from the City-Parish 311 call center, including ones made over the phone, online, and through the 311 mobile app. Reports to 311 are recorded in a database and then transferred to the IS department's enterprise GIS database for analysis. The GIS team took this tabular data, spatially enabled it, and created a 311 dashboard that now presents the information in an easy-to-read format that combines interactive maps, pie charts, and bar graphs.

When users open the 311 dashboard, the initial view displays a count of all open, in-progress, and closed tickets by parent category, such as blight, drainage, and transportation. Users can then apply filters to view data by neighborhood, type of 311 request, request status, date range, council district, or ZIP code. When users select a pie slice related to a particular subtype, the parent category's map updates. Selecting an individual service request provides users with detailed information related to the reported issue.

“Most citizens or policy makers may not be familiar with GIS data. The 311 dashboard provides a broad overview but then allows users to easily filter the data to see what is meaningful and relevant to them. It’s an easy system for users whose GIS knowledge varies widely.”

Brandon Jumonville

Senior GIS Analyst, City of Baton Rouge-Parish of East Baton Rouge

“Our dashboards are powerful, but they’re driven by the hard work of *[the]* information services *[department]*, who intake and manage data,” said Brandon Jumonville, senior GIS analyst with IS. “The meaningful data in Operations Dashboard for ArcGIS will help inform decisions and inform the public.”

Seeing the Whole City, Then Relevant Areas

From increased transparency to improved communication, the GIS team and IS as a whole have seen significant benefits from using Operations Dashboard. Jumonville said that the ability to graphically and visually provide information to stakeholders and the public has made a more “meaningful impact,” as it is much easier for people to understand the 311 information and what’s occurring in their city. Previously, data was only available in tabular format.

“Operations Dashboard for ArcGIS gives us the power to extract data, process it, and communicate it in a way that’s easy to understand,” he said. “We now have the opportunity to get the information out across a wide variety of disciplines and organizations.”

“Operations Dashboard for ArcGIS lets us take our open data and present it in a new, more useful way for city officials, law enforcement, and the public,” added Kron.

The filtering capability in the 311 dashboard has improved the user experience, allowing users to view only the information they want. And with the maps, users can simply find and select service

requests around a particular area to view associated information, without having to search thousands of records in a table.

“I think that’s the power the dashboard provides. Most citizens or policy makers may not be familiar with GIS data,” said Jumonville. “The 311 dashboard provides a broad overview but then allows users to easily filter the data to see what is meaningful and relevant to them. It’s an easy system for users whose GIS knowledge varies widely.”

Another benefit of the 311 dashboard is that there are enough basic analytical tools for users to employ to answer spatial questions on their own without having to request the GIS team to analyze the data.

“Operations Dashboard has rapidly evolved from when we initially started using it. We have basically automated the work of an analyst using this tool,” said Kron. “It’s made it easier for our GIS analysts to configure our data in a user-friendly format.”

Uses for Operations Dashboard Get Expanded

Citizens have responded positively to the platform as well. According to Kron, when IS presented the dashboard to neighborhood groups, city residents were amazed that so much information was available to them for free. He said it’s been a “win-win for us and the public,” which has helped the local government increase transparency and build public trust.

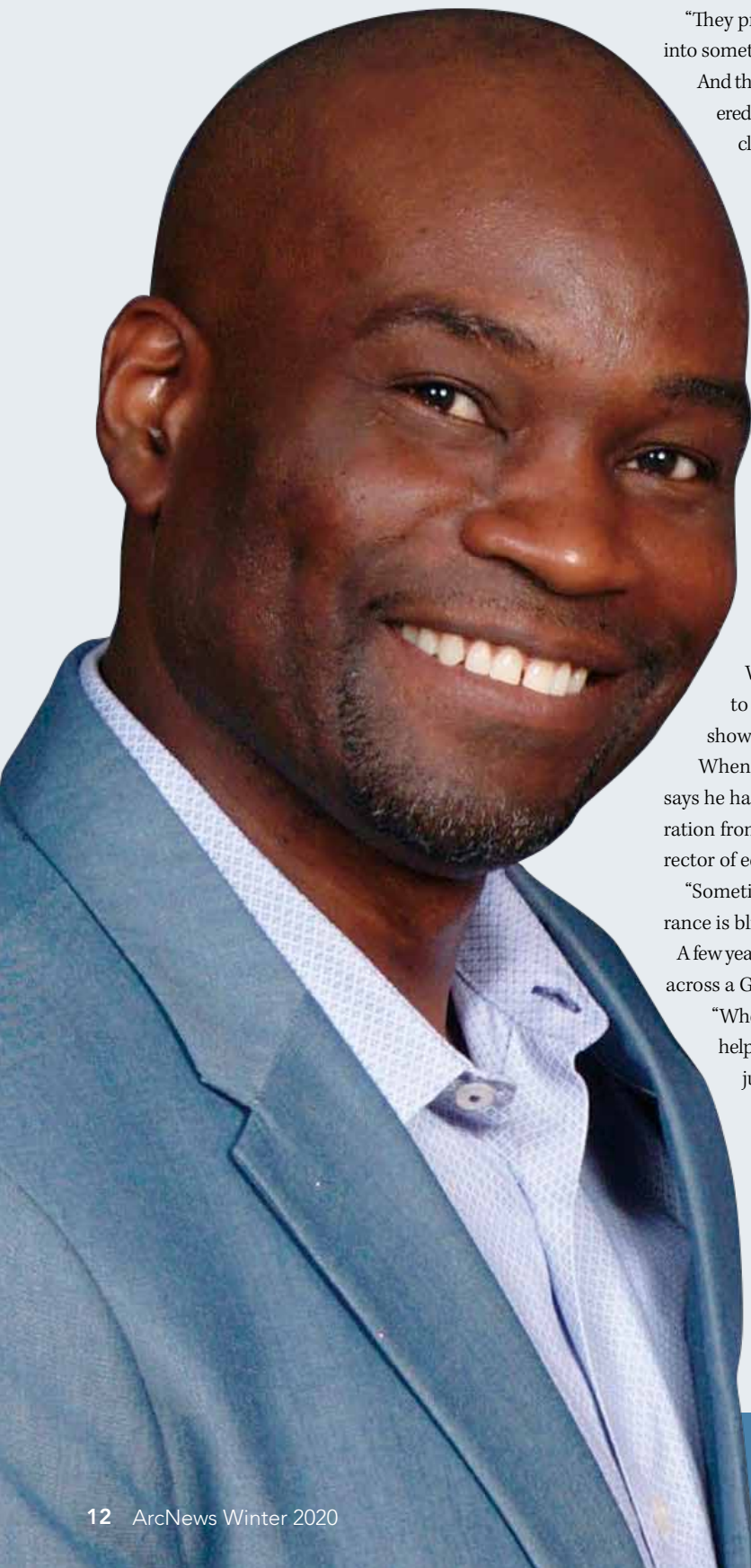
Neighborhood associations are now using the 311 dashboard to provide details on what’s happening in their neighborhoods, and local universities are employing the open data for research. Other organizations are creating additional dashboards with the data, too, including several for the Public Safety Common Operational Platform, also known as PSCOP. This secure ArcGIS Online platform gives law enforcement personnel access to near real-time data and helps them identify crime trends and patterns, as well as keep better track of officers in the field.

Overall, the promising uses of Operations Dashboard for Baton Rouge are expanding rapidly.

“Operations Dashboard for ArcGIS has given our city access to information, increased data sharing and transparency in our operations, and provided different toolsets for people that never had *[them]* before,” said Kron. “We are excited for all of the possibilities, moving forward.”

GIS Manager Puts People at the Center of GIS

Curious, eager to learn, willing to take chances, and quick to act. Those are qualities that describe Ian Wint, GIS manager at the City of Fort Lauderdale, Florida. And that's how he's forged a successful 24-year career in GIS.



"Don't be afraid to fail. Try new things," he advises other GIS practitioners. And for managers, "Don't admonish your staff for a failure if you're trying something risky. You've got to create an environment where people feel comfortable taking risks."

In his 20 years at the City of Fort Lauderdale—19 of which he's spent as the GIS manager—Wint has overseen the steady growth and development of GIS there. He's taken plenty of risks, being an early adopter of new technology and opening up GIS to other departments and city leaders before that was the norm, and that's paid off immensely.

"We've got GIS proliferated throughout the city," he said. "It's one of those things where success breeds success. One colleague sees something happening in one area, finds out that their colleague received assistance from GIS, and then they think, oh, that could work for me, too!"

Wint has always seen GIS as more than a mapping tool.

"After my initial introduction to GIS, I saw it as something that I thought could live on its own to solve problems," he said.

Wint first became aware of GIS when studying urban planning at the University of Waterloo in Ontario, Canada. A couple of his geography teachers in high school, who queried him on what he wanted to be after he did well on an exam, told him about urban planning.

"They probed enough in a way that would help them focus me into something that would be super interesting," Wint recalled.

And they were right. Wint even remembers when he first discovered GIS: in the winter semester of his second year. He saw a class on his schedule that merged urban planning and computers, and he thought that sounded really interesting.

"I showed up and was immediately hooked," he said. To help pay his way through school and gain experience in the field, Wint got a job as a GIS technician at a company called Geomatics International, where his main responsibility was to digitize data. But he also wanted to learn about what others were doing and show value apart from digitizing, so he looked for ways to automate tasks.

This enterprising nature helped catapult Wint into his first job out of college, which could have easily intimidated any bright-eyed and bushy-tailed recent grad. A boutique community planning firm called Glatting Jackson was looking to introduce GIS to the company via its new environmental planning department.

"My job was to come in and springboard that," said Wint. He was the sole GIS hire at the time. "My role was to bring GIS in and then work with project managers to show how GIS could provide added benefit to client work."

When he thinks back on that being his first real job, Wint says he had a lot of confidence in his education and good preparation from his mentor, professor Brent Hall (who is now the director of education and research at Esri Canada).

"Sometimes you don't know what you don't know, and ignorance is bliss," he said with a laugh.

A few years later, while posting a job opening for his team, he came across a GIS specialist listing for the City of Fort Lauderdale.

"When I read the job description, I thought, wow, this would help expose me to applying GIS to a variety of areas, not just in planning," Wint said. "A decent-sized city has so many different departments—fire, police, utilities, public works, finance—and so many different disciplines, I thought it would be exciting and a challenge to apply GIS to all those different disciplines."

So he went for it and got the job. He was only the second person the city had hired to do GIS. Six months in, the GIS coordinator who had brought him on resigned, so Wint became the acting GIS coordinator.

"I was doing both jobs by myself for a little over a year and a half" he said. "I learned a lot during that time!"

The city conducted a public search to find a new coordinator and landed on Wint as the best candidate for the job. And he's been leading the way in building up GIS at the City of Fort Lauderdale ever since.

Wint has taken GIS from being a mapping tool that only the GIS department used to a platform that his peers and even city leaders find indispensable. What that took was getting the technology into people's hands.

"If you come and ask me for a map, and I create one and hand it to you, you're happy that you have a map, but you don't care what went into making it. If you're a city manager or department head, well, you've got your map, and you don't think about me again until you need another map," Wint explained. "But if I can hand you GIS technology that you're using and that becomes part of your daily job, it becomes something that you rely on, something tangible that you need. What that does is, whenever I need to get support for funding or things of that nature, then you're more likely to understand why I need that funding."

One of the earliest GIS projects Wint did at the city is one that has paid dividends over the years. He and his team inventoried Fort Lauderdale's water and sewer infrastructure, most of which is buried. This gave field crews something to rely on to understand where the city's assets are. It also gave engineers and others base data on asset location.

"What we've done is we've built on that through the years," said Wint. "Thanks to the advancement of Esri technology, we have field crews that go out there using Survey123 [*for ArcGIS*] and Collector [*for ArcGIS*] to do inspections."

Managers and supervisors can also track progress using dashboards. And Wint says the people who use the technology now tell him that they wouldn't be able to do their jobs without it.

"We've had hiccups where we've had to take a Survey123 solution down for a day," said Wint. "And as much as some people would see this as a negative, I see it as a positive when people are calling the help desk about that, saying they can't get their work done."

Wint and his team have deployed solutions for fire hydrant inspections, which help find low water pressure patterns throughout the city; parking, which the customer service team can use to solve discrepancies when residents contest parking violations; the building department, which can now easily see whether a development can be built on certain property types; and more. The GIS department also assists tremendously before, during, and after hurricanes.

For Hurricane Irma in 2017, Wint's team helped first responders gain situational awareness before the storm, telling police officers where criminal activity was happening so they could get a handle on it before lockdown and showing wind levels to the fire department so it could send out the right equipment. During the storm, GIS helped utilities monitor sewer pump stations to mitigate inundation. And after the hurricane, the technology was instrumental in keeping track of customer service calls about downed trees, inoperable traffic lights, debris, and the like so authorities could act accordingly.

"In times when things are moving very quickly, you want quick visuals," said Wint. "GIS has become integral for hurricane preparedness and disaster relief."

As GIS grows more central to business applications that focus on everything from land use to asset management, Wint views that as a good thing.

"It further cements why GIS is needed and the value of GIS in an organization," he said.

Wint is committed to continuing to develop GIS technology that can help the people around him, who are largely not GIS experts.

"It can make their jobs easier, make them more efficient, and give them access to information they never had before," he said.

The Next Generation of Mapmaking in ArcGIS Online: Map Viewer Beta

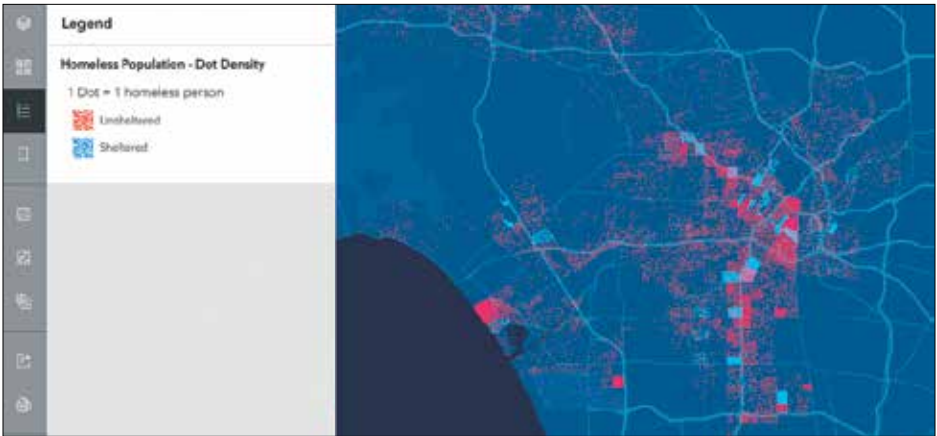
Map Viewer Beta is the newest next generation mapmaking tool to make its debut in ArcGIS Online. Inspiring experimentation and creativity, it provides enhanced experiences for key map-authoring workflows. With a dot density mapping style, smart summaries for field attributes, interactive data filtering, additional color ramps, and improved pop-ups, the new Map Viewer helps users explore and map their data in compelling ways.

All ArcGIS Online users have access to Map Viewer Beta through their app launcher and when opening items. In the future, the new Map Viewer will also be available in ArcGIS Enterprise.

Dot Density Mapping Style

Dot density is a new mapping style that's only available in the new Map Viewer. It personalizes data by representing a count with an individual dot. This style works well with polygon data that contains count attributes, such as census data, incidents, or crime. It can be used to visualize the distribution of one attribute or compare multiple attributes.

For example, a user can use one point to represent one person experiencing homelessness in Los Angeles, California. Once all these dots are put together on a map, it reveals detailed patterns about homelessness and where it occurs. This is a powerful way to humanize data and make it relatable.



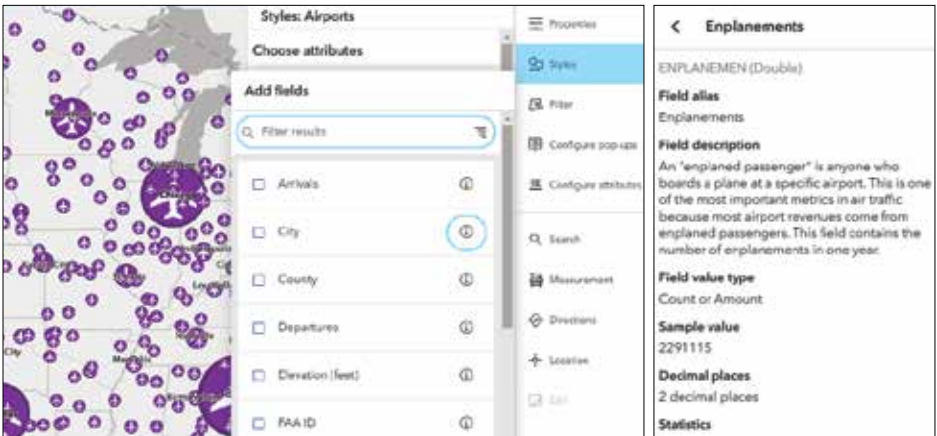
↑ A dot density map shows concentrations of people experiencing homelessness across Los Angeles, California.

Smart Summaries for Field Attributes

Sometimes a layer has hundreds of fields. This can make it difficult to find and map a particular field of interest. Map Viewer Beta includes a convenient search bar and sorting options to locate fields quickly.

But what about when the field name isn't enough for users to understand what the data represents? Smart summaries, also available in the new Map Viewer, help by providing a synopsis of each field's attribute information. The smart summaries showcase many types of field information, including top values, which show how the data is organized; numeric statistics, such as minimum, maximum, average, and standard deviation; and data fields, like oldest, most recent, average, and time span.

By searching, filtering, and referencing the smart summary, users have an easier time finding fields in a layer.



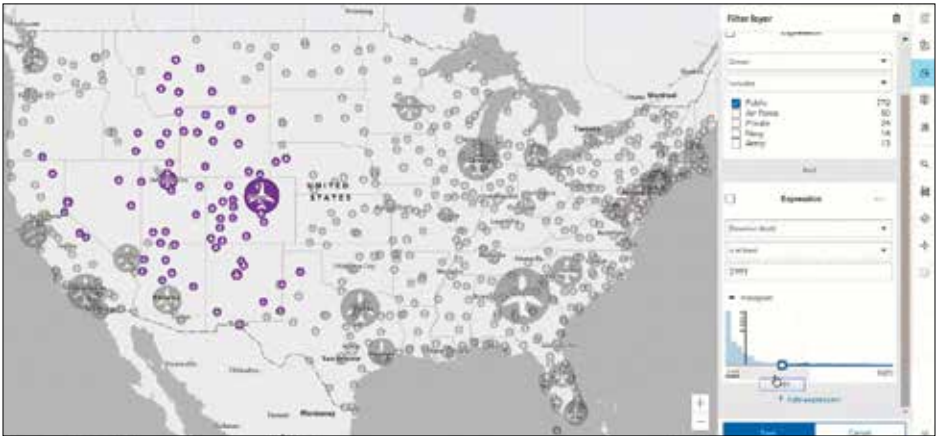
↑ In Map Viewer, users can quickly locate the fields they want to map by searching and sorting them.

↑ Smart summaries describe attribute information.

All ArcGIS Online users are encouraged to use the new Map Viewer and provide feedback to the ArcGIS Online team. Getting-started resources, as well as feedback and discussion forums, are available in the ArcGIS Online Map Viewer Beta GeoNet space at go.esri.com/GeoNetMapViewer. Learn more about this next generation mapping tool at go.esri.com/MapViewerBeta.

Interactive Data Filtering

Filtering helps users see the most important features by limiting the visibility of other features in a layer. As users adjust the data filter in the new Map Viewer, it provides instant visual feedback. This interactive experience helps users explore and understand the data before setting the filter.



↑ When users adjust the data filter, Map Viewer delivers instant visual feedback.

Categorized Color Ramps for Every Occasion

Map Viewer Beta contains more than 300 color ramps. Each is tagged and categorized so users can easily explore their options and find the best ramp for their data. Categories include best for light or dark backgrounds, bright or subdued, and color-blind friendly. They also show color groupings, such as blues. Additionally, depending on the mapping style and theme, certain color ramps are displayed to guide users to the best combinations.

Improved Pop-Ups

Both the pop-up authoring and viewing experiences are drastically improved in the new Map Viewer. By mixing and matching the pop-up content elements (attributes, images, and text), authors can logically organize information for their viewers. Additionally, authors can easily reorder content elements by just dragging them.

Map Viewer Beta also provides viewers with the opportunity to look at attachment images in a pop-up. Multiple image attachments automatically appear in a carousel. And viewers can dock pop-ups to get a better viewing experience, particularly on mobile devices.

Esri® Hardware and Content Offerings

Esri works with leading hardware vendors to provide server, desktop, mobile, and content products that are for use with ArcGIS® software. Take advantage of our cost-effective bundles to configure or upgrade your geographic information system (GIS).

- GPS
- Servers
- Field Laptops
- Data Appliances

For more information, visit esri.com/hardware.

esri | THE SCIENCE OF WHERE®

Spike Smart Laser Measurement Solution

ArcGIS Enterprise Server Solutions

ArcGIS Pro Laptop Solutions

ArcGIS Pro Workstation Solutions

Copyright © 2020 Esri. All rights reserved.

Navigation Takes a Turn for the Better

Built to get fleets where they need to go, Navigator for ArcGIS is a voice-guided, turn-by-turn navigation app that works hand in hand with organizations' GIS data.

A recent update to the app, available for iOS and Android devices, now brings more location intelligence from the ArcGIS platform directly to drivers and field crews. With easier access to routes, greater route control, and increased interaction with maps, field staff can confidently travel from one destination to the next and easily pause navigation or skip stops when necessary.

It's Easier to Follow Optimized Routes

One of the most significant updates to Navigator is that operations managers and GIS specialists can now share route layers from ArcGIS Online and/or ArcGIS Enterprise directly with drivers in the app.

Previously, Navigator would take a list of stops and create an optimized route, which drivers would receive as a link in an email or a text. Before they could get going, they had to tap the link to open the route in Navigator. Now, however, the person who makes the route has more control over it and can specify the order of stops in a variety of ways. And drivers receive their fully optimized routes right in Navigator.

So how does this help? Let's say a delivery service company has to make 100 stops in a day, and it employs five drivers. Which drivers should take which stops? What's the most efficient and cost-effective way to make these deliveries? And how will the company tell the drivers where to go?

For starters, an operations manager or a GIS specialist can use routing tools in ArcGIS Online, ArcGIS Enterprise, or ArcGIS Pro to break those 100 stops into five optimized routes that allow each driver to complete his or her work in the most logical sequence. That person can then share those routes with the company's drivers

using ArcGIS Online or ArcGIS Enterprise, since Navigator users are connected to ArcGIS just like employees back in the office are.

Once a route is shared with a driver, it automatically loads to his or her device—no need to wait for a download. The driver can then select the route, which opens in Navigator, and get moving without having to worry about connectivity. Additionally, if a driver ends up in an area with no cell service, he or she can continue to follow the directions using Navigator because the app stores the route locally on the device.

Drivers Gain More Control over Assignments

Many Navigator users have been asking for the ability to pause multistop routes in the middle of the day without having their routes canceled and losing the rest of their stops. Now that's possible. With the recent update, users can pause and resume routes in Navigator at any time, giving drivers the flexibility to manage unplanned disruptions.

Since drivers sometimes need to adjust their day on the fly, they can also now skip stops in Navigator by marking them as visited. That way, they can easily proceed to the following stop without risking that the remainder of the route will be canceled.

Users Can View More Information

With this release of Navigator, users can see and wield the GIS assets on their maps in ways they've never been able to before.

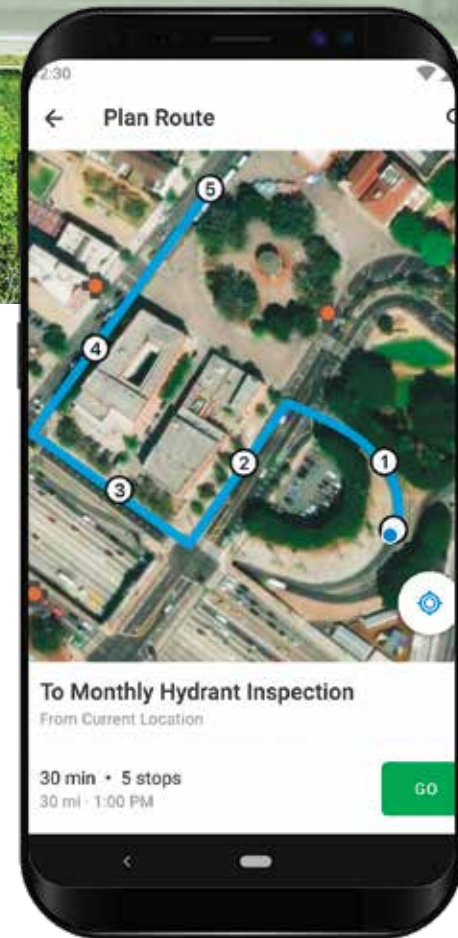
The app now allows full interaction with GIS features and assets. Users can see all the attribute information—including any media or attachments, like PDFs, photos, charts, or graphs—associated with individual features. This enables field crews to verify that they are at the right work site, and they can easily find the assets they were sent there to work on.

Esri has also rethought the Navigator interface to make it more consistent with other ArcGIS field operations apps. Now, it takes fewer taps to work with routes and route layers and, overall, is easier for drivers to use.

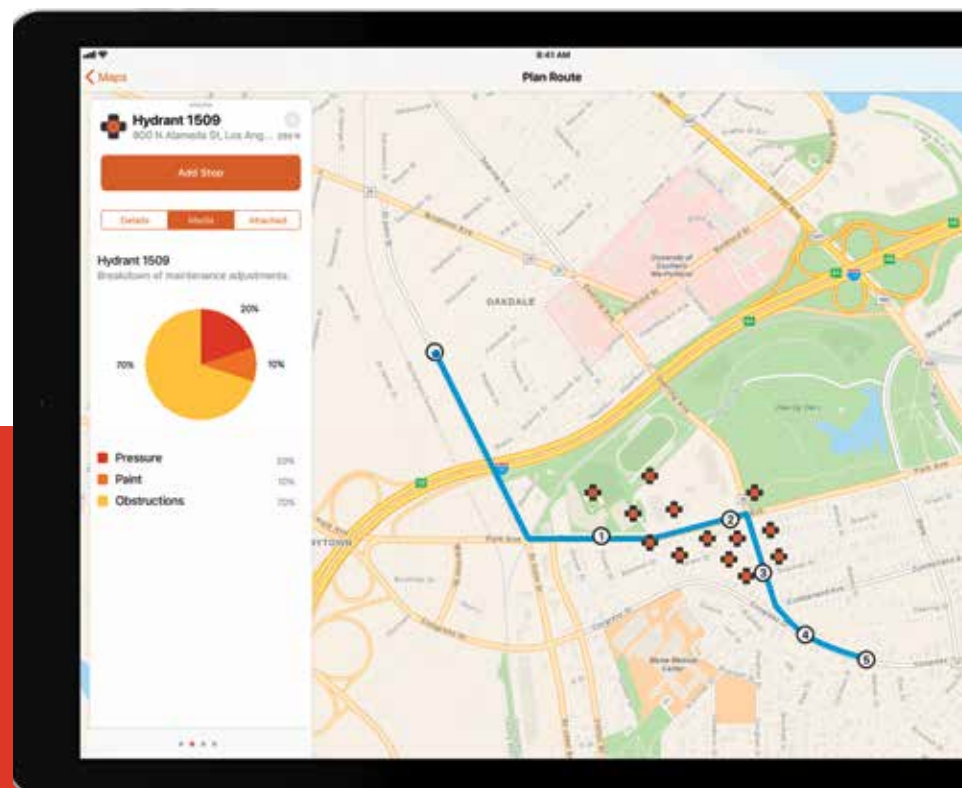
Get Started with Navigator for ArcGIS

Navigator is available for phones and tablets in the Google Play Store and Apple's App Store. Using the app requires an ArcGIS account (any license level works, including the low-cost Viewer user type) and an assigned Navigator license.

To get a free trial or find out more information about pricing and licensing, visit the Navigator for ArcGIS home page at esri.com/navigator.



↑ Operations managers and GIS specialists can now create optimized routes for each driver to follow.



↑ Drivers can add stops to their routes, which gives them greater flexibility.



↑ Navigator for ArcGIS allows users to interact with GIS features and assets.

Navigator for ArcGIS is one part of the field operations suite of apps that Esri offers. Together, these apps help organizations enhance field teams' performance. Users can employ them to plan and assign fieldwork, navigate to work locations, understand who and what is on-site, gather data while working in the field, monitor fieldwork progress and the locations of fieldworkers, and coordinate unplanned work with field staff. Learn more about Esri's field operations capabilities at esri.com/fieldoperations.

Location Tracking for Field Personnel Gets Wider Release

Tracker for ArcGIS Is Now Available in ArcGIS Online

In today's fieldwork environment, "out of sight, out of mind" can easily translate to "out of sight, out of control." Without knowing where their field personnel are, fire captains have a harder time accounting for their crews, service delivery managers risk the wrath of angry customers, and field workforce supervisors may overlook gaps in their territories. In each scenario, there is a negative and potentially costly consequence for the organization.

The newly released Tracker for ArcGIS app from Esri bridges the visibility gap between personnel in the field and staff at the office. And now this app, which was previously only available in ArcGIS Enterprise, is available in ArcGIS Online, providing the benefits of a fully hosted solution. This enables more organizations to keep better track of their fieldworkers, which strengthens agility and quickens response times.

The Tracker for ArcGIS mobile app records the location tracks of field personnel, and the corresponding Track Viewer web app lets authorized supervisors view them. The web app leverages the location tracking layer that's now available in ArcGIS Online and ArcGIS Enterprise 10.7 and up.

Using Tracker helps organizations better support supervisors, managers, fieldworkers, and customers in numerous ways.

It improves efficiency in the field. Location track analysis can identify where coverage of an area is either missing or oversaturated, which enables field resources to be more effectively allocated. Track analysis can also reveal more specific patterns—for example, in productivity, crime, or speed violations.

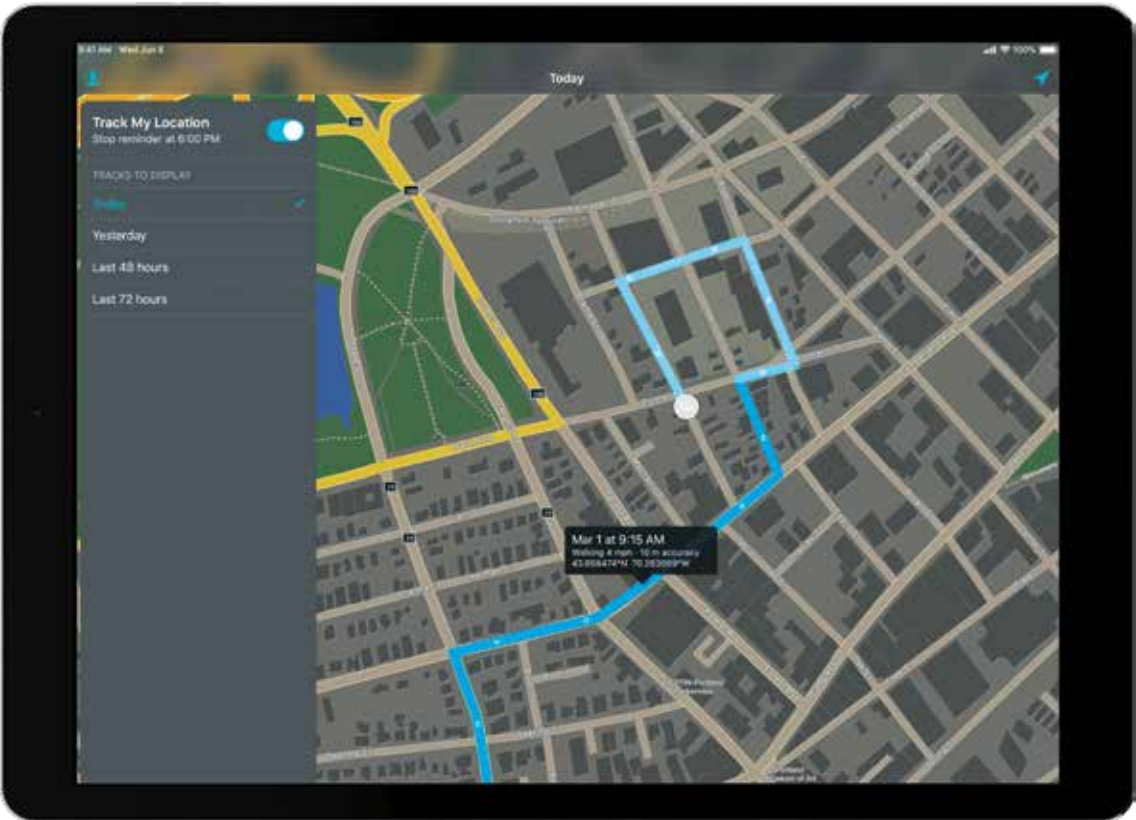
It shows proof of work. Track history can be used to verify where and when an asset or site was last visited, the duration of the visit, and who made the visit. Organizations can rely on this information to verify that service-level agreements are being met and that they are following other compliance requirements.

It helps supervisors know where everyone is. By sharing their locations, fieldworkers empower supervisors to better respond to unanticipated events. Tracker for ArcGIS gives everyone an understanding of where staff resources are in relation to needs and also gives office staff the ability to monitor fieldworkers' safety.

Field personnel who use the Tracker mobile app are in complete control of when location tracking is on. They just tap a button within the mobile app to start or stop capturing location tracks. The app is optimized to minimize battery drain as well. Users have the option to set reminders for when it's time to start and stop recording their location. Once location tracking is activated, track data is recorded directly to the mobile device and then synced automatically to ArcGIS Online in connected environments or as soon as connectivity is available. Only those who have permission to view tracks—typically managers or supervisors—can observe and interrogate location track data.

The Tracker mobile app is available for download from the App Store and Google Play. To sign in to the app, users need a premium app license for Tracker for ArcGIS. The Track Viewer web app can be used by ArcGIS administrators to create track views (feature layer views), as well as by any authorized supervisor to view tracks.

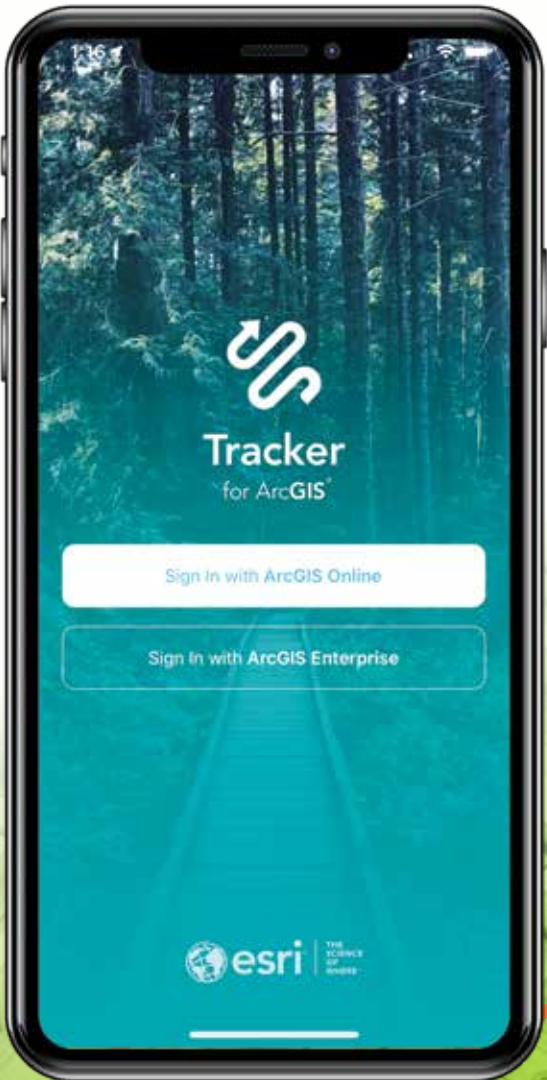
Tracker for ArcGIS is a premium app that can be added to any ArcGIS user type license. Learn more at esri.com/tracker.



↑ Field personnel have complete control over when they track their locations.

↓ Tracker for ArcGIS, which was first released in ArcGIS Enterprise, is now also accessible in ArcGIS Online.

↓ With fieldworkers sharing their locations, supervisors can better respond to unforeseen events.



there, teachers and students use the digital maps for a variety of activities. They can explore the spatial associations of natural phenomena, such as where volcanoes occur in relation to tectonic plate boundaries; compare place characteristics, like the types of shops in city centers versus suburbs; describe spatial distributions and land patterns of tropical rain forests and deserts, for example; and collect data for field-based assignments.

An early rollout of MOE-EduGIS, in which teachers learned about the platform and students used mobile GIS apps to examine their neighborhoods, proved successful. In May, the MOE will move forward with its plan to make MOE-EduGIS available to all secondary school geography teachers in Singapore.

A Meeting of Minds

For many teachers, MOE-EduGIS has already taken them beyond their schools and on what may become a lifelong learning journey.

In November 2019, around 55 teachers from 30 secondary schools attended the GIS Networked Learning Community (NLC) celebratory meeting, where they were able to learn about and try out MOE-EduGIS. The event brought together teachers who were enthusiastic about geography and using GIS in education, or who were simply interested in discovering innovative ways of deploying the technology.

A presenter from Esri started the day by giving a demonstration of ArcGIS StoryMaps, which the MOE is encouraging teachers and students to use to exhibit their work. The event then built toward a series of breakout sessions with presentations and discussions on using MOE-EduGIS. Teachers talked about challenges they faced when employing the platform, the personal discoveries they made in using the technology, how it went leading GIS-focused professional learning groups for other teachers at their schools, and how they implemented GIS-infused lessons for their students.

Attendees internalized the lessons learned and built on one another's ideas for implementing MOE-EduGIS. Teachers also discussed GIS project ideas that they can undertake with their students next year.

Navigating Data—and the Zombie Apocalypse

One project that attendees were able to learn from was conducted by Riverside Secondary School in September 2019. Thirty groups of secondary students were asked to map the best route to avoid zombies. Of course, there were no actual undead hordes hungrily hunting for fresh young brains; rather, this was a scenario that two of the school's teachers—the information and communication technology subject head, Jonathan Chia, and the geography teacher, Hui Shi Goh—set up, with support from Doris Lee, a developer from MOE's geography unit.

The goal was to have students plot their escape within a one-kilometer radius of the Woodlands train station, a major public transit hub located near the school. Students were told that the zombies would avoid areas of high temperature and humidity. Participants had to tag the locations of convenience stores and medical clinics as well to show that they were collecting supplies along the way.

The group took about an hour to do the lesson. The students used a weather tracker to collect temperature, humidity, and even wind speed readings and Survey123 for ArcGIS to enter the data into the MOE-EduGIS platform. Students and teachers then reviewed the data together and compared the various routes to see which groups had found the safest paths.

"The students got into it quite easily," recalled Chia. "But beyond it being a game, they learned how to digitally navigate and collect data, measuring the weather elements. More importantly, they were able to see that data is needed to support one's theories or claims. This is good for their thinking and development."

Not only did students learn valuable lessons about GIS during this exercise but teachers at Riverside Secondary School did, too. Some of them are now looking into using MOE-EduGIS for other subjects, such as physical education and science.

"This would be an opportunity to leverage the Smart Nation initiative," said Goh, referring to a national program to adopt digital and smart technologies throughout Singapore. "Data could be collected nationwide to build maps for future learning tools and shared with other subjects to generate more awareness on the usefulness of MOE-EduGIS."

Lee echoed this sentiment. "As a user and developer, I'm passionate about enriching a student's learning experience," she said. "In expanding the use of MOE-EduGIS, we can empower more of them to make informed decisions."

GIS Becomes Integral to Education

Next up, in May, the MOE will officially launch MOE-EduGIS to all secondary school teachers in Singapore. At the same time, the MOE will release the 2021 geography syllabi for 13- to 14-year-old students throughout the country.

A central component of the revised syllabi is that they recommend using geospatial technology for geography education. All geography teachers will be provided with a MOE-EduGIS account. Additionally, they will be able to sign up for a variety of professional development programs.

This time around, it seems that GIS will finally make its way into core geography curriculum in secondary schools across Singapore.

MOE-EduGIS by the Numbers

800

In 2019, about **90** teachers and **800** students from over **50** pilot schools used MOE-EduGIS.

They created close to **1,300** web maps, **500** web apps, and **120** story maps.

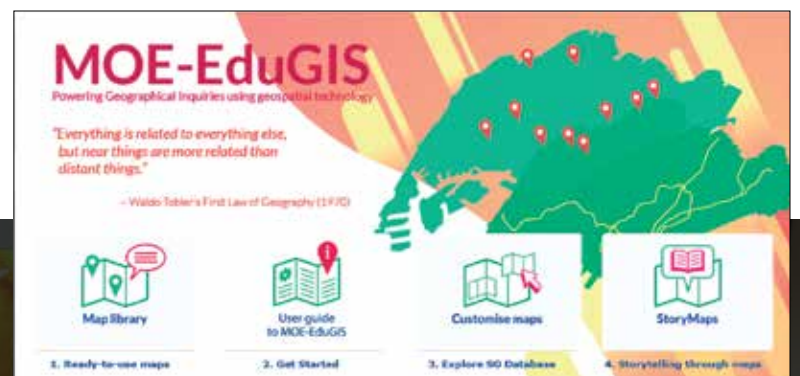
1,300

150

In 2020, all geography teachers in more than **150** secondary schools will have access to MOE-EduGIS in preparation for revised syllabi that will be implemented in 2021.

↓ In November 2019, around 55 teachers from 30 secondary schools attended the GIS Networked Learning Community (NLC) celebratory meeting, where they learned about using MOE-EduGIS.

→ MOE-EduGIS is a GIS platform from Singapore's Ministry of Education (MOE) that aims to enhance students' spatial thinking skills using desktop, web, and mobile GIS apps.





"Both the MBA and GIS courses required scientific processes, while providing an exceptional framework for exploration and creativity."

—Karisa Schroeder '18
MBA—Location Analytics
Product Marketing, Esri

University of Redlands A Leader in Spatial Education

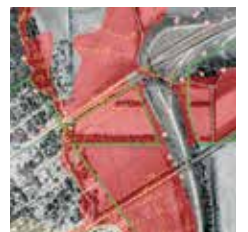
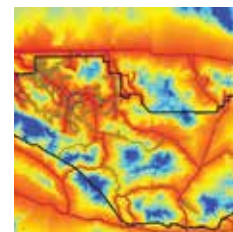
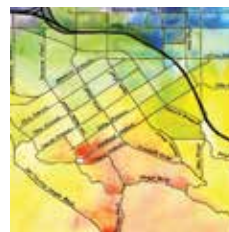
HARNESS THE POWER OF WHERE

Earn a **Master of Science in GIS** or **Master of GIS** in an environment where international faculty and students use cutting-edge GIS technology, theory, and applications.

Use the power of location intelligence to improve decision-making and organizational performance, equipped with a **Redlands MBA** with a concentration in **location analytics**.

Undergraduate students can declare a **spatial studies minor** to develop GIS and spatial thinking skills in class and through internships and community service.

All Redlands academic programs enable access to Esri technology, training, people, events, and internships, including classes taught by Esri employees.



The University of Redlands is a private, nonprofit university located in Redlands, California—close neighbors and partners with geospatial leader, Esri.



spatial.redlands.edu

3D GIS Helps Taiwan Prepare for Flood Events

By Wen-Ray Su, Chun-Hung Huang, and Chun-Hung Yang,
the National Science and Technology Center for Disaster Reduction



Taiwan, a 14,000-square-mile island in the Pacific Ocean about 100 miles off the coast of China, has a tropical and subtropical climate, which means it is prone to heavy rains and flooding. To help evaluate the viability of flood-based emergency response plans and procedures, the National Science and Technology Center for Disaster Reduction (NCDR) is taking a page out of the military's playbook. Using 3D GIS, the center has put together a war game simulation for flooding.

The Flooding Wargame Simulation Platform for Training and Emergency Response is based on military battle drills, which outline how soldiers will enact specific maneuvers when they encounter certain situations. Applying this concept to flooding is designed to help officials comprehend various disaster situations and determine whether their emergency response plans and procedures—including resources deployment, evacuation support, and route planning for distributing relief supplies—are suitable for reducing the impact of a flood-based disaster. The key to these kinds of drills is to make the simulation as similar to a real disaster as possible.

To do this, NCDR worked with GIS company RiChi Technology and used ArcGIS Enterprise, ArcGIS Pro, and ArcGIS API for JavaScript to build the Flooding Wargame Simulation Platform for Training and Emergency Response. Employing 3D GIS, the platform simulates various types of flooding disasters. Now, officers at emergency operations centers (EOCs) across Taiwan's 22 cities, counties, and special municipalities can use the platform to analyze both disaster risk and preparedness when it comes to floods.



↑ The flood-prone areas around Guishan Elementary School are mapped using the Flooding Wargame Simulation Platform for Training and Emergency Response.

EOS

ARROW SERIES

High Accuracy GNSS Receivers
For Real-Time Location On Any Device

Apple Android Windows

ARROW 100
Submeter & Subfoot GNSS

ARROW GOLD
1 cm RTK with SafeRTK®

WWW.EOS-GNSS.COM

Made In Canada

An Optimized 3D Model Experience

The research team at NCDR and staff from RiChi Technology built the Flooding Wargame Simulation's 3D GIS platform in two parts. They created the 3D model that processes and displays buildings and, at the same time, integrated that visualization into the platform's functionality.

To build the 3D model, the team used ArcGIS Pro to combine building block shapes with building heights in a feature layer. For the purposes of its technical work, the team published the layer to ArcGIS Enterprise and used ArcGIS API for JavaScript to create an app that shows extruded building heights.

To accommodate the lower-performance computers used by some of NCDR's stakeholders, the team implemented a pattern that limits the number of buildings retrieved at one time in the simulation. This helps in more condensed urban environments, for example, by adjusting the model's performance dynamically to each specific flooding simulation. The location of the flood area is set to the center of the map, and the system only displays 3D buildings within a radius of 500 meters from this point. As users pan the map, the 3D buildings form gradually on-screen.

A Fast, Easy-to-Use Platform

In designing the platform's functionality, NCDR's primary focus was to make it fast and easy to use. The research team wanted to ensure that the platform could provide analysis results in just a few steps. It also wanted to present those results as thematic maps that show the flood areas, affected populations, any protected objects (e.g., vulnerable residents who would need to be escorted out of the flood area), emergency shelters, the network of disaster relief agencies, and a visualization of all this in 3D.

Indeed, the operation contains three steps: users assign a spatial analysis area, set a feasible flooding spot, and enter the flood depth. The system then calculates the lower-elevation areas around the flooding spot to show which locations would likely be affected.

The terrain data comes from a digital terrain model (DTM) with an equally spaced 20 x 20-meter grid. This amount of detail makes efficient computing difficult, though. To reduce the amount of time it takes to calculate what will happen in each

section of the grid, the DTM is separated into segments by town. Grids for rivers were also omitted from the DTM to reduce the amount of data the platform has to process.

After the flood-prone areas are found, the system computes the different depth levels of the flood in various places by intersecting the lower-elevation areas with impact factors, including which populations and protected objects will be affected. This enables users to see how much of the population will probably need to be rescued. In addition, the system assesses the number of residents that nearby emergency shelters can receive and does a network analysis of rescue resources.

All this is presented in 2D thematic maps that also show the distribution of emergency and rescue supplies, the locations of large pieces of construction equipment, where disaster relief agencies are located, and more. Commanders from Taiwan's Central Emergency Operations Center (CEOC) and 22 local EOCs can then look at these maps on computers and touch screen monitors to determine the extent of relief services needed and arrange their distribution.

The 3D Visualization

Users can also use the Flooding Wargame Simulation Platform to visualize simulated flooding disasters in 3D. This part of the platform is based on the DTM, satellite images, street maps, and the 3D building models. It also integrates real-time video feeds from Taiwan's closed-circuit television (CCTV) monitors. During flood simulation exercises, this helps on-site rescue units communicate and coordinate with each other so they can develop emergency solutions that take into consideration the potential severity of building damage, flooding, and traffic, as well as the viability of potential rescue and escape routes.

Additionally, the platform makes it easier to engage in flood disaster planning for more vulnerable populations. For example, all senior citizen welfare institutions are shown on-screen, and those located on the first floor are marked specifically to take into consideration elderly people who have lower physical abilities. These details can then help social welfare institutions evaluate their own disaster risk levels and aid other organizations in setting up the government's Prevention and Evacuation Program, arranging emergency housing, and training rescue and response teams.



↑ After Typhoon Soudelor struck Taiwan in 2015, Guishan Elementary School was muddy and virtually inaccessible. Satellite imagery shows the school before the disaster (right) and after (left). (Photo courtesy of Guishan Elementary School.)

Being able to take these precautions—and more—in advance of a real flood-based disaster will ensure that Taiwan is well-prepared to weather big storms.

For more information about the Flooding Wargame Simulation Platform for Training and Emergency Response, email NCDR researcher Wen-Ray Su at wrsu@ncdr.nat.gov.tw.

About the Authors

Wen-Ray Su is a researcher in the information division at NCDR, where he focuses on disaster management, system analysis, and spatial information. Chun-Hung Huang is a database administrator for the information division at NCDR, whose work revolves around using information technology to enhance the effectiveness of disaster management operations. Chun-Hung Yang is a project manager for the information division at NCDR. He analyzes hazardous weather events and integrates disaster information to produce data on disaster risk.

Supercharge your applications.

Look for Geocortex at an Esri event near you or on the ArcGIS Marketplace.



The Power of Shared Information for the Pacific Ocean

By Gemma Van Halderen, United Nations

The Pacific Ocean covers more than 30 percent of the earth's surface, is the largest water mass on the planet, has a basin bigger than the landmass of all the continents combined, has twice the amount of water as the Atlantic Ocean, and is the planet's deepest water body. So what investments are made in the Pacific Ocean, what benefits does it provide, and what do we know about its natural capital?

Over the course of 2019, the United Nations (UN) Economic and Social Commission for Asia and the Pacific (ESCAP) partnered with Esri to develop a Pacific Ocean Accounting Portal that uses GIS to direct attention to these and other questions about the Pacific Ocean.

The idea to create a portal using Esri's ArcGIS Hub technology was conceived at the inaugural United Nations World Geospatial Information Congress, held in Deqing, Zhejiang Province, China, in November 2018. The congress provided a convening, participatory, and inclusive environment to intensify collaboration at the regional and global levels and encourage the development of value-added apps and services to address local, national,

regional, and global challenges. Esri president Jack Dangermond was a keynote speaker at the congress, and I had the pleasure of meeting with him to discuss the idea of combining the power of GIS and statistics to address local, national, and regional challenges in Asia and the Pacific, specifically focused on oceans.

Fast-forward 12 months, and at the 2019 Esri Ocean and Atmospheric GIS Forum, held in Redlands, California, in November, a prototype Pacific Ocean Accounting Portal was born.

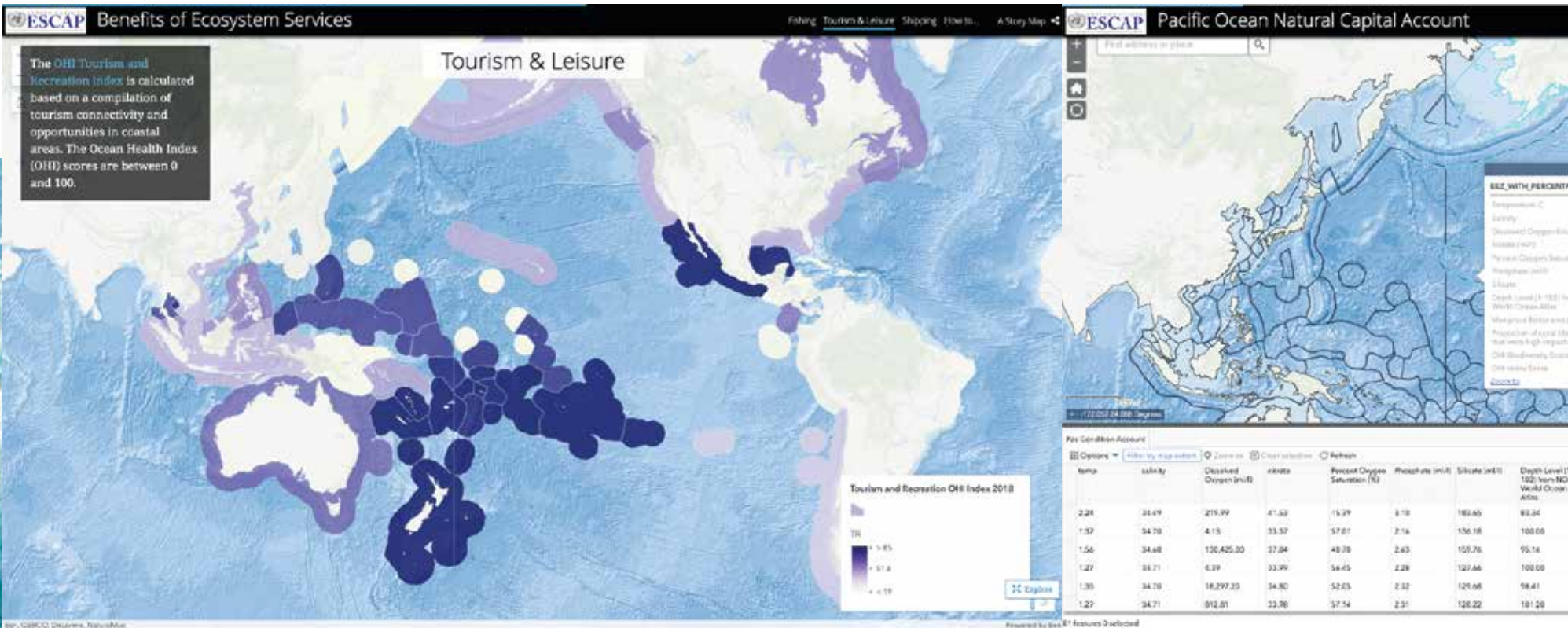
"We measure what matters" is a well-known phrase, and measurements need to be of practical use, particularly to decision-makers. The reality is that many decision-makers are time poor and need tools to help them quickly understand what the issue is and what's going on. Decision-makers also often focus on public concerns, such as jobs, the economy, security, people's well-being, and disasters.

By combining the power of GIS with statistics, the Pacific Ocean Accounting Portal aims to bring attention to the Pacific Ocean in ways that decision-makers can quickly see and understand. It also seeks to support the many countries that rely on

it—especially the small island developing states that depend so heavily on the Pacific Ocean for their livelihoods.

The UN is committed to the power of information, yet we know very little about the ocean. The UN 2030 Agenda for Sustainable Development is a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are 17 Sustainable Development Goals (SDGs). The SDGs recognize that ending poverty and other deprivations go hand in hand with developing strategies to improve health and education, reduce inequality, and spur economic growth—all while taking action to tackle climate change and preserve oceans and forests.

One goal, Life Below Water, also known as SDG 14, is devoted to our oceans. World leaders have agreed to monitor and measure progress in SDG 14 via 10 indicators, including marine pollution, fisheries subsidies, marine and coastal ecosystem management and protection, and ocean acidification. In Asia and the Pacific, however, we only have sufficient data to measure progress on 1 of the 10 globally agreed-on indicators for SDG 14—coastal and



↑ The portal employs several innovations to make it easy for people to access data and information about a whole host of topics, including how tourism affects ocean health.

The prototype Pacific Ocean Accounting Portal was developed by Daniel Clarke, an associate statistician for UN ESCAP, and Keith VanGraafeiland, a product engineer at Esri and the ocean curator for ArcGIS Living Atlas of the World. Email them at clarke@un.org or kvangraafeiland@esri.com for more information.

marine area conservation (indicator 14.5.1)—and 1 agreed-on proxy for marine pollution (indicator 14.1.1).

Data about the Pacific Ocean does exist, and many actors are working to bring visibility to this data in general and to the data that's relevant for SDG 14. But ESCAP's research shows that data about the Pacific Ocean is fragmented, not easy to access, not always publicly accessible, and not comparable. In fact, the data is often not integrated with other data systems, which means it is underpowered.

The Pacific Ocean Accounting Portal was developed to demonstrate what is possible if data is brought together in a user-centric, publicly accessible portal—and in a standardized and structured way.

The prototype portal employs several innovations to make it easy for people to access data and information about one of the world's largest natural resources. The portal spatially integrates public data about the protection, rehabilitation, restoration, and governance of the Pacific Ocean; what condition this huge body of

water is in; and the benefits that people and whole communities can reap from the Pacific Ocean, including fishing and tourism.

Using ArcGIS Hub, users can access the data in real time via dashboards, story maps, tables, and infographics. The portal adds value to data by leveraging a well-known organizing framework, the System of National Accounts, from which gross domestic product (GDP) and other economic measures are derived. Decision-makers and portal users can, therefore, find answers to three fairly basic questions: How is the Pacific Ocean being managed, how healthy is it, and what is it being used for?

Increasingly, people are asking these questions. Michael B. Jones, president of TMA BlueTech (formerly The Maritime Alliance), gave a compelling speech at the Esri Ocean and Atmospheric GIS Forum immediately following ESCAP's demonstration of the portal. He spoke on the economic value of the ocean. Jones cited estimates from the Organisation for Economic Co-operation and Development (OECD) that measured the direct contribution of the ocean economy to the world economy in 2010 to have been US\$1.5 trillion (in gross value added). This translates to 2.5 percent of world gross value added, less than 3 percent of world GDP, and 5–6 percent of the global real economy. These powerful figures are just one example of the types of information the portal's organizing framework is designed to provide.

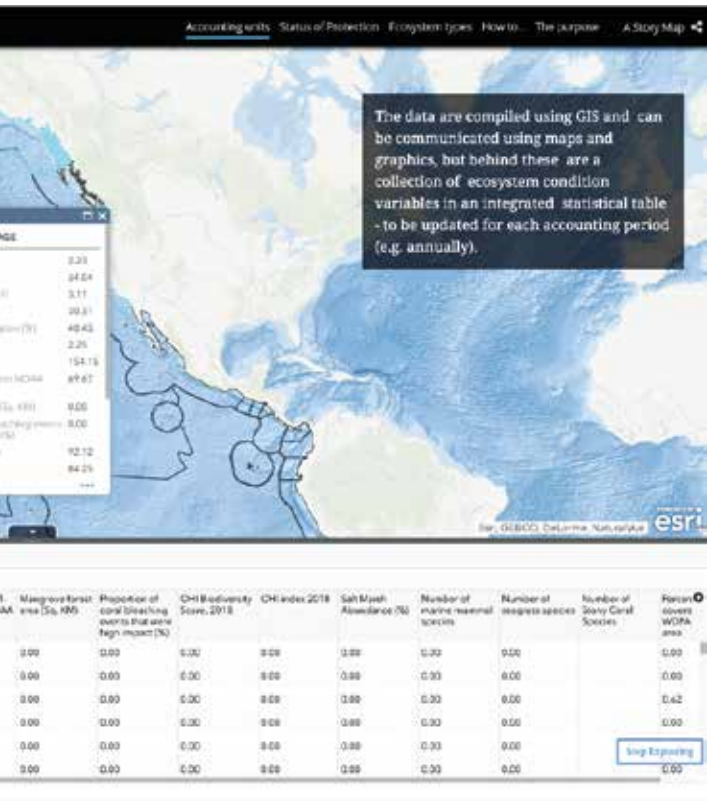
The portal demonstrates that challenges do exist when it comes to really getting power from data. Integrating various

types of data, including geospatial and statistical data, is one of these challenges. Bringing geospatial and statistical experts together is another. However, the portal has shown that these challenges can be overcome.

In fact, the prototype portal itself provides an opportunity for innovation. It's not just a portal of useful, related datasets; the datasets are actually integrated so users can find data and information about a particular spatial unit, such as an island, a marine zone, or the ocean as a whole. Integrating data spatially requires innovation, and ESCAP welcomes comment on the methodology it adopted. If there is an efficient and appropriate approach for integrating data across data types with spatial resolution that is meaningful for decision-makers, we welcome ideas!

Next steps for the portal are to showcase it to a wide audience—especially decision-makers who rely heavily on meaningful and official data and statistics—build excitement, and mobilize resources for future developments and use. ESCAP's demonstration of the portal at the Esri Ocean and Atmospheric GIS Forum was the first of several planned presentations that are intended to inform next steps for the data portal and its future.

Both ESCAP and Esri invite you to visit the prototype Pacific Ocean Accounting Portal at ow.ly/Z6V050xlpjw and learn more about the Pacific Ocean through the power of ArcGIS Hub technology. Please send any feedback or comments to stat.unescap@un.org.



← Combining the power of GIS with statistics, the Pacific Ocean Accounting Portal brings attention to the Pacific Ocean in ways that decision-makers can understand.



About the Author

Gemma Van Halderen is director of the United Nations (UN) Economic and Social Commission for Asia and the Pacific (ESCAP). Van Halderen joined the UN in 2018 after spending nearly 30 years working for the Australian Bureau of Statistics. She was the inaugural cochair of a UN Expert Group on the Integration of Geospatial and Statistical Information, reporting to both the UN Statistical Commission and the UN Committee of Experts on Global Geospatial Information Management. She also coauthored the scholarly article “Integrating statistical and geospatial information, cultures and professions: International developments and Australian experience,” which can be found at ow.ly/yZme50xlpnF.



Oregon/Washington BLM Modernizes Range Monitoring with Digital Workflows

Office Increases Efficiency and Data Quality with Custom Mobile Data Collection, Data Management, and Reporting Tools

By Micah Babinski, ELYON International, Inc.

The Oregon/Washington Bureau of Land Management (BLM) manages approximately 14 million acres of rangeland and administers over 2,000 grazing allotments. To fulfill this obligation, it employs more than 50 full-time staff in numerous district and field offices. These individuals share a commitment to a common mission: ensuring the health and productivity of public rangelands for the use and enjoyment of current and future generations.

During field season, when the weather in eastern Oregon and Washington allows for remote field visits, range program staff study and monitor grazing use on public land. They have numerous study protocols in their toolkit, which are described in various technical references and professional monitoring manuals, including *Utilization Studies and Residual Measurements Technical Reference 1734-3*, available on the BLM website, and *Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems*, Volume 1: *Core Methods*, published by the US Department of Agriculture's (USDA) Agricultural Research Service (ARS) Jornada Experimental Range (JER). This data helps the range program identify stocking distribution patterns; select the best treatments to maintain rangeland health; and (along with other factors) determine stocking rates, or how many grazing animals the land will support.

Historically, BLM staff collected this data on paper, a workflow that required them to carry clipboards, paper forms, cameras, and standalone GPS units in addition to their survey

instruments, food, water, and safety gear. The BLM had previously deployed customized ArcPad software to collect data, but factors—including technological change, changes in national policy, reluctance to adopt new methods, and limitations in available technology—prevented successful implementation. As the 2015 field season drew to a close, paper forms remained the only option for field data collection.

In January 2016, BLM staff and contractors met at the Oregon State Office (OSO) in Portland, Oregon, to discuss the situation. The team first determined why the previous modernization effort fell short. With these lessons in mind, they turned their attention to an emerging opportunity.

The Service First (S1) Mobile GIS program, sponsored by BLM's Oregon/Washington State Office and the US Forest Service, Region 6, had recently made significant improvements to the S1 Mobile Mapper app, a custom mobile app, built with ArcGIS Runtime SDK for Android, that is optimized for offline data collection. The OSO had also developed expertise with Esri partner Latitude Geographics' Geocortex Essentials, a framework for developing robust, focused, geocentric apps with an advanced module capable of generating customized PDF reports based on GIS web services.

"With the availability of S1 Mobile, the range program in Oregon/Washington felt the time was right to transition to electronic data collection," said Molly Anthony, the project sponsor and co-lead for the Oregon/Washington range program

at the time. "We saw that new technology could help streamline our data collection in the field."

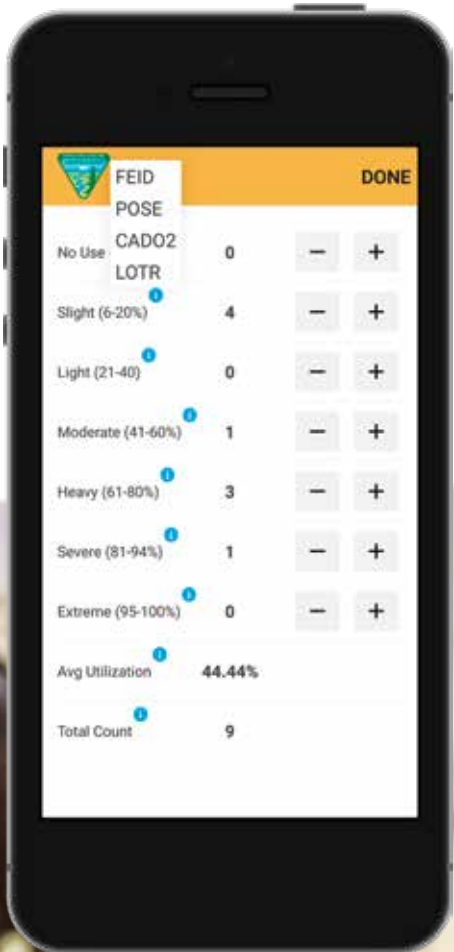
With these advances in technology and an increasingly tech-savvy workforce, a new plan emerged. The organization would first create a range monitoring data standard, which would describe the schema required to store information on five frequently used utilization and monitoring protocols. Then, they would implement this schema in a series of geodatabase tables related to sample points, an existing enterprise dataset that stores information about sampling and monitoring activities. Using an on-premises editable feature service, staff would then use custom functionality within the S1 Mobile app to collect dynamic range monitoring data on their Android devices, take photos of their study locations, and sync their offline edits directly with a geodatabase version. The edits could then be imported into ArcGIS Desktop, quality controlled using ArcGIS Data Reviewer, and submitted for posting to the enterprise geodatabase.

Numerous challenges confronted the project team. The database structure had to be exhaustively documented and meticulously aligned with existing standards and conventions. The S1 Mobile app had to be enhanced to provide three things: real-time averaging of vegetation utilization values (i.e., the percentage of vegetation that's grazed or browsed), behind-the-scenes calculations of summary data on sampled plants, and an intuitive user interface to make data entry simple in demanding conditions. Desktop

and web developers had to create tools that could generate complex PDF documents based on the data and autopopulate attribute data—including the elevation, grazing allotment, township, range, and section where the data was collected—to reduce the burden on field staff. All the apps and tools needed to be validated by field-going staff to make sure they were easy to use and would meet their requirements. The team also had to ensure that range program staff were provisioned with government-furnished mobile devices, assist them with configuring Department of Interior-mandated security settings, and coordinate the installation of Wi-Fi networks in remote offices to accommodate synchronizing the disconnected edits.

The project pushed the boundaries of the organization in terms of technological innovation and governance structures. As team members worked through these challenges, they generated important lessons learned that will assist the organization in the future. A key lesson learned was the value of Esri-hosted feature services for rapidly creating prototypes. They allow GIS specialists to experiment with different schema choices

→ Intuitive data entry screens and real-time averaging of utilization values provide BLM staff with a streamlined data collection experience.



The Oregon/Washington Bureau of Land Management (BLM) manages approximately 14 million acres of rangeland and administers over 2,000 grazing allotments. (Photo courtesy of the Oregon/Washington BLM.)



Mobile GIS specialist Paul Ferro (right) trains BLM rangeland management specialists on the Key Species protocol, which evaluates the grazed percentage of key plant species observed along a transect line, at the BLM Prineville District Office in March 2018. (Photo courtesy of the Oregon/Washington BLM.)

without requiring the complex change management procedures necessary in a shared enterprise geodatabase environment. This enables a more agile approach, allowing the team to quickly align deliverables with stakeholder expectations.

As the 2018 field season approached, the team finally had all the key components of the Range Monitoring system in place. Using the S1 Mobile app, users were able to easily enter the five utilization and monitoring protocols and to sync and submit their offline edits directly in a geodatabase version. This prompted email notifications to be sent to GIS specialists, who then imported the mobile versions into ArcMap, ran the ArcGIS Data Reviewer quality control checks aligned with the data standard, and submitted the data for posting to the corporate database. With the Range Reports Geocortex app, range program staff were able to quickly generate PDF

documents that mimic the look and feel of the legacy paper forms, which staff then printed and placed in official allotment files stored at the district office, as mandated by BLM policy. These forms and their associated spatial data could then be used to inform management decisions about particular allotments and perform analysis that would have been impossible before.

In spring 2018, BLM staff and contractors trained on all aspects of the system. All range program staff in attendance were able to go over the data collection and reporting process using their own devices, accounts, and Wi-Fi networks.

"Staff at any level who are comfortable using a smartphone should be able to translate that ability into data collection using the S1 Mobile app for range monitoring," said Jamie McCormack, a range management specialist for the BLM Burns District Office.

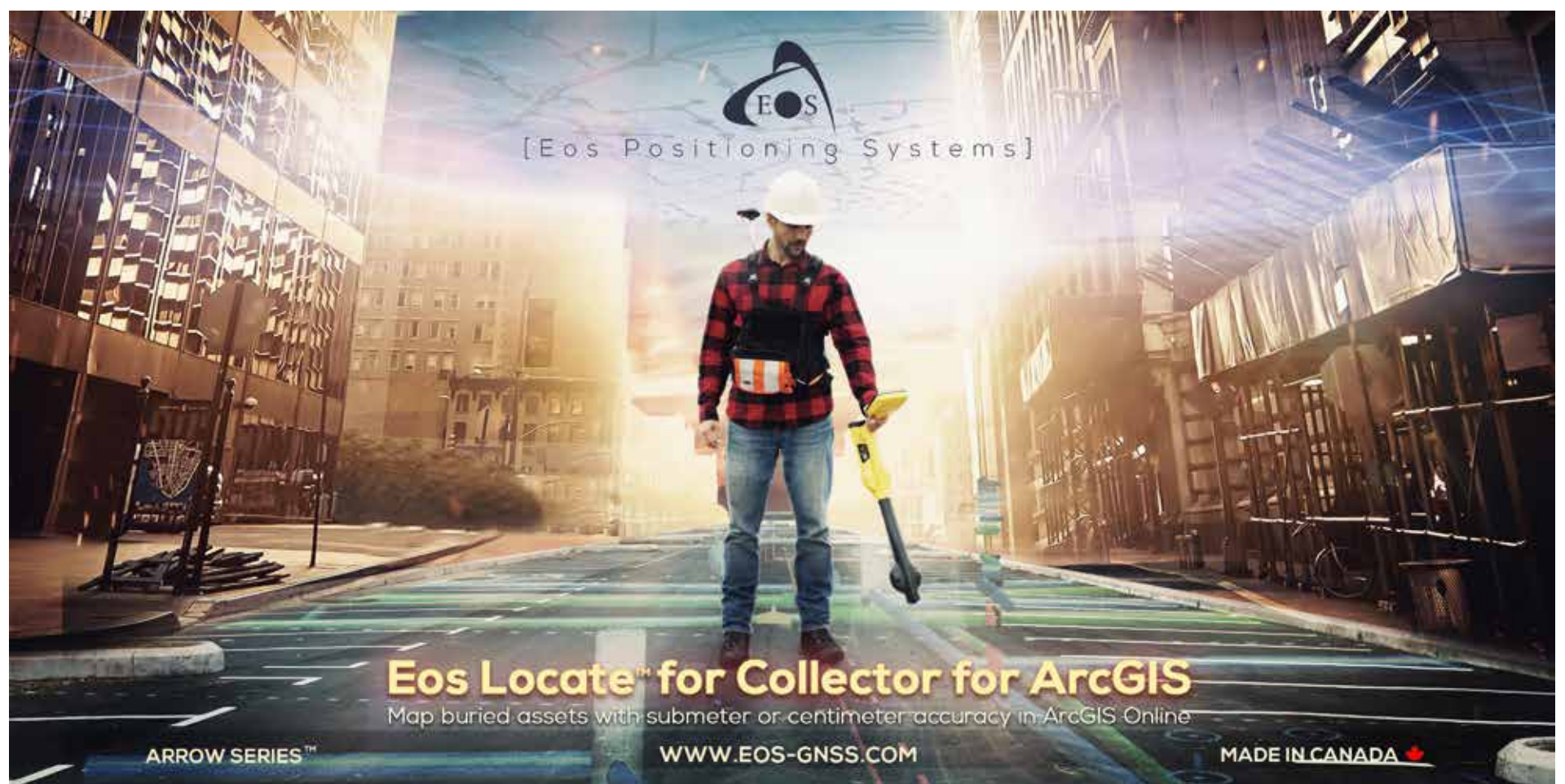
That summer, the BLM realized the benefits of the system made possible by the hard work of the project team and the valuable input from range program staff. By now, more than 30 mobile edit versions have been submitted via the system, providing a wealth of valuable information that will help the BLM determine how best to administer grazing on the public lands it manages.

The range monitoring system demonstrates how the people, technology, and processes that make up an enterprise GIS can modernize a legacy workflow and help the BLM's range program fulfill its demanding and critical mission.

For more information on this project, contact Micah Babinski, GIS project manager for ELYON International, Inc., at mbabinski@blm.gov or 503-808-6305. For questions about S1 Mobile Mapper, contact the team at blm_or_s1mobiledevteam@blm.gov.

About the Author

Micah Babinski, GISP, PMP, is a GIS project manager with ELYON International, Inc. He works on-site with the Oregon/Washington BLM. Babinski has been part of the GIS industry for nearly a decade and previously held positions at the City of Portland, Oregon, and Multnomah County, Oregon. He graduated from the University of Washington and is an active member of the Urban and Regional Information Systems Association (URISA) and the Project Management Institute (PMI).



With Help from Esri Partners, Communities Get Smart Upgrades

Now more than ever, communities have tools at their disposal to make them smarter, more agile, and more accessible to everyone. GIS plays a huge role in that, and Esri partners are available to help users streamline their GIS processes and keep their geospatial technology up-to-date. Read on to find out how four Esri partners have used their GIS expertise to assist a city in making a smart growth plan, enhance a sidewalk navigation app, help standardize a call-before-you-dig program, and put together a road map to upgrade GIS according to what customers want.



Town Makes Smart Growth Plan—And Shares It

The Town of Bennett, Colorado, located 20 miles east of Denver International Airport, is experiencing record-setting growth. Over the next 10 years, it is expected that the number of households will increase by 300 percent—from just under 1,000 to more than 4,000.

Understanding and managing this growth responsibly are priorities for the town. With a grant from the Colorado Department of Local Affairs and the Adams County Parks, Open Space & Cultural Arts department, the local government was able to work with multiple consultants, including **North Line GIS** (northlinegis.com), to put together a capital asset inventory and master plan. Through this collaboration, the Town of Bennett evaluated its current infrastructure; developed a growth plan; and implemented ArcGIS technology as the primary access point for employees and consultants to retrieve and use data, information products, and presentations. Because of how easy it is to use, ArcGIS Online was chosen as the primary platform for gathering and presenting data.

Employing the capital asset inventory and master plan—along with apps, including Collector for ArcGIS, Survey123 for ArcGIS, and Operations Dashboard for ArcGIS (which were all specially configured)—consultants and staff completed assessments of Bennett’s water resources, sanitation and storm water systems, land use, parks, roads, and buildings. They attached images, spreadsheets, and asset manuals to the features. They also logged the capacity and condition of all town-owned assets in ArcGIS so the local government can identify priorities and triggers for capital improvement.

Once the data had been compiled, consultants and town staff used Web AppBuilder for ArcGIS and customized templates to capture and update data and come up with best practices for ongoing data maintenance. Configurations include the Capital Project Review Dashboard that pulls from feature services used by multiple apps. To ensure ongoing success, North Line also trained town staff on how to use the apps and make configuration changes as needs arise.

Additionally, North Line helped staff develop a series of internal story maps to serve as a single point of access for all the apps. This makes it easy for various departments within the Town of Bennett to quickly and easily retrieve the information they need.

Now, Bennett has easy access to all the data and tools that can show how development will impact the town’s infrastructure and budget, so it can address growth head on instead of waiting for it to happen.



↑ North Line GIS put together a capital improvement assessment plan for the Town of Bennett, Colorado, complete with a dashboard that shows the town’s water resources, sanitation and storm water systems, parks, roads, and more.

A Sidewalk Accessibility App Gets Upgraded

Sidewalks should be accessible and safe for everyone, no matter their abilities. That’s why **pathVu** (pathvu.com) is building a global map of sidewalks, pathways, and trails to improve accessibility and walkability. The company’s pathVu Navigation mobile app, which works with other accessibility solutions available on smartphones, uses real-time, data-driven maps to help pedestrians steer clear of sidewalk obstructions and hazards. For users in wheelchairs, for example, pathVu applies what it calls the Route Accessibility Index (RAI) to let them know where it’s safe to cross the street based on the conditions of the sidewalks and whether or not there are curb ramps.

The data used in the app is collected with PathMet, a device equipped with sensors that records sidewalk conditions and identifies things like tripping hazards, surface roughness, and pathway width. This geolocated data, complete with photographs when possible, can let cities know where they are failing to meet quality standards for their citizens and help them prioritize improvements that need to be made to sidewalk infrastructure.

Although pathVu Navigation was already operational, the company wanted to enhance and fix certain aspects of the mobile app to make sure the code was up to standard and verify that it was following best practices. So pathVu worked with **Chetu** (chetu.com) to help with iOS and Android development and ensure that all back-end features could be incorporated into the app. Chetu, a custom software developer, was also recruited to help improve pathVu’s GPS precision and strengthen the mapping features that would encourage users to make pathVu Navigation their main navigation app.

The app’s code was originally written in Apple’s Swift programming language, so Chetu’s ArcGIS certified developers followed the same structure. They used ArcGIS Runtime SDK for iOS and ArcGIS Runtime SDK for Android, as well as the Xcode 9.4 integrated development environment (IDE) for the Mac operating system. Chetu also worked on the Android version of the mobile app to fix bugs and bring it up to speed, integrating the same functionality into the Android platform as it did in iOS.

Now, pathVu Navigation can provide custom navigation for users based on their comfort settings in the app. This means that routes are based on their abilities to navigate certain conditions rather than just the shortest route (which is how the app operated before). In addition, the app can alert users to particular points of interest based on favorites they have set up in the app. pathVu Navigation is available to download for free from the App Store and Google Play.

→ The pathVu Navigation app uses real-time, data-driven maps to help pedestrians of all abilities steer clear of sidewalk obstructions and hazards.



Web Maps Help Prevent Damage to Water Lines

In Loudoun County, Virginia—about 40 miles west of Washington, DC—more than 80,000 households receive their drinking water and wastewater services from Loudoun Water. The utility maintains more than 1,250 miles of water distribution pipelines; over 950 miles of wastewater collection system pipelines; and an expanding system for reclaimed, nonpotable water.

Loudoun Water is continually improving how it prevents damage to its underground infrastructure, instituting best practices championed by the Common Ground Alliance, an association committed to helping members ensure the safety of their underground utility facilities. One system that is crucial for safety and damage prevention is a Call 811 line, which allows residents and businesses to dial that number before beginning a digging project to ensure that they avoid all belowground utilities.

For its own call-before-you-dig needs, Loudoun Water implemented a Web AppBuilder for ArcGIS widget from **Avineon, Inc.** (avineon.com), called Mark 811. Mark 811 is a ready-to-use, configurable tool for both web and mobile environments that’s accessible via web browsers on desktop computers and mobile devices. It enables employees and contractors to use web maps to identify where facilities are and generate manifests (electronic records that show the marked locations of underground utilities) that are submitted to the appropriate Call 811 center.

With Mark 811, Loudoun Water’s fieldworkers now use their mobile devices to document work. And by extending the power of enterprise GIS to include 811 functions, Loudoun Water has been able to generate a logical workflow for standardizing how manifests are created and submitted.

“The Web AppBuilder widget approach to this critical business function has enabled us to deliver meaningful user experiences and functionality to our stakeholders,” said Celine Yang, a GIS analyst at Loudoun Water. “It provides us *[with]* ease of deployment and an effective way to



operationalize web applications in line with our web- and mobile-friendly digital strategy for utility operations.”

In the first three quarters of 2019, the utility used the widget for more than 11,000 manifests, reducing the amount of time it took to prepare and generate them and increasing overall efficiency.

Mark 811 is available on ArcGIS Marketplace at [ow.ly/U0Cd50xioqn](https://www.arcgis.com/marketplace/details/arcgis/widget/mark-811-locator-and-manifest-generator/00000000000000000000000000000000).

← Mark 811 enables employees and contractors to use web maps to identify where underground facilities are and generate manifests.

City Sees a Clear Path for Moving Forward with GIS

The City of Griffin—part of the Atlanta, Georgia, metropolitan area—has been using ArcMap and ArcGIS Server for years to support its planning efforts and improve asset management. To continue to meet regulatory requirements, refine its overall operations, and embrace recent technology releases, the city recently set out to examine what it would take to move to the cloud and transition to ArcGIS Pro and ArcGIS Enterprise, as well as evaluate its existing hardware and network infrastructure. Griffin reached out to the GIS and IT experts at **eGIS Associates** (egisassociates.com) for guidance.

To see about getting the city current on Esri technology and explore what would be required to implement ArcGIS Pro and ArcGIS Enterprise, eGIS conducted a Geospatial Road Map analysis for the city. The analysis provides an impartial look at an organization’s GIS to find out how it aligns with stated goals, mandates, and objectives. For Griffin, the Geospatial Road Map analysis also included an inventory of the hardware, software, and data associated with the city’s GIS; interviews with GIS and IT staff; and collaboration with the GIS manager, who provided insight into the city’s long-term goals and current product demand. eGIS also interviewed Griffin’s GIS customers, which include elected officials and leaders and staff from other city departments, to determine their current level of satisfaction with the GIS products and services they receive, as well as possible future needs in these areas.

“During the interviews, we found the customers were very happy with the products they were receiving from the GIS division but knew more was possible,” said Tripp Corbin, CEO of eGIS Associates. “The GIS team and city departmental directors also realized they could be doing a lot more with GIS. They are excited about the possibilities that new technologies, such as ArcGIS Pro, ArcGIS Enterprise, and ArcGIS Online, will bring to the table to improve daily operations. This support will be critical to the growth and success of GIS at the city.”

eGIS compiled and analyzed all the gathered information to develop a road map of recommendations and priorities needed for the city to successfully implement ArcGIS Pro, ArcGIS Enterprise, and ArcGIS Online.

“The Geospatial Road Map report we received from eGIS provided us with a very clear path to move forward as we implement new products and technologies from Esri,” said Brian Haynes, the GIS administrator for the City of Griffin. “We feel that we know the answers to the questions we started with and a lot more. The eGIS staff members were a pleasure to work with, and we were very pleased with their thoroughness and professionalism.”



↑ The City of Griffin, Georgia, has put recommendations from eGIS Associates into action by implementing Survey123 for ArcGIS.

Esri partners represent a rich ecosystem of organizations around the world that work together to amplify The Science of Where. Their products and services range from configured apps, add-ons, widgets, and custom-built solutions to complete ArcGIS system implementations, content, and hardware. Discover partners, solutions, and services that meet your needs at [esri.com/partners](https://www.esri.com/partners).



Want to promote this?
Learn how at
cgu.edu/giscert

CENTER FOR **INFORMATION**
SYSTEMS & TECHNOLOGY
Claremont Graduate University

GIS TRAINING
EXPRESS™

Professional GIS training in our Seattle facility or at your site.

- ✓ Expert ArcGIS® Training
- ✓ Custom Classes and Workshops
- ✓ GIS Certification Institute Qualified
- ✓ URISA's Pacific NW Education Center
- ✓ Veterans' GI Bill Benefits

Selected programs of study at the King County GIS Center are approved for those eligible to receive benefits under Title 38 and Title 10, USC.

King County GIS CENTER *We help you put GIS to work!*
gistraining@kingcounty.gov
www.kingcounty.gov/gis/training

Environmental GIS Degrees
100% Online

Master's in Environmental GIS

Graduate Certificate in GIScience

5 start dates per year
Fully accredited
Professional faculty
Accelerated

UNITY COLLEGE
Distance Education

online.unity.edu/gis

Startup's Panoramic Mapping Platform Helps Port of San Diego Share Data

The Port of San Diego is world renowned for its marine recreation, natural scenic beauty, and bustling nightlife. Its carefully managed 34-mile waterfront is home to a variety of businesses—from fisheries, shipping companies, and port commerce to tourist- and resident-focused establishments.

Always open to innovations in problem-solving technology, the port is consistently on the lookout for forward-thinking solutions it can use to streamline processes and improve results. Its staff span a range of specialties, including operations, planning, facilities, environmental protection, and public safety. Each group is focused on a specific aspect of the port's management, and each regularly collects its own asset data to better understand conditions both above and below the water's surface.

To develop a better, more cohesive way to visualize assets, the port chose to work with Esri start-up partner **EarthViews** (earthviews.com). The web-based mapping company (which is currently being rebranded from FishViews, Inc.) is uniquely suited to the project because of its expertise in integrating panoramic high-definition (HD) imagery with related high-precision aquatic data.

"We began the project envisioning what was possible, but the benefits went beyond even what we thought," said EarthViews CEO Courtney Gallagher.

EarthViews built a custom, web-based platform for the port that now gives employees the ability to navigate San Diego Bay virtually. By joining an Esri basemap with 360-degree panoramic imagery of the above-water shoreline and 3D below-water bathymetric imagery, EarthViews generated a virtual experience that enables users to assess and catalog asset conditions, whether they're onshore or underwater.

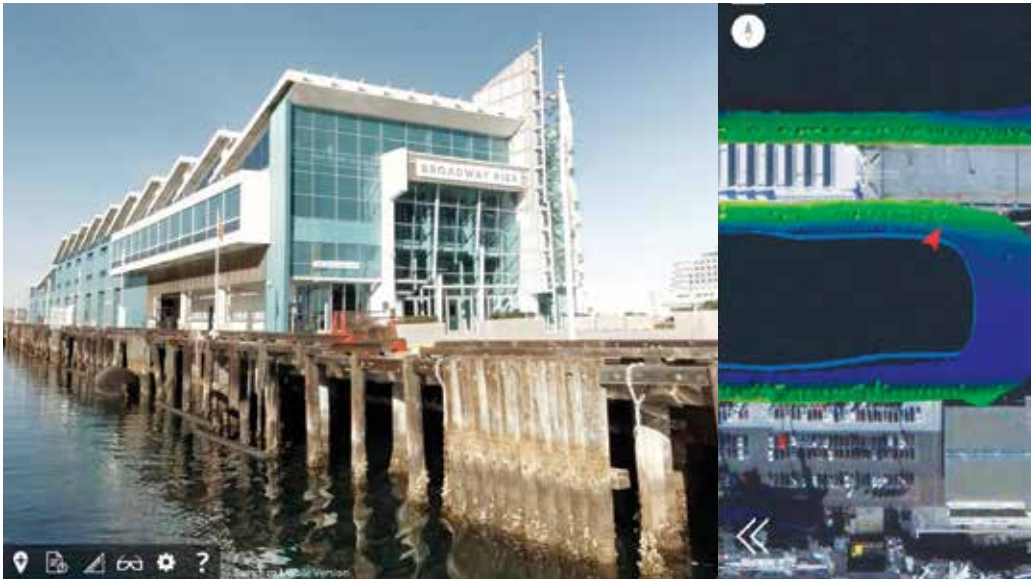
"What we created was this visual platform where port employees can now attach data that's relevant to them—that also might be relevant to other departments—in a place where everybody can get to it and see it easily," said Gallagher. "It adds additional context to the data that each group is using."

The platform's integrated tagging feature allows port staff to add location-specific information and points of interest directly to the surface imagery. EarthViews combined this custom feature with an ArcGIS Online map to create an interactive virtual tour of both the shoreline and the underwater environment. Port employees can also use the ArcGIS Online map to toggle between the above-water and below-water imagery.

The virtual tour gives port employees across all agencies the ability to easily and accurately analyze data from a shared source. This is enhancing employees' understanding and spatial awareness of the port's infrastructure and conditions.

"What is so powerful about this project is that EarthViews only had to go to San Diego once to take the 360-degree photos and collect bathymetry data, then integrated that with other relevant information that the port already had; and now the Port of San Diego has this tool to share data in a way that enhances communication and adds value across multiple departments," said Gallagher. "Because we can continue to integrate the port's relevant information, it creates this living, visual catalog of infrastructure."

The Esri Startup Program gives emerging businesses an edge by helping them integrate spatial functionality into their products and services. Learn more at developers.arcgis.com/startups.



↑ The multibeam sonar layer on the right shows port employees the water depth and helps them gain insight into what things look like underwater near Broadway Pier.



↑ With 360-degree imagery (left) and bathymetry data overlaid on an ArcGIS Online map (right), users can take a virtual tour of the marina.



Setback Mapping in Newport Beach, California, Gets an Update

By Jordan Baltierra, City of Newport Beach, California

Many municipalities have detailed and enigmatic zoning codes. Oftentimes, these can be quite challenging for homeowners to navigate when they want to renovate or expand their homes.

In the City of Newport Beach, California, the zoning code contains more than 300 pages of complex development standards that apply to a tapestry of subdivisions that have popped up since the city's incorporation in 1906. Within the city's zoning code, there are also standards for building setbacks—the distance a structure or part of a structure is set back from the property line. But these can differ from one residential district to another.

In 2017, the planning department at the City of Newport Beach approached the GIS team to find a better way to maintain and display setback data. As the lead on the project, I chose to bring the city's legacy tabular setback data, plus a set of static setback maps, into a centralized GIS polygon layer. To do this, I used ArcGIS Desktop and Geocortex Essentials from Esri partner Latitude Geographics.

Unconventional Setbacks

In the United States, most cities adopt their setback requirements through zoning codes to regulate building site areas and control what their streetscapes look like. Setbacks are usually

classified by a parcel's property lines—the front, sides, and rear. For instance, a standard low-density residential property with a rectangular shape would have a setback of 20 feet in the front, 3–4 feet on the sides, and 10 feet in the back.

In Newport Beach, however, this standard is not uniform. Some areas have alternative setbacks that have been codified into the municipal code. Thus, the city has varying setback standards based on factors such as the width and shape of a lot, how close it is to the harbor, and its adjacency to an alley. The City of Newport Beach's zoning code also references 59 individual planned communities that contain their own specific setbacks and standards. Additionally, there are several unique properties in the city that don't meet any of these standards. These properties require city staff to review and define site-specific setback determinations and then get them approved by the city's planning commission.

Although Newport Beach's zoning codes can be overwhelming, the city uses GIS to display setback requirements visually. This ensures that planning staff and residents are applying the correct setbacks to each property. But the city wanted to be able to maintain this data dynamically and was keen to give staff and residents more ways to access it.

A Lot of Data, a Lot of Detail

Using ArcGIS Desktop, the general workflow for creating the setback data was to use the city's existing parcel polygon data as a base and cut the parcels into their designated setbacks. Newport Beach has more than 29,000 parcel features, and approximately 26,000 of them are zoned for residential use. That means that 26,000 parcels require setback information—and, at the outset of the project, they had to be edited manually.

One challenge I faced while getting the setback data into a centralized GIS feature class was cutting the polygons using a trace and offset. This has the potential to create slivers—polygons with a very small shape area that are hard to see. They sometimes end up displayed on property reports as extra fronts, sides, or rears of buildings, when they actually don't exist at all. I used quality control checks, like querying shape areas below a certain square footage threshold, to help identify these slivers and either merge them into an adjacent setback or delete them if they're redundant.

Another challenge was figuring out which side of the property was actually the front, side, or rear setback. In general, the front of a house is normally the property line that faces the street. But in Newport Beach, there are some areas where this is not the case, such as when a house butts up against the beach, a cliffside, or the harbor. In addition, many properties have more than one front setback.

Instead of having GIS staff hem and haw over the setbacks of each property, the GIS team decided to release the data into the Geocortex map viewer as soon as possible so planning staff could perform quality control on the data organically, while using the application. Having staff from the planning department not only consume the data but also contribute to its quality gives them ownership of it and is essential for the longevity of the data.

To display the setback data, I leveraged the City of Newport Beach's internal Geocortex web map viewer. Now, all city staff and Newport Beach residents who visit the city's planning counter can view setback information for individual properties, which helps them with renovation and permitting.

Maintaining a Dynamic Layer

Parcels are not static features. They get merged, split, and reshaped over time. Many of the city's GIS layers are dependent on the ebb and flow of this parcel base. As such, the City of Newport Beach's GIS team does continual maintenance on its parcel data.

When the setback layer became part of this base, it had to be added to the parcel maintenance workflow. One idea for how to do this was to automate spatial queries so they could find any geometric inconsistencies between parcels and their setbacks. Ideally, all setback polygons can be aggregated and dissolved into a single polygon that's identical to its underlying parcel. So using ModelBuilder and Python scripting, I developed an automated geoprocessing tool that dissolves and compares geometries. This enables the city's GIS staff to address each inconsistent record individually.

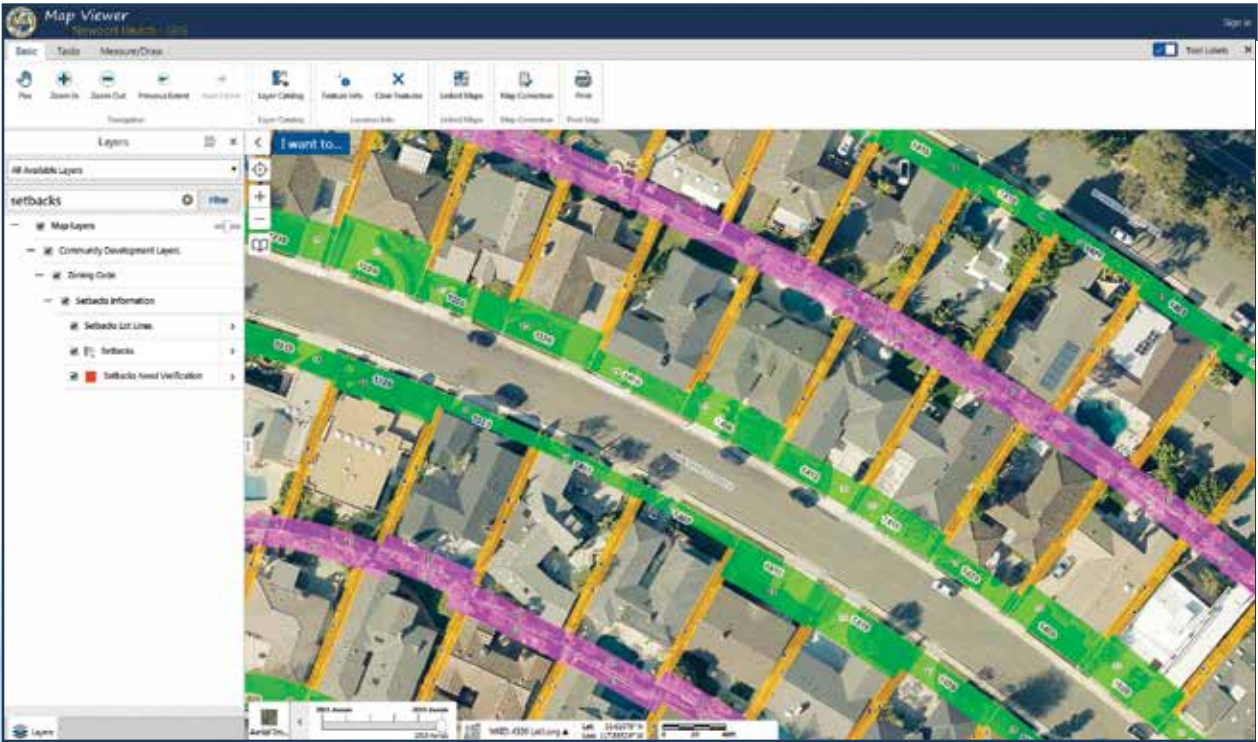
A More Comprehensible Zoning Code

For the City of Newport Beach, bringing its legacy setback data into a centralized GIS feature class has been beneficial to planning staff and residents alike. The setback layer has become an invaluable tool that bridges complicated zoning policy with comprehensible cartographic visualization.

For more information about maintaining and displaying setback data using ArcGIS technology, email City of Newport Beach GIS specialist Jordan Baltierra at jbaltierra@newportbeachca.gov.

About the Author

Jordan Baltierra is a GIS specialist at the City of Newport Beach, California, where he has worked for eight years. Previously, he was a GIS operator I for the City of Anaheim, California. Baltierra studied geography, GIScience, and cartography at California State University, Long Beach.



↑ The City of Newport Beach now shows its setback data on a map viewer made with Geocortex from Esri partner Latitude Geographics.



With GIS, Communities See How Land-Use Changes May Affect Local Water Quality

By Kara Salazar, Lydia Utley, Bryan Pijanowski, Dan Walker, Jarrod Doucette, and Kristen Bellisario, Purdue University; Brian Miller, Illinois-Indiana Sea Grant; Michael Wiley, University of Michigan; Ed Rutherford, NOAA-Great Lakes Environmental Research Laboratory

Nutrient reduction in bodies of water is a critical goal for communities in the United States, particularly in northern states that border the Great Lakes, where nutrient loads—high concentrations of pollutants like nitrogen and phosphorus—threaten the health of rivers, tributaries, inland lakes, and bays. Communities often need to know the quality status of their watersheds and how development plans might affect that. Many questions arise during the planning process, such as the following:

- Are current nutrient loads impairing surface water quality?
- If we develop a particular site, would our streams or other bodies of surface water cross a critical threshold where they change from a healthy state to impaired?
- What mitigation management strategies are the most cost-effective?

To answer these questions, communities need science-based tools that link planning decisions to water quality. These tools need to be established within a framework that involves community organizations, natural resource experts, scientists, extension specialists from land- and sea-grant universities, and concerned citizens.

In 2006, a group of 22 scientists from nine institutions formed a coalition—the Tipping Point Planning team—to promote and educate communities about the science of tipping points as it relates to local watersheds. By combining GIS with the research outcomes of stream health, land-use change, and nutrient loading—and directly linking data to the local decision-making process—communities in the Great Lakes states can plan for a sustainable future.

The result of this partnership is the Tipping Point Planner Program, a facilitated workshop designed around a collaborative, web-based decision support tool that provides communities with information about local land use and watersheds in various multimedia formats. The interactive modules help participants do four things:

- Evaluate natural resource assets.
- Prioritize community goals.
- Assess past and potential future changes by displaying maps and gauges that indicate tipping point status.
- Explore what-if scenarios with real-time models.

At the end, the Tipping Point Planner generates an action plan that brings together these four items in a PDF, which contains maps, charts, and planning priorities.

ArcGIS Technology Supports User Engagement

ArcGIS Enterprise 10.7 serves as the back end for the Tipping Point Planner decision support system. Tipping Point Planning team members and the science team at Purdue University develop offline tools using a variety of desktop GIS solutions, including ArcGIS Desktop and ArcGIS Spatial Analyst. All the maps and data layers used for the modules were built in ArcMap at first and, later, in ArcGIS Pro.

For Purdue's science team, ArcGIS Pro and its smart mapping capabilities have been extremely helpful for quickly visualizing data and running analysis. ArcGIS Enterprise and ArcGIS Online host the Tipping Point Planner Program's finalized map services and data layers. The online Tipping Point Planner decision support tool then pulls those maps and data layers from ArcGIS Enterprise and ArcGIS Online to display them to users.

Taken together, these services constitute an affordable infrastructure for hosting the data in a reliable and user-friendly way.

GIS Supports the Science Behind the Decision-Making Tool

In this context, a tipping point is when an ecosystem shifts from a healthy state to an unhealthy state. A watershed in a healthy state typically contains a vibrant community of native fish species in clean water. When a watershed transitions from a healthy state to an unhealthy state, it is usually indicated by the mixture of native and invasive fish species in water that has potentially harmful algal blooms.

In Tipping Point Planner workshops, participants get to evaluate how proposed land-use changes may affect water quality in their communities. The online decision support tool integrates a variety of spatial models. These include Purdue University's land-use forecast tool, called Land Transformation Model (LTM); water quality tools such as Purdue's Long-Term Hydrologic Impact Analysis (L-THIA)

model and the US Geological Survey's (USGS) SPARROW (Spatially Referenced Regression on Watershed) model; and the University of Michigan's land-use biotic tipping point model, which provides users with the status of nutrients, sediments, fish, and aquatic insects in streams. Incorporating separate models like this enables planners to analyze a range of plans over a period of two to five decades.

Additionally, the Tipping Point Planner's GIS-based tools enable users to visualize the results of the models on a map. Users can zoom in and out and pan across the map to see stream quality ratings at different spatial scales (e.g., local versus regional). The team also employed the National Hydrography Dataset alongside land-use classification to generate a seamless network of stream reaches and elevation-based catchments, which allows users to see how land drains into specific rivers or streams. And topical pages, which show things like how to decrease nutrients or protect farmland, are modeled after ArcGIS StoryMaps, with a narrative pane on the left that guides users through the decision support tool and a main stage on the right where users interact with the map, data, and graphs.

The Tipping Point Planner in Action

Many cities in the Great Lakes region need to improve their water quality. In Peoria, Illinois, for example, water surge from storms and melting snow often exceed the capacity of existing storm water infrastructure, which results in sewer overflow and other excess nutrients polluting the Illinois River. Like a lot of other communities, this has afflicted Peoria for years—to the point that both the United States and the Illinois Environmental Protection Agencies (EPAs) have mandated that the city develop a plan to address the problem.

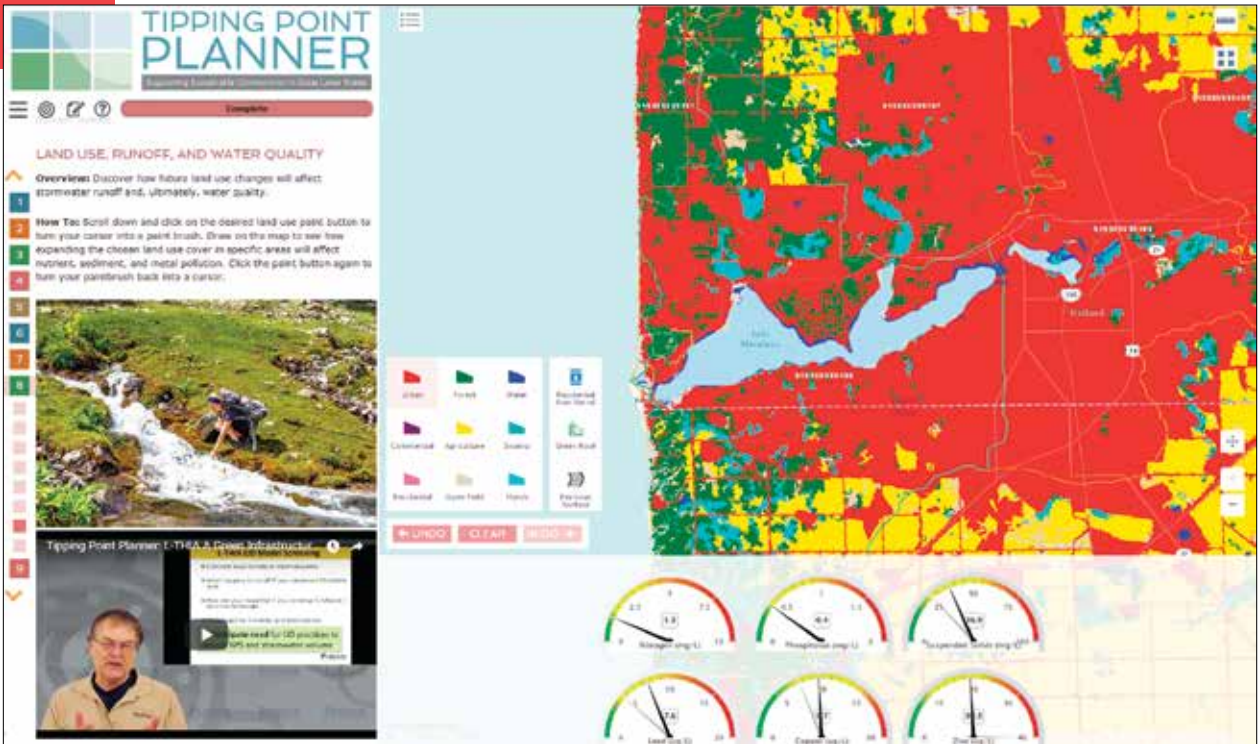
The City of Peoria and its innovation team organized a Tipping Point Planner Program workshop to explore solutions. An extension specialist from Purdue held an initial discussion with community leaders about their specific watershed problems, goals, and community engagement options. This person also conducted a series of workshops that brought in Tipping Point Planning team members who have specialties in community planning, GIS, public engagement, biology, and landscape modeling.

"Peoria has an issue they're trying to resolve before they cross the tipping point, and there are very costly solutions to it, but we're helping them explore alternatives that are less costly and would provide other environmental benefits as well," said Bernie Engel, professor of agricultural and biological engineering and associate dean of agricultural research and graduate education at Purdue University, who is leading the Peoria project.

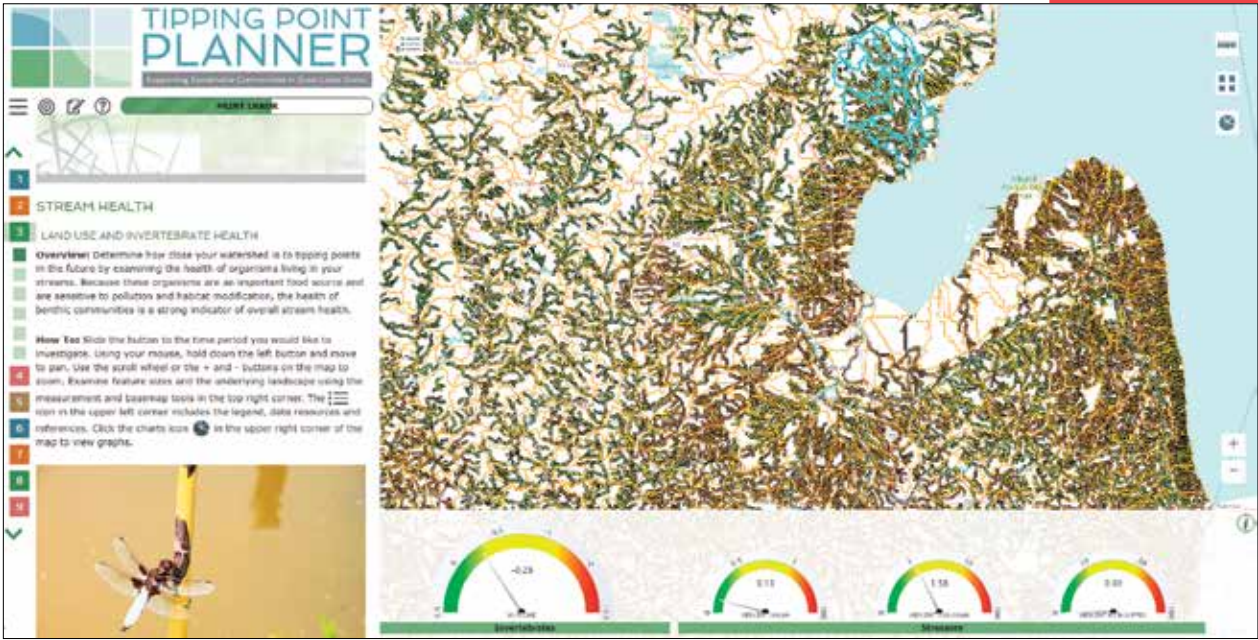
The Tipping Point Planner Program helped Peoria's innovation team figure out not only what environmental variables needed attention but also how to choose from a host of solutions presented to them based on model simulations of anticipated nutrient reductions and the costs of various remediation options. Using the decision support tool and a specific sewer flow model developed by Purdue's agricultural and biological engineering department, the City of Peoria got the guidance it needed to settle on a green infrastructure-based plan to address its sewer overflow problem. The plan, which the city is moving forward with, focuses on reducing impervious surface areas such as pavement and incorporating more porous surfaces into the community in the form of parks and open spaces.

◀ In Au Gres, Michigan, community leaders participated in a two-day facilitated workshop put on by the Tipping Point Planner Program to examine opportunities to protect nearby watersheds.

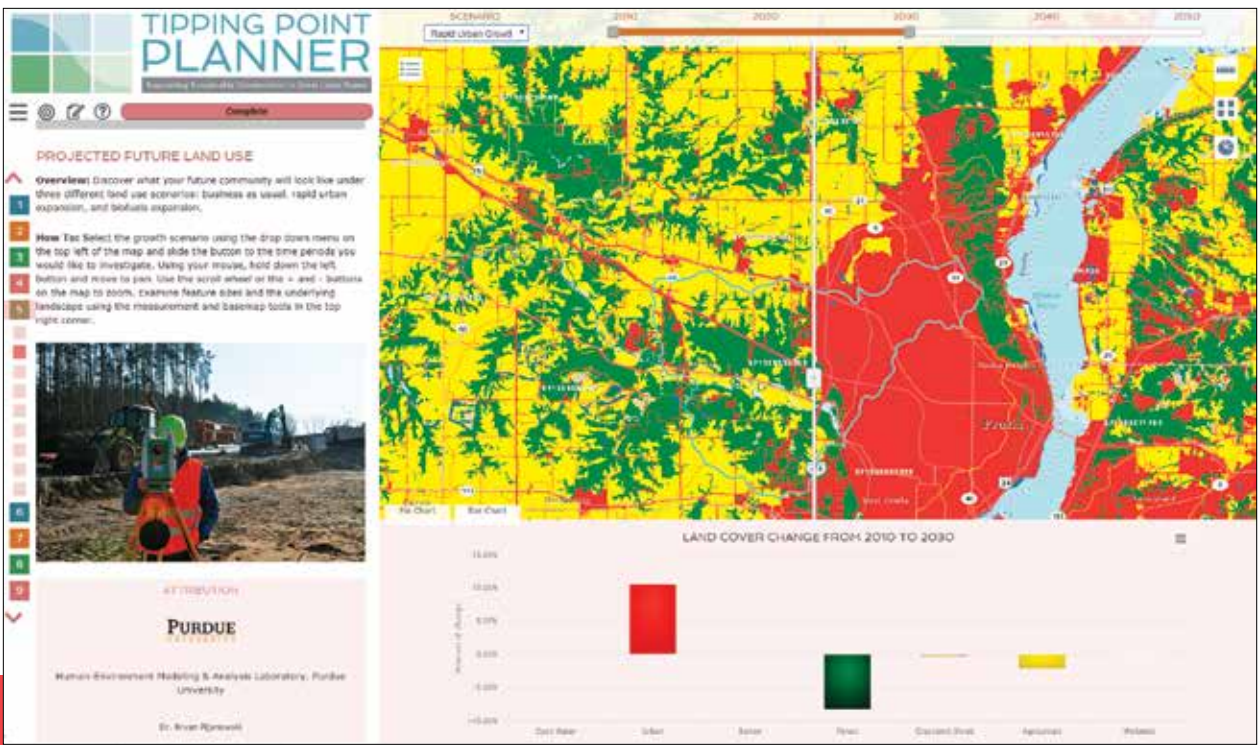




↑ The decision support tool helps program participants evaluate natural resources, prioritize community goals, assess changes, and explore what-if scenarios to come up with action plans.



↑ Michigan Sea Grant and Huron Pines found that two watersheds near Saginaw Bay in Lake Huron are currently in great condition but that they need to come up with a plan to protect them in the future.



↑ The City of Peoria, Illinois, is using the Tipping Point Planner Program to figure out how to mitigate sewer overflow and other excess nutrients polluting the nearby Illinois River.

Discovering Tipping Points Before They Can Occur

Other communities are benefiting from the Tipping Point Planner Program as well.

To address the future of two watersheds near Saginaw Bay in Lake Huron—the Au Gres River watershed and the East Branch Au Gres watershed—two Tipping Point Planning team partner organizations, Michigan Sea Grant and Huron Pines, hosted a Tipping Point Planner workshop at Au Gres High School in July 2018. Over two days, community leaders, citizens, city planners, and natural resource professionals from the Saginaw Bay area took part in scientist-led group sessions and used interactive tools to explore three topics: green infrastructure, open space modeling, and nutrient modeling.

Workshop participants ended up finding out that their watersheds are in great condition but that they lack a plan to protect these largely unadulterated landscapes. Using the Tipping Point Planner modules, attendees identified priority areas for conservation.

Following the workshop, participants had access to the decision support tool and worked on generating a finalized action plan. A month later, the Tipping Point Planning team hosted a follow-up workshop with the partner organizations to support their action planning efforts.

Technology Expands to Support an Evolving Project

As it becomes more common to use spatial models in the planning process, it is more important than ever to provide users with a variety of model outputs online—something the Tipping Point Planning team is already doing and will continue to develop. This allows scientists and specialists to process more data using more sophisticated methods. And using an online platform could serve as a near real-time utility for the planning process in the future.

For more information on the Tipping Point Planner Program, visit tippingpointplanner.org or email the project extension lead, Kara Salazar, at salazark@purdue.edu. For questions regarding the use of ArcGIS technology or any of the scientific work that supports the Tipping Point Planner Program, contact Purdue professor Bryan Pijanowski at bpijanow@purdue.edu.

About the Authors

Kara Salazar is an assistant program leader and extension specialist for sustainable communities at Purdue Extension and Illinois-Indiana Sea Grant. Lydia Utley is a data analyst at Purdue University and Illinois-Indiana Sea Grant. Bryan Pijanowski, PhD, is a professor of landscape and soundscape ecology at Purdue University. Dan Walker is a community planning extension specialist at Purdue Extension and Illinois-Indiana Sea Grant. Jarrod Doucette is an academic IT specialist at Purdue University. Kristen Bellisario, PhD, is a postdoctoral research associate at Purdue University. Brian Miller, PhD, is the retired director of Illinois-Indiana Sea Grant. Michael Wiley, PhD, is a professor of natural resources and resource ecology at the University of Michigan. Ed Rutherford, PhD, is a research fishery biologist at the National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory.

Smart Community Enhances Asset Management with Location Intelligence

→ With Lucy Mobile, which works with Collector for ArcGIS, field staff can now collect and record asset data in the field.

The City of Gresham, Oregon, Implemented ArcGIS Enterprise and LucyAM to Improve Its Critical Public Service Infrastructure Data

By Raj Patil, Lucy

Gresham, Oregon, which lies about 15 miles east of Portland, is the state's fourth-largest city. While it's a city that treasures its agricultural and homesteading history, the area is growing rapidly, and residents are passionate about building a smart community.

Part of this entails better managing critical public service infrastructure, which includes assets related to water, wastewater (collection and treatment), storm water, transportation, and parks services. These assets fall under several city departments, including environmental services, budget and financial planning, and innovation and information.

To address this in the context of an expanding city, Gresham adopted a comprehensive asset management strategy as part of the Strategic Technology Plan it released in 2014. Two solutions eventually emerged that, together, serve as the core platform for implementing the plan: Esri's ArcGIS Enterprise and LucyAM from Esri partner Lucy.

The primary goal was to gain a thorough understanding of the city's assets with an eye toward managing them long term in a cost-effective way. With ArcGIS Enterprise, the city was able to create a location-based registry that now serves as the system of record for all of Gresham's public service assets. This is linked to the LucyAM solutions platform, which is the system of record for asset maintenance. From there, the city has been able to build up an arsenal of GIS-based maps, apps, and dashboards that help staff streamline their workflows and improve efficiency.

Initial Challenges Elicit a GIS Road Map

While ArcGIS Enterprise is hosted on-premises, LucyAM is a software-as-a-service (SaaS) solution that Gresham chose to host in a cloud environment. This posed challenges for integrating the two. It had the potential to limit the city's ability to deliver maps and apps to field crews on their mobile devices and could have

affected workflows that require recording field data simultaneously in the Lucy and ArcGIS environments.

To overcome these obstacles, the city's GIS and IT teams developed a road map to modernize Gresham's ArcGIS deployments. It involved implementing ArcGIS Enterprise 10.7, which would enable the city to better leverage capabilities such as field mobility, streamlined integrations, online (cloud) data management, web mapping, configurable out-of-the-box apps, and analytics.

A key part of this road map involved having the city link its GIS-managed asset registry with LucyAM, making this the standard model across the enterprise for managing asset data and engaging with location-centric information. This configuration ensures that quality-assured asset data comes from a single, authoritative source and is available to LucyAM. That way, the City of Gresham can confidently monitor asset conditions and any work or inspections being done on assets.

This setup allows users to make changes to asset records in the field using Lucy Mobile, a field app that's integrated with Collector for ArcGIS. And the quality assurance process ensures that changes made in the field get reviewed by city staff before they're included in the ArcGIS Enterprise-based asset inventory. From there, the GIS team can validate the city's asset data based on crews' field knowledge and then leverage ArcGIS technology to create maps, apps, and information products that enrich Gresham's overall maintenance strategy.

Several Ways to Think Strategically About Assets

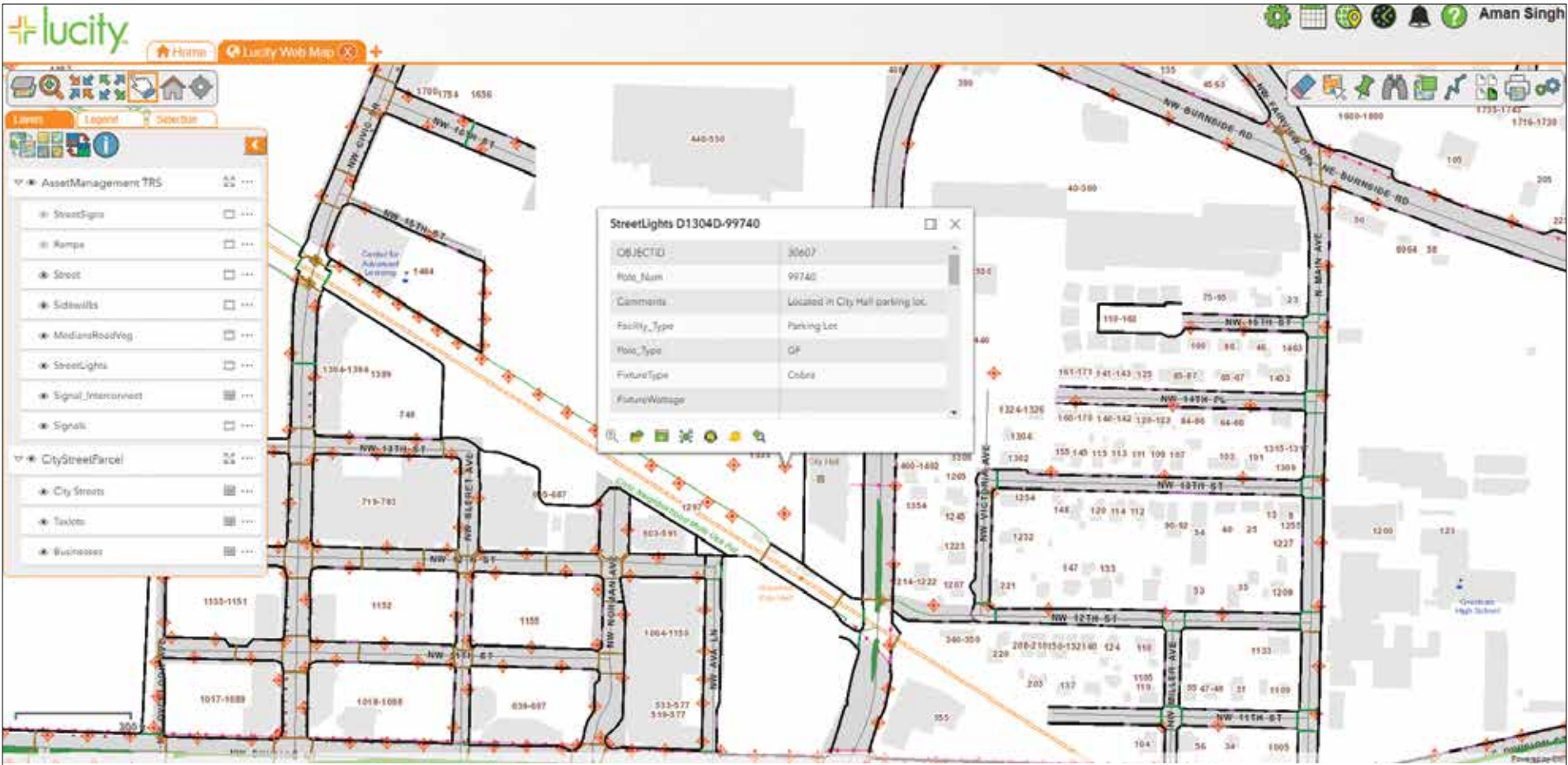
Since going live with LucyAM a year ago, the City of Gresham has streamlined how it collects data in the field and manages it in the enterprise geodatabase. This has, in turn, made it easier for the city to take advantage of other Esri technology as well, including ArcGIS Online, ArcGIS Pro, Collector for ArcGIS, Survey123 for ArcGIS, ArcGIS Insights, and Operations Dashboard for ArcGIS.

Now, for example, the city's environmental services department uses Collector and Survey123 to gather storm water asset inspection data in the field, and the records are stored in feature layers hosted in ArcGIS Online. Members of this team then visualize the data using Operations Dashboard, which provides them all with a common operating picture and allows them to monitor asset inspections, confirm asset attributes, and ensure that field crews are doing proper asset maintenance.

In addition, the city's GIS team now uses ArcGIS Pro and ArcGIS Online to create maps and apps that help staff members and the community find and visualize information about street reconstruction projects, traffic counts, the city's hydrant flushing program, and more. And field crews use Survey123 and Collector, rather than paper-based workflows, to validate asset locations and perform field inspections.

The GIS team also uses Insights to conduct various types of analyses that help city leaders make data-driven decisions. With its simple and dynamic maps, charts, and tables, Insights helps city managers and supervisors analyze asset and maintenance management data to improve asset performance. Insights helps the GIS team identify hot spots that might indicate critical failure points throughout the asset network and then put together state-of-the-art asset reports that city leaders can use to order targeted asset maintenance. This ensures that there is a clear line of sight between what the city invests in asset management and the community's service-level expectations.

"The impact of ArcGIS tools combined with the Lucy platform on meeting the city's objectives has been significant," said Chris Strong, the City of Gresham's transportation division manager. "We are starting to see greater efficiencies across our operations and an improved ability to think strategically about asset investments. It also is causing us to reexamine other business processes and workflows, which can promote better effectiveness in how we deliver services."



↑ The City of Gresham uses Lucy Web Map, part of LucyAM, to manage streetlight data.



← The city's environmental services department uses Operations Dashboard for ArcGIS to monitor storm water assets and ensure that field crews are doing proper maintenance on them.

More Accurate Data Leads to Lots of Improvements

The City of Gresham has realized a number of key benefits in using ArcGIS Enterprise and Lucity's asset management solutions. They include the following:

- **An accurate, consolidated asset registry.** Having a centralized ArcGIS geodatabase that's full of asset information operating in conjunction with a centralized enterprise asset management system ensures that asset data is always accurate and relevant. For example, the city's transportation division used to keep its asset registry for traffic signs on a single computer outside the ArcGIS geodatabase. This architecture, which bypassed typical quality assurance processes, was simpler to maintain, given how often signs have to be installed and modified in Gresham, but it resulted in having what was essentially a stand-alone record that most city personnel couldn't access. By implementing ArcGIS Online and ArcGIS Enterprise, however, the city was able to migrate this data to Gresham's comprehensive geodatabase. Now, a wider range of end users can get accurate information about traffic signs.
- **Dispensing with separate asset management systems.** As users at the City of Gresham learn the value of having a spatially relevant collection of asset data and work records, they are abandoning the separate asset management platforms, databases, and spreadsheets they used to use. For instance, a database that was set up to track how the city responds to illegal

dumping in Gresham's storm water system is getting moved to LucityAM, where it is being integrated with a map that shows related assets—such as inlets, pipes, and manholes—that may influence how the city responds.

- **Improved communication.** LucityAM's configurable dashboard allows users to select and visualize work orders based on certain criteria, including who is managing the work order and when a response is expected. This has been helpful, in particular, for managing requests related to streetlight outages, since information is often passed among city staff, contractors, and the electric utility en route to resolving the issue.
- **Timely tracking of expenses.** When an asset is damaged, the City of Gresham can now use a map to identify which asset it is and then use LucityAM to keep track of all the labor and materials costs that go into repairing or replacing it. This allows the city to get reimbursed for damaged assets more quickly.
- **Being able to prioritize assets for repair and replacement.** The City of Gresham is currently exploring how to take several streams of integrated data and link them to consolidate capital improvement projects. For example, Gresham is embarking on a multiyear project to repave a quarter of its streets. Using ArcGIS and Lucity software, city leaders have been able to identify where this project coincides with underground assets that are in poor condition. Now, when the city closes streets for repaving,

engineers can get to the underground assets while the pavement is stripped and fix or replace them before the new pavement goes down. Not only does this coordinated process provide a timelier, more cost-effective schedule for replacing utility assets, but it also cuts down on how often traffic gets impacted by street closures.

Effective Data Governance Produces a Smarter Community

Now that the City of Gresham has one system of record that streamlines its asset information and associated inventory and maintenance schedules, city staff can be assured that, no matter where or how they access the data, it is quality assured and authoritative. With the location intelligence capabilities of the ArcGIS platform working in step with the comprehensive tools of LucityAM, asset managers can ensure effective and efficient data governance. All this means that the City of Gresham can operate its critical public service assets at their lowest possible life cycle costs. That's the way to build a smart community.

About the Author

Raj Patil is the director of strategic alliances and international business for Lucity, a Central Square Company.

Master demographic analysis tools and techniques—online

As a student in our 12-credit Graduate Certificate or 30-credit Master of Professional Studies in Applied Demography program, you can explore:

- › principles of demography and measurement of population dynamics
- › geospatial data and methods in diverse applied settings
- › the application of demographic tools in marketing, planning, public policy, and research
- › the integration of theory, data, and methods in project development utilizing applied demographics

Now accepting applications for the 2020 academic year.

worldcampus.psu.edu/adesri



A world of possibilities. Online.

Managing Data Geospatially Makes Pipeline Operator More Efficient

Crestwood Equity Partners LP is a Texas-based midstream pipeline operator that offers a range of services, including storage, transportation, marketing, and supply and logistics for natural gas, natural gas liquids, crude oil, and disposed water. The company operates approximately 2,300 miles of pipeline onshore in the contiguous United States and provides all its services with a commitment to safety, compliance, and sustainability.

Maintaining and managing data are key to Crestwood's successful day-to-day operations. But the company had three disconnected databases, which made this more difficult. So the GIS team decided to merge Crestwood's databases into one and chose a new data management system—the ArcGIS Pipeline Referencing extension—to better edit and administer its information.

How to Make Data Management More Uniform

Crestwood collects a variety of data to support pipeline operations, including events along the pipeline, such as road and water crossings, and details on pipeline locations. The data helps Crestwood manage pipeline installation and maintenance, as well as environmental and population risks. Because the company has field offices around the United States, streamlining data management was a top priority to improve operational efficiency.

To bring its databases together, Crestwood looked to implement a geodatabase data model that involved a spatial implementation of the pipeline open data standard (PODS), a database designed specifically for managing pipeline data. The team also wanted a compatible tool that would work with PODS to edit data and improve information management.

“Every operator has to choose how they store their data and what tools they want to use to interact with that data and report it throughout their organization,” said Craig Hawkins, GISP, Crestwood's manager of asset information and GIS. “This primarily supports operational needs and meeting regulatory requirements. So we needed a way to make managing data more uniform.”

Turn to ArcUser for GIS Technical Know-How


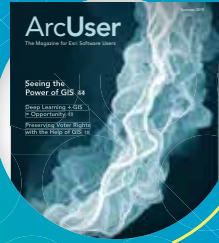
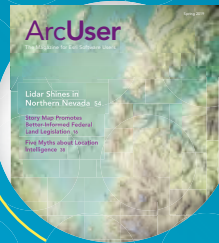
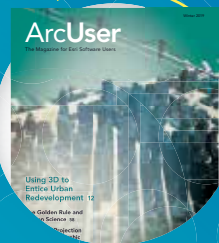
If you are working in the rapidly changing world of GIS, *ArcUser* magazine can help you improve your skills and become more productive with Esri® software.

Professionals in the industry and Esri staff share their expertise through the following:

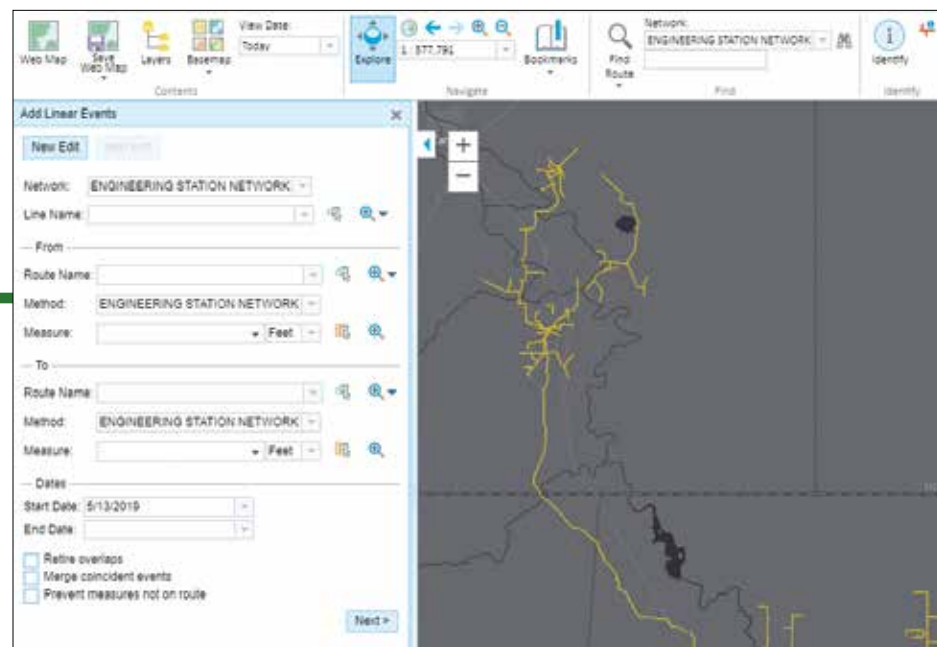
- Step-by-step tutorials
- How-to technical articles
- Tips and tricks
- Features

ArcUser, published four times a year by Esri and available to users at no charge, also publicizes GIS courses, upcoming conferences, and books about geospatial technology.

Subscribe today at go.esri.com/subscribe.



Copyright © 2020 Esri. All rights reserved.



↑ The data Crestwood collects to support pipeline operations is now managed from one solution.

Crestwood chose ArcGIS Pipeline Referencing to complement PODS and help with data editing. An extension to ArcGIS Pro and ArcGIS Enterprise, ArcGIS Pipeline Referencing lets users integrate data from multiple linear referencing system (LRS) networks so data managers can get a comprehensive view of pipelines.

Financially Sound and Flexible Choice

When Crestwood migrated to the PODS database in November 2017, the GIS team simultaneously implemented ArcGIS Pipeline Referencing tools.

“After evaluating many pipeline data management software options in the market, we decided to implement ArcGIS Pipeline Referencing software,” said Heidi Shannon, Crestwood's supervisor of pipeline as-builts, records, and data. “The intuitive interface and integration with our existing enterprise GIS platform allowed for a smooth implementation.”

The use of ArcGIS Pipeline Referencing made financial sense for Crestwood as well. Only one person out of Hawkins's seven-person team is assigned as the main editor, so the company was able to purchase just one license at an affordable price to suit its business needs.

Crestwood also chose ArcGIS Pipeline Referencing for its flexibility. Hawkins explained that with other software providers, the company's data would be locked into a proprietary data model, whereas with ArcGIS Pipeline Referencing the team can use any data model it chooses. Additionally, Hawkins likes being able to work directly out of a geodatabase and said the tools are simple to use.

Hawkins and the GIS team worked closely with the Esri product team and a third-party vendor throughout the testing and implementation phase to get guidance and assistance. Over a period of about six months, the team tested ArcGIS Pipeline Referencing in a development environment, trying out a variety of workflows before the solution went into production.

Data Is Now Easy to Manage, Share, and Use

Implementing ArcGIS Pipeline Referencing has already improved data management at Crestwood. Because data is now stored in one place, information can easily be shared with the entire organization.

“Some of the different workflows we had were not efficient,” recalled Hawkins. “Simply having everything in one location has been tremendously helpful. We have had efficiency gains across the board because we can easily manage that database and report out from one location instead of three.”

Staff at Crestwood are keen on a variety of features the extension offers, including the user-friendly interface and the ability to version.

“All the tools are pretty straightforward in the interface, and versioning allows us to keep track of our data governance,” said Hawkins. “We are able to make our edits in a version and then perform *[quality assurance and quality control]* before we post and reconcile to the database.”

Once the data is published with the software, it is available in Crestwood's GIS environment quickly. This includes any map services. As such, internal stakeholders who use the company's web app can consume the data almost immediately.

Hawkins is also pleased that ArcGIS Pipeline Referencing enables the team to maintain compliance with the Pipeline and Hazardous Materials Safety Administration (PHMSA), the regulatory body that oversees pipelines. This means that the team can manage all its ArcGIS technology—as well as all its records, data, and software—without the help of a third-party vendor.

“The Esri software *[including ArcGIS Pipeline Referencing]* has allowed us to link records to our features in our geodatabase, so they're easily accessible in different formats, like web apps,” Hawkins explained.

This meets PHMSA's requirement that certain data and its associated records be traceable, verifiable, and complete (TVC).

“Publishing our data via web apps has allowed different stakeholders to interact with information more efficiently,” said Hawkins. “We've heard positive feedback from stakeholders throughout the company.”

New Expressive Tools for Storytelling

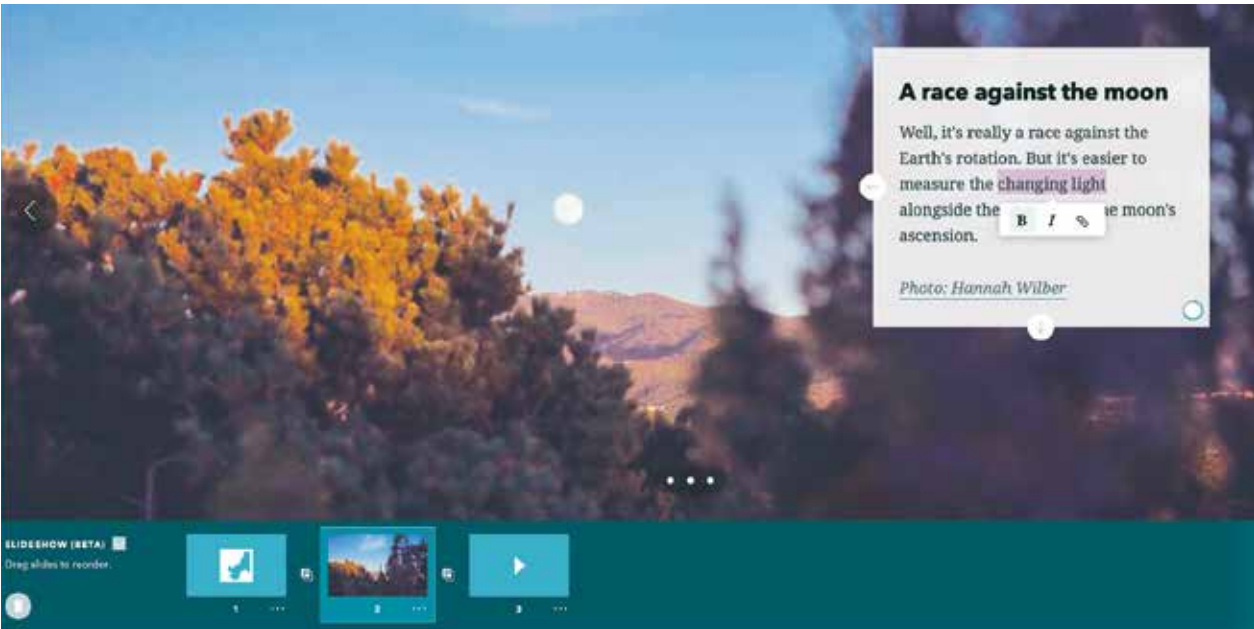
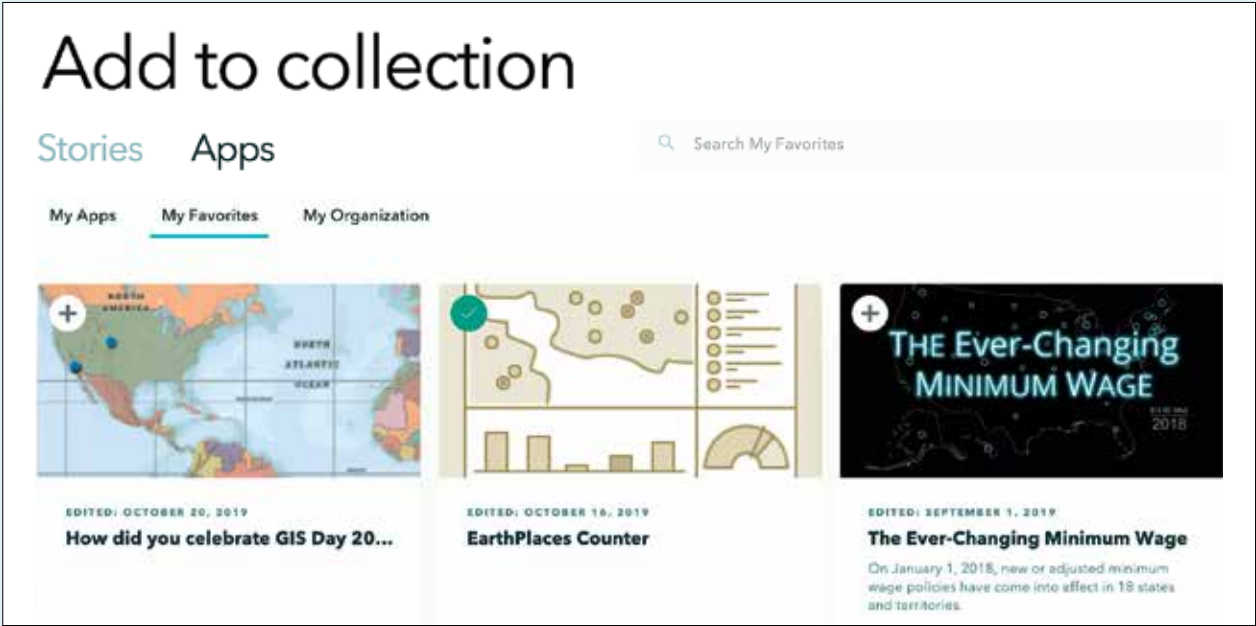
Updates to ArcGIS StoryMaps Enhance Capabilities and Increase Ease

ArcGIS StoryMaps, Esri’s new storytelling app, has several new features to help users design and tell their stories more creatively. New capabilities allow users to automatically play stories from beginning to end, make collections of related stories, present a slideshow, and preview stories on different devices.

Turn on Autoplay
With published stories, users can now play them automatically from beginning to end on a loop. This is great for showcasing a story map that isn’t intended to be actively read—for example, on a kiosk monitor at a conference. By clicking the More Actions button in the header, users can select the option to turn autoplay on or off.

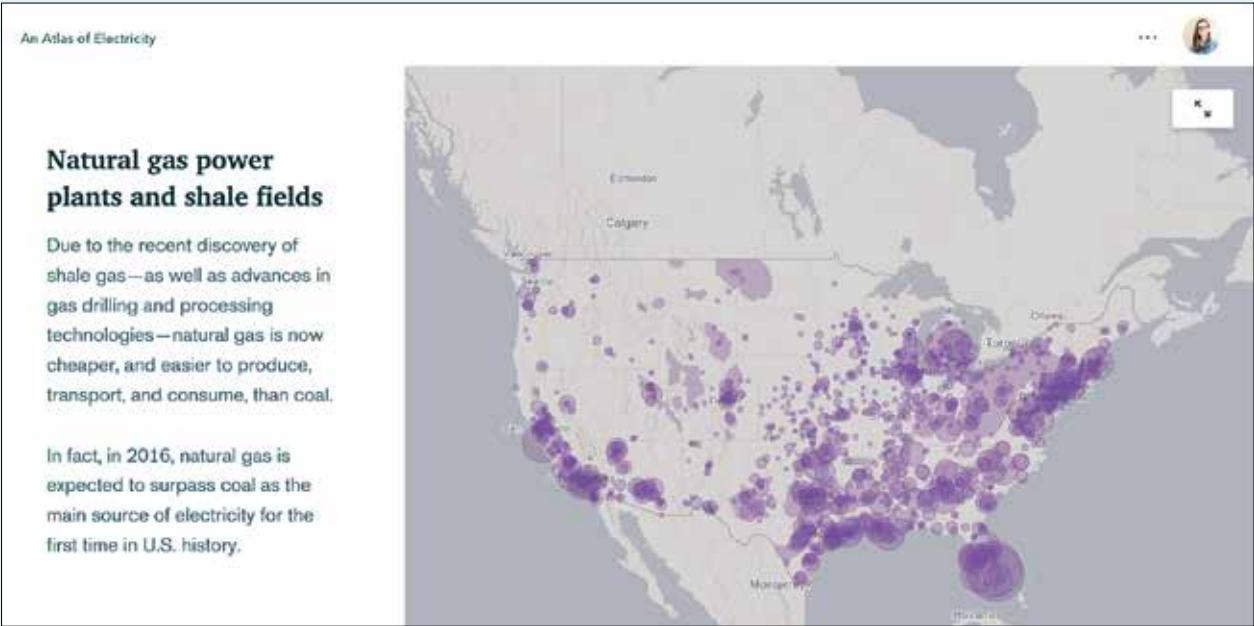
Author Collections
Users can now bundle related and thematic stories and apps by authoring collections (also in beta), which makes them easier to present and share. Creating a collection is simple. Users just have to click on their profile picture and then click on My Collections, where they can add story maps to a set. When publishing a collection, users can choose whether to share it with everyone or just their organization, depending on the desired audience.

→ Users can put related story maps and apps in a collection.



Put on a Slideshow
A new immersive block called Slideshow (currently in beta) allows users to more easily turn their stories into live presentations. It works best for displaying full-page media, such as images or videos, with small amounts of descriptive text in a narrative panel. Users can add a series of slides to sections of their story maps. Viewers can then move laterally through the slideshow by either using the arrows on the right and left edges of the screen or swiping left and right on touch screen devices. After they have looked at the slideshow content, viewers can keep scrolling down through the rest of the story map.

← The immersive Slideshow block lets users add a sequence of slides to their story maps.



↑ Users can preview how their stories will display on different screen sizes.

Preview Stories on Multiple Devices
As users author and make changes to stories, they can now use the Preview button in the ArcGIS StoryMaps app’s header to see how their stories display on small, medium, and large screens. Users can then make adjustments based on what their content will look like on a phone, tablet, or desktop computer.

Get Started
Ready to take these enhancements for a spin? Try out the new ArcGIS StoryMaps capabilities at storymaps.arcgis.com. To learn more, see great stories from the story maps community, and find helpful resources for getting started, visit esri.com/storymaps.

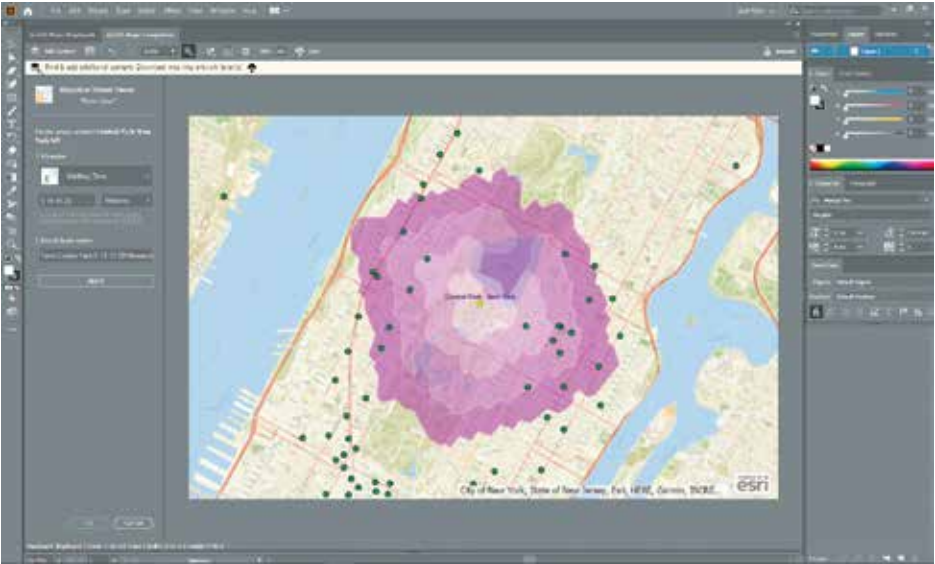
New Subscription Option Lets More Creatives Reimagine Mapping

ArcGIS Maps for Adobe Creative Cloud Plus Offers Middle Ground User Option

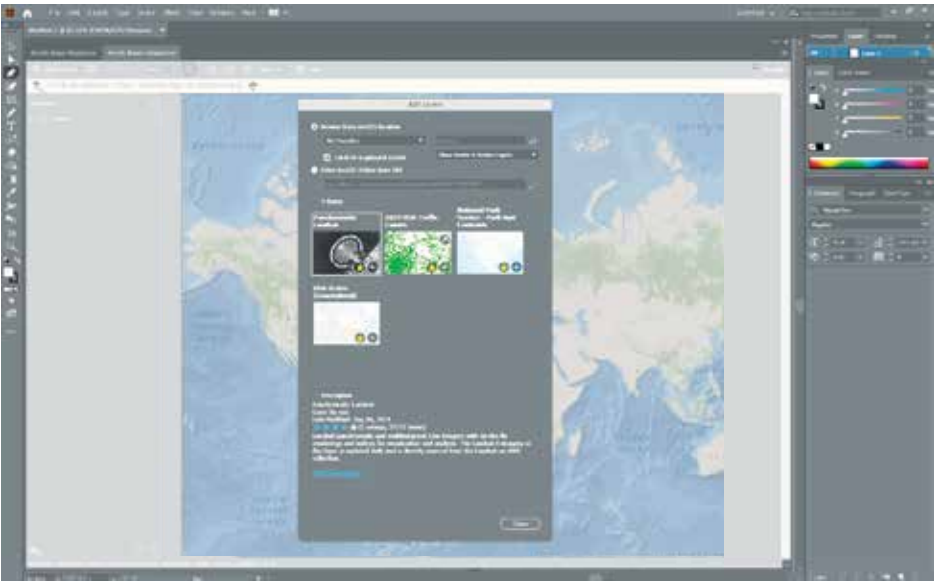
ArcGIS Maps for Adobe Creative Cloud, a downloadable extension for Adobe Photoshop and Adobe Illustrator, gives creatives an easy way to incorporate data and maps into their designs. And with the new Maps for Adobe Plus user option, released in September 2019, users can now run a number of different visualization tools, designate their most-used maps as favorites, and add demographic data to their projects—all while running the extension in Adobe Creative Cloud.

Prior to Plus, Maps for Adobe was only available with an ArcGIS Online account or as a complimentary extension to Photoshop and Illustrator. Users who opt for the ArcGIS Online account pay a higher price and are provided with all the bells and whistles of Maps for Adobe, as well as ArcGIS apps and services that allow for private sharing within an organization. But some designers and cartographers don't need everything that comes with ArcGIS Online, so they've been able to use the Complimentary option, which operates within Photoshop and Illustrator. While this plan gives users access to public maps and layers hosted in ArcGIS Online, it limits how designers can use the maps and projects they create with the plug-in.

With Maps for Adobe Plus, which costs just \$10 per month, users now have access to the visualization tools they need to create exciting, map-based narratives that incorporate sharp design and branding. Users of Plus can also do more with data-driven analysis tools than Complimentary users can. They can bring premium basemaps and hundreds of data layers into their Photoshop and Illustrator projects as well without leaving their Adobe software programs. With Maps for Adobe Plus, designers have full distribution privileges to their maps and designs (as long as they comply with standard Esri attribution guidelines).

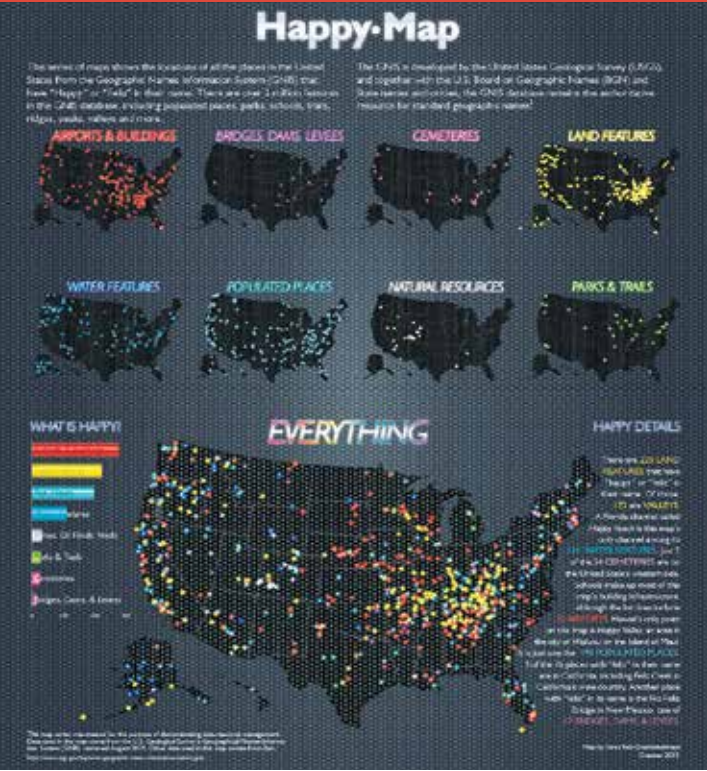


↑ The new Visualize Travel Times tool in Maps for Adobe Creative Cloud Plus calculates the area someone can walk, drive, bike, or take public transit to within a specified time or distance.



↑ Plus users can create a favorites list of items they've added to Photoshop or Illustrator from ArcGIS Online, making it easier to keep track of and find particular basemaps and layers.

→ Users of Maps for Adobe Plus can do more with data-driven analysis tools than Complimentary users can.



↑ With Maps for Adobe, designers can create exciting narratives that tell geographic stories, such as where cheetahs used to be found throughout Africa (the map) versus the areas they inhabit now (the rock formations).

ArcGIS Maps for Adobe Creative Cloud was built with Adobe users in mind. The product's interface mimics the look and feel of Adobe's core products, so users have a sense of familiarity when using it. For any project that involves maps, such as illustrations for a book or slides for a sales presentation, users of Maps for Adobe Creative Cloud can design appealing visuals that pull location-based data into easy-to-read maps.

Some of the new things users can do with the advanced features in Plus include the following:

Visualize Travel Time—Similar to the Create Drive-Time Areas tool in ArcGIS Online, the new Visualize Travel Times tool in Plus employs ArcGIS technology to calculate the area someone can walk, drive, bike, or take public transit to within a specified time or distance along a street network. Users can create multiple visualization projects—showing how far someone can walk in three, five, or seven minutes, for example—by entering either the times it will take to travel or the distances to be traveled, separated by a space. This saves designers from having to analyze multiple travel times and distances themselves.

Put Items on a Favorites List—Users can now create a favorites list of items they've added to Photoshop or Illustrator from ArcGIS Online. For example, if a designer is working on two separate projects—say, a map of a city's public transportation options and an unrelated poster that shows where city services are located—he or she can keep track of the basemaps and layers for each project in distinct lists. Once the user has designated items as favorites, he or she can use mapboards in Photoshop or Illustrator to find them.

Add Demographic Data—Maps for Adobe Plus also gives users demographic and landscape data for the people, places, and boundaries associated with specific points, lines, or polygons. It uses ArcGIS GeoEnrichment Service, which provides facts about particular locations and areas, and can enrich any point, line, or area feature. Users can also employ the GeoEnrichment Service to obtain geographic context for their projects, such as a town's ZIP code or the geographic boundaries for a drive-time service area.

Reimagine mapping. Try ArcGIS Maps for Adobe Creative Cloud Plus today by downloading it at esri.com/mapsforadobe.

The Relevance of Cartography

A Cartographer's Perspective

A column by Tim Trainor

President of the International Cartographic Association



The Importance of Institutions

Institutions are important. While there may be a tendency to think of institutions as physical things, such as buildings on a university campus, institutions are also people.

Universities and government agencies are examples of crucial institutions that advance the fields of cartography and geospatial science. Professional associations are also institutions and serve different purposes. For instance, national and international cartographic associations—like the International Cartographic Association (ICA), which celebrated its 60th year in 2019—bring together people who have various levels of interest in maps, mapping, and other related topics in geospatial science. These institutions can include formally trained cartographers, professionals who practice cartography in their work, researchers in a diverse range of geospatial science topics, and people who have a general interest in cartography and maps. Lots of people love maps, so it's easy to see why those who share this interest come together through the various programs put on by cartographic organizations.

Institutions like national and international professional societies are well positioned to address areas of interest in cartography and GIScience for those who are beginning to explore or are already immersed in the profession. These societies often have a better understanding of trends in their field than federal agencies, universities, or other organizations do. National and international societies also provide a forum with various channels that members can use to discuss ideas, share experiences, and advance their professional practices. These channels include national and regional conferences that offer attendees opportunities to present ideas, show research findings, or simply meet colleagues to catch up on what they've been working on recently. Last July, cartographers convened in Tokyo for the 29th International Cartographic Conference (ICC), a biennial event that offers an extensive program for learning, sharing, collaborating, and having fun. The next ICC will take place in Florence, Italy, in July 2021.

Another channel that professional associations make available is publications, which offer members the opportunity to disseminate thoughts, ideas, findings, and experiences. Many national cartographic societies have journals and publications that highlight recent works. For example, the *Cartography and Geographic Information Science* journal in the United States has a long history as a peer-reviewed publication outlet. The ICA's *International Journal of Cartography* serves as an international medium for publishing research and development in cartography and geospatial science and helps ensure the relevance of cartography on a global scale. The most recent edition, published in May 2019, captures the 14 best papers from the ICC in Tokyo.

Publications take on other forms as well, such as websites, newsletters, and proceedings. The first point of entry for gathering information about the ICA, what it is about, and what it has to offer as an international professional association is through its website, icaci.org. The organization devotes considerable effort to ensuring that its website contains relevant and timely information for everyone's use. The ICA also offers several other publications, available at icaci.org/publications, for those seeking information about cartographic and GIScience research, upcoming events, and general information about the ICA. All the contributions by authors and presenters at the 2019 ICC are now available there, as are publications and proceedings from past conferences stretching back to 1993. *The ICA News*, which is also accessible from that page, is a newsletter published twice a year that features work from members and other professionals covering a wide variety of topics on cartography and geospatial science. *eCARTO News*, another popular ICA newsletter that's published monthly, captures the latest interesting cartographic news and developments from around the world. Cartographers can also share their ideas and work with a diverse global community of GIS professionals through this publication, Esri's *ArcNews* magazine.

The bulk of the ICA's work is done through commissions and working groups whose

subject matters reflect topics that are of interest not only to the professional cartographic community but also to society at large. There are currently 28 commissions at the ICA, though that number changes every four years, and the issues that they address vary dramatically. The full list, available at icaci.org/commissions, reflects the diversity of cartography and geospatial science, though it does not necessarily demonstrate the comprehensive nature of the disciplines. Some of the themes these commissions cover include education and training, geospatial analysis and modeling, location-based services, map design, spatial data infrastructure (SDI) and standards, and user experience. A few commissions focus on special interest themes as well, including how cartography and children come together and the production of maps and graphics for people who are partially sighted or blind. And for any pressing topics that are not covered by commissions, the ICA Executive Committee establishes a working group.

A perfect example of the value of institutions like the ICA can be seen through the work of the Commission on SDI and Standards. Government departments and agencies, commercial enterprises, universities, and even the general public rely on geospatial data, but standards didn't always exist for geospatial data or even software and hardware. In some cases, separate efforts within the same organization resulted in different systems. One problem that was evident early on was that one system and its data could not work within another system. When government agencies recognized the need for standards, they reached out to national cartographic associations and, ultimately, the ICA to coordinate efforts to work on this. Having standards within a nation leads to greater effectiveness and efficiency, and having standards that are useful globally has an even greater benefit. The Commission on SDI and Standards began coordinating with the International Organization for Standardization (ISO) and later with other professional organizations, such as the Open Geospatial Consortium, Inc. (OGC), and a careful, scientific, and practical approach to formulating geospatial standards emerged. Today, as the field of geospatial data and technology evolves, the ICA's Commission on SDI and Standards continues its important work.

Institutions continue to offer us platforms for collaboration. Members can share a common purpose, expand their knowledge, and—as with the ICA Commission on SDI and Standards—achieve goals that allow their discipline to move forward. The valuable work advanced by the ICA continues to influence new developments, improve current capabilities, and encourage participation by diverse professionals around the world.

About the Author

Tim Trainor is a part-time consultant to the United Nations (UN) and is the former chief geospatial scientist for the US Census Bureau. He has extensive experience in cartographic and geospatial topics that include exploring methodological, technical, and substantive issues relating to cartography and the collection, management, and integration of geospatial information. Trainor served as cochair for the UN Committee of Experts on Global Geospatial Information Management and as head of the US delegation to that committee. He was the senior agency official for geospatial information for the US Department of Commerce and was an executive member of the US Federal Geographic Data Committee. He is involved with several professional associations, including the Cartography and Geographic Information Society. Trainor holds a postgraduate diploma in cartography from the University of Glasgow, Scotland, within the Faculty of Science; a master's certificate in project management from the George Washington University School of Business and Public Management; and a bachelor of arts degree from Rutgers University.



geoSherpa™

Your Guide to Web GIS

**Empower Users
Simplify Web GIS**

Web GIS Training Solution

- Step-by-Step Guided Tours
- Video Tutorials
- Frequently Asked Questions



www.geowidgets.io



**Want to mitigate this?
Learn how at
cgu.edu/giscert**

**CENTER FOR INFORMATION
SYSTEMS & TECHNOLOGY**
Claremont Graduate University

**Get GIS News,
Views, and
Insights from
ArcWatch**

Current and future mapmakers and geospatial app makers can have the latest stories, tech tips, training information, and product news delivered straight to their in-boxes.

go.esri.com/subscribe

Copyright © 2020 Esri. All rights reserved.

How to Grow Your GIS Career

By Haley Zehentbauer and Rachel Rodriguez, Urban and Regional Information Systems Association's Vanguard Cabinet

What is the best way to grow my career in the geospatial industry?

Many emerging GIS professionals ask themselves this question. But navigating and making the most of a budding career can be daunting. It is especially challenging to do in a technology-driven culture, where things seem to be ever evolving. So how can you manage yourself and your aspirations in a way that leads you down a path of success?

Getting educated on the latest technologies is a start, though lack of funds for training can impede this. Having employers support your professional development can help, though some organizations don't make this a priority.

Regardless of which side of the coin you're on, investing in yourself opens up an abundance of opportunities to expand and grow. That's where getting involved with a professional organization comes in. Many GIS practitioners use them to get to know the geospatial community, explore new career paths, and give back.

The Urban and Regional Information Systems Association (URISA) offers scores of ways to get involved with and learn from the geospatial community. For emerging geospatial practitioners, URISA also provides considerable guidance for how to develop a successful career in the GIS industry.

Various Ways to Get Involved

Participation in a professional organization doesn't follow a specific formula. Everyone has commitments in their home and work lives, so contributions take many forms, from attending events or volunteering to help with activities to being a member of a committee or accepting a leadership role. Any contribution will pay dividends not only to your professional growth but to the geospatial community as well.

The key to getting involved is to try to find a niche that piques your interest or that can expand your geospatial skill set. At

URISA, there are more than 10 committees that members can volunteer with, including the Policy Advisory Committee, the Professional Education Committee, the Marketing Committee, and the Vanguard Cabinet.

Most young professionals are encouraged to participate in the Vanguard Cabinet, an advisory board composed of emerging GIS professionals who organize events and programs targeting those who are new to the field. This group is an excellent introduction to URISA, but keep in mind that it is not the only option for young professionals. Local URISA chapters, which put on their own events, educational workshops, and webinars, also have committees that need members. And if your state or province doesn't currently have a local URISA chapter, then there's certainly an opportunity for you to establish one.

Another way to get involved with the geospatial community early in your career is to volunteer with GIS Corps, which provides free GIS services to communities in need. This is a great way to gain experience while giving back. And if you just graduated or aren't super technical, don't worry; GIS Corps doesn't turn people away and gives volunteers all sorts of opportunities to develop new skills.

The Business Value of Professional Development

Ideally, managers and team leads should consider their staff members' career goals and provide adequate flexibility and opportunities for professional development. Doing so can help managers identify employees who are dedicated to building their technical and nontechnical skill sets and even pinpoint some of them for future leadership roles.

Two additional benefits of giving employees time to engage in professional development are that it helps retain top talent and encourages staff to speak highly of the organization to potential clients and hires. Thus, by helping employees progress alongside their geospatial industry colleagues, companies open themselves up to growing their businesses in new ways.

Managing GIS

A column from members of the Urban and Regional Information Systems Association



For emerging GIS professionals who work at organizations that encourage professional development, they should always maintain an open dialogue with their team leads about how much time they can devote to it. This shows respect for the company and the team's workload.

For those whose employers do not formally recognize the value of professional development, don't get discouraged! You can still evolve as a GIS professional. You just need to find creative outlets, areas for exploration, and avenues for continued education outside of work.

URISA's Unique Appeal

Why should emerging geospatial professionals get involved with URISA specifically? Put simply, it's a worthy investment in yourself and your career.

Being a member of URISA and participating in events exposes young and emerging GIS professionals to other people in the industry—in particular, those with more experience. This not only enables new geospatial practitioners to strengthen their networks, but it also increases their chances of forming mentor-mentee relationships. In addition, URISA helps members build leadership and management skills and learn new and emerging technology.

Many members cite growing their networks as the most rewarding part of being involved with URISA. The organization provides numerous opportunities for members to meet colleagues from around the world, make new friends, share ideas, and find people to work with. Some of these connections could end up having a lasting effect on your career.

At URISA, young professionals gain valuable educational experiences while giving back to the GIS community. And don't forget, if you're aspiring to become a certified GIS Professional (GISP) through the GIS Certification Institute (GISC), being involved in and making contributions to the profession are vital to receiving and maintaining certification.

Make Opportunities Happen

In countless ways, URISA helps emerging GIS professionals improve their skills, enhance their contacts, and reach their career goals. Perhaps more importantly, it also provides them with a way to give back to the GIS community. So young professionals have a lot to gain by becoming members.

Ultimately, you are in the driver's seat of your career. As an emerging professional in the GIS industry, you can navigate where you want to go by taking advantage of opportunities that exist through URISA. But don't just wait for these opportunities to present themselves. Go out and make them happen!

Take a look at your future and ask yourself if you know the best way to grow your career in the geospatial industry. If you need help, URISA is always there.

For more information on how to get involved with the geospatial community, email Haley Zehentbauer at haley.zehentbauer@outlook.com or Rachel Rodriguez at rachel.r.rodriguez@gmail.com.

Young professionals and Vanguard Cabinet members from the Urban and Regional Information Systems Association (URISA) pictured in October 2019. From left to right, Caitlyn McNabb, Christina Brunsvold, Rachel Rodriguez (front), Kristin Johnston, Caitlyn Meyer, Alex Lopez-Rogina, and Haley Zehentbauer (back).



About the Authors

Haley Zehentbauer graduated from Youngstown State University and is a business analyst for the Stark County, Ohio, IT department. She is past president of the Ohio chapter of URISA and the current chair of URISA's Vanguard Cabinet. Rachel Rodriguez, GISP, has more than 10 years of experience working in the geospatial community for state, local, and tribal governments. She is currently a senior GIS analyst at Los Angeles County and the coordinator for its Countywide Address Management System (CAMS). Rodriguez recently wrapped up her term as chair of URISA's Vanguard Cabinet.

New Training and Certification Offerings

Training

New Instructor-Led Courses

Esri's instructor-led courses are developed in-house by subject matter experts who have a deep understanding of ArcGIS best practices and recommended workflows. All instructors have Esri Technical Certifications and CompTIA CTT++ certification. Courses are available online, at Esri training centers nationwide, and on-site at customer organizations.

For experienced intelligence analysts, a new course covers how to apply the latest ArcGIS tools to imagery. And managers can now learn how to get that all-important employee buy-in for undergoing digital transformation.

- **Image Exploitation for Defense and Intelligence**

Learn essential concepts for visualizing and analyzing imagery using ArcGIS Pro and ArcGIS Image Analyst. Geared toward imagery analysts in the defense, intelligence, and national security communities, this course explores a variety of imagery data and tools and provides hands-on practice with common imagery workflows, including mensuration, change detection, and image classification.

- **Preparing for Change**

Managers who are modernizing GIS-supported workflows or deploying ArcGIS capabilities that will disrupt how employees work will benefit from this course. An Esri change management practitioner facilitates open discussion and focused planning as attendees learn to apply the foundational steps of a people-focused change management initiative. Course materials include templates that participants can use to jump-start their change management efforts immediately after class.

Keep Your Tech Skills Sharp with Esri MOOCs

Massive open online courses (MOOCs) are free, convenient, and fun ways to stay up-to-date with GIS topics and fast-changing technologies. Participants get access to ArcGIS software, and each course includes video lectures by Esri experts, hands-on software exercises, and interactive forums to engage with learners from around the world. A certificate of completion is awarded to everyone who completes all the course content.

- **Spatial Data Science: The New Frontier in Analytics**

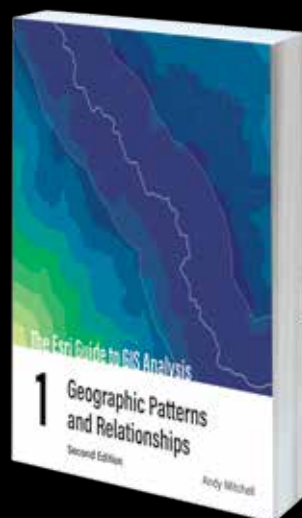
In this six-week MOOC, opening February 26, 2020, learners will discover how to extract deeper insight from data using advanced analytical methods, predictive models, and spatial algorithms, including machine learning and deep learning techniques. The course includes access to ArcGIS Pro, ArcGIS Notebooks, ArcGIS API for Python, and popular open data science packages. Learn more and register at go.esri.com/sds-mooc.

Esri Press

The Esri Guide to GIS Analysis, Volume 1: Geographic Patterns and Relationships, Second Edition

By Andy Mitchell

In the second edition of *The Esri Guide to GIS Analysis, Volume 1: Geographic Patterns and Relationships*, author Andy Mitchell helps readers understand the basis of spatial analysis: geographic patterns and relationships. This new edition, with easier-to-read maps and text, dives beneath the surface of mapping, beyond simply displaying data to reveal geographic insights. It shows readers the basic concepts of spatial analysis and GIS and helps them establish essential map-building skills so they can better use the technology to uncover patterns and reveal relationships. The new *Esri Guide to GIS Analysis, Volume 1*, also includes online lessons that reinforce the concepts outlined in the book. Both new and experienced GIS users will find the guide useful for building the skills they need to be able to handle a wide range of analysis and do more advanced GIS. April 2020, 300 pp. E-book ISBN: 9781589485808 and paperback ISBN: 9781589485792.



For more information on all Esri Press publications, visit esri.com/esripress.

Certification

The Directory of Esri-Certified Individuals, available at go.esri.com/directory, now includes more than 3,000 people around the world who have validated their expertise in applying ArcGIS software. Together, these experts have earned more than 8,500 Esri Technical Certifications.

Certified individuals can elect to share their achievements in a personal success story published on the Esri Training website. These stories offer a glimpse into how a passion for GIS often leads to new opportunities and unexpected journeys.

Esri instructor Cheyenne Armstead disliked science classes all the way through college—until she enrolled in a geography class. “[It] changed the trajectory of my whole life,” she said. “I was introduced to GIS and fell in love with it.”

After earning a bachelor's degree in geography, she taught high school before deciding to return to school and earn a master's of science in GIS. Armstead credits her dual love of GIS and learning for successfully achieving the ArcGIS Desktop Associate certification (go.esri.com/arccgis-desktop-associate).

“Who knew that my earlier disdain for science would turn into a full-blown passion,” she exclaimed.

Looking for inspiration for your GIS journey? View all certification success stories at go.esri.com/certification-success and explore the latest Esri Technical Certification exams, at esri.com/training/certification. Also join the Esri Technical Certification groups on LinkedIn and GeoNet to connect with other professionals and discuss all things certification.



Go to esri.com/training for more information. Find courses at esri.com/training/catalog/search. Keep up with Esri training news by subscribing to the newsletter (go.esri.com/training-news), visiting the *Esri Training Matters* blog (esri.com/trainingblog), connecting with the Esri Training Community on GeoNet (go.esri.com/training-community), and following @EsriTraining on Twitter.

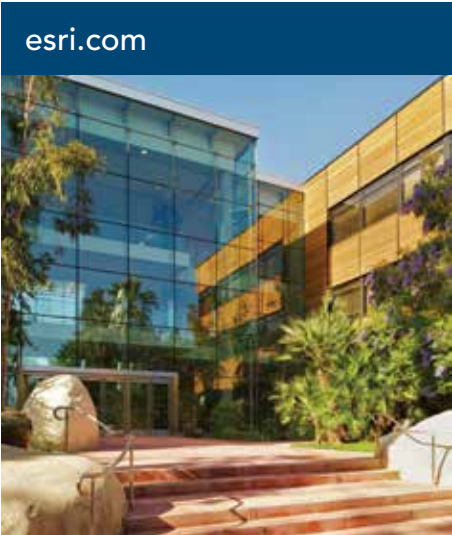
Extend the Capabilities of ArcGIS

Discover a world of apps, data, solutions, and services from Esri's global partner community.

go.esri.com/arccgismarketplace



Esri Corporate Headquarters



- Esri Technical Support
esri.com/support
- Esri Desktop Order Center and Software Information
Tel.: 1-800-447-9778 (USA only)
- Esri Products
esri.com/products
- Esri Store
esri.com/store
- Esri Developer Network
developers.arcgis.com
- Customer Care Portal
my.esri.com

Esri US Regional Offices

- Boston—Middleton, MA
Tel.: 978-777-4543
- Charlotte—Charlotte, NC
Tel.: 704-541-9810
- Denver—Broomfield, CO
Tel.: 303-449-7779
- Minneapolis—St. Paul, MN
Tel.: 651-454-0600
- Olympia—Olympia, WA
Tel.: 360-754-4727
- Philadelphia—Chesterbrook, PA
Tel.: 610-644-3374
- Redlands—Redlands, CA
Tel.: 909-793-2853, ext. 1-1906
- San Antonio—San Antonio, TX
Tel.: 210-499-1044
- St. Louis—St. Charles, MO
Tel.: 636-949-6620

Federal Office

Washington, DC—Vienna, VA
Tel.: 703-506-9515

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

Esri Distributors Worldwide

- Esri Australia Pty. Ltd.—Australia
www.esriaustralia.com.au
- Esri BeLux N.V.—Belgium
www.esribelux.com
- Esri Bulgaria Ltd.—Bulgaria
www.esribulgaria.com
- Esri Canada Limited—Canada
www.esri.ca
- Esri Chile S.A.—Chile
www.esri.cl
- Esri China (Beijing) Holding Co. Ltd.—China
www.esrichina.com.cn
- Esri Colombia SAS—Colombia
www.esri.co
- Esri Northeast Africa—Egypt
www.esrinea.com
- Esri Finland Oy—Finland
www.esri.fi
- Esri France S.A.—France
www.esrifrance.fr
- Esri Deutschland GmbH—Germany
www.esri.de
- Esri China (Hong Kong) Limited—Hong Kong
www.esrichina.hk
- Esri India Technologies Ltd.—India
www.esriindia.com
- Esri Italia Sp.A.—Italy
www.esriitalia.it
- Esri Japan Corporation—Japan
www.esrij.com
- Esri Eastern Africa Limited—Kenya
www.esriea.co.ke
- Esri Lebanon sal—Lebanon
www.esrilebanon.com
- Esri Southern Africa—Mauritius
www.esri-southernafrica.com
- Esri Nederland B.V.—The Netherlands
www.esri.nl
- Esri Muscat Co LLC—Oman
www.esrimuscat.com
- Esri Panama, S.A.—Panama
www.esri.pa
- Esri Polska sp. z o.o.—Poland
www.esri.pl
- Esri Portugal—Sistemas e Informação Geográfica, S.A.—Portugal
www.esri-portugal.pt
- Esri Romania S.R.L.—Romania
www.esri.ro
- Limited Liability Company ESRI CIS—Russia
www.esri-cis.ru
- Esri Saudi Arabia Ltd.—Saudi Arabia
www.esrisaudiarabia.com
- Esri South Africa (Pty) Ltd.—South Africa
www.esri-southafrica.com
- Esri Korea, Inc.—South Korea
www.esrikr.com
- Esri South Asia Pte. Ltd.—Singapore
www.esrisa.com
- Esri España Soluciones Geospaciales SL—Spain
www.esri.es
- Esri Sverige AB—Sweden
www.esri.se
- Esri (Thailand) Co. Ltd.—Thailand
www.esrith.com
- Esri Bilgi Sistemleri Muhendislik ve Egitim, Ltd.—Turkey
www.esriturkey.com.tr
- Esri (UK) Ltd.—United Kingdom
www.esriuk.com
- Esri Ukraine Ltd.—Ukraine
www.esri.ua
- Grupo Esri de Venezuela, C.A.—Venezuela
www.esriven.com

Esri has more than 80 distributors in other countries around the world. For more information, contact Esri (tel.: 909-793-2853, ext. 1-1235; fax: 909-307-3070) or visit esri.com/distributors.



Career Opportunities

Esri is hiring smart people with all levels of experience for positions at our headquarters, regional offices, and R&D Centers. Your work will affect the way people live and how organizations solve problems. We offer exceptional benefits, competitive salaries, profit sharing, and a collaborative and stimulating environment. Join us and be part of Esri’s mission to make a difference in our world.

Software Development and ArcGIS Product Engineering

- Insights Java Developer:** As part of a growing team of server and cloud software engineers, help Esri build the future of location analytics technology. Preferred candidates include professionals in Amazon and Microsoft Azure cloud services, Java, RESTful web services, and new and upcoming middleware and server-side technologies.
- 3D Graphics Developer—ArcGIS Pro:** Use your experience in 2D and 3D graphics programming to develop GIS visualization technology and expand the capabilities of the ArcGIS platform. You will design and develop products that support the needs of geodesigners, urban planners, architects, engineers, and others who work with geographic information.
- Software Developer—Raster:** Develop complex, state-of-the-art software systems for airborne and space synthetic aperture radar (SAR) applications. Be part of a fast-paced, high-performance engineering team that interacts with commercial, US Department of Defense, and US intelligence community users; program management; integration and test engineers; and senior technologists.
- Intelligence Solutions—Software Developer:** Collaborate closely with other product development team members to help intelligence organizations leverage the investments they make in geospatial technology and data.
- Mapping Product Engineer:** Combine your cartography expertise with your programming skills to help build the next generation of mapping and symbology tools in ArcGIS. You’ll be actively involved in designing the user experience of ArcGIS Desktop and will help ensure software quality by building and validating realistic workflows and scenarios.
- Raster Product Engineer—Defense and Intelligence Specialist:** Work with development and product engineer leads to design, create, and engineer software, solutions, and content for defense, intelligence, security, military, and other remote sensing users.
- Technical Writer—ArcGIS Enterprise:** Blend your passion for writing and interest in cutting-edge technology to advance developer-focused documentation for ArcGIS Enterprise. You’ll have a hand in developers’ success by working with teams to improve documentation in the development, test, and production environments.

Product Management

- Product Manager—Story Maps:** Create and execute Esri’s product strategy for story maps, which generate inspiring, immersive stories by combining text, interactive maps, and other multimedia content that is shared within an organization or everyone around the world.

Business Development

- Sales Director—Nonprofit:** Be a thought leader and increase awareness of GIS as an essential enterprise-wide solution for the nonprofit market. Introduce, showcase, and promote Esri products that demonstrate and communicate the value of geospatial intelligence for decision-making within nonprofits.
- Esri Partner Network Manager:** Use your experience in technology sales, business development, and operations to support and drive top-line growth through a growing partner channel.
- Account Manager—Local Government:** Merge your enthusiasm for the public sector with your knowledge of geospatial technology to define and successfully execute a strategic account plan.

Presales and Solution Engineering


- Solution Engineer—Partners and Startups:** Become a core member of the partner team and collaborate with emerging technology companies to help them build successful products. Work closely with the team that guides startups, developers, and partners in creating new products with the ArcGIS platform and taking them to market.

Educational Services and Technical Support

- Instructors—Utilities and Defense & Intel (multiple locations):** Use your teaching skills and GIS knowledge to help Esri users be successful with ArcGIS software. Provide a rich learning environment via hands-on training, engaging instructional delivery, and facilitated activities.
- Training Sales Team Lead:** Leverage your team building and management experience to lead a team of sales consultants who sell training services. Also use your consultative sales skills to work with strategic customers on their training needs.

Esri is an equal opportunity employer (EOE). All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability status, protected veteran status, or any other characteristic protected by law.

esri.com/careers Follow @EsriCareers on Twitter



Precision Powered.
Reality Captured.
Confidence Delivered.

Geospatial.trimble.com/esri



Add a Subscription, Change Your Address, or Unsubscribe
Subscribe, unsubscribe, or update information at esri.com/manage-subscriptions.
Outside the United States, contact your local distributor.
To request other publication services, see page 2.

 **esri**® 380 New York Street
Redlands, CA 92373-8100

Presorted
Standard
US Postage
Paid
Esri

Copyright © 2020 Esri.
All rights reserved.
Printed in the United States of America.

The information contained in this document 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: Director, Contracts and Legal Department, Esri, 380 New York Street, Redlands, CA 92373-8100 USA.

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

@esri.com, 3D Analyst, ACORN, Address Coder, ADF, AML, ArcAtlas, ArcCAD, ArcCatalog, ArcCOGO, ArcData, ArcDoc, ArcEdit, ArcEditor, ArcEurope, ArcExplorer, ArcExpress, ArcGIS, arcgis.com, ArcGlobe, ArcGrid, ArcIMS, ARC/INFO, ArcInfo, ArcInfo Librarian, ArcLessons, ArcLocation, ArcLogistics, ArcMap, ArcNetwork, ArcNews, ArcObjects, ArcOpen, ArcPad, ArcPlot, ArcPress, ArcPy, ArcQuest, ArcReader, ArcScan, ArcScene, ArcSchool, ArcScripts, ArcSDE, ArcSdl, ArcSketch, ArcStorm, ArcSurvey, ArcTIN, ArcToolbox, ArcTools, ArcUSA, ArcUser, ArcView, ArcVoyager, ArcWatch, ArcWeb, ArcWorld, ArcXML, Atlas GIS, AtlasWare, Avenue, BAO, Business Analyst, Business Analyst Online, BusinessMAP, CityEngine, Community, Community Analyst, CommunityInfo, Community Maps, Companion, Database Integrator, DBI Kit, Drone2Map, EDN, Esri, esri.com, Esri—Team GIS, Esri—The GIS Company, Esri—The GIS People, Esri—The GIS Software Leader, Excalibur, FormEdit, GeoCollector, GeoEnrichment, GeoEvent, Geographic Design System, Geography Matters, Geography Network, geographynetwork.com, Geoloci, GeoPlanner, Geoportal, Geotrigger, GIS by Esri, gis.com, GISData Server, GIS Day, gisday.com, GIS for Everyone, Indoors, Insights, JTX, MapIT, Maplex, MapObjects, MapStudio, ModelBuilder, MOLE, MPS—Atlas, Ortho Maker, PLTS, Rent-a-Tech, SDE, See What Others Can't, SML, Sourcebook-America, SpatialABS, Spatial Analyst, Spatial Database Engine, StoryMaps, StoryMaps Basic, StoryMaps Cascade, StoryMaps Crowdsourc, StoryMaps Journal, StoryMaps Series, StoryMaps Shortlist, StoryMaps Swipe and Spyglass, StoryMaps Tour, StreetMap, Tapestry, the ARC/INFO logo, the ArcGIS Explorer logo, the ArcGIS logo, the ArcPad logo, the Esri globe logo, the Esri Press logo, The Geographic Advantage, The Geographic Approach, the GIS Day logo, the MapIT logo, The Science of Where, The World's Leading Desktop GIS, *Water Writes*, and Your Personal Geographic Information System are trademarks, service marks, or registered 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.

173305

SEE HOW PEOPLE AND NATURE CAN THRIVE, TOGETHER.

The stewards of our planet's most important ecosystems depend on Esri location technology for a holistic view of the relationship between humans and natural landscapes. By mapping the wildlife and surrounding areas, rangers and conservation groups can ensure the future of our most precious species for generations to come.

If Esri can help conservationists see how to monitor and protect vital habitats, what could you see?

See what's possible at esri.com



SEE
WHAT
OTHERS
CAN'T